THE DEVELOPMENT OF LEADING INDICATORS FOR THE SOUTH AFRICAN BUILDING INDUSTRY USING QUALITATIVE AND QUANTITATIVE DATA

by

Gideon Johan Justus Snyman

B.Comm.(Stell.) B.Comm.(Hons.)(UNISA) M.Comm.(Stell.)

Dissertation submitted in fulfilment of the degree

DOCTOR OF PHILOSOPHY

In the Faculty of Fine Art and Architecture
Department of Construction Economics and Management

UNIVERSITY OF CAPE TOWN

Supervisor: Prof. W.F. Kilian
Co-supervisors: Prof. E. van der M. Smit and Prof. B. Boaden

AUGUST 1994

THE DEVELOPMENT OF LEADING INDICATORS FOR THE SOUTH AFRICAN BUILDING INDUSTRY USING QUALITATIVE AND QUANTITATIVE DATA

by

Gideon Johan Justus Snyman

B.Comm.(Stell.) B.Comm.(Hons.)(UNISA) M.Comm.(Stell.)

Dissertation submitted in fulfilment of the degree

DOCTOR OF PHILOSOPHY

In the Faculty of Fine Art and Architecture
Department of Construction Economics and Management

UNIVERSITY OF CAPE TOWN

Supervisor: Prof. W.F. Kilian
Co-supervisors: Prof. E. van der M. Smit and Prof. B. Boaden

AUGUST 1994

ACKNOWLEDGEMENTS

All successfully completed projects are the result of teamwork. The author would therefore like to thank the following people and organisations for their assistance over many years:

Prof. Wilsey Kilian, doyen of building economists in South Africa, for his rigorous and practical approach to building economics. For guidance in things great and small and for loyal support over many years;

Prof. Eon Smit for the fine example he sets as dedicated academician, and for supervising the theoretical and statistical aspects of this study;

Prof. Bruce Boaden for guidance and helpful comments, especially in the closing stages of this project;

Dr. C.A. Puhl for contributing her communication and editing skills. The author learnt something about editing; Dr. Puhl professes to have learnt something about economics;

Mrs. Olive Franzsen, my able secretary, for being involved in this project since its inception. For typing and retyping the manuscript in a professional and gracious manner, and for encouragement throughout;

Mr. Martin van Rensburg, Mr. Frans Cilliers and Mr. Danie du Toit for their willingness to undertake the computer programming required for the successful completion of this study;

The staff of the South African Reserve Bank, especially Dr. Burg van der Walt, for providing certain basic data, as well as good advice in dealing with the NBER methodology;

The Bureau for Economic Research, my previous employer, for providing the basic qualitative time series data used in this study;

Mr. Jon van Coller for guidance and advice with the NBER procedures;

Carol, my dear wife, for her encouragement, fortitude and patience beyond the call of duty;

My widowed mother, Hilda, who - despite the advice of her bankers - sent me to University. I dedicate this study to her.

* * * * * * *

ABSTRACT

TITLE: **The development of leading indicators for the South African building industry using qualitative and quantitative data**

AUTHOR: Gideon Johan Justus Snyman

DATE: August 1994

ADDRESS: P.O. Box 7119, Stellenbosch, 7599, South Africa
Tel: 091-21-883 8151; Fax: 091-21-887 2339

The building industry is complex, diversified, and labour-intensive. These aspects, together with its inherent instability, are analysed. Improved forecasting methods can assist in economic planning within the industry and formulation of public policy. Economic stabilisation policies can benefit participants in the industry and society at large.

In this study leading indicators are developed for the South African building industry to assist in forecasting future demand levels. Use is made of qualitative survey data and quantitative time series. The quarterly qualitative data emanate from the Bureau for Economic Research, University of Stellenbosch. These data are gathered by questionnaire from building contractors and sub-contractors according to the Konjunkturtest developed by the Ifo Institute, Munich, Germany. Principal component analyses of the business survey variables reveal that respondents behave purposefully and that these qualitative data are suitable for use as cyclical indicators in a composite index.

The monthly quantitative data are compiled by the South African Reserve Bank and the Central Statistical Service, Pretoria, South Africa. The variables used in the construction of the leading indicators are weighted according to the scoring system developed by the National Bureau of Economic Research, United States of America. The six criteria applied in this scoring system are: economic significance of the variables; statistical adequacy; timing at turning points; conformity to historical business cycles; currency; and smoothness.

Separate composite leading indices are compiled from 33 qualitative variables and 8 quantitative time series, with the relevant scores as weights. It is found that these indices lead turning points of the reference cycle by between three and a half months and ten and a half months. However, the lead times are not consistent. This finding is in accordance with international experience. A combined leading indicator is constructed from these qualitative and quantitative indices (1971 to 1991). It is found that the statistical performance of the final composite leading indicator does not surpass the performance of the individual composite indices. It is suggested that the best forecasting results can be achieved if the qualitative and quantitative leading indices are used independently, yet in conjunction with other economic indicators and other forecasting models.

* * * * * * *

CONTENTS

CHAPTER 3

The construction process: Some theoretical aspects

CHAPTER 4

Instability in the South African building industry

CHAPTER 5

Business surveys: History and development from an international perspective

CHAPTER 6

The South African experience with business surveys

CHAPTER 7

The information value of the BER surveys of building contractors and sub-contractors: A principal component analysis

CHAPTER 8

Devising a composite leading indicator for the South African building industry by applying NBER methodology to BER business survey data

CHAPTER 9

Devising a composite leading indicator for the South African building industry by applying NBER methodology to quantitative time series

CHAPTER 10

Comparisons, conclusions and summary

LIST OF TABLES

* * * * * * *

LIST OF GRAPHS

NOTE: Explanation of shaded areas. In the case of the data base 1946 to 1994 the shaded areas represent the downward phase of the overall business cycle in the South African economy, as dated by the South African Reserve Bank. In the case of the data base 1970 to 1994 the shaded areas represent the downward phase of the sectoral reference cycle for construction, as dated by the South African Reserve Bank.

LIST OF FIGURES

* * * * * * *

LIST OF ABBREVIATIONS

ARMSCOR	Armaments Corporation of South Africa
BC	Buildings Completed (a CSS time series)
BCD	Code for variables relating to Building Contractors and Developers
BER	Bureau for Economic Research, University of Stellenbosch
BER BCI	Bureau for Economic Research Building Cost Index
BPP	Building Plans Passed (a CSS time series)
CIRET	Centre for International Research on Economic Tendency Surveys
CPAF	Contract Price Adjustment Formula
CPAP	Contract Price Adjustment Provisions
CSS	Central Statistical Service
ESKOM	Electricity Supply Commission of South Africa
Ifo	Ifo Institute for Economic Research, Munich
ISCOR	Iron and Steel Corporation of South Africa
MCD	Months for cyclical dominance
MEC	Marginal efficiency of capital
NBER	National Bureau of Economic Research, U.S.A.
OECD	Organisation for Economic Co-operation and Development
SARB	South African Reserve Bank
SASOL	South African Coal, Oil and Gas Corporation
SBC	Code for variables relating to Sub-contractors
SNA	System of National Accounts
U.K.	United Kingdom
U.S.A.	United States of America

* * * * * * *

Chapter 1

Introduction: Statement of the problem

1.1 Purpose of study

One of the major functions of economists internationally is to predict turning points in the macroeconomy so that the public and private sectors can plan their productive activities in an efficient and effective manner. The better the prediction, the better the business plan. With hundreds of recognised general economic indicators available for South Africa, a specific industry faces a huge amount of irrelevant information along with that which they find truly useful. A meaningful synthesis of relevant information is often lacking. One such industry is the building and construction industry. It is an important industry as investment in buildings and construction works comprises almost half of gross domestic fixed investment. The building industry is complex, diversified, labour-intensive and inherently unstable, subject to strong fluctuations for a variety of reasons. Furthermore, the building industry differs from other industries in many significant respects, so that economic indicators that are useful for these industries are often not applicable to building.

There is a need in the building industry for a single indicator which comprises major economic indicators, quantitative or qualitative, in a way that reflects their relative importance and allows prediction of turning points with high accuracy. **The purpose of the present study is to develop a composite leading indicator for the building industry in South Africa by combining relevant economic indicators and using a scientific approach.** In this sense this investigation makes a contribution to the **Economics of Building.**

It is generally agreed that the building industry is more prone to violent fluctuations in the demand for its product than most other industries. These fluctuations in building activity have severely disruptive effects on participants in the industry. Available resources, especially labour, materials and management, are often over-extended or under-utilised because of the instability that is so prevalent in the industry. Forecasting the course of the building cycle could assist participants to improve their planning and could thereby enhance their ability to cope with cyclical variations in demand. However, forecasting the course of the building cycle is complicated by the diversity of building activity. A reliable leading indicator could assist forecasting by the monitoring of the level of building activity and by the prediction of turning points in the building cycle. By improving forecasting in this field, more efficient use can be made of available resources in the industry.

1.2 The importance of this study

It was mentioned above that violent fluctuations in the demand for buildings result in disruptions in the industry. Such destabilising effects can take the form of excess demand on the resources of the industry. Conversely, resources may lie idle during recessions. Financial loss may result should contractors and other participants in the industry not be able to adapt timeously to changed circumstances. Unemployment can lead to real hardship for workers. The under-utilisation of productive resources implies wastage and its occurrence should be minimised in a developing country such as South Africa with its rapidly growing population.

To cope with instability of demand in the building industry, policy-makers and participants need to acquire knowledge of the probable course of the building cycle. This entails the measurement and forecasting of building activity. Specifically, it is essential that turning points in the building cycle be forecast with high accuracy. Various forecasting techniques, such as time series analysis or econometric modelling, can be applied with this objective in mind. One such forecasting technique has been developed by the National Bureau of Economic Research, U.S.A., and has been successfully applied and adapted in a number of countries and for various industries. This is known as the leading indicator approach to forecasting. A composite leading indicator for the South African building industry is devised in this study.

The importance of this study, which deals specifically with short-term trends in the industry and the prediction of turning points in the building cycle, can be identified on a number of levels. These pertain to policy makers, the participants in the building industry, members of the economics profession, and society at large.

1.2.1 For policy makers

As will be illustrated in chapters 2, 3 and 4, the government attempts to use investment in the public non-residential sector of the building industry in a contra-cyclical manner to stabilise the overall economy. Macroeconomic stability can be achieved by various measures of which contra-cyclical government spending is an important element. As will be shown, such contra-cyclical policies can only be successfully implemented if policy makers have a clear understanding of the state of the building industry at the time of decision-making. Furthermore, cognisance has to be taken of lags that exist between decision-making, announcement and implementation of contra-cyclical policies. It will be shown that contra-cyclical policies were implemented successfully during the fifties and early sixties. Since then, the spending patterns of government have become pro-cyclical and have exacerbated the instability in the building industry. Therefore, the need for accurate forecasting of the building cycle is clear. A composite leading indicator, giving timely warning of impending change, could make an important contribution if policy makers are to make wise decisions that impact directly on the lives of those involved in the building industry.

1.2.2 For participants in the building industry

Building contractors and sub-contractors are faced with recurring shortages of building materials and skilled labour during economic expansion phases. However, during recessionary periods the members of the workforce suffer because of retrenchments of labour. Such instability affects labour productivity severely. Training programmes are also affected by fluctuations of the building cycle. Contractors' cash flows are affected, together with their levels of profitability. The degree of competition in tendering is directly influenced by cyclical fluctuations which, in turn, affect contractors' pricing policies. To tender correctly builders need to know what the state of the building industry is expected to be during the course of the building project. Improved forecasting can benefit building contractors' use of available resources, can enhance planning and management of their work loads, and improve their tendering strategies.

The sales performances of builders' merchants and terms of credit are affected by fluctuations of the building cycle. In addition, inventory levels and storage costs are influenced by sudden variations in demand for building materials. Such disruptive cyclical swings can be smoothed out by improved forecasting of turning points of the building cycle. Longer lead times can assist builders' merchants by moderating their destocking and restocking cycles. This could lead to the more efficient use of their financial resources and increase their return on assets employed.

Manufacturers of building materials feel the effects of economic change after other participants. This implies that when builders' merchants enter a destocking cycle, the concomitant destabilising effects on production levels of manufacturers of building materials are amplified. Furthermore, investment in new plant and machinery requires a long delivery lead time. In the case of South Africa, where many sophisticated plant and equipment items have to be imported, these lead times can be more than three years. If bottlenecks in the supplies of building materials are to be avoided, manufacturers require accurate forecasts of turning points in the building cycle. Production and stock levels, as well as their human resources, can then be planned more effectively. Capital equipment can be used more efficiently. Loss of market share can be avoided if upswing phases of the building cycle are correctly anticipated.

1.2.3 **For members of the economics profession**

Macroeconomic forecasting is fairly well developed in South Africa. A number of forecasting organisations, such as banks, institutes attached to universities and private consulting firms make use of time-series analysis and/or econometric modelling when predicting trends in gross domestic product, consumer spending, investment and other macroeconomic variables. A number of leading indicators that have been developed for the South African economy are discussed in Chapter 8. However, no composite leading indicator exists for the South African building industry. In this study a composite leading index is developed for the South African building industry by applying the NBER scoring system. This leading indicator is based on qualitative and quantitative data sources and represents a unique and original contribution to the field of economic forecasting in the South African setting.

1.2.4 For society at large

The retrenchment of labour has severely disruptive effects on society at large. Experienced artisans often leave the building industry for good during severe recessions. This cyclical phenomenon places undue pressure on available training facilities. Retraining of the labour force is often required and can lead to wastage of available manpower resources. Furthermore, it is known that the building industry is labour intensive. When artisans or labourers are laid off because of a lack of building work their dependants face much hardship. Conversely, when a strong upswing phase of the building cycle is experienced, labour bottlenecks appear, labour productivity declines and the quality of management drops. As a result of cyclical instability available labour and materials resources are often under-utilised or over-extended. Ultimately, an inefficient allocation of resources, as well as declining productivity leads to higher building costs. In South Africa, with a large housing backlog, rapidly rising building costs could seriously retard the ability of individuals to become homeowners. Therefore, society at large could benefit greatly if better planning ensures that labour and materials are available when required, thus keeping down overall building costs. Improved forecasting of cyclical swings in the building industry can help to achieve these objectives. In this study, a composite leading indicator is devised for the building industry in South Africa to improve the accuracy of forecasting and the prediction of turning points in the building cycle.

1.3 Method of study

This study integrates two internationally accepted research approaches - the one qualitative, the other quantitative - and, as far as could be ascertained, these two approaches have never before been applied in this manner.

To devise a composite leading index to assist forecasting of turning points in the building cycle, use is made of both qualitative survey data and quantitative time series, together with a scoring system that is designed to select from the available economic time series those indicators that are deemed suitable for inclusion in the composite index. Quantitative time series are scored with the same scoring system and the qualitative and quantitative time series are then combined into a single composite leading index. The survey method applied in this study has been devised and developed by the Ifo Institute for Economic Research in Munich, Germany, known as the Konjunkturtest. The survey data are compiled according to this method by the Bureau for Economic Research (BER), University of Stellenbosch. These survey indicators are based on the responses of building contractors and developers, as well as sub-contractors.

The quantitative time series are drawn from published data of the BER, the South African Reserve Bank (SARB) and the Central Statistical Service (CSS). The scoring system has been devised and developed by the National Bureau of Economic Research (NBER) in the United States of America. It is applied to determine appropriate weights of the variables considered. This scoring system entails a number of specific criteria that are applied to select and classify economic time series, according to their cyclical characteristics. The timing characteristics of the various qualitative survey indicators analysed in this study are determined by comparing each indicator to a reference cycle. The historical diffusion index of construction activities, compiled by the South African Reserve Bank, Pretoria, is used as the reference cycle.

1.4 **Scope of study**

Without an appreciation of the unique features of the building industry, the Economics of Building cannot be fully understood. Chapter 2 focuses on investment theory and leading indicators. Chapter 3 deals with the theoretical framework within which all subsequent empirical analysis is undertaken. This chapter provides in-depth analysis of the special characteristics of the construction industry. For the moment it is sufficient to note four major features that pertain to:

* the physical nature of the product;
* the structure and organisation of the construction process;
* the determinants of demand; and
* the method of price determination.

Chapter 4 is devoted to a discussion of instability of demand in the South African building industry. It provides a macroeconomic overview of cycles in the building industry and builds on a number of concepts developed in Chapter 3. Chapter 4 deals specifically with fluctuations in interest rates, the availability of housing finance, the volatility evident in investment in private non-residential buildings, the role of the public sector and the effect of instability of demand on building costs. An assessment is made of the importance of the survey indicators that are used in this study to devise a composite leading indicator for the South African building industry.

Chapters 5 and 6 are devoted to a discussion of the survey method and survey data. Chapter 5 describes the historical development and methodological aspects of the Konjunkturtest in an international context. The nature of qualitative data is explained and the benefits of business surveys are spelt out. A synopsis of the theoretical and empirical development of qualitative business surveys is provided according to a framework based on the work of two specialists in this field of economic diagnosis, Aiginger (1977) and Strigel (1981).

Chapter 6 deals with business surveys in use in South Africa. The various stages of qualitative data development in South Africa are traced and the position of the current study is explained in terms of the Aiginger-Strigel framework. It is clear that this study falls within the "leading indicator stage". The development of BER surveys as a source of qualitative building information is explained, from their inception in 1969 to the present. Several principles are laid down with which the BER survey questionnaires should comply. Details of literature studies and overseas study tours are provided that deal with the gathering of information on the use of the Konjunkturtest and the NBER scoring system. A choice had to be made as to the research method for determining the information content of the large amount of qualitative building data. It was decided to undertake a principal component analysis to establish whether business behaviour is purposeful and whether the survey variables are useful as cyclical economic indicators. In the final section of Chapter 6 a description of the basic survey questionnaire is provided.

The analysis of the information content of the qualitative building data is undertaken in Chapter 7. A brief description of the method for extracting principal components is provided. It is explained that this investigation of qualitative building data is of an exploratory and confirmatory nature to determine whether business people behave in a purposeful manner. The principal component analyses of contractors' and sub-contractors' responses to BER questionnaires indicate that people in business behave purposefully and that they tend to project their perceptions of current business conditions into the future. Furthermore, their responses exhibit a certain internal reliability. Two principal components are identified, viz. a "work load" and a "financial" factor. These two factors play a crucial role in shaping respondents' perceptions of their business conditions. It can be concluded that the survey indicators used in this study are suitable for further analysis aimed at determining their cyclical characteristics according to the NBER scoring system.

Chapter 8 deals with the difficult task of selecting survey indicators that are to form part of the composite leading indicator being devised. To limit the subjectivity surrounding the choice of indicators, six criteria are applied in the NBER scoring system. These selection criteria relate to the economic significance, the statistical adequacy, timing characteristics, conformity to historical business cycles, smoothness and currency of each indicator. The NBER method of calculating a composite index is summarised and the weighting system used to compile the weighted U.S. index of leading indicators is given. The advantages of using a composite index are explained and the nine major types of economic processes that are covered in the U.S. leading index are itemised. Attention is focused on the periodic revisions of the NBER scoring system and it is emphasised that though individual time series included in the U.S. leading economic indicator may vary, the method of scoring has not changed since the 1975 comprehensive review. The arguments surrounding "measurement without theory" and relevant conterarguments are considered. The reference cycle for the South African construction sector, as compiled by the SA Reserve Bank, is analysed according to its cyclical characteristics. Given this background information, the NBER scoring system is applied to South African qualitative building data. Each of the six criteria is dealt with separately and a composite index is constructed from 33 survey variables. In the final section of Chapter 8 the timing characteristics of the composite index are assessed. It is concluded that the composite index leads the reference cycle and that the leads are not entirely consistent. This finding is in accordance with experience in overseas countries.

In Chapter 9 the same scoring system is applied to quantitative time series. To identify potentially useful series, 23 available indicators are considered. Those that coincide or lag the reference cycle are discarded. From this initial selection eleven indicators are chosen and the scoring system is applied. The final analysis yields eight suitable indicators that are combined in a composite leading index. This leading index is then evaluated. It is shown that the lead times are not consistent. This finding also conforms to overseas experience.

Chapter 10 provides data on the combined index of the above qualitative and quantitative leading indices. This composite indicator is evaluated and the applicability of this composite leading indicator for forecasting the building cycle in South Africa is considered. Directions for further research are provided. A section providing a general summary and conclusions rounds off the study.

* * * * * *

Chapter 2

Investment and leading economic indicators: Theoretical foundations

2.1 Introduction

In all countries gross domestic fixed investment forms an important part of the gross domestic product. Fluctuations in investment are closely linked to fluctuations in the business cycle. The nature and causes of the business cycle have been adequately dealt with by various authors, e.g. Boehm (1982, 1990), Chirinko (1993), Evans (1969), Gordon (1987), McCallum (1987), Mankiw (1991), Smit (1982), Van der Walt (1982) and Zarnowitz (1985).

In this chapter the emphasis is focused on the determinants of investment, i.e. the economic forces shaping investment behaviour. Specific attention is paid to the question: "What motivates investors to invest in buildings?" By reviewing these issues, a better understanding will be gained of the role of investment, the need of forecasting and the importance of developing a leading economic indicator for the South African building industry.

A comprehensive literature on the determinants of investment has been built up over the past century. Informative review articles have been published by Eisner and Strotz (1963), Jorgenson (1971) and Chirinko (1993). A large number of factors that influence investment behaviour have been identified, yet no single factor is of overriding importance. It follows that each change in aggregate investment spending is the result of changes in more than one factor. The issue is complicated by the fact that the relative importance of each of the many factors is not constant over time. The instability of the factors themselves implies that what is of relatively great importance in an economic boom may be of minor importance in a recession. Nevertheless, Shapiro (1970:269) has observed that "... the examination of the principal determinants of investment expenditure is not without great value in itself. It is the first step in an organised approach to one of the most difficult and important questions in economics". The "important question" referred to in the quotation is similar to the one posed earlier, i.e. what determines investment behaviour?

Several determinants of investment are identified and discussed in this chapter. The task of evaluating the relative importance of each and of tracing the interactions between them has been undertaken by Du Toit (1975) for the South African investment function.

It is appropriate to distinguish between the primary and the secondary determinants of investment as they appear in the literature. The primary determinants deal with output (or sales), financial factors (the interest rate and the role of finance), technological change and innovation, and expectations and uncertainty. Profits are covered in the sales item. Among the secondary factors are classed determinants such as the role of government, taxes, the market structure facing investors (oligopolies or monopolies) (Shapiro, 1970:225), or risks and business confidence (Dernburg & McDougall, 1968:129).

Gross domestic investment is usually split into plant and equipment and inventory investment, together with investment in residential and non-residential structures. Shapiro (1970:225) has observed that: "A list of causal factors for each of these ... categories would not be identical, and the relative importance of those factors that would be found on all (these) lists would be different on each list". For example, the expenditures by people for owner-occupied housing are not dominated by profit considerations as is the amount of investment expenditures for commercial and industrial buildings, or durable equipment (Shapiro, 1970:202). Given the objective of this study, it is appropriate that specific attention be paid to those factors that influence investment in residential and non-residential structures (i.e. buildings).

A study of the literature on investment theory treats capital as a homogeneous concept. This is confirmed by Weintraub (1983:621). The majority of authors develop models that are appropriate for investment in plant and machinery (i.e. producers' durable equipment). Few authors deal specifically with investment in buildings in their macroeconomic studies, Bon (1989), Evans (1969), Hillebrandt (1985), Shapiro (1970) and Smith et al. (1988) being some of the exceptions. The major reason is that buildings display special characteristics such as durability, spatial fixity, heterogeneity of product and the extensive involvement of governments in the building market (Smith et al., 1988:29). The special characteristics of the building industry, and the influence these characteristics have on the determinants of investment in buildings, are discussed in greater detail in Chapter 3 of this study. For the moment the emphasis is on the determinants of investment in general terms.

2.2 Keynes's marginal efficiency of capital (MEC)

Investment can be defined as the additions to the capital stock in a specific period. If the actual capital stock is lower than the desired capital stock, additional investment can move it to that point. It is assumed that the desired capital stock is at the optimal level. The theory of investment behaviour therefore depends on the theory of optimal capital accumulation (Evans, 1970:73). This theory was given its most thorough pre-Keynesian exposition by Fisher (1907, 1930). Fisher assumed that the business firm wanted to maximise its present value, i.e. the properly discounted flow of net receipts (Evans, 1970:73). This first criterion is the only one that is consistent with utility maximisation. A second assumption is that perfect capital markets exist. The business firm will then maximise its present value if it invests in those projects whose net present value is positive at the market rate of interest (Evans, 1970:73).

Keynes defined the marginal efficiency of capital as the "rate of discount which would make the present value of ... the returns expected from the capital asset during its life just equal to its supply price" (quoted in Shapiro, 1970:209). The internal rate of return can be derived from the following equation (Evans, 1969:74):

$$C_o = \frac{R_1}{(1+r)} + \frac{R_2}{(1+r)^2} + \frac{R_n}{(1+r)^n} + \frac{S_n}{(1+r)^n}$$

where C_o represents the cost or the supply price of the capital good and S is the scrappage price thereof. R represents the flow of income and the marginal efficiency of capital is denoted by r.

It should be emphasised that r is expressed as a percent. This has given rise to confusion and some authors have equated the current interest rate to r. However, Weintraub (1983:618) and Shapiro (1970:209) have stressed that the two concepts are not identical. Weintraub (1983:618) emphasises that the appropriate interest rate (i) was "to come from outside" and was independent of the marginal efficiency of capital (r). Having established the marginal efficiency of capital, and by comparing it to the current market rate of interest, one is able to tell whether the contemplated investment promises to be profitable or nonprofitable. The excess of r over i (if any) represents the net rate of return expected on the capital asset after allowance for all costs, including the interest cost of the capital asset over the duration of its life, together with the depreciation cost of the asset itself (Shapiro 1970:209).

According to Shapiro (1970:210) two elements yield the internal rate of return. The first of these - the income flow expected from a capital good - depends on the business outlook. Should the level of business confidence improve, the MEC will be raised, assuming a constant capital goods supply price (the second element). Alternatively, if the supply price of the capital good decreases and the expected income flow expected from the good remains unchanged, then this will also raise the MEC of that capital good. Profitability of the investment depends on a third element, i.e. the market rate of interest (i). Shapiro (1970:210) emphasises that a drop in the interest rate will not affect the marginal efficiency of that capital good. Yet if $i > r$ before the drop in i and if $r > i$ after the drop, then the purchase of the capital good will appear profitable. In contrast, should the expected income flow be revised downward or the price of the capital good rise, then the expected profitability of the investment will be reduced, or a loss may arise. A rise of the market rate of interest will also affect profitability adversely. This principle partly explains why demand for capital (e.g. buildings) is negatively affected by a rise in the level of the market rate of interest. The sensitivity of changes in the demand for capital, resulting from fluctuations in interest rates, is dealt with at a later stage.

The foregoing analysis has shown that the demand for capital is dependent on the marginal efficiency of capital. However, this does not represent an investment theory. Haavelmo (1960:215-216) and Jorgenson (1963:248) are agreed that "demand for capital is not demand for investment". It is necessary that the relationship between the marginal efficiency of capital (MEC), the profit maximising capital stock and the flow of investment be analysed.

Du Toit (1975:42) mentions that Keynes did not distinguish clearly between those factors that relate to the size of the capital stock and the factors that determine the rate of investment. It should be realised that the marginal efficiency of capital decreases as the capital stock increases. This occurs by virtue of the assumed declining marginal productivity of capital. Graphically, the relationship can be expressed as a negatively sloped curve with the MEC on the y-axis and capital stock on the x-axis. The implicit assumption is that the producer price of capital goods is fixed for a particular MEC curve. Therefore, many such curves will exist for different capital goods prices. A capital demand curve can be derived by arguing that business firms have different investment projects which they might like to undertake (Evans, 1969:76). Assume that a firm is aware of the present cost of a project and can estimate the expected future returns arising from each project. All possible investment projects can then be ranked according to their internal rates of return for each given market interest rate. Du Toit (1975:36) mentions that such a ranking can only be achieved if it is also assumed that the various investment projects are independent of one another, and cites Duesenberry (1958:56-57) in this regard. It has been shown above that the firm will undertake those profitable investment projects where the MEC is greater than the market rate of interest i. The capital stock will then expand up to the point at which the MEC is equal to i. This implies a negative relationship between the MEC and the capital stock, which flows from the assumptions of declining marginal productivity of capital and the profit maximisation principle. It is also assumed in this illustration that the supply price of capital goods and the market interest rate are constants.

2.3 **Marginal efficiency of investment**

In a growing economy it can be assumed that the desired capital stock will be greater than the actual capital stock. Given the assumption of profit maximisation behaviour on the part of investors, investment will be profitable up to the level of the market rate of interest. Once this point is reached and investment has moved the actual capital stock to the point at which it is equal to the desired capital stock, all net investment will cease.

This illustration shows that investment will be positive if a gap exists between the actual and desired capital stock. It does not provide information on how much will be invested, or how long it will take to fill this gap. Evans (1969:76) asserts that additional information is needed to determine the rate of investment per unit time. Such information relates to the costs of adjustment in producing capital goods.

It is known that it takes time to produce the capital goods required to fill the gap between the actual and desired capital stock. It may be possible for an individual firm to expand its capital stock without affecting the costs of production of the capital goods industries. However, for all business firms combined, this is not possible because of the limited productive capacity of the capital goods industries (Evans, 1969:77). Chirinko (1993:1885) observes that the issues surrounding these adjustment costs were introduced by Eisner and Strotz (1963). In varying its capital stock a firm may face either external costs, due to an upward sloping supply curve for capital goods, or internal costs. In the case of external costs the rising supply price of capital goods is the result of increasing marginal costs of firms operating within the capital goods industry. These external adjustment costs are very much in the spirit of Keynes's short-run analysis (Chirinko, 1993:1885). Evans (1969:77) mentions the possibility that the productive limit of the capital goods industry may cause the level of backlogged orders to rise, without a rise in the list price. However, a premium may be paid for faster delivery, thereby raising the effective supply price of capital goods, despite constant list prices (Evans, 1969:77).

Increasing internal adjustment costs are usually associated with integrating new equipment in a going concern (Evans, 1969:77) as new capital goods are "broken in" and workers retrained (Chirinko, 1993:1885). Lost output may also result from additional labour for "bolting-down" new capital equipment. Differences in productivity may arise between newly purchased and installed capital (Chirinko, 1993:1885).

It has been shown that the MEC depends on the expected income stream yielded by the capital good and the supply price of the capital good. The higher the supply price of the capital good, the lower the MEC (assuming that the income stream and the scrappage value are constant). Furthermore, it has been shown that as adjustment costs rise, the supply price of capital goods rises. Thus, the faster the rate of investment, the higher the cost per unit and the lower the marginal efficiency of each investment project (Evans, 1969:77). This yields a negative relationship between marginal efficiency of investment (MEI) and investment (I). The faster the rate of investment, the more sharply will the external adjustment costs rise, leading to rapidly rising supply prices of capital goods. This implies that the MEI curve slopes downward at an increasing rate that is concave to the origin if presented graphically. If the market rate of interest is substituted for the MEI, the schedule becomes the investment demand schedule (Evans, 1969:78). Shapiro (1970:216) observes that this schedule indicates the rate of investment spending per time period at each possible market rate of interest and he asserts that it is "... specifically the upward-sloping supply curve of capital goods that produces the downward-sloping MEI curve".

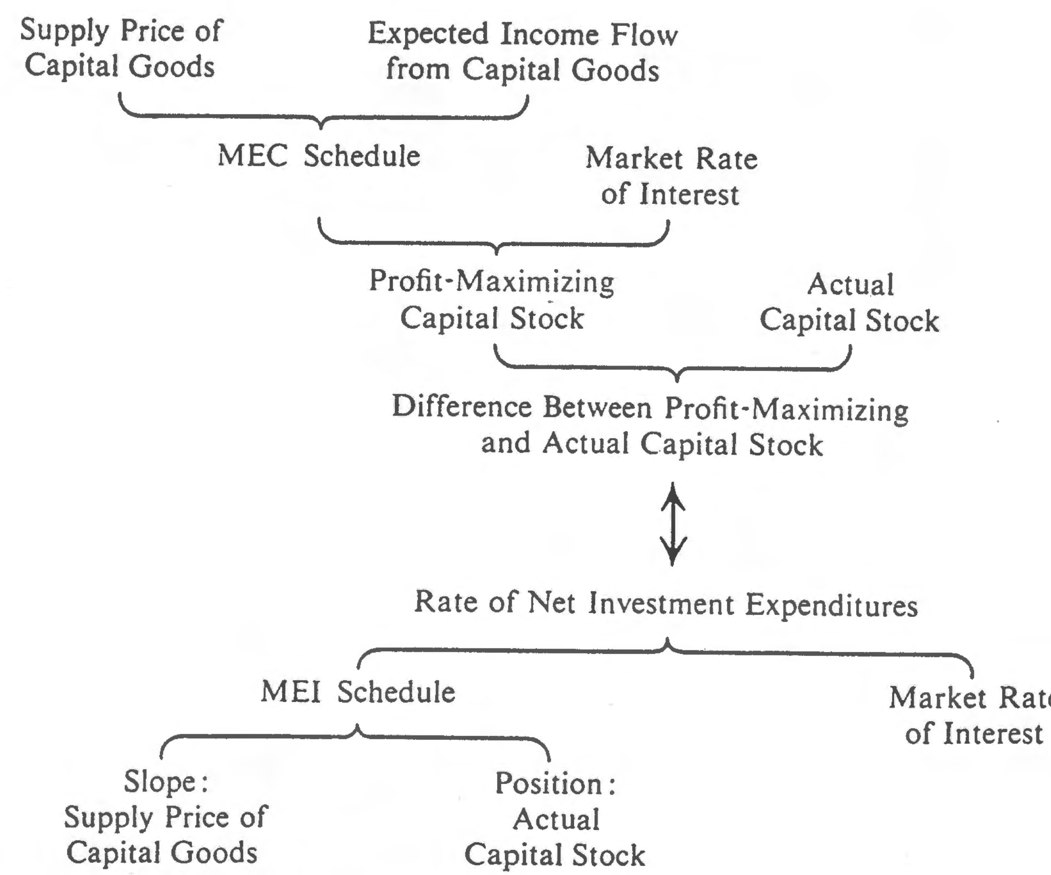
Thus, the negative relationship between the MEI and investment itself occurs because an increasing rate of investment can only be accomplished at a higher unit cost. This reduces the rate of return that equalises returns and costs. Given the derived MEI schedule, the current market rate of interest can be used to determine the rate of investment. Profit maximising firms will continue to invest until the MEI is equal to the market rate of interest. It follows that a lower interest rate will motivate firms to undertake investment projects that they previously regarded as unprofitable. The adjustment process occurs in two phases. Firstly, a lowering of the interest rate increases the desired capital stock. Secondly, an increase in the rate of investment lowers the MEI through an increase in the costs of capital goods until the MEI decreases to the level of the lower interest rate (Evans, 1969:78).

The Keynesian approach is summarised in the accompanying schematic presentation (Shapiro, 1970:221). Refer to Figure 1. It has been shown that investment depends on the gap that exists between the actual and desired capital stock. Once the actual capital stock is equal to the desired capital stock, net investment will be zero. Therefore, a prerequisite to the appearance of net investment spending is a rise in the profit-maximising capital stock. This illustration provides an overview of the process whereby a demand for additional capital is translated into a demand for a flow of investment.

It has been shown that profit-maximising business firms will invest up to the point at which the MEC is equal to the market rate of interest. How quickly this gap is closed depends on the shape or elasticity of the marginal efficiency of capital (also known as the capital demand curve). If the MEC schedule is relatively inelastic then additions to the stock of capital will move the economy quickly down such a schedule (Shapiro, 1970:258). He concludes that, other things being equal, the more inelastic the MEC schedule is, the sooner appreciable downward pressure on the MEI schedule will appear as "feedback" from the growth in the stock of capital. It has been shown that the elasticity of the MEI schedule depends on the elasticity of the supply curve of the capital goods industries. Whereas the effect of a change

Figure 1

Illustration of the Keynesian approach to investment which simulates the translation for a demand for a stock of capital into a demand flow for investment.



<u>Source</u>: Shapiro (1970:221)

<u>Legend</u>: MEC = Marginal Efficiency of Capital
MEI = Marginal Efficiency of Investment

in the rate of interest on the rate of investment spending in any period depends on the elasticity of the MEC schedule (not the MEI schedule), it is appropriate to consider the factors that determine the elasticity of the MEC schedule itself.

2.4 Determinants of the elasticity of the MEC schedule

It is assumed that an individual firm may buy capital goods in the expectation that such a purchase will turn out to be profitable. Therefore, the elasticity of the MEC schedule for the overall economy may be assumed to depend on the significance of any given change in the interest rate as a factor altering the capital-maximising stock for all firms combined (Shapiro, 1970:258). As some firms may desire to expand their capital stocks substantially for any given drop in the rate of interest, there may be other firms that are unaffected by this drop in the interest rate. This could occur if the latter are operating below capacity. The combined responses of all firms will then determine the elasticity of the MEC schedule.

Shapiro (1969:259) observes that the lower market rate of interest leads to a reduction in one cost of doing business, yet one finds different reactions by different businesses to such a drop. He cites an important factor that will determine how great an increase in the profit-maximising stock will result from any given reduction in the interest rate. This is the extent to which firms find it technologically possible to substitute what is now the relatively cheaper capital input for what is now the relatively more expensive labour input. It is known that the interest rate can be regarded as the cost of capital, in the same way that the wage is regarded as the cost of labour. Therefore, a fall in the rate of interest is then a decrease in the cost of capital.

Assuming no change in the existing state of technology and the wage rate, there will be a tendency throughout the economy to substitute the cheaper factor input, capital, for the relatively more expensive input, labour, in the production of any constant level of output (Shapiro, 1970:259). All firms may not react in a like manner as some firms will be constrained by their technology from substituting capital for labour.

Therefore the first factor influencing the elasticity of the MEC schedule is essentially technological by nature. Shapiro (1970:260) concludes that the greater the substitution possibilities available within the existing state of technology, the more elastic the MEC schedule will be.

A second factor can be identified and concerns the cost saving represented by a switch toward greater capital use as a result of the drop in the rate of interest (Shapiro, 1970:261). In a numerical example Shapiro shows that a fall in the rate of interest leads to no reduction in the quantity of labour employed, but leads rather to the use of more durable capital goods in combination with an unchanged quantity of labour. He compares two firms whose methods of production are identical, producing the same value of output with equal quantities of labour, but where the durability of the capital goods employed is different. The figures used in this example are carefully chosen and indicate that with all other input costs held constant, the purchase price of the more durable capital goods is only three and a half times that of the less durable capital goods. Yet the life of the more expensive capital goods is five times that of the cheaper capital goods. Consequently, the depreciation cost of the less durable capital goods is greater than that of the more durable capital goods. Shapiro (1970:263) concludes with a general statement that, for the overall economy, a fall in the interest rate will give rise to some tendency toward production of any given level of aggregate output with more durable capital goods. Consequently, there will be a tendency to produce any given level of output with a larger stock of capital goods when the interest rate decreases. Shapiro (1970:263) observes: "A fall in the rate of interest would, of course, tend to encourage substitution of capital for labour and the use of more durable capital goods simultaneously. Both tend to increase the profit-maximising capital stock consistent with any given level of output, and therefore, both work toward a higher rate of investment spending".

Other authors have identified additional factors that influence the interest elasticity of the MEC schedule. Du Toit (1975:54) argues that under conditions of uncertainty business people can misjudge the discount rate used in their estimates when deriving the MEC of various investment projects. In such cases the MEC will exceed the market rate of interest by the risk or uncertainty factor. He also argues that situations may arise where the uncertainty element may dominate the MEC, with the result that the interest rate effect may become insignificant. Normally this will be the case with projects which have a long life span. Such projects will tend to have an interest-inelastic capital demand curve because of the risk and uncertainty factor (Du Toit, 1975:55).

Technological change and fear of obsolescence are factors that can influence the interest elasticity of the MEC schedule. Rapid technological improvement in an industry can encourage business people to recover their costs of investment over a shorter period. Du Toit (1975:55) argues that the nature of the discounting process is such that the expected income streams which lie far into the future are more sensitive to interest rate fluctuations. By shortening the "payback" period on investment, the MEC could become interest-inelastic as a result of uncertainty on the part of business people (Du Toit, 1975:56; Shapiro, 1970:211).

As noted by Shapiro (1970:261), the sensitivity of the MEC schedule to interest rate changes is influenced also by the life span of capital goods. Du Toit (1975:56) proffers three reasons why this could be so. Firstly, the effect that amortisation periods have on the elasticity of the capital demand curve is related to the fact that the discounted value of a short-term annuity is influenced to a lesser extent by an interest rate change than in the case of a long-term annuity. Secondly, it can be argued that the interest burden of projects with a short life is relatively small when compared with long-lived capital goods. In such cases changes in interest rates will not alter total costs very much. Thirdly, when dealing with short-lived capital goods, the ratio between depreciation and interest costs will tend to be high so that an interest rate change will have a modest effect on the cost of using capital.

Finally, Du Toit (1975:57) quotes an argument put forward by Tarshis (1961:983) that the elasticity of the demand curve for capital will also depend on the distribution of the MEC values of all investment projects. Tarshis (1961:983) argues that "... the closer to one another are the expected yields from different projects, the greater is the elasticity, at least around that figure; and the greater the degree of variation in expected yields, the lower is the elasticity".

In conclusion, various factors influence the elasticity of the MEC schedule on which the profit-maximising capital stock and investment depends. One factor is especially relevant in the case of buildings and this relates to the durability or life span of buildings. This is discussed in the next section.

2.5 Elasticity of the MEC schedule and its influence on investment in buildings

Shapiro (1970:263) observes: "Since the thirties, most economists have argued that the rate of investment spending for an industrially advanced economy such as that of the United States is interest-inelastic. Although this appears to be the consensus, this general conclusion is not equally applicable to all forms of investment spending". He finds that, to the extent that investment does respond to changes in the interest rate, the most pronounced response seems to occur in the field of investment spending for residential and business structures. Though the reasons are implicit in the previous arguments it is nevertheless appropriate to explore these explicitly.

An additional million square metres of living space or office space per year can be provided only by the construction of the required houses, apartments, office buildings, or factories. Since the product yielded by the process of construction is measured in square metres of floor space per year, production of this space is capital intensive in a technological sense. This means that the sum of depreciation and interest cost per unit of output forms a large fraction of total cost per unit of this kind of asset. Furthermore, not only is the asset very capital intensive, but these particular capital goods are durable. To provide another million square metres of floor space this year requires the construction of buildings that will provide this same output for many years. Since the interest cost on durable capital goods continues for many years, even small changes in the interest rate can mean a substantial difference in the cost per unit of output, in this case square metres of floor space per year. Shapiro (1970:264) concludes his analysis by observing:

> In other words, where the technology makes for capital-intensive production and where the nature of the capital employed is **very durable, a change in the interest rate can make a great difference** (emphasis added) in cost per unit of output, and this will markedly affect the rate of investment expenditures in this type of capital goods.
>
> ... We may expect the response to changes in the rate of interest for the economy as a whole to have the greatest impact on the stock of structures, less on the stock of producers' durable equipment, and least on the stock of business inventories (Shapiro, 1970:265).

One may conclude from these arguments that the demand for buildings is sensitive to interest rate fluctuations, yet it has also been argued above (Du Toit, 1975:54) that the risk and uncertainty factor will normally influence investment projects with a long life span by lowering the elasticity of the capital demand curve. Given Shapiro's (1970:264-265) strong arguments in favour of greater interest elasticity of the demand curve for buildings, it is reasonable to assume that the effects of the durability factor overshadow the effects of the risk and uncertainty factor. A possible explanation for this finding is that buildings, though being durable, capital intensive and immovable capital goods, are nevertheless adaptable in their uses. Bon (1989:36-37) argues that buildings are:

> ... often designed to be convertible to new uses, if not outright versatile. This holds especially for their structural systems and the basic mechanical and electrical systems, such as heating, ventilating, and air-conditioning systems, water and sewerage systems, and vertical transportation systems. Most other building components, such as interior partitions, furnishing, communications systems, or electrical wiring, can be readily rearranged to fit new needs, or be replaced altogether. Although they tend to be specific to a particular function, they are hardly fixed even in the short run, due to maintenance and replacement activities.

Hillebrandt (1985:62) concurs with this argument. She observes that an "... industrial building is only a casing for the manufacturing process. The layout of machinery within a building can often be completely altered and modernised without altering the building itself". Possibilities that exist for converting existing buildings to new uses therefore reduce the effects of the risk and uncertainty factor that ostensibly give rise to an interest-inelastic demand schedule for long-lived capital goods.

An additional question needs to be considered. Is the interest elasticity of the MEC schedule the same at high interest rates and at low interest rate levels? Shapiro (1970:265) suggests the "... likelihood of less inelasticity at high levels of the interest rate than at low, so that a change in the rate from 10 to 9 percent will probably lead to a greater increase in the profit-maximising stock than will a rate change from 5 to 4,5 percent". He concludes by observing that whatever may be the elasticity of the overall MEC schedule, one may expect it to be more inelastic at low rates of interest than at high levels (Shapiro, 1970:265). In support, Du Toit (1975:58) quotes Hansen (1951:135) who states that "... in industrially advanced countries, which enjoy a relatively low rate of interest, the investment demand schedule (despite the relatively high interest-elasticity of investment demand for many kinds of construction) tends to be fairly interest-inelastic".

In support of Hansen's argument regarding construction, results of empirical studies that relate to housing may be cited. Grebler and Maisel (1963) and Smith, Rosen and Fallis (1988) found the interest elasticity of new housing construction in the U.S.A. to be relatively high. This could be attributed to the institutional character of the mortgage market. (Also refer to Section 2.7 that deals with these issues).

This finding is of particular relevance in the South African setting. It is known that prime interest rates were raised from 22% to 25% p.a. in August 1984 as part of the government's economic austerity programme to curb inflation. According to the above analysis the interest elasticity of the demand curve for buildings should be greater at higher rates of interest than at low rates. This implies that the interest rate rise should lead to a sharp reduction in the level of investment in the building industry. Evidence will be provided in Chapter 4 that investment in buildings did indeed fall sharply in subsequent years.

A final aspect to be considered under this heading relates to the volatility of interest rate movements. Quoting a study by Ingersoll and Ross (1988), Pindyck (1991:1141) indicates that volatile changes in interest rates have important implications for investment spending. Ingersoll and Ross (1988) show that for long-lived projects, a decrease in expected interest rates for all future periods need not necessarily accelerate investment immediately. The reason is that such a change also lowers the cost of waiting (i.e. postponing the investment decision until interest rates fall further). This can have an ambiguous effect on investment. Pindyck (1991:1141) concludes: "This suggests that the level of interest rates may be of only secondary importance as a determinant of aggregate investment spending; interest rate volatility may be more important". Pindyck (1991:1141) argues that if a goal of macroeconomic policy is to stimulate investment, stability and credibility surrounding macroeconomic policy may be more important than the particular levels of tax rates or interest rates. Phrased differently, if uncertainty over the state of the economic environment is high, tax and related incentives, such as interest rate reductions, may have to be very large to have any significant impact on investment.

These findings are especially relevant in the South African case. Evidence will be provided in Chapter 4 that interest rates were particularly volatile during the nineteen eighties. In fact, prime interest rates fluctuated between 12% p.a. and 25% p.a. Volatility in interest rate movements must have contributed to poor overall levels of investment in buildings during this period. Interest rate volatility must also have exacerbated the fluctuations evident in the building industry during the nineteen eighties.

2.6 The cost of funds

In the preceding sections the focus was on the level of the interest rate and how fluctuations in interest rate levels may affect investment spending. As all investment spending must be financed in one way or another, it is appropriate to identify two additional factors that may influence investment spending. These two factors are: the cost of finance (credit) and the availability of credit. In this section the emphasis is on the cost of funds for investment purposes. The availability of funds is discussed in the following section.

In terms of previous arguments, business firms will invest up to the point at which the marginal efficiency of capital equals the market interest rate, i.e. where MEC = i. The main determinants of MEC are output and capital stock (Evans, 1969:86). A further assumption made in this regard is that capital markets are perfect. This implies that the cost of borrowing is the same for all firms. However, this is not a realistic assumption under any circumstances (Evans, 1969:86). Shapiro (1970:266) states that there is no such thing as **the** market rate of interest; rather there is a whole complex of rates. The rate that any particular borrower pays depends on a number of factors, e.g.

* the term of the loan;
* the size of the loan;
* the collateral offered; and
* especially, the creditworthiness of the borrower.

Nevertheless, in the interests of simplification it is permissible to speak of **the** market rate of interest. However, at this stage it is necessary to distinguish among various interest rates paid by different firms and analyse their differential effects on the cost of borrowing. By including the cost of funds as a determinant of investment spending one needs to modify the argument surrounding the marginal efficiency of capital.

"Firms will invest until the rate of return on the last investment is equal to the marginal cost of funds (MCF) for this last investment" (Evans, 1969:86). It is necessary to add this qualification to the Keynesian MEC argument because there is increasing risk attached to additional borrowing. Whereas some firms may be able to borrow an extra amount without significantly increasing the interest rate charged or the internal risk factor, this is not true for the majority of firms (Evans, 1969:86-87). He observes that the importance of credit is well embedded in the classical theories. For example, an elastic credit supply was emphasised by the overinvestment theories of Cassel and Spiethoff (Evans, 1969:333). Keynes argued that if banks did not make funds available for expansion of productive capacity, the increase in investment could not take place (Evans, 1969:87). Kalecki argued that the true cost of borrowed funds to the firms increased as the debt/equity ratio increased. This he called the principle of increasing risk (Evans, 1969:87).

In deriving a marginal cost of funds (MCF) schedule Evans follows the exposition of Duesenberry (1958). Firms may finance investment in one of three ways. They make use of:

* internal financing, i.e. from either retained profits or depreciation;
* borrowings from banks or bond markets which require fixed interest payments; or
* equity financing, usually via the stock market where dividends are paid from profits, but where such dividend payments are not mandatory (Evans, 1969:87, 89).

Different costs and different risks are inherent in each method of financing. In the case of retained earnings and depreciation (i.e. internal funds) no risk applies to funds that the firm has already received. However, the business firm could lend such funds to other borrowers, usually at the market rate of interest. Should it not do so, then this loss of revenue represents an imputed cost to the firm.

When choosing between external sources of funds, firms will usually choose banks or bonds rather than shares (Evans, 1969:88). This is because equity capital is much more expensive than borrowing from banks or through the bond market. The main reason for this is that interest payments paid to banks or bondholders are tax-deductible, whereas dividend payments to shareholders are not. Yet, as has been shown, there is increasing risk attached to increased borrowing. Consequently, the true cost of borrowing will rise as more funds are borrowed. The true cost of borrowing in this case will include "... the extra imputed risk premium required to service the additional debt relative to the earnings available" (Evans, 1969:88).

Due to the differential tax treatment the cost of equity financing is more expensive than the true cost of bond financing. If a firm offers more and more of its stock on the market it will invariably depress the price of the stock and raise the yield that is paid. The gradual upward slope of the equity-financing portion of the marginal cost of funds schedule is not attributable to an imputed risk factor because the firm is under no obligation to pay dividends (Evans, 1969:89). Rather, it is attributable to the higher dividend yields that will have to be paid.

The marginal cost of funds (MCF) schedule can be derived from these considerations. In Figure 2 the lowest true cost of funds is represented by "Retained earnings and depreciation", followed by "Bank or bond financing" and finally "Equity financing". When the marginal cost of funds schedule is combined with the MEI schedule, investment is determined at the intersection of these two schedules, shown in Figure 3.

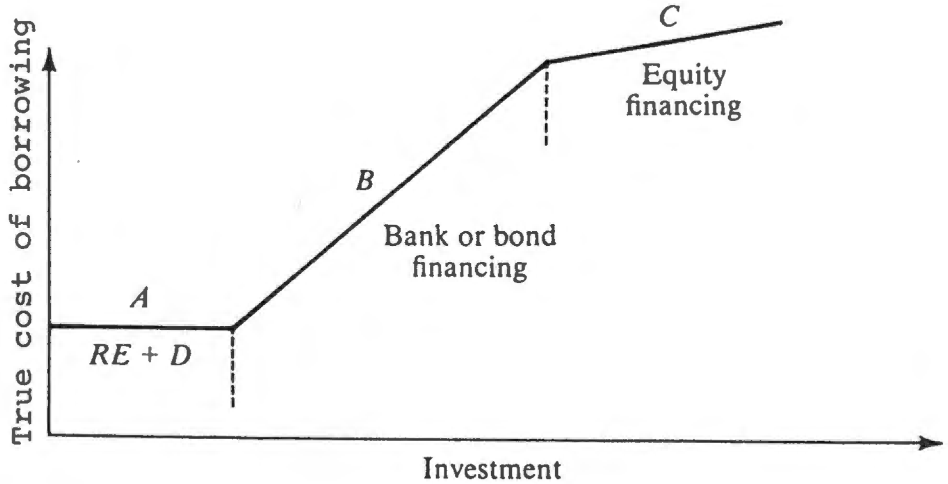
In summary, the determinants of the MEI schedule are, in the main, the capital stock and the level of output that influences the supply price of capital goods. The age of the capital stock and variability of output will also affect the position of the MEI schedule to a lesser degree (Evans, 1969:90). The determinants of the MCF schedule are:

* profits minus dividends (i.e. retained earnings);
* depreciation; and
* the market interest rate.

Duesenberry's (1958) explanation also includes the stock of debt as a determinant, yet Evans (1969:90-91) argues that subsequent empirical evidence has shown that whereas the flow of funds is an important determinant of investment, the stock of funds measured in various ways is not.

Figure 2

Marginal cost of funds schedule

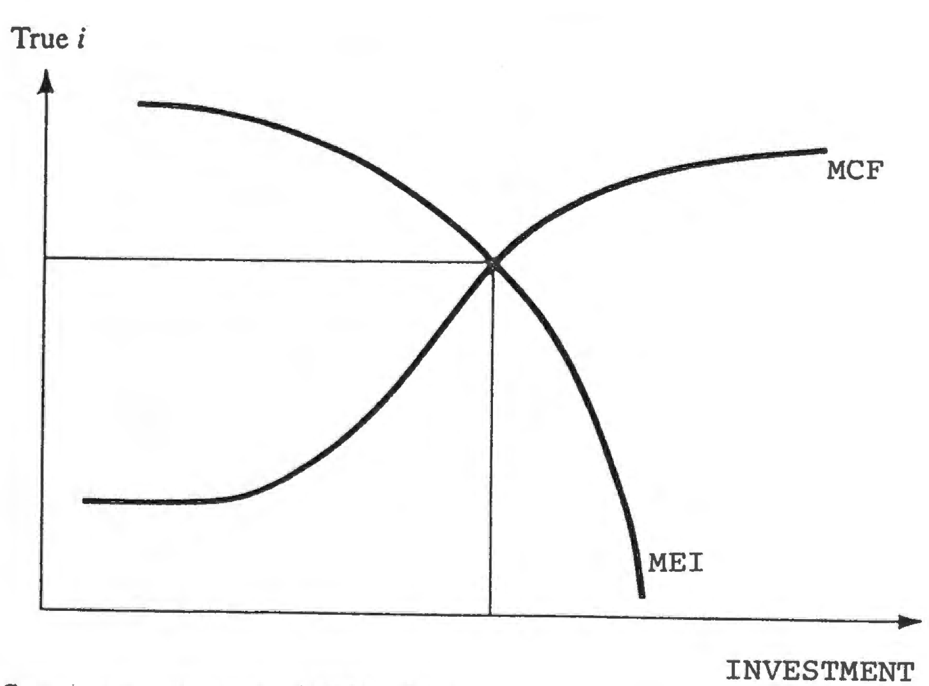


Source: Evans (1969:89)

Legend: RE + D = Retained earnings and depreciation

Figure 3

Intersection of MEI and MCF schedules
determine investment



Source: Evans (1969:90)

Legend: MEC = Marginal Efficiency of Capital
MEI = Marginal Efficiency of Investment

It is appropriate to investigate whether the intersection of the MEI and MEF schedules shift over the course of the cycle. Phrased differently, do interest rates have symmetrical effects over the business cycle? Evans (1969:91) observes that the position of the MEI schedule depends primarily on output and therefore shifts outward when output increases and shifts back when output decreases. The MEI schedule may intersect with an unchanged MCF schedule in the elastic part of the MEF schedule. Such could be the case in an economic recession when the MEI schedule has shifted back. This implies that internal funds (retained earnings and depreciation) are important determinants of investment in recessionary phases of the business cycle. It also implies that the interest rate is not an important determinant of investment in recessionary periods.

However, if the MEI schedule intersects the MCF schedule in an inelastic portion of the MCF schedule, then this would imply that the interest rate is an important determinant of investment in economic boom periods. Evans (1969:91) concludes: "Thus in a boom the interest rate would be important, whereas in a recession cash flow would be the important financial determinant of investment. This is known as the bifurcation hypothesis".

However, should profits and retained earnings (i.e. cash flow) increase in equal proportion to output, then synchronisation between output and residual funds occurs. This implies that the MEI and MCF schedules shift back in equal proportion, with the MEI schedule intersecting the MCF schedule in the inelastic portion of the MCF curve. This means that the interest rate remains an important determinant of investment, even in economic recessionary periods. Evans (1969:92-93) claims that empirical studies undertaken with realistic lag structures suggest that there is a tendency towards such synchronisation.

Nevertheless, Evans (1969:93) argues that the bifurcation hypothesis (i.e. that the interest rate is an important determinant of investment only in boom years) is a familiar phenomenon and is widely accepted in the field of economics. Briefly, the argument states that monetary policy can be used to stop a boom, but not a recession. The bifurcation hypothesis therefore considers the argument that monetary policy is ineffective in a recession. In this regard Keynes's special "liquidity trap" case can be cited, where interest rates are at an institutional minimum and cannot fall further. However, Evans (1969:93) asserts that the "liquidity trap" case has not been the experience of the postwar U.S. economy. In the current discussion of the role of the interest rate as a determinant of investment spending, this special case may be ignored. It is assumed for analytical purposes that interest rate levels can be changed by the monetary authorities.

As stated above, the empirical evidence suggests that substantial synchronisation occurs, i.e. the intersection of the MEI and MCF schedules occur in the same relative position over the entire course of the business cycle. Nevertheless, monetary policy is asymmetrical over the course of the business cycle and Evans (1969:93) proffers the following alternative explanation for this phenomenon.

Firstly, it should be acknowledged that the statement that monetary policy will not stop a recession does not express the same idea as one that states that monetary policy is ineffective in a recession. These two statements would be equivalent if monetary policy were to be used in a unilateral downward direction during recessions. For example, if interest rates were raised during a recession, it would depress investment and prolong the recession, yet monetary policy would have been effective in the sense that real economic variables had responded to changes in a monetary variable, i.e. the interest rate. Alternatively, if interest rates were lowered during a recession, investment would not be stimulated by much and the above statements would be equivalent. In this case the poor response of investment to a drop in the interest rate is attributable to the fact that the MEI schedule intersects with the MCF schedule in the inelastic portion of the MEI curve.

Quoting U.S. experience in the depression of the nineteen thirties, Evans (1969:93-94) argues that "... during recessions a fall in the interest rate will not raise investment very much, but an increase will lower it substantially. The explanation for this is to be found primarily in the shape of the MEI curve at different interest rates rather than the region of intersection of the MEI and MCF curves". It has been argued in a previous section that the MEI schedule becomes more inelastic at lower interest rates. This argument was based, in the main, on the existence of production ceilings that cause the supply price of capital goods to rise as investment increases.

It is known that gross fixed investment is always positive in recessions and even in depressions. The explanation is that not all firms are in equilibrium at any given time.

Some firms wish to raise their desired level of capital stock, despite the general decline in demand (Evans, 1969:94). For such firms a decrease in the interest rate will lead to an increase in investment. Yet there are still increasing internal adjustment costs associated with the introduction of new capital equipment. Therefore, if a firm is integrating new capital goods as rapidly as possible without incurring serious bottlenecks, then a decrease in the interest rate is unlikely to cause any further rise in the rate of investment (Evans, 1969:94).

"On the other hand, a rise in the interest rate will result in cancellation of those projects which were previously profitable" (Evans, 1969:94). Therefore, the concave slope of the MEI can be justified for recessions, as well as for economic booms. This means that if interest rates are high, the MEI and MCF schedules will intersect in a relatively elastic portion of the MEI curve; if interest rates are low, the intersection will be in a relatively inelastic portion.

"Thus even if synchronisation of the MCF and MEI does occur, we can still conclude that high interest rates will lower investment substantially, but low interest rates will raise it much less. It is not necessary to rely on the bifurcation hypothesis to explain this result" (Evans, 1969:95).

2.7 **Availability of funds**

It has been assumed up to this point that funds are always available to finance the investment spending, albeit that the cost thereof may differ for different firms. However, this assumption is not realistic as shortages of credit are often widespread and represent a further determinant of investment worth considering. This section deals with the availability of credit at any given interest rate.

Authors distinguish between the internal and external availability of funds. Shapiro (1970:268) argues that there "... is a definite preference among businessmen for internal over external financing, the interest rate apart, because of the reluctance to take on debt with the fixed interest charges and repayment schedule that such debt carries". Issuing new stock as a form of external financing also has certain undesirable features. Firstly, it may lead to a dilution or the loss of control previously exercised by a group of stockholders. Secondly, any type of external financing, such as bank and bond borrowing or new stock issues, involve the disclosure of detailed information that firms would prefer to keep confidential for competitive reasons (Shapiro, 1970:268).

These considerations lead Shapiro (1970:268-269) to conclude: "In the investment decision of many firms, the source of funds becomes as important or even more important that the cost of funds". Whilst this statement may over-emphasise the importance of the source of funds for investment, it is nevertheless true that an increase in the internally generated funds may be expected to have similar results to those of a fall in the interest rate. It has previously been shown that a drop in the level of interest rates (other factors remaining unchanged), leads to some increase in the profit-maximising capital stock and to some increase in the rate of investment spending.

The implications for policy purposes are important. If a government wishes to alleviate unemployment by stimulating investment it may do so by cutting taxes on profits or by reducing the interest rate, or implementing both possibilities simultaneously. The reduction of taxes will enlarge the flow of funds from internal sources whilst the reduction in the interest rate will stimulate investment by reducing the cost of funds from both internal and external sources (Shapiro, 1970:268-269).

Turning to funds from external sources, Evans (1969) and Shapiro (1970) emphasise the rationing and residual aspects of the availability of funds for investment purposes. Shapiro (1970:266) argues that there is some stickiness of interest rate movements in an upward and downward direction. He states that: "When loan demand exceeds the amount of funds available, banks tend, at least at first, to ration the available funds so that the loan applications of preferred clients are met in whole or in part, while those of less desirable borrowers are denied". Shapiro (1970:266) concludes from such behaviour that this is not substantially different from the situation in which supply and demand for funds are brought into balance by changes in interest rates. This finding is further evidence that a change in the interest rate is not the only factor that affects investment spending.

Evans (1969:189) observes that many writers on the housing function have recognised that housing is sensitive to credit conditions and have identified this variable as a major short-term determinant of investment in residential construction. Quoting the findings of a study by Guttentag (1961), Evans (1969:189) states that credit which home builders and home buyers receive is essentially a residual. Banks and other financial institutions also make loans for fixed investment purposes and prefer to service these business loans first. In a sense, what is left over once these business loans have been satisfied then becomes available to home builders. Evans (1969:191) observes that the availability of credit is a cyclical phenomenon and that one good cyclical measure of the tightness of credit is the spread between short-term (commercial paper) and long-term (corporate bond yield) rates. In general, short-term rates will rise relative to long-term rates during booms, signifying general tightness of credit. Short-term rates will usually fall more than long-term rates during economic recessions.

Smith, Rosen and Fallis (1988:51) state that short-run variations in housing activity in the U.S. are due to the overwhelming dependency of housing on mortgage credit, to the nature of the U.S. housing finance system that provides this mortgage credit, and finally, to the relatively high interest rate elasticity of new housing construction. Essentially, this was the conclusion that Grebler and Maisel (1963) came to in their review of previous housing studies. Smith et al. (1988:51) quote a similar study conducted by Friend (1970) which stated:

> The greater impact of monetary stringency on housing than on the rest of the economy apparently is due mainly to a capital rationing effect, resulting from deficiencies in current institutional arrangements for providing mortgage credit: and probably also to an interest rate effect, reflecting a greater interest elasticity of housing demand than of demand generally.

The authors add in a footnote that Burnham (1972) also reached the same conclusion in a review paper.

Smith et al. (1988:51) quote a study by Grebler and Burns (1982) which focused on the short cycle in housing construction which "... precedes or is coincident with the ordinary business cycle". It was found that a key economic indicator, housing starts, reacts significantly to changing capital market conditions, and also to changes in income. Often when capital markets are tightening, incomes are rising, but the capital market effect usually outweighs the effect of changes in income.

In their review of recent developments in economic models of housing markets, Smith et al. (1988:51) find that many housing studies emphasise the "... primary role of the supply of mortgage credit, and the secondary role of the price of mortgage credit, in explaining fluctuations in new residential construction activity". This suggests that the price of mortgage credit does not "clear the market", i.e. the supply of mortgage funds does not generally equal the demand for mortgage funds at the market interest rate. This disequilibrium characteristic of the mortgage market is responsible for the rationing effect, i.e. the difficulty in obtaining mortgages during periods of financial restraint. The "qualifying problem" arises. Problems are experienced by many households and builders who are not able to obtain mortgage funds at the quoted interest rate. Consequently, nonprice rationing techniques are employed to new loan applications. Examples are (Smith et al., 1988:51-52):

* lowering the loan to value ratio;
* tightening borrower income requirements;
* imposing a ceiling or loan size; and
* giving preference to larger depositors of long standing.

In summary, these arguments suggest that tightening credit conditions can have a negative effect on investment in housing in a similar manner to rising interest rates. An additional investment determinant is discussed in the next section.

2.8 Irreversibility of investment

Chirinko (1993:1905) observes that a fundamental issue in investment research is the translation of the demand for the stock of capital into a demand flow of investment. This has been implicit in the Keynesian investment model up to this point. Yet an important characteristic of the capital accumulation process that is often overlooked relates to the fact that investment is partly or fully irreversible. Researchers have in recent years examined the investment dynamics that arise from irreversible investment and the ongoing resolution that, in combination, give value to postponing investment decisions similar to a financial call option (Chirinko, 1993:1905). These factors create an opportunity cost for investing today, as opposed to postponing investment and learning more about prospective returns. Consequently, these factors can influence the benefits and costs that characterise optimal investment policy.

Pindyck (1991:1110) expands the argument by stating that one problem with existing investment models is that they ignore two important characteristics of most investment expenditures. Firstly, investment expenditures are, in the main, mostly sunk costs that cannot be recovered. As an example of such a sunk cost, Hillebrandt (1985:33) mentions a highly specific building which has no resale value. Secondly, the investment expenditure can be delayed, giving the firm an opportunity to wait for new information to arrive about prices, costs, and other market conditions before it commits resources to investment. These are the factors that will influence the income stream over the life of the capital good and thereby help to determine the marginal efficiency of capital (Pindyck, 1991:1110). Therefore, the ability to delay an irreversible investment expenditure can profoundly affect the decision to invest.

Furthermore, he claims that it also undermines the theoretical foundation of standard neoclassical investment models, and invalidates the traditional net present value rule which states: "Invest in a project when the present value of its expected cash flows is as least as large as its purchase and installation cost" (Pindyck,1991:1110). (By including the installation cost in this definition of the net present value rule, allowance is made for the adjustment costs discussed in Section 2.3.) A modification is required to the traditional net present value rule by virtue of the irreversibility of investment.

Pindyck (1991:1111-1112) argues that an irreversible investment opportunity is much like a financial call option. Firms obtain valuable investment opportunities (or options) by virtue of their ownership of land, natural resources, or patents, together with their firm's managerial resources, technological knowledge, reputation, market position and possible scale. These attributes enable the particular firm to undertake investment expenditures that individuals or other firms cannot undertake. It is important to realise that these options are valuable. They are valuable, in part, because the future value of the asset obtained by investing is uncertain. Should the asset rise in value, the net payoff from investing rises.

If it falls in value, the firm need not invest, and will, by waiting, only lose what the firm spent to obtain the investment opportunity.

However, when a firm actually makes an irreversible investment expenditure, it exercises its option to invest. In doing so, it gives up the possibility of waiting for new information to arrive that might affect the desirability or timing of the expenditure. The firm cannot disinvest should market conditions change adversely. Pindyck (1991:1112) claims that this lost option value is an opportunity cost that must be included as part of the cost of the investment. He concludes that the net present value rule must be modified in such a way that the value of the unit of capital must exceed the purchase and installation cost, by an amount equal to the value of keeping the investment option alive.

Pindyck (1991:1112) argues that studies have shown that this opportunity cost of investing can be substantial, and investment rules that ignore it can be grossly in error. Furthermore, " ... this opportunity cost is highly sensitive to uncertainty over the future value of the project, so that changing economic conditions that affect the perceived riskiness of future cash flows can have a large impact on investment spending, larger than, say, a change in interest rates" (Pindyck, 1991:1112).

Irreversibility may therefore have important implications for an understanding of aggregate investment behaviour. It has been shown that irreversibility of investment is particularly sensitive to various forms of risk, such as uncertainty over future product prices, or rentals in the case of buildings erected for commercial gain. Also, operating costs that determine cash flows are subject to risk. Finally, uncertainty over future levels of interest rates, and uncertainty over the cost and timing of the investment itself, can affect investment decisions adversely (Pindyck, 1991:1110).

Irreversibility may therefore also have macroeconomic policy implications. Should the objective of macroeconomic policy be to stimulate investment, stability and credibility could be much more important for policy purposes than tax incentives or reductions in interest rates (Pindyck, 1991:1110-1111).

Pindyck (1991:1112) concludes that "... given the importance of risk, policies that stabilise prices or exchange rates may be particularly effective ways of stimulating investment. Similarly, a major cost of political and economic instability may be its depressing effect on investment".

He argues that this finding is likely to be of particular importance for the developing economies. For many developing countries investment as a fraction of gross domestic product has fallen dramatically during the nineteen eighties (Pindyck, 1991:1141). This has also been the experience in South Africa.

It will be shown in Chapter 4 that South Africa had a very poor investment performance during the eighties, especially so in the case of buildings and other construction works. In addition to prevailing political and economic instability, the country experienced pronounced interest rate and exchange rate volatility during the eighties. It is clear that if the country wants to improve its investment performance by stimulating economic growth, then a return to stable macroeconomic policies and fiscal discipline is a prerequisite.

In evaluating Pindyck's arguments it should be kept in mind that buildings are merely "casings" (Hillebrandt, 1985:62) or shells within which certain economic processes are undertaken. Bon (1989:36-37) argues in favour of the different uses of buildings which improve their chances of convertibility. Therefore, ignoring the case of highly specific buildings, one can conclude that the irreversibility of investment plays a less important role in investment in buildings than, for example, in the case of other capital goods which are highly specific, e.g. a steel mill which can only produce steel. Despite this general conclusion, there is little doubt that Pindyck's arguments in favour of political and economic stability are soundly based, and relevant to the South African situation.

2.9 **Jorgenson's neoclassical investment theory**

The analysis of the investment gap that exists between the actual and desired stock of capital is, in essence, one of comparative statics. Jorgenson (1963, 1967, 1971) proposed an alternative analysis based on comparative dynamics. His investment theory has been reviewed by Du Toit (1975) and Chirinko (1993). Econometric studies undertaken by

Jorgenson focused on the U.S. manufacturing industry (Evans, 1969: 145-147) and are therefore less relevant for purposes dealing with investment in buildings. Nevertheless, a brief review is appropriate as the major finding, viz. that investment depends on output, is also relevant in the case of investment in buildings.

In explaining the neoclassical framework, Jorgenson (1967:212-213) argues that: "Reduced to its barest essentials, the theory requires only that capital accumulation be based on the objective of maximising the utility of a stream of consumption". He states that "...the firm maximises the utility of a consumption stream subject to a production function relating to the flow of output to flows of labour and capital services" (Jorgenson, 1967:213). This problem of maximising utility is solved in two stages. Firstly, a production plan is chosen so as to maximise the present value of the productive enterprise. Secondly, consumption is allocated over time so as to maximise utility, subject to the present value of the firm. It is noteworthy that this investment behavioural theory involves more than just the maximisation of profit (Du Toit, 1975:79). Jorgenson (1963:247) observes that: "The central feature of the neoclassical theory is the response of the demand for capital to changes in relative factor prices or the ratio of factor prices to the price of output".

He argues that the demand for investment goods in the complete neoclassical model of optimal capital accumulation depends on "... the change in the demand for capital with respect to a change in the implicit price of capital services, the time rate of change in the price of capital services, and the level of replacement demand" (Jorgenson, 1963:227).

Du Toit (1975:63-64) and Chirinko (1993:1878-1881) have identified a number of assumptions on which Jorgenson's investment theory is based. These are:

* complete knowledge of the future;
* input and output prices are taken as exogenously determined, i.e. the business firm is a price taker;
* capital stock can be adjusted immediately, i.e. no adjustment costs are assumed;
* perfect capital markets exist;
* the capital stock is always fully utilised;
* a perfect market exists for used capital goods;

* labour and capital are assumed to be homogenous inputs which produce a homogenous output (production), therefore, it matters not whether the firm purchases or rents its capital goods;
* the assumption of the maximisation of the present value implies that the business firm is not interested in the "time profile" of profits;
* the analysis does not allow for discrete changes in variables;
* vintage effects (i.e. the age of capital stock, whether the capital equipment is new or old) are absent; and
* capital depreciates at a geometric rate.

Chirinko (1993:1878) provides a refined version of the neoclassical investment model and argues that by maintaining that the production function has a constant elasticity of substitution between capital and variable inputs, then the relationship between desired stock of capital, the level of output and the user cost (or rental price) of capital will depend on:

* output;
* a distribution parameter applicable to output;
* the purchase price of new capital (relative to the price of output);
* the real financial cost of capital, net of taxes;
* the geometric rate of capital depreciation;
* the rate of the investment tax credit (applicable to U.S. firms);
* the discounted value of tax depreciation allowances; and
* the rate of business income taxation.

It is noteworthy that this relationship emphasises the dependence of the desired capital stock on a quantity variable, output, and a set of price variables that are combined in the user cost of capital. The refined neoclassical model of investment is obtained by dividing total investment into net and replacement components. Allowance is made for a delivery lag distribution for new investment, geometric depreciation of capital, together with the assumption that replacement investment is proportional to capital stock at the beginning of the period. Finally, a stochastic error is appended (Chirinko, 1993:1878).

Du Toit (1975:77) observes that criticism of this investment theory has been focused on some of the assumptions. For example, uncertainty is a crucial factor in investment decisions, yet the neoclassical theory assumes perfect knowledge of the future. Secondly, it has been shown that the cost of funds in an important determinant of investment spending, yet in this model only the interest rate is assumed to reflect the cost of obtaining additional capital. Thirdly, Du Toit (1975:79) quotes Ackley (1961:476) who argues that the behaviour of managers of firms is not always economically purposeful, but can be based on hunch, whim, prejudice, rules of thumb, or other noneconomic factors.

In his evaluation of the neoclassical investment model Chirinko (1991:1879) identifies a number of specific problems. Firstly, the profit-maximising firm chooses the capital stock, other factors of production, and output simultaneously. Secondly, the optimal capital stock is derived by assuming that the delivery of capital goods occurs immediately, yet that net investment is based on a delivery lag distribution. Thirdly, returns to scale are assumed to be constant, instead of exhibiting decreasing returns to scale in the production technology. Fourthly, vintage effects may matter if new capital can not readily be combined with existing capital. Fifthly, the validity of constant geometric depreciation of capital can be questioned. Finally, the value of the elasticity of substitution (assumed to be unity by Jorgenson) has generated significant controversy, as has the neoclassical treatment of expectations and the relative importance of prices, quantities and autonomous shocks as determinants of investment spending (Chirinko, 1993:1879-1880).

Despite these criticisms, and after a thorough review of the literature on investment, Chirinko (1993:1898) concludes that when regarding the determinants of investment "... the weight of the evidence clearly points to a **modest response of investment to prices and a much greater response to output**" (emphasis added).

In summarising, it has been shown that in the Keynesian investment model the central role is played by the marginal efficiency of capital. In the neoclassical investment model this argument is extended and relates investment changes to output changes that are constrained by a production function incorporating labour and capital.

It is appropriate to recall that the previous sections of this chapter have been concerned primarily with the role of the interest rate, the cost of funds, the availability of funds and the irreversibility of investment. The neoclassical model is concerned primarily with changes in output. It can be concluded that there are numerous factors that determine the level of investment. To gain perspective Shapiro (1970:224) observes that "... there is virtual unanimity of opinion that shifts in the schedule are much more important in explaining the observed changes in investment expenditures than are the movements along a given schedule that result from changes in the interest rate". With the exception of Jorgenson's neoclassical model which emphasises output changes, the discussion on the determinants of investment has, in the main, centered on shifts along the investment schedule which depend on the elasticity of the schedule. In the following sections discussion will focus on four factors that contribute to shifts in the investment schedule itself. These are (Shapiro, 1970:224):

* the level of income and output;
* changes in the level of income and output;
* expectations; and
* technological change and innovation.

2.10 **Determinants of investment that influence the shifts in the MEC schedule**

2.10.1 **The level of income and output**

A distinction can be made between autonomous and induced investment. Autonomous investment is independent of the level of income, whereas induced investment is dependent on the level of income. The latter form of investment increases as the level of income rises (Shapiro, 1970:240-241).

Profits (Kuh, 1963:262-263) enter the picture as it is reasonable to assume that profits increase as output expands and income rises. Therefore, the higher the level of aggregate income, the higher aggregate profits will tend to be. Higher current profits may create expectations of a continuation of present levels or even a rise in aggregate profits in the future. Given the higher level of profits and the expectations of more to come, business people may desire a rise in the profit-maximising capital stock. This will cause a shift in the

MEC schedule to the right, i.e. for a given capital stock, the marginal efficiency of capital will be raised. This implies an increase in investment spending, as well as aggregate income. The growth in income will depend on the value of the multiplier (Shapiro, 1970:247).

A second reason is related to previous arguments proffered in the section dealing with the cost of funds. Higher profits also lead to higher levels of depreciation and retained earnings. Such increased internal sources of funding can stimulate investment spending as firms definitely prefer internal funding to external funding (Evans, 1969:88; Kuh, 1963:263; Shapiro, 1970:268).

A third factor sometimes advanced in support of a direct relationship between the level of income and investment spending is related to the size of the capital stock required to produce any given level of output. If a stable price level is assumed, a higher income level implies a proportionately higher level of output. If it is also assumed that technology is constant in the short term, then it follows that a larger capital stock is required to produce the higher level of output. A higher level of profit-maximising capital stock can only be achieved by net investment (Shapiro, 1969:248). Therefore, net investment depends positively on output and inversely on the initially available stock of capital (Zarnowitz, 1985:540).

Shapiro (1969:249) argues that to the extent that the rate of investment spending is linked to the absolute level of income, it is investment undertaken primarily for replacement, modernisation or cost-cutting purposes, rather than for outright expansion of capacity. This has relevance for investment in buildings as an example of long-lived assets, because "... the more durable the newly acquired capital equipment is, the more distant will be the time when gross investment will be pushed outward by the need to replace this additional portion of the capital stock" (Shapiro, 1970:248).

Eisner and Strotz (1963:125) are sceptical of the role of profits as a determinant of investment. They argue that in a time of credit restrictions certain very profitable firms may be allocated funds for investment, whilst others may be excluded from obtaining finance, merely because current profits may be low. Financiers might be hesitant to lend capital to firms in the latter group. In such cases the level of profits would primarily determine which firms will be able to invest. However, this would not provide reliable information about the aggregate effects on investment of a change in aggregate profits. Despite this scepticism, Du Toit (1975:166) concludes that sufficient evidence exists to acknowledge that the flow of profits is an important determinant of investment.

In summary, important factors that determine investment are to be found in the level of output and profits. Shapiro (1970:248) quotes Meyer and Kuh (1957) in a footnote who conclude that "... while profits may be the proximate cause of investment, their dependence on the output level really means that output ultimately determines investment levels".

2.10.2 **Changes in the level of income and output**

Changes in output give rise to the acceleration principle. In defining this principle, Knox (1966:120) states: "In its simplest form the acceleration principle postulates that an increase in the rate of growth of output is accompanied simultaneously by a rise in net investment". However, Evans (1969:80-86) shows that qualifications of the "naive accelerator" give rise to another form of the accelerator, the "flexible accelerator" principle. In this model, current investment equals some fraction of the gap between the desired and the actual capital stock (Zarnowitz, 1985:539). These qualifications relate to the existence of excess capacity in the economy, lags between ordering and actual delivery, uncertainty over output levels during any given year and replacement investment (Evans, 1969:81-82). Eisner (1963:240) put forward a "permanent acceleration hypothesis" which implies that firms will invest to the extent that they believe increases in demand to be permanent. In support of this approach, Birch and Siebert (1976:17) argue that the entrepreneur will only decide to change the capital stock once demand has changed permanently. Such a decision may take several periods of observation. Much empirical research has been generated during the past century on the economic effects of the acceleration principle. One example, the Jorgenson investment model, has been discussed in a previous section.

The durability of capital goods plays a major role in the acceleration principle. The demand for buildings, as an example of a long-lived capital asset, and the acceleration principle are therefore closely linked. This relationship is investigated in Section 3.3.1 in which a detailed worked example is given (Hillebrandt, 1985:60-63). Therefore, this issue will not be pursued at this point.

2.10.3 Technological changes and innovations

A distinction can be drawn between technological change and innovation. A technological change is usually defined as a change that results in a shift in the production function (Shapiro, 1970:230). It is concerned with the relationship between physical qualities of inputs and physical qualities of output. The traditional input factors are land, labour and capital. Normally, technological change is associated with greater output with unchanged input, or unchanged production of output with less input. Zarnowitz (1985:533) observes that Schumpeter (1939) saw economic growth itself as a cyclical process, reflecting technological progress and spurts of innovations. These innovations would give rise to opportunities for new, profitable investment. The temporary exhaustion of such opportunities would lead to reduced levels of investment. Innovations usually follow inventions, e.g. steam engines gave rise to railways, jet engines to supersonic flight, rocket engines to space flight, etc.

Technological change can be either (Shapiro, 1969:232):

* capital-using and labour-saving;
* capital-saving and labour-using; or
* capital-saving and labour-saving.

Assuming that an unchanged level of output is produced, then those technologies that are capital-using and labour-saving will tend to shift the MEC schedule upward, thereby raising the rate of net investment. Technologies that are capital-saving and labour-using, as well as those that are capital-saving and labour-saving will tend to shift the MEC schedule downward, thereby reducing the rate of investment spending (Shapiro, 1969:232-233).

Eisner and Strotz (1963) argue that because technological advance can be expected to result in a reduction of cost and expansion of industry output, there is no certainty that it will lead to an increase in the amount of capital devoted to the industry (quoted in Shapiro, 1969:234-235). Consequently, the lack of any rigid link between technological progress and the stock of capital also rules out a fixed, direct tie between technological progress and the rate of investment. Shapiro (1969:234) argues that because production of output in the U.S. has grown more rapidly than either labour or capital input, it would appear as if technological progress has, in the long run, reduced both the capital-output ratio and the labour-output ratio. Phrased differently, this implies that technological change in the U.S. economy has been both capital-saving and labour-saving.

A number of examples can be given that illustrate the effects of capital-saving technology in the case of buildings. During the post-war period the development of new construction materials and new construction techniques made possible "thin-walled" office buildings. Such buildings call for smaller capital input per unit of output (in this case square metres of lettable floor space) with no apparent sacrifice in durability (Shapiro, 1970:233). Hillebrandt (1985:62-63) argues that technological change may induce requirements for new buildings for replacement. For example, improved atmospheric conditions required in cotton manufacturing may need new types of factory buildings. Certain large computers require a fully controlled atmosphere and special buildings to house them. Double-glazing in modern buildings can improve their thermal qualities and so generate savings in energy costs.

Whereas capital-saving technology changes can have a dampening effect on investment spending, innovation can have a strongly positive effect on investment by shifting the MEC schedule upward.

Mensch (1979) demonstrates that throughout the past 200 years the pace of technological innovation has systematically varied. This happens because, as Schumpeter specified, the rate at which inventions become innovations is subject to "the wagon train effect". Inventions may and do occur at about any time, but innovations occur in bunches within a short period of time, causing the rise of new processes, products and industries. Mensch (1979) has traced this development process for hundreds of innovations and shows that there is great regularity in the way this happens.

Graham and Senge (1980) have investigated the long-wave hypothesis. They show that during an economic growth phase, demand is imposed on the capital goods sector. At the peak of the cycle a labour shortage encourages capital intensive production, putting even greater pressure on the capital goods industries. With rising capital costs there is a relative reduction in the cost of labour. This diminishes the need for new capital goods. A "rapid collapse" of the capital goods sector follows and then physical depreciation of capital goods sets a lower limit to the production of capital goods.

Their view of cyclical fluctuations corresponds with those of the real business cycle theorists, such as Long and Plosser (1983) and Prescott (1986). According to Mankiw (1990:1653), the real business cycle theorists assume that there are large random fluctuations in the rate of technological change. This theory argues that the business cycle is the natural and efficient response of the economy to changes in the available production technology. Many real business cycle models explain recessions as periods of technological regress, i.e. declines in society's technological ability. Mankiw (1990:1653) argues, instead, that it is a more common presumption that technological progress occurs gradually.

In summary, technological change can lead to capital-saving production techniques. In contrast, innovation in new technology requires growth in the capital stock that stimulates new investment. Shapiro (1970:235) asserts that "innovational genius" has, in the long run, by far overshadowed the capital-saving effects on investment. Innovation therefore emerges as an important determinant that shifts the MEC schedule upward, thereby raising the rate of investment spending.

2.10.4 **Expectations**

Smit (1982) has analysed the psychological theories of the business cycle. He observes that John Stuart Mill (1909) postulated that business people act in accordance with their expectations of profit. When expectations arise that the price of some commodity is likely to increase, from an extra demand, a short crop or import restrictions, then there is a tendency among dealers to profit from such an event by resorting to inventory investment of that commodity. Speculators may be attracted if the price rise is seen to be sustainable. This disposition among people in business tends in itself to produce the effect on prices and demand which were originally anticipated (Smit, 1982:27).

This illustration shows that business people's expectations of future profits can have real economic effects. Critics of psychological causes of the business cycle claim that the improvement in expectations was preceded by one or more changes in real economic variables. Nevertheless, there is a tendency for "... moderate optimism warranted by the facts to blossom into unwarranted and unrestrained optimism" (Shapiro, 1970:227). As optimism spreads and more and more firms act on these expectations, the resultant increased expenditures for new plant and equipment, together with an increased demand for lettable space (buildings), produce the very results expected. That the subsequent economic downturn may give rise to exaggerated pessimism is considered by few participants in the economy.

Shapiro's (1970:227) description of events plainly assigns great importance to changes in expectations in investment determination. It also has important policy implications. De Kock (1975:1-2) emphasised the dangers inherent in the inadequate awareness of the business cycle phenomenon. He argued that:

> One has the impression that in taking their economic decisions, many businessmen, financiers, investors and others in the private sector at times tend to give insufficient weight to cyclical considerations. During cyclical upswings, for example, they sometimes tend to act as if boom conditions, with all the accompanying stresses and strains, have come to stay, and during cyclical downswings as if recessionary conditions have become more or less permanent. And in framing monetary, fiscal and other economic policies, the authorities constantly have to guard against making the same mistake (De Kock, 1975:1-2).

Expectations, and their role in shaping economic behaviour, are of particular relevance for this study, because the leading indicator that is developed in this investigation is based, in part, on a number of business survey variables. Many of these expectational variables are aimed at determining the anticipations of business people. Jöhr (1978), one of the modern exponents of the psychological business cycle theories, postulates that socio-psychological infection is a key factor in the explanation of business cycles. Socio-psychological infection is seen as the process whereby business information is diffused and strengthened by interaction between economic participants. Jöhr (1978) sees the business cycle as a self-strengthening process of expansion and contraction based on monetary factors, the acceleration principle, monopolistic market structures and the specific psychological characteristics of business people and consumers (quoted in Smit, 1982:33-35). The link between the psychological business cycle theories and the opinion survey method comes about because the survey method is designed to determine business sentiment at a particular point (Smit, 1982:35). Chapters 5 and 6 of this study are devoted to a discussion of the business survey method employed to capture the expectations of people in business. These issues will therefore be pursued at that point.

An influential theory regarding the formation of rational expectations developed in the mid 1970's when Lucas (1976) published his critique of the prevailing practice for quantifying the effects of alternative policies. He argues that, in formulating plans, economic agents necessarily look into the future. The decision rules guiding their actions depend on parameters describing their expectations of future variables, as well as parameters of taste and technology (Chirinko, 1993:1899). In particular, the decisions that determine most macroeconomic variables, such as consumption and investment, depend crucially on expectations of the future course of the economy (Mankiw, 1990:1647). Lucas (1976) pointed out that most policy interventions change the way individuals form expectations about the future. In a nutshell, people learn from their mistakes. Therefore, economic agents would anticipate the outcome of specific policies of government and adjust their behaviour in such a way as to negate the policy action.

Mankiw (1990:1651) provides two examples of how government action may affect investment behaviour. Firstly, the government may announce that it will not tax capital in order to encourage accumulation of capital and induce investment. However, once the capital is in place, the government may be tempted to renege on its promise because the taxation of existing capital is nondistortionary. Secondly, the government may announce that it will give a temporary monopoly to inventors of new products to encourage innovation. However, once the product has been invented, the government may be tempted to revoke the patent to eliminate the distortion of monopoly pricing. In each case rational agents understand the incentive for the government to renege, and this expectation can affect their investment behaviour. Mankiw (1990:1651) concludes that the solution is to remove the government's discretionary power by binding it to a fixed policy rule.

Davidson (1982/83:183) criticizes the rational expectations hypothesis by arguing that the hypothesis assumes ergodic behaviour (i.e. behaviour which can be replicated in future). Yet Hicks (1979) and Shackle (1955) have cogently argued that real world situations are unlikely to be replicated (i.e. are nonergodic). Davidson (1982/83:195) argues that:

> From a strictly logical standpoint, all important economic choices where the outcome lies in the future and where circumstances can never be completely replicated over historical time are crucial. Any economic deed which once undertaken cannot be undone without significant (capital) costs must mean that the initial circumstances in all its relevant attributes cannot be replicated. The choice to undertake such actions therefore may alter the existing probability structure in unpredictable ways. From the standpoint of an individual's subjective distribution function, therefore, cruciality, like beauty, is in the eye of the beholder. If agents believe their investment, production, and (at least) big ticket consumption decisions marry them to their choices, then this behaviour need not conform to the REH (rational expectations hypothesis).

On policy matters Davidson (1982/83:197) proposes that if "... nonergodicity is a prevalent property in many economic situations, then ... (the) governmental role is to develop, where possible, adaptable economic institutions which attempt to reduce uncertainties by controlling the economic environment so as to limit future time outcomes to those that are closely compatible with full employment and reasonable price stability".

He finds support in this view from Pindyck (1991:1141) who states, with reference to macroeconomic policies in less developed countries that "It is therefore important to understand how investment might depend on risk factors that are at least partly under government control, for example, price, wage and exchange rate stability, the threat of price controls or expropriation, and changes in trade regimes". Pindyck (1991:1141) also argues in favour of interest rate stability and credibility of government's macroeconomic policies in order to stimulate investment. These issues were discussed in Section 2.8.

It falls outside the scope of this study to debate the merits and demerits of the rational expectations hypothesis. Nevertheless, it is appropriate to mention that this development had a profound effect on econometric model building and economic thought. Mankiw (1990:1658) puts it succinctly: "Although some economists still doubt that expectations are rational, and despite the mixed evidence from surveys of expectations, the axiom of rational expectations is as firmly established in economic methodology as the axioms that firms maximise profit and households maximise utility".

In summarising, it has been shown that expectations of business people can have real economic effects. Expectations of profits can therefore lead to an upward shift in the MEC schedule and to an increase in the rate of investment. If it is assumed that business people act in accordance with their expectations (rational or otherwise) and allowance is made for the time lag between anticipation and implementation of business plans, then it is clear that business surveys (that capture information on business people's expectations) can play a meaningful role in forecasting. Empirical studies have shown that anticipations data can be successfully used as leading indicators.

2.11 **Other determinants of investment**

In the previous sections of this chapter the focus was on shifts along the MEC schedule and shifts in the MEC schedule itself. It was shown that investment is derived from changes in the profit-maximising capital stock. Many factors have been considered and no claim is made that these factors are all equally important or that they represent an exhaustive list. Yet those that were discussed are relevant in the context of this study. This section deals with other determinants not explicitly dealt with up to this point. These relate to the role of government, especially taxes, and the market structure (i.e. oligopolistic, monopolistic or competitive markets).

2.11.1 **The role of government**

The role of government can be discussed with reference to its monetary and fiscal policy or direct intervention in the investment process. A discussion of the effectiveness of monetary policy of government falls outside the scope of this study. Nevertheless, it is appropriate to mention that the level of interest rates and the availability of finance can be manipulated by the monetary authorities. The effects that these measures may have on the determination of interest rates and the availability of funds, and hence, on the level of investment, have been considered in previous sections of this chapter. In this sub-section the emphasis is on the role of fiscal policy and, especially, taxes as determinants of investment.

Government can influence investment decisions in a number of ways:

* directly, through its anti-cyclical fiscal policies, i.e. expansion of its own investment programme in times of recession and curtailment in times of economic boom;
* indirectly, through depreciation allowances applicable to capital goods;
* indirectly, through investment tax credits that are designed to stimulate private sector investment;
* indirectly, through reducing depreciable lives of capital goods; and
* indirectly, through income tax rates applicable to corporations.

The justification for **public works programmes** can be traced back to the Great Depression of the nineteen thirties and the acknowledgement of the key role government can play in times of severe unemployment. This realisation came about as a result of the short-term analysis of Keynes (1936). These aspects are discussed in somewhat greater detail in Section 3.3.3.4.1 where anti-cyclical government expenditure is considered in terms of its effect on buildings. Therefore, it remains to focus on the impact that tax policies can have on investment spending.

Depreciation allowances reduce taxable income payable by corporations and thereby boost profits (Stevens, 1992:184). The role of profits has been discussed in Section 2.6 that deals with the cost of funds. It was shown that retained earnings and depreciation provide an internal source of funds for financing investment expenditures. Therefore, to the extent that investment is funded from profits, to that extent will tax depreciation allowances influence investment spending. An implicit approach is followed in the neoclassical investment model discussed in Section 2.9. In this formulation the discounted value of tax depreciation allowances enters the neoclassical model via the user cost of capital (Chirinko, 1993:1878). By reducing the user cost of capital, a movement along the MEC schedule is generated, thereby raising investment spending via the expansion of the profit-maximising capital stock.

An **investment tax credit** introduced in the U.S. during 1962 permitted firms to deduct 7% of their total current investment outlays on equipment (Eckstein, 1967:86-87). It proved to be a particularly powerful incentive for stimulating investment (Evans, 1969:536). In terms of earlier analysis, the reduction in the user cost of capital would cause a shift along the

MEC schedule (Chirinko, 1993:1878).

Aaron and Pechman (1981:6) argue that a reduction of the **depreciable lives**, together with changes in tax rates and tax credits, have a sizable effect on investment through their impact on the user cost of credit. By shortening the depreciable life of a capital good, internal funds are boosted because the depreciation allowance is greater. In terms of earlier analysis this implies a shift along the MEC schedule.

Income tax rates on corporations can influence investment to the extent that retained earnings will be affected. This will affect the amount of internal funds available for investment spending by influencing the user cost of capital (Chirinko, 1993:1878). For example, should corporate income tax rates be reduced, then the user cost of capital will also decrease, leading to an increase in the rate of investment spending. Stevens (1992:184) shows that the same effects (i.e. increased income) can be expected in the case of a reduction in capital gains tax. However, reductions in a sales tax, an excise tax and a property tax, will reduce **costs**. To the extent that this lowers the user cost of capital, to that extent will it raise investment spending (Chirinko, 1993:1878). A value added tax that follows the "consumption variant", i.e. allows the full tax content of the capital purchase as a tax credit, will stimulate investment (Tait, 1972:86).

2.11.2 **The influence of market structures**

In the neoclassical model perfect capital and goods markets are assumed. Markets adjust automatically in a system of general equilibrium. However, Austin (1980:75, 83), Gordon (1978:23, 40-44) and Mankiw (1990:1657-1658) have shown that imperfect competition models may be more applicable in real world situations.

Shapiro (1970:229) argues that misplaced expectations have become a less important factor in the fluctuations in investment spending as a result of the continuing tendency toward greater concentration in more and more industries. He states that massive errors of overexpansion and overcontraction are more likely to occur in industries where hundreds of small firms operate than in industries dominated by a few large corporations. In cases where there are only a few big participants in an industry, Shapiro (1970:229) says, each firm is in a better position to study its market objectively and is better equipped to discover what each of its few competitors is doing. He argues that in industries where there are a large number of firms, there is a tendency for each to expand to satisfy an increase in demand, irrespective of the competitive behaviour of other firms. It would seem to be more economically efficient if the increase in demand were to be met by the expansion of only a few of their number.

In industries where there is a tendency towards economic concentration and only a small number of large firms dominate the industry, it is likely that each firm will have secured a substantial market share for itself. This means that investment expenditure will be planned on the basis of the long-run growth potential of the industry. Such informed investment behaviour is likely to be less susceptible to waves of optimistic or pessimistic expectations that may accompany economic booms and recessions (Shapiro, 1969:229).

This argument suggests that the more concentrated the industry, the more investment will be affected by economic factors particular to a specific industry. For example, in an extreme situation where a monopolist dominates a particular industry, the nature of investment undertaken by the monopolist can be expected to be "lumpy" (Pindyck, 1991:1139). This implies that to meet growing demand, the monopolist will not invest on an incremental basis. Capacity additions will then be large and, possibly, infrequent, depending on the rate of growth in the demand for the monopolist's product. Such lumpy investment expenditure can result from the technological constraints of the production function or from the desire to obtain scale economies. For instance, it is clear that one half of a steel mill will serve no purpose. Similarly, a 400-room hotel usually costs proportionately less to build and operate than two 200- room hotels. This argument suggests that firms must decide carefully when to add capacity, and how large an addition to make (Pindyck, 1991:1139).

The issue of economic concentration in the South African setting has been studied by Du Plessis (1978), Fourie and Smit (1989), Fourie and Smith (1993) and Leach (1992a; 1992b). Policy options were considered by Fourie (1993). The most relevant finding for this study is the conclusion Du Plessis (1978:267-268) came to. He found that in South Africa the manufacturing, wholesale, retail and construction industries are almost similarly concentrated in terms of a Lorenz curve which is a relative measure of concentration. However, in terms of the absolute number of firms, construction is the most concentrated, followed by manufacturing, wholesale and retail, respectively. The data indicate that 10% of the largest firms control almost 75% of turnover in construction. This implies a high level of economic concentration (Du Plessis, 1978:268).

Kilian and Snyman (1985b:28) argue that price control has contributed to the emergence of an oligopolistic market structure in the building materials manufacturing market in South Africa. Price control on building materials was introduced after the Korean War in the early nineteen fifties and abolished in the early nineteen eighties. The existence of price control had the effect that weaker firms were taken over by stronger competitors in times of adverse trading conditions. Despite the abolition of price control, the building materials manufacturing market remains highly concentrated. For instance, only three cement companies exist that distribute their product in terms of a market-sharing cartel; one large glass manufacturing plant supplies sufficient float glass to meet local building requirements; one large brickmaker dominates the face brick market. Various barriers to entry exist, e.g. there is effective import tariff protection (Fourie and Smith, 1992:118, 125), and large and expensive capital-intensive industrial plants are required. These barriers to entry inhibit competition in the market place.

In summary, it can be concluded that the existence of an oligopolistic or a monopolistic market structure can influence the pattern of investment in a particular industry. Investment in highly concentrated industries will tend to be lumpy. The construction industry and the building materials manufacturing sector are both highly concentrated in South Africa.

2.11.3 The relationship between the price of new assets and existing assets (Tobin's Q model)

Keynes (1936:151) foresaw that a new business will not attract investors if a similar existing one can be acquired on the stock exchange at lower costs. Zarnowitz (1985:535) observes that this insight gave rise to an influential theory of Tobin (1969) which makes investment in new plant and equipment an increasing function of Q, the ratio of the value placed by the security markets on the existing firm to the replacement cost of its capital. A more general definition of Q is given by Chirinko (1993:1888). He defines Q as the ratio of the financial value of the firm to the replacement cost of its existing capital stock. This implies that the concept of value need not necessarily be linked to the security markets. In the case of housing, as shall shortly be shown, it is homeowners who make these value judgements.

Zarnowitz (1985:535) mentions a number of the advantages of the Q model of investment. Firstly, it is relatively simple. Secondly, it uses observable variables. Thirdly, it provides an analytically attractive linkage between investment and the expectations of the financial assets markets. Finally, it implicitly relates the expected profit rate to the required rate of return on capital in the stock market and, hence, to the interest rate. However, Zarnowitz (1985:536) states that the hypothesis has not fared well in empirical tests. This can be explained partly because of the use of average Q, instead of the theoretically more appropriate marginal Q. Furthermore, simplifying restrictions are used in this work. These are the assumptions of homogenous capital and perfect financial markets with no liquidity constraints on firms. Finally, these idealisations certainly clash with the Keynesian views of the instability of financial markets (Zarnowitz, 1985:536). Chirinko (1993:1889) adds that investor sentiment creates a problem for Q models insofar as investment decisions are based on fundamentals. Consensus does not exist on the extent to which firms should react to investor sentiment when making investment decisions (Chirinko, 1993:1889).

Kantor (1990) provides a perspective on investment spending in South Africa with particular emphasis on housing. He finds that Q does rather well in predicting the level of real house building activity during the period 1977 to 1985. In the period 1986 to 1989 the value of Q drops whilst the level of house building activity rises. He notes that real activity levels rose despite the fact that house prices have failed to keep up with home building costs, but offers no explanation for such an occurrence (Kantor, 1990:7-8).

In this comparison Kantor (1990) implicitly assumes home building costs to be a proxy for new house prices. The Q value is then derived in the following manner:

$$Q = \frac{\text{home building costs (prices of new houses)}}{\text{prices of existing houses}}$$

Zarnowitz (1985:535) has argued that investment is an increasing function of Q. Therefore, if Q rises, investment should rise. In the period 1986 to 1989 investment rose, yet Q dropped (i.e. the denominator did not rise as much as the numerator). One must conclude that another factor(s) must have contributed to this divergent behaviour. Kantor (1990:8) seems to be unaware of the strong positive effects that the First-Time Homeowners' Subsidy Scheme had on new housing construction during the period 1986 to 1989. During this period the subsidy was applicable to new housing but not to existing housing (De Vos, 1987:2-5; Kilian and Snyman, 1987:10).

2.12 **Theoretical considerations governing the choice of leading economic indicators**

The foregoing analysis of the determinants of investment indicate two broad categories of factors, quantity and price variables. Chirinko (1993:1906) argues that the study of the theory of investment "... concerns the relative importance of prices, quantities and (technology) shocks as determinants of investment. While there is clearly no uniformity in the (research) results and the role of shocks remains to be assessed, it appears ... that, **on balance, the response of investment to price variables tends to be small and unimportant relative to quantity variables**" (emphasis added).

An individual economic indicator that leads changes in the overall economy is known as a leading indicator. Similarly, an economic indicator that leads lower and upper turning points in the investment cycle can be useful in determining the probable future course of investment. In the context of this study, a leading economic indicator with a proven ability to presage fluctuations in investment in building would be a suitable candidate for inclusion in a composite leading indicator for the South African building industry.

It follows that leading economic indicators will have to be chosen not in an arbitrary manner, but on the basis of the theoretical considerations discussed in previous sections of this chapter. Therefore, output and price variables will need to be included in the composite leading indicator. Yet the foregoing analysis has also indicated that expectations play an important part in shaping investors' behaviour. If it is assumed that investors behave purposefully and act in accordance with their expectations, then it can be concluded that valuable information can be gathered by including anticipations data in the to-be-constructed leading economic indicator. Survey indicators provide this data.

From the foregoing arguments and the analyses in previous sections of this chapter it is possible to identify a number of output, price and expectational indicators that could be included in a composite leading indicator for the South African building industry. Qualitative indicators are analysed in Chapter 8, quantitative time series in Chapter 9.

2.12.1 **Output variables**

The value and volume of work undertaken by participants in the building industry would give a reliable indication of the demand for investment in buildings. Survey indicators of values and volumes of building work undertaken are examined. In Chapter 9 certain quantitative indicators are considered that relate to intentions to build, e.g. the number of house plans passed and the total value of residential plans passed.

Keynes acknowledged the important role played by the supply price of capital goods. Other authors have emphasised the adjustment costs of additional investment. Given limited resources, an increase in demand for investment in buildings could manifest itself in the demand for labour and building materials. Excess demand would be reflected in bottlenecks in the supplies of labour and materials. Survey variables representing the availability of labour and materials used in the building industry are important factors to be analysed further.

The availability of funds to finance the investment could equally be a precursor of increased investment in buildings. Survey variables reflecting financial constraints are examined in Chapter 8. The general domestic liquidity situation in South Africa is reflected in fluctuations in the total value of gold and foreign reserves. Similarly, the demand for housing funds is reflected in the cyclical movements of mortgages granted by financial institutions for the construction of new dwellings. The latter two indicators are examined in Chapter 9.

Fluctuations in output are also reflected in changes in competitive market conditions. When economic conditions are buoyant, competition eases. It becomes much keener in times of poor trading conditions. Two indicators that reflect changing demand (output) conditions in the market place are examined in Chapters 8 and 9.

These are:

* the degree of competition in tendering amongst builders; and
* the average number of tenders received for a particular building project.

2.12.2 **Price variables**

Chirinko (1993:1878) has shown how prices of capital goods and the financial cost of capital, net of taxes, impacts on investment through their effects on the user cost of capital. Keynes (1936) showed that investment would be undertaken up to the point at which the marginal efficiency of capital is equal to the market rate of interest. It is clear that the cost of capital, represented by an appropriately chosen interest rate, needs to be examined in the analyses in Chapters 8 and 9. Both a survey variable reflecting the cost of finance as a general financial constraint and a specific interest rate are investigated.

The important role played by the supply price of capital is acknowledged by the inclusion for examination of an index representing tender prices of new buildings. Empirical evidence will show that this particular price index is very sensitive to output changes. It rises rapidly when demand for new buildings is high, and vice versa.

Finally, the relationship between prices, costs and profitability is captured by inclusion of a profitability/productivity measure that is developed in Chapter 9. It represents the ratio of movements in the index of tender prices (mentioned earlier) and movements in a composite index of labour and materials prices. It will be shown that this price/cost/profitability indicator is cyclically sensitive, i.e. it responds to changes in output (demand). Productivity fluctuations that react to changes in output (demand) are also captured in this derived indicator. A detailed explanation is given in Chapter 9.

2.12.3 Expectational variables

Katona (1960), Jöhr (1978) and Shapiro (1970) have shown that expectations can influence the economic behaviour of consumers and investors. It is reasonable to assume that economic agents act in accordance with their expectations (rational or otherwise). It follows that anticipations data need to be examined. A number of survey variables are analysed in Chapter 8.

2.13 Summary

A fundamental issue considered in this chapter on investment theory concerns the translation for the demand for a stock of capital into a demand for a flow of investment. Various determinants of investment have been considered. Keynes (1936) showed that the supply price of capital goods and the future income stream determines the marginal efficiency of capital. Profit-maximising firms will invest up to the point at which the marginal efficiency of capital is equal to the market rate of interest. This internal rate of return equilibrates costs and expected future returns. Duesenberry's (1958) contribution was to show that the marginal cost of funds would rise, the more the profit-maximising firm borrowed. The marginal efficiency of investment is determined by the interest rate and the supply price of capital goods. Adjustment costs arise in incorporating new capital equipment in the firm. These determine the elasticity of the marginal efficiency of investment schedule via their impact on the supply price of capital goods. Investment is determined at the intersection of the marginal efficiency of investment schedule and the marginal cost of funds schedule.

Shifts along the marginal efficiency of capital schedule are influenced by the elasticity of that schedule. Shifts in the marginal efficiency of capital schedule are influenced by output, changes in output, technology shocks and expectations. Jorgenson's (1963, 1967) neoclassical model of investment shows that output changes determines the level of investment spending. The acceleration principle plays an important role in induced investment. Replacement demand is important in the context of autonomous investment.

Technological change implies shifts in the production function of labour and capital. Technological improvements often lead to capital-saving production techniques. Innovations create a demand for additional capital stock to meet increased output requirements. Expectations play a role in that anticipations influence investment behaviour. Rational expectations of government policy action can negate their desired objectives. Changes in the tax regime and concentration of economic power in the hands of oligopolists or monopolists can influence investment in a negative or positive manner.

It was shown that the factors governing the choice of leading economic indicators must proceed from the theoretical considerations discussed in this chapter. Various output and price variables, coupled with expectational variables, are identified for inclusion in the empirical analysis undertaken in Chapters 8 and 9.

An analytical framework dealing with investment in buildings is presented in the following chapter.

* * * * * * *

Chapter 3

The construction process: Some theoretical aspects

3.1 Introduction

As has been stated in preceding chapters, the objective of this study is to devise a composite leading indicator for the South African building industry. The empirical aspects are dealt with in Chapters 8 and 9. An appropriate conceptual framework for this research is required. Consequently, this chapter considers some aspects of economic theory which pertain to the construction process. It is argued that the construction industry is different to other industries and that economic theory requires suitable adaptation for a better understanding of the construction process. This analytical framework consists of a definition of key concepts. It includes a discussion of the determinants of demand that form part of the special characteristics of the construction industry. The important role of interest rate movements was considered in Chapter 2 and is again emphasised in this chapter. The role of the public sector as largest single client of the construction industry is considered. The interrelationship between the construction industry and the overall economy also receives attention.

Reference is often made in this chapter to factors that contribute to general instability in the construction process. Instability in the specific South African context is discussed as a separate topic in the next chapter of this study. Given the theoretical analysis of the causes of instability in the current chapter, it should become clear that a need exists for reliable planning and forecasting that takes this instability into account. A reliable leading indicator can benefit participants in the South African building industry and help in the formulation of public policy.

For a better understanding of certain aspects of the economic theory of construction it is necessary to define various concepts used in this investigation.

3.2 Definition of concepts

3.2.1 Definition of building/construction economics

Writing in the mid-seventies Turin stated: "Building economics, being a relatively new juxtaposition of two not very clearly defined concepts, is to say the least a blurred notion" (Turin, 1975:viii). He went on: "... if economics is concerned with the allocation of scarce resources, it follows that building economics should be concerned with scarce building resources" (Turin, 1975:ix).

Hillebrandt defined this concept in more concise terms: "Construction economics is a branch of general economics. It consists of the application of the techniques and expertise of economics to the study of the construction firm, the construction process and the construction industry" (Hillebrandt, 1985:3).

As shall be shown in subsequent sections of this chapter, it can often be misleading to apply economic concepts indiscriminately to the construction industry. The special characteristics of the construction industry often do not fit into the general economic mould in which it is assumed that firms sell homogenous products under perfectly competitive conditions. Therefore, the emphasis is on various aspects of the Economics of Building. These relate, inter alia, to issues such as fluctuations in building activity and building costs, interest rate movements and their impact on effective demand, as well as the role of the public sector in determining total building demand.

3.2.2 Definition of construction

Hillebrandt (1985:24) provided a description of construction. She stated that construction may be regarded as an industry whose total product is durable buildings and works. It is the contracting part of the industry which undertakes to organise, move and assemble the various materials and component parts so that they form a composite whole of a building or other type of construction work. The product which the contracting industry is providing is basically the service of moving earth and materials and of assembling and managing the whole process. To the extent that the service given and the management supplied are similar through various building types, the industry can be regarded as one industry. However, the service and management will vary according to the technical process involved, and to that extent there is not one industry but many sub-industries which may be regarded as coming under the umbrella of the main industry concept.

It is important to realise that the construction industry falls within the service sector of the economy and not the manufacturing sector. This aspect will be discussed in greater detail in Section 3.3 of this chapter.

3.2.3 **Definition of investment in buildings**

When compiling macroeconomic accounts, the South African Reserve Bank (SARB) uses the internationally recognised System of National Accounts (SNA), published by the United Nations Organisation (Supplement to the SARB Quarterly Bulletin, June 1991:1).

In the classification of "investment by type of asset" five broad categories are distinguished. These are:

* residential buildings;
* non-residential buildings;
* other construction and land improvements;
* transport equipment; and
* machinery and equipment.

According to national accounting principles "total construction" comprises "investment in buildings" and "investment in other construction and land improvements". In the context of this study "construction" will refer to both these categories.

According to this SARB Supplement (June 1991:10) investment in **residential buildings** consists of the value of work put in place on the construction of buildings which are entirely or primarily dwellings (houses, hostels and flats), as well as expenditure on major alterations and additions to these buildings. Transfer and similar costs in respect of the purchase (or sale) of existing residential buildings are also included. Included also, is the installation of new permanent fixtures such as fixed stoves, central heating, air conditioning, lighting, plumbing and water-supply facilities, and all other fixed equipment customarily installed before dwellings are occupied.

Investment in **non-residential buildings** consists of the value of work put in place on buildings and structures which are entirely, or primarily, for industrial or commercial use, as well as outlays on non-residential government buildings such as schools, hospitals and administration buildings. Outlays on major alterations of and additions to these buildings and structures are also included, as are transfer and similar costs in respect of purchases (or sales) of existing non-residential buildings. Examples of private non-residential buildings are factories, warehouses, office buildings, stores, restaurants, hotels, garages and farm buildings. Also included are outlays on the installation, alteration and improvement of these structures.

The third broad category, fixed investment on **other construction and land improvements,** comprises the value of work put in place in respect of the construction and major alteration or renewal of works, such as permanent roads, bridges, harbours, car parking facilities, airports, pipelines, oil-wells, mine-shafts, dams, drainage and boreholes.

It is also appropriate to consider how data on investment in buildings are compiled by the South African Reserve Bank.

According to the Supplement to the SARB Quarterly Bulletin (June 1991:10), estimates of investment in buildings are verified against the value of buildings completed, as surveyed monthly by the Central Statistical Service. This task is undertaken for benchmark years, as well as for other years and quarterly estimates. Investment in private residential buildings is estimated from the results of the Central Statistical Service's monthly survey of buildings completed. Benchmarks are estimated from annual surveys by the Central Statistical Service. The cost of completion as submitted by the local authorities, is re-allocated to previous months to provide for the actual time when the values were put in place.

It is important to note that residential buildings completed by other economic sectors, for instance mining or the farming community, are shown as investment in residential buildings by that sector. Self-help schemes are included in this category, but outlays on materials for constructing squatter units are included in consumption expenditure. The latter factor has important implications for researchers who attempt to relate building manufacturers' sales to effective housing demand. Normally, one finds a "shortfall" in investment in housing, i.e. actual building materials sales seem to exceed the demand originating from the formal housing sector. Given that many thousands of informal housing units have been erected in South Africa during the past several years, and that such materials are classified as consumption expenditure and not as housing investment, it explains this apparent discrepancy between official data and unrecorded data in the informal housing sector.

From the foregoing it is clear that the category "construction works" comprises a heterogeneous group of construction activities. Whilst, by comparison, the category "buildings" is more homogeneous, wide disparities nevertheless exist between the various types of structures, design specifications, quality standards and regional dispersion of activities in the building sector.

At this point it is also appropriate to mention that in subsequent empirical analyses the emphasis will be placed on the building industry in total. Three reasons are proffered for this approach:

* notwithstanding the diversity mentioned above, the building industry exhibits certain common features e.g. structures that all have foundations, walls, windows, doors, ceilings and roofs;

* the building industry in South Africa is organised into a separate industry, as distinct from the civil engineering industry and the employers' body controlling the building industry is called the Building Industries Federation of South Africa (BIFSA);

* economic data pertaining to the building industry in South Africa are much more comprehensive and meaningful than in the case of the civil engineering industry (Martin, 1981:1; Kilian, 1982:ii).

However, for purposes of theoretical analysis the term "construction industry" will be used in the remainder of this chapter. It is meant to encompass both building work and civil engineering construction.

3.3 The special characteristics of the construction industry

Whilst working in the seventies as an economist at the National Economic Development Office, London, Hillebrandt found that her "...experience there convinced (her) that there were special problems of the construction industry in which application of the basic concepts of economics would be very helpful, but that this industry was in certain respects so different from others that the theory needed tailoring before meaningful application was profitable" (Hillebrandt, 1985:xi).

She also stated more forcefully: "In view of (the) **unique characteristics of construction,** there is a need for the **development of new theoretical economic analysis,** or at least for adaptation of existing theory, to assist in the understanding of the workings of the construction process, the construction industry and the construction firm" (Hillebrandt, 1985:9) (emphasis added).

The desire to promote a better understanding prompted her to write a book on the subject entitled Economic theory and the construction industry. To date, two editions and five reprints of this book have appeared. It therefore seems as if her endeavours to promote a better understanding of the construction industry has found a receptive audience.

When writing in the mid-seventies, Turin was severely critical of a "lack of understanding" amongst members of the building industry and its related professions. He stated:

> One of the regrettable features of the construction industry (conceived in its wider meaning to include all the activities related to the design, production, assembly, maintenance and management of the environmental hardware which go under the name of building and civil engineering works) is that its practices lend themselves to easy **generalisation and mythical half-truths** which, under the cloak of good old common sense, disguise serious and sometimes **fundamental misconceptions**. One reason for this is the variety of interests and concerns of the participants involved in the construction process at different stages.

> It would be nice to assume that such participants shared common objectives and observed common rules for achieving them; unfortunately this is seldom the case. The building process is therefore plagued with **unwarranted assumptions**, flouted regulations, parallel circuits, informal arrangements and ad hoc adjustments necessary to reconcile the reality with its abstract representation (Turin, 1975:xi) (emphasis added).

Yet, such "lack of understanding" to which the above authors refer is not confined to the United Kingdom, but extends to South Africa as well. Similar problems were identified by Kilian (1982). He conducted a thorough evaluation of the system of contract price adjustment formulae (CPAF) and in the process found it necessary to clarify the working of the South African construction industry "... to remove some existing misconceptions held in high places" and to undertake "... the difficult task of interpreting to participants in and around the construction industry how the process actually works, what forces act upon it; how these forces influence decisions, actions and relationships, in order to decide on the most suitable course of action to be taken to improve the vexing problems surrounding the CPAF" (Kilian, 1982:3-4).

Furthermore, in a recent in-depth theoretical and statistical analysis of contract price adjustment provisions (CPAP) Kilian and Snyman (1990:41) also found reason to assert: "For a better understanding of CPAP, bureaucrats and practitioners should take cognizance of the principles of CPAP. In so doing, the 'unwarranted misconceptions' can be obviated".

This "lack of understanding" of the workings of the South African construction industry stems from the fact that many building and property practitioners, as well as macroeconomists, generalise from their knowledge of the manufacturing industry, fully believing that what applies in that sector of the economy will similarly apply to the construction industry. Turin's "fundamental misconceptions" will then permeate through the entire fabric of what such an economist fondly believes to be logical.

Indeed, material differences exist between the manufacturer and the contractor in construction (Turin, 1975:x; Kilian, 1982:8). Emphasising that the construction industry is a service industry, Kilian wrote that the manufacturer has some advantages which the contractor does not enjoy. Manufacturers have design options, substitution options as regards materials used, high capacity utilization, the possibility of producing for stock, and the option of adjusting prices after the costs have been incurred. They have a fixed site rarely affected by changes in weather conditions and multiple production of one design.

In contrast, the contractor has to construct a project where it is wanted, according to design specifications which the contractor has had limited time to study, where few substitution options and few opportunities exist for influencing the overall demand for these services. No amount of advertising will increase the demand for airports, roads or whatever. Kilian (1982:8) argued that: "It has often been said that contractors can only react to changes in market conditions".

He emphasises that nowhere else does the everyday temporary integration of different independent firms appear as they do in construction. Such a system of temporary integration is only possible because construction is a service industry and subcontracting firms can integrate with the main contractor for the duration of the contract" (Kilian, 1982:8).

For a better understanding of the special characteristics of the construction industry, it is necessary to distinguish between the physical nature of the product, the structure of the industry and organization of the construction process, the determinants of demand and the method of price determination (Hillebrandt, 1985:7).

3.3.1 **The physical nature of the product**

The final product of the construction industry is usually large and heavy. The immobility of the product implies that all stocks of materials and labour must be moved to a specific locality where "on site, in place" construction takes place. This implies further that the entire construction process is "spatially centred around the product" (Kilian, 1976:11). The exception is mobile homes, popular in the United States of America, but without relevance in the South African setting.

Another feature of the product is the bulkiness of the materials used in the process of erection. "Insufficient on-site dumping place for aggregates, or even the transport of ready-mixed concrete to a central city building ... add ... considerably to cost and construction time" (Kilian, 1976:11).

Normally, materials used in the construction process are made elsewhere by other industries. This feature can cause supply and quality control problems. If stored on site, stock losses of materials by theft has important financial implications for the contractor. It is widely recognised that site security is an important responsibility of management.

The final product of the construction industry is usually a one-off design. This has important cost implications as the economies of scale of multiple production runs cannot be achieved. The exception in this case relates to large scale mass housing schemes (e.g. Mitchells Plain in Cape Town). Yet, given certain public housing policy changes implemented during the early eighties, this exception has become less relevant in South Africa. The one-off nature of design mentioned above also has implications for productivity insofar as it is difficult for labour and management to "learn through experience" when designs are constantly changing (Turin, 1975:xi).

Referring to the special nature of the product, Hillebrandt (1985:10) stated that: "Construction is an investment-goods industry, i.e. its new products are wanted, not for their own sake, but on account of the goods or services which they can create or help to create". For example, a factory building is required to produce other commodities. One could also argue that a school building is a place in which education is produced. Housing has a dual role. It can be considered as a place where accommodation/shelter is produced; traditionally, however, housing is required for direct enjoyment and consumption. It can also, therefore, be argued that housing is a durable consumer good. Nevertheless, capital expenditure on housing is classified by the South African Reserve Bank as investment expenditure in terms of accepted national accounting principles. It is appropriate to mention at this point that the investment-goods nature of non-residential buildings has important implications for the stability of investment generally and the building industry specifically. These aspects are discussed in greater detail in Chapter 4 of this study.

Interest rates

Hillebrandt (1985:7-11) pointed out that the final product of the building industry is expensive and that the value of the capital good is high in relation to the income of the purchaser. This implies that when financing is required, use is made of credit (usually long-term borrowed funds, i.e. mortgages) which has important implications for the building industry. This is so because fluctuations in the cost of credit (i.e. the interest rate), as well as the availability of credit, impact directly on the demand for buildings. These aspects are discussed in greater detail in subsequent sections of this chapter.

Hillebrandt (1985:8) also mentions that because substantial amounts are involved, each contract often represents a large proportion of the work of an individual contractor in any particular year, causing substantial discontinuities in production functions within the contractor's organisation. Hindle (1991) has analysed how contractors in South Africa cope with these difficulties. He finds that contractors diversify their business activities, improve their marketing skills and often enter into negotiated contracts with clients.

Finally, it is necessary to consider the durability of capital goods and its significance for the building industry. Dernburg and McDougall (1968:318-319) identify three important consequences of the durability of capital goods:

* the mere fact that capital goods are durable introduces a strong element of instability into the economic system, especially in the case of investment in buildings;

* greater durability will lead to the economy languishing longer in a recession than if the capital goods depreciated rapidly; and

* durability of capital goods give rise to the phenomenon of replacement waves that will most likely become diffused over time.

Of primary concern at this point is the relationship, on the one hand, between the durability of buildings, the rate at which buildings depreciate, the size of the stock of buildings, together with additions to the stock and, on the other hand, the instability evident in the building industry. To fully appreciate this linkage it should be acknowledged that buildings depreciate very slowly and that the net additions to the stock of buildings are small in relation to the stock itself. Furthermore, it should be kept in mind that consumers spend their money on consumer goods. An upward shift in the demand for consumer goods induces new investment in the capital goods industry. The acceleration principle will come into play in such circumstances. Hillebrandt (1985:60) explained the operation of the acceleration principle by stating that if the output of any consumption good increases, the demand for the investment goods used in its production will increase at a greater rate. The operation of the acceleration principle can best be illustrated by a numerical example, as shown in Table 3.1. This example has been adapted from Hillebrandt (1985:60-61).

Table 3.1

Illustration of the acceleration principle and its destabilising effects on the demand for buildings

Year	Output of good A during year	Stock of buildings to produce A during year	Demand for new buildings to produce A to be built in preceding year		
			Replacement[a]	Net increase[b]	Total
1	100	200	10	0	10
2	100	200	10	0	10
3	100	200	10	40	50
4	120	240	12	20	32
5	130	260	13	0	13
6	130	260	13	-20	0
7	120	240	12	0	5
8	120	240	12	0	12
9	120	240	12	0	12

[a] Assuming replacement equal to 5 per cent of stock per annum.
[b] Assuming buildings constructed in year prior to increase in output of good.

Source: Hillebrandt (1985:60).

In year 1, year 2 and year 3 the output of good A is constant at 100 and the stock of buildings to produce A is also constant at 200. Five per cent of the buildings are replaced each year so that the demand from this source is constant at 10. Then in year 4 the demand for good A rises by 20 per cent to 120, and the demand for the stock of buildings rises to 240. Provided that this rise was anticipated, the new buildings to produce this output in year 4 should have been built in year 3. Therefore, in years 1 and 2 there is no demand for a net increase in buildings. In year 3 there is a demand of 40 to enable production to be increased in year 4. In year 5 the demand for good A continues to rise, but at a decreasing rate, to 130. The demand for stock of buildings rises to 260, showing a shortfall of 20 which must be constructed in year 4. Note that the demand for good A is still rising, but the demand for new buildings is falling because it is related to the rate of increase in total demand which is already falling. By year 6 there is no longer any expansion in demand for good A and the demand for new building in year 5 falls to the replacement level of 13. If in year 7 the demand for good A decreases by 10, then the stock requirements will decrease by 20 and there will not even be a replacement demand in year 6 because 13 units of the surplus stock of buildings will be used for replacement. In year 7 there will still be 7 units of surplus capacity to set against the replacement need of 12, so that new building will be only 5 units. Not until year 8 will there be a real replacement need of 5 per cent of the stock of buildings.

Hillebrandt's numerical example has illustrated that the **rate of change in investment in buildings is determined, to a significant extent, by the rate of change in final demand.** The derived demand for buildings depends not only upon the durability of buildings, but also upon the existing stock. From a contractor's point of view, it is additions to the stock which are crucial to the well-being of the building industry. In this setting, additions to the stock of buildings equal new investment in buildings. Yet, contractors "... find themselves in the unenviable position where they cannot influence the new demand for buildings. All they can do is react to changes in demand. Instability is the inevitable result" (Kilian and Snyman, 1979:20).

Hillebrandt (1985:62) shows that the worst destabilising effects of the accelerator can be dampened if it is acknowledged that often some surplus capacity exists in industry so that it is possible to raise output by increasing employment by overtime, shift working, etc. Secondly, as an industrial building is only a casing for the manufacturing process the machinery and equipment can often be shifted around without altering the building itself.

Thirdly, investment decisions to expand productive capacity may be postponed or cancelled if the rise in final output is perceived as being merely of a temporary nature. Fourthly, the investment intentions of business people are not determined solely by the acceleration principle, but also by other factors such as profit opportunities, their costs, the availability of capital and the cost of capital. Finally, the ability and desire to expand may also be affected by government policy and technological change. These factors may mitigate the operation of the accelerator. Nevertheless, "... it is easy to see that, in the acceleration principle, we have a powerful factor making for economic instability" (Samuelson, 1970:247).

The acceleration principle also operates in the case of housing. By invoking this principle, Kilian and Snyman (1979:20) explained the sudden surplus of housing that arose during the mid-seventies in South Africa, a period of severe recession. Total housing demand decreased as a result of a drop in immigration, high mortgage rates and a decrease in real incomes. The effective demand for housing dropped to a level below the existing stock of dwellings. However, some new investment still occurred as a result of the unmovable nature of the stock, personal tastes and some speculative homebuilding. Hillebrandt (1985:62) argued that housing demand is strongly dependent on other determinants, such as government social policy, which may mask the effects of the accelerator.

In summary, the physical nature of the final product of the construction industry, especially the fact that it is immovable and extremely durable, has important implications for the way in which the industry has structured itself. Discussion of these organisational aspects is given below.

3.3.2 The structure of the industry and organisation of the construction process

Structural features of the construction industry relate to contracting firms, design firms, labour and materials.

The construction industry is characterised by a large number of geographically-dispersed contracting firms. Size of contract, together with the complexity thereof, are important factors which determine whether a contractor is capable of undertaking a project or not. Large firms exist side by side with small firms. This is because there are few barriers to entry in the construction industry and also because firms tend to specialise in a particular sub-sector of the total construction industry. For example, small contracting firms may operate successfully in the housing market, yet not have the technical skills to erect a high-rise structure. The complexity of project and the degree of specialisation that is required result in a fairly inflexible industry structure. The high degree of specialisation in construction even obviates the interchange of artisans in related trades (Kilian, 1976:15).

However, varying degrees of mobility can be achieved by the temporary integration of independent firms that combine for the completion of a single project. Kilian (1976:14) stated that: "This feature of temporary arrangements is probably unique to the construction industry and while it does create flexibility it also forms a major source of insecurity for participants". From the individual contractor's point of view it is fortunate that the structure of the industry is such that certain mechanisms exist that enable a contractor to cope with the vagaries of demand. Firstly, production can readily be increased or decreased by employing more labour or by retrenchment of labour. Secondly, capital equipment (e.g. cranes, trucks, concrete mixers, etc.) can be rented, instead of being purchased. Finally, as mentioned above, the individual contractor has the option of engaging a larger number of specialist sub-contractors on a temporary basis. In South Africa, as in the United Kingdom, there is a move towards specialised sub-contracting so as to take advantage of the benefits offered by the greater continuity of construction activities (Hillebrandt & Cannon, 1989b:xviii; Hindle, 1991:76, 88).

The construction industry is also characterised by "... separation of design in professional offices from construction firms, which has such important repercussions" (Hillebrandt, 1985:8). Two exceptions are worth mentioning; one is the "turnkey project" whereby the contractor is appointed to be responsible for the whole project, including design and construction (Hillebrandt, 1985:77). This non-traditional method of contracting has the merit of enabling the contractor to have a say in design, and it also saves time. Furthermore, another non-traditional organisational system, known as "project management/construction management" is becoming more popular in the U.S.A, the U.K and South Africa (Flanagan & Norman, 1989:130; Chapman & Webb, 1983:31). This system functions on the basis that a project management firm is appointed by the employer/ client as his representative to manage the entire process of design and/or construction. The project management firm is, in reality, marketing its managerial skills and usually still engages an outside contractor to undertake the actual construction work involved.

However, despite the growing popularity of certain non-traditional contracting systems, the traditional organisational method is still most widely used, viz. where the client appoints his principal professional adviser and/or designer. In the case of the building industry the main professional adviser will normally be an architect and in the case of civil engineering work, such an adviser will be a consulting engineer. Normally, the contractor has no part in the design process (Hillebrandt, 1985:76).

This practice has important cost implications, as asserted by Kilian (1982). Referring to the fact that in South Africa the designers are remunerated on a percentage of the final cost of the construction project, Kilian (1982:63-64) observed: "Such a system of remuneration by percentage can never escape from the criticism, true or false, that the practitioners have a vested interest in increasing, rather than reducing cost." He argued that where a person's income is derived proportionately from the final cost of the project, there will exist a strong motivation on the designer's part to choose the more expensive of different options. Therefore, a system which places a person's professional integrity at odds with his personal gain must remain exposed to criticism.

Kilian is supported in this assertion by Denny who outlined the new system of relationships between developers, builders and the professions, proposed by the British Property Federation during the eighties. Denny (1985:14-15) stated:

> At present consultants have little incentive to design within a target price, or to ensure buildability. On the contrary, on a percentage fee basis, the higher the cost, the more the designers benefit. ... (Therefore) it is suggested that consultants should work for a fixed fee. The (proposed) system also gives the client the option of paying a supplementary fee as an incentive if the tender price is within a stated percentage of the target cost and if designs are completed by predetermined dates.

Turning to manpower, it is widely known that the civil engineering industry is capital intensive whilst the building industry is very labour intensive (Buckley & Enderwick, 1989:108). This is because the nature of the building process does not lend itself to the use of capital intensive methods (Hillebrandt & Cannon, 1989:xviii). Furthermore, the structure of the building industry affects labour in various ways.

Firstly, the strenuous physical nature of the work on the construction site makes severe demands on artisans and labourers. Secondly, because the production process moves from site to site, workers often have to be transported over long distances. Thirdly, as few workers can protect themselves against the elements and inclement weather, they can suffer real hardship. Fourthly, the long training period of five years for artisans and technicians

"... introduces an inelasticity into the supply of labour which can seriously affect the capacity of the industry to cope with sudden increases in demand" (Kilian, 1976:36-37). Consequently, undesirable practises, such as labour piracy, can occur during the upswing phase of the building cycle. However, during recessions there is competition among workers for available jobs.

Another feature affecting labour relates to the system whereby the worker's benefits (pension, medical fund and holiday bonus) are deducted from workers' wages on a weekly basis and then lodged with the Industrial Council for the Building Industry. The worker does not lose these benefits should employers be changed. Consequently, there is less worker loyalty than in other sectors of the economy. In similar vein, should the contractor's work load diminish, then workers are more easily laid off than in other industries (Kilian, 1976:53). This weak employer-worker bond has the unfortunate side-effect that experienced workers, when retrenched during a severe recession, will frequently leave the construction industry, seldom returning when activity levels improve (Campbell et al., 1974:18; Kilian, 1976:36; Manski & Rosen, 1978:217).

The productivity of labour is affected in two ways by fluctuations in the demand for the product of the construction industry. Firstly, during severe recessions workers will work harder to retain their employment. Secondly, because of capacity constraints and the volatility of the demand for construction work, materials manufacturers have difficulty in maintaining supplies during upswing phases of the business cycle. Consequently, materials bottlenecks occur. Shortages of materials on site impact directly on labour productivity. For instance, when bricks become scarce, workers will slow down to stretch available supplies. Ultimately, construction costs rise because of the inefficient use of scarce resources and the volatility of demand.

In summary, certain structural features such as the large number of dispersed contracting firms, temporary integration, separation of design and construction functions, and inelasticities in the supplies of labour and materials are some of the unique characteristics of the construction industry. Most of these features have cost implications because they impact directly on the productivity of labour.

3.3.3 Determinants of demand

These can be divided into four broad categories, viz. demographic, income factors, financial factors, and the role played by the public sector. Demand itself can be either latent or effective. Usually, demographic factors focus on latent demand. In contrast, income and financial factors impact directly on effective demand, also known as economic demand (Hillebrandt, 1985:45).

This distinction between latent and effective demand is necessary because: "Most of the peculiarities of the demand for construction stem from the fact that it is partly a derived demand, similar to that of other capital goods .... This derived demand has the implication that the demand is extremely sensitive to changes in the economy, for instance, the availability of the capital required and government policy are (just) two factors which impinge on the demand for construction" (Kilian, 1976:23).

Whilst the issues surrounding instability of demand in South Africa are dealt with in the next chapter, the immediate concern here is to identify those factors that determine the demand for construction. It should not be inferred that these factors operate independently. On the contrary, demand factors are all interrelated, yet some are more important than others. In addition, some of these demand factors exert their influence over the long term, whilst others have short-term effects.

3.3.3.1 Demographic factors

Authors have distinguished a number of demographic factors.

3.3.3.1.1 Population

Population and population growth rates are important demographic determinants (Roest, 1973:141; Kilian, 1976:133; Hillebrandt, 1985:57). In South Africa the population growth rate is almost 3% per annum. This leads to a large latent demand for housing.

3.3.3.1.2 **The age structure of the population**

This factor will influence the demand for clinics, hospitals and retirement homes (Hillebrandt, 1985:57). Jordaan (1991:7, 11) points out that South Africa has a relatively young population. This implies a rising latent demand for housing.

3.3.3.1.3 **Immigration and emigration levels**

The difference between these two variables is known as net migration and can be either positive or negative (Hillebrandt, 1985:57; Kilian & Snyman, 1987:8). Positive net migration is important because it represents the movement of families who require instant accommodation upon arrival. The South Africa experience with migration patterns is discussed in Chapter 4 of this study.

3.3.3.1.4 **The headship and family formation rate**

This relates to the persons in any age group that head households. The headship rate can be influenced by changes in marriage and divorce rates, as well as the tendency for more young, single people to leave the family unit and establish their own households (Markandya, 1983:821; Hillebrandt, 1985:57).

3.3.3.1.5 **Urbanisation**

A process of urbanisation usually accompanies a period of industrialisation. This factor is important in the South African context (Urban Foundation, 1990:1). Informal settlements have been established near virtually every city in South Africa. This phenomenon is found in most developing economies.

3.3.3.1.6 **Vacancies**

Vacancies of houses and "doubling-up" of families usually accompany periods of high unemployment (Kilian & Snyman, 1987:8). However, vacancies seem to disappear virtually overnight when economic conditions improve.

3.3.3.1.7 **Slum clearance and demolitions**

These factors are subject to public policy changes (Hillebrandt, 1985:57). In South Africa this factor has played an historical role, especially in the context of the polity of separate development and racial segregation.

In summary, it is important to realise that many researchers who emphasise the tremendous need for housing in South Africa fail to distinguish between latent and effective demand. It is a truism to state that latent housing demand can only be transformed into effective demand if income and financial factors are taken into consideration. These aspects are discussed below.

3.3.3.2 **Income levels and income elasticities**

Many economists have studied the question "How does the demand for buildings change when incomes change?". Traditionally, these empirical studies have centred on private housing demand and researchers have made use of either cross-sectional data or time series analysis. The effect of income changes on demand finds expression in the concept known as the "income elasticity of demand". In the context of housing, the income elasticity can be defined as the percentage change in the quantity of housing demanded compared to a percentage change in income, with ceteris paribus assumptions. For example, a value of 0,6 implies that should income change by 10%, the demand for housing should change by 6%.

Hillebrandt (1985:49) cited a number of studies (Holmans, 1970; Clark & Jones, 1971; Johnston et al., 1972; Vipond & Walker, 1972) that were based on cross-sectional analysis. These studies found that the permanent income elasticity of demand for housing ranges from 0,6 to 1,0. A study by Whitehead (1974), based on time series analysis, yielded a higher elasticity. Hillebrandt (1985:49) ascribed the difference in results yielded by cross-sectional and time series analysis to changes in the underlying conditions in the market for housing and in the population structure ruling at the time that these studies were conducted.

In their empirical analysis of urban housing demand in Bristol, U.K., researchers Ball and Kirwan (1977:365) found the income elasticity of demand for owner-occupied housing as a whole to be about 0,66. Their findings were somewhat higher than the income elasticity determined by Wilkinson in 1973 that related to the Leeds area in the United Kingdom. They ascribe this variation to differences in the structure of housing in the Bristol and Leeds regions.

In his review of the income elasticity of demand for housing Moolman (1981) cites a four-year comprehensive study undertaken in 1970 by Carliner (in Moolman, 1981:26). The results of the empirical analysis were obtained from the University of Michigan, U.S.A. This study followed up any moves that the families in the study made, and "income" was very carefully defined.

The most important findings were:

* demand elasticities, especially for durable goods such as housing, are greater out of permanent income, i.e. income expected over one's life cycle, (0,631 for owners; 0,520 for renters) than out of current annual income (0,499 for owners; 0,439 for renters);

* income elasticities for young houseowners were very much higher than for older houseowners.

Rosenthal (1989:74) made use of a comprehensive data base that combined time series and cross-sectional data on owner-occupiers in the United Kingdom. He found that income elasticities were relatively robust at 0,70 to 0,75 being somewhat higher than the results yielded by studies already discussed.

In South Africa Mouton undertook a study to determine the housing need of whites in the Tygerberg region of Cape Town. He identified income as an important determinant of housing demand and found a positive relationship between national income and investment in housing (Mouton, 1976:36). However, he did not determine the income elasticity of housing in South Africa.

Martin (1989:222) stated that, as far as could be ascertained, the demand elasticity of housing in South Africa had not yet been established. He suggested that should such a research project be conducted, cognisance should be taken of the various housing market segments. This would be necessary on account of the wide spectrum of levels of affordability of housing amongst the upper, middle and low-income groups in South Africa (Martin, 1992:1).

It can be concluded from these research findings that the income elasticity of demand for housing lies between one and zero. The fact that the values are less than one implies that housing is relatively insensitive to changes in incomes. These empirical findings also correspond with theoretical considerations, viz. that the income elasticity of demand of a necessity is generally smaller than one. Housing can be regarded as a necessity and not as a luxury good.

The preceding analysis implies that if real incomes were to rise by, say, 10% that the demand for housing would rise by approximately 5% or 6%. In practice, this would take the form of a rise in the number of residential buildings, as well as a rise in the average size and quality of dwellings. Conversely, if real incomes were to decline by 10%, then the quantity of housing demanded would decrease by less than 10%. It is known that demand for new housing can fluctuate violently even should nominal incomes keep pace with inflation. Consequently, other economic forces must be operating that cause such marked fluctuations in the demand for buildings, generally, and new housing specifically. These important economic variables are discussed in the next sub-section that focuses on the financial determinants of the demand for buildings.

3.3.3.3 **Financial factors**

Briefly, these factors relate to the cost of credit, i.e. the interest rate, and the availability of finance. The economic effects of subsidies and property taxes, the prices of existing houses (that are good substitutes for new houses) and building costs can also be placed under this heading. The analysis in Chapter 2 has indicated the importance of interest rates in investment theory.

3.3.3.3.1 **Interest rates**

The point was made earlier (in Section 3.3.1) that the durability of a building implies that a high cost is involved. Therefore, it is quite normal that buildings are financed with borrowed money. This position applies to both householders and to firms. Citing Stone in this context, Kilian (1976:12) argued that the effective price for a building is not generally its capital cost but the cost of servicing the loan for its purchase. The situation is not substantially changed when the building owner uses his own capital, since by doing so he loses the income he would otherwise enjoy. Kilian asserted that the effective price of buildings is affected by the rate of interest prevailing, as well as by the costs of construction.

Referring specifically to housing, Kilian (1976:12) asserted that for potential home-owners, upward changes in interest rates can place a house as effectively beyond their reach as an increase in price. He argued that the monthly instalments on redemption and interest are more important to most would-be buyers than the total price of the house. This is especially true in South Africa, where interest paid on home-owners' mortgages are not deductible for income tax purposes.

For instance, the rise in the effective cost of housing can be illustrated with the following numerical example where it is assumed that the mortgage rate rises from 12% p.a. to 20%. In the case of a R60 000 mortgage repayable over a 20 year term, the monthly repayment in the first case is R660,65. At the 20% mortgage rate level, the monthly repayment rises to R1019,29 (data calculated from tables in Homeownership Handbook No. 22, 1990:4-7). This represents an increase of 54,3% in the monthly repayment. Increases of such magnitude can put a house effectively out of the reach of many people who can just afford a mortgage of R60 000 at 12%, but are forced to vacate their home at a mortgage rate of 20%. Indeed, such was the experience in South Africa during the period 1990 to 1991 when mortgage rates rose to punitive levels as a result of strict monetary policies.

The principle that the effective price of a house is determined directly by the interest rate level was explained in somewhat different terms by Stevens (1990:57) who asserted that "Whilst it is generally appreciated that variations in interest rates directly affect monthly repayment amounts, it is not always recognised that an increase in bond interest rates is tantamount to an increase in house prices".

It is clear that the effective cost of a house is determined by the monthly mortgage repayment instalment. The monthly repayment amount is, in turn, determined by three variables. According to Stevens (1990:58) these are: the initial amount of the mortgage loan - which varies according to the purchase price of the property, the deposit that can be afforded and the financial standing of the borrower; the rate of mortgage interest, and the term of the bond.

Stressing the importance of interest rate fluctuations Stevens pointed out that in the case of an initial sum of R60 000 and a 20-year bond term, an increase in the interest rate from 5% to 8% is equivalent to a R16 044 increase in loan value. By comparison he cites a rise in the mortgage rate from 17% to 20% that is equivalent to an increase in capital loan value amounting to R9 490 (Stevens, 1990:58-59). It is clear that at low interest rate levels a three percentage point rise has disproportionately large effects on the loan value.

Clearly, then, the level of mortgage rates plays a critical role in determining the cost of home-ownership. Similarly, the interest rate level is of prime importance to developers of industrial and commercial buildings. Property developments that are viable at an interest rate level of, say, 12% may not be viable at an interest rate of 18%. Hence, fluctuations in interest rates directly affect the effective demand for buildings. This analysis comports with the findings in Section 2.5 which indicates that the demand curve for buildings is interest-elastic.

Furthermore, the rate of interest also affects the firms in the construction industry, for they are very dependent on credit from banks and their suppliers of materials (Hillebrandt, 1985:14). Speculative property developers may also find that their holding costs become prohibitive. The consequence of fluctuating interest rate levels is instability of demand for buildings. This is illustrated in the context of the South African building industry in the next chapter of this study.

3.3.3.3.2 **Availability of finance**

Whereas the cost of finance (the interest rate) plays a critical role in the construction sector, the availability of finance, or the lack thereof, can contribute to instability of the residential and non-residential construction sector (Campbell et al., 1974:21; Gough, 1975:221; Martin, C., 1989:69; Martin, R.C., 1978:11). In the new housing market the problem stems from the fact that speculative builders often build new houses for an uncertain (future) demand, only to experience difficulties when interest rates rise and housing finance emanating from building societies is in short supply (Hillebrandt, 1985:15). In the early eighties in the U.K. "... there (were) long periods when the loans made by building societies (were) restricted by the inflow of funds to them and the demand for credit was not therefore being met at the ruling rate of interest" (Hillebrandt, 1985:58).

Hillebrandt (1985:14-15) proffers a number of reasons why the inflow to building societies can decrease and lead to "credit squeezes". Firstly, in a period of reduction of employment and incomes there is a general reduction in saving. Secondly, borrowers will postpone repayment of their mortgage as long as possible under such circumstances. Thirdly, in an inflationary environment savers may favour equity investment above deposits at building societies in the hope that equity prices will outstrip inflation.

To obviate the "alternating periods of mortgage glut and famine" Thom (1984:892) suggested that the approach should be to:

> ... encourage the development of a more competitive mortgage market within which interest rates adjust more rapidly to capital market pressures. Such a policy would probably require societies to set their rates individually, rather than through the 'cartel' system which operates at present, and would be encouraged by greater penetration from other institutions.

South Africa experienced much the same problem as did the United Kingdom. For instance, Kilian (1976:137) stated that "... private investment in residential buildings is almost completely dependent on the availability of building society funds". The reason for recurring "credit squeezes" during the seventies could be attributed to the fact that building societies "... while lending long, borrow short to some extent" (Kilian, 1976:204). The consequence was instability in the homebuilding market, as well as in the market for existing houses. The recurring shortages of mortgage finance could be attributed, in part, to the fact that housing is a sensitive socio-economic issue. Consequently, the monetary and fiscal authorities granted building societies certain tax incentives to depositors. As the cost of funds for building societies was lower than the market rate, the ruling mortgage rate could be kept below the prime overdraft rate. This represented a form of "hidden subsidisation" to home-owners.

However, during the middle- and late-eighties the South African authorities followed a more market-oriented approach to the management of the economy. The competition between banks and building societies for both deposits and loans intensified. Banks, with stronger capital bases than building societies, took over certain building societies. Rationalisation continued and certain large building societies took over smaller, more vulnerable building societies.

When the Deposit-Taking Institutions Act came into being in February 1991, banks and building societies became subject to the same Act. Rationalisation in the financial markets therefore led to greater freedom for housing finance institutions to bring their mortgage rates in line with prime lending rates. A relatively more flexible mortgage rate structure could henceforth fulfil its rightful function in the economy and bring about greater equilibrium between the supply and demand for housing funds. In so doing, raising fees, "back-to-back" financing and other questionable practices which were quite common in the housing market during the recession of 1981/82 in South Africa could be obviated (Kilian & Snyman, 1987:9).

Yet, despite the more market-oriented monetary policies of the South African authorities, liquidity in general and housing finance, in particular, remain cyclically sensitive. The practical implications thereof and their destabilising effects are illustrated in the context of the South African building industry in the next chapter of this study.

3.3.3.3.3 **Subsidies**

To explain the economic effects of housing subsidies use will be made of the concept of "notional housing units" (Hillebrandt, 1985:40-41). This becomes necessary because housing is not homogeneous. The quality of housing differs according to varying standards of light, space, plumbing, electricity and aesthetics that influence subjective assessments of their relative values. Hillebrandt and other researchers (Clark & Jones, 1971; Holm, 1967) have suggested the use of money values, the rateable value of property, technical fittings and equipment or the date of construction as possibilities to measure equivalent units of housing. The number of square metres can not suffice on account of wide disparities in the quality of finishes.

It has often been stated that the widespread use of housing subsidies leads directly to inflationary conditions in the South African housing market. This is a common fallacy which is prevalent amongst many property and building practitioners and represents another one of those "fundamental misconceptions" to which Turin has referred.

The position was clarified a number of years ago by Kilian and Snyman (1987:10) who made use of Hillebrandt's "notional housing units":

> A subsidy decreases the real unit cost of a house to a purchaser. At a lower real unit price, more notional housing units will be demanded by the purchaser, in accordance with traditional economic theory. This will lead to a demand for larger houses. Consequently, subsidies tend to increase average house sizes. Because larger houses cost more than smaller ones, subsidies wrongly get blamed for increases in house prices that invariably accompany economic boom periods. Fundamentally, home-owners, who enjoy the benefits of interest rate subsidies, are able to acquire houses which they would otherwise not have been able to afford.

In summary, a housing subsidy reduces the individual's effective price of a house, i.e. the monthly mortgage repayment instalment. Consequently, more notional units of housing will be demanded. This gives rise to a demand for larger or more luxurious houses. Alternatively, one could argue that a housing subsidy increases the income of the individual. In the final analysis, the economic effects of rising real income levels and housing subsidies are similar, i.e. both the number of houses demanded and the average size of a dwelling tend to increase.

3.3.3.3.4 **Property taxes**

On the issue of the economic effects of taxation on property Kilian (1976:13) asserted that property taxes, transfer duty and other imposts on property and property developments, as well as certain tax concessions, have an influence on the product of the building industry. These influences occur because they are cost factors in either the construction or the occupancy of the building. Despite the regressive nature of property tax, especially, their overall influence does not contribute to instability in the industry.

During the past decade two new types of taxes have been introduced in South Africa that affect home-owners and investors in buildings. These are the tax on fringe benefits and value-added tax. The economic effects on housing of the phasing-in of fringe benefits taxation were judged to be largely neutral by Kilian and Snyman (1987:10) who asserted that "Even though the increased tax burden will raise the real cost of home-ownership, the subsidized home-owner will not perceive it as such. It is rather more likely that he will merely view this additional tax burden in the same way he does all other taxes".

Referring to value-added tax, introduced in South Africa on 30 September 1991, Rode (1991:77-78) mentioned that the net result of the scrapping of general sales tax of 13% on materials and plant, along with the introduction of 10% value-added tax (VAT) would result in a reduction of between 5% to 6% in the erection costs of non-residential buildings. This was possible because of input tax credits granted to VAT vendors, i.e. contractors. However, in the case of the erection of residential properties, a homeowner would not be granted an input tax credit. Final costs to the new homeowner could therefore rise by approximately 4% due to the phasing-in of VAT at 10% on total construction costs and the scrapping of general sales tax at 13% on the materials and plant component. Furthermore, when VAT is payable, no transfer duty of 3% on properties is due. Therefore, the net effect of VAT on new residential buildings was estimated to be an increase of about 1% (Rode, 1991:77-78).

The rate of VAT was raised from 10% to 14% in April 1993 in South Africa. This had the effect of raising overall building costs to the consumer by roughly 4,9% between the first and second quarters of 1993. This percentage rise included the effects of a higher fuel price, also announced in April 1993 (CSS: Statistical News Release P0153, 28 September 1993).

It is clear from the preceding analysis that upward or downward adjustments to property taxes have cost-raising or cost-reducing effects. Usually, these adjustments occur infrequently and, consequently, they do not contribute much to instability in the demand for buildings.

3.3.3.3.5 **Interrelationship between building costs and prices of existing dwellings**

This sub-section deals with the substitution effect that exists between the demand for new and existing dwelling houses.

Existing houses are ready substitutes for new houses and vice versa. Should a decrease in interest rates or a rise in real income encourage spending on accommodation, prices of existing houses will usually rise. The construction costs of new houses will, in similar circumstances, also rise due to the increase in housing demand that will lead, in turn, to increases in materials prices, labour costs and a widening of contractors' profit margins. However, the rise in house prices and home building costs need not be uniform. Yet, there exists an interrelationship such that "... sharp building cost increases have the effect of 'pulling-up' depressed property prices, in circumstances where the replacement costs of new houses exceed those of equivalent existing dwellings" (Kilian & Snyman, 1987:10). Nevertheless, a gap remains between the prices of existing houses and new houses.

Some commentators regard this gap as a price differential that, presumably, will someday be closed. For example, one source stated that "... the price differential between new and existing houses has remained roughly 30%" (United Quarterly Housing Review, 1990:2). Another source is quoted as saying: "The 30 to 40 percent price differential between building and buying an existing home is not likely to close until the middle of next year" (Argus, 11 August 1990). The implicit suggestion that new houses are "expensive" and existing houses are "cheaper" is further evidence of the "unwarranted assumptions" to which

Turin has referred.

Rode et al. (1990:31) analysed this issue and asserted:

> Rigorous research done by Real Estate Surveys for the Rode Report on the South African Property Market showed that a house's market value declines at about 1,5% per annum relative to a new house of the same size. This implies that a large sample of existing houses with an average age of about 20 years should stand at a discount of about 30% to new houses. From this, we conclude that house prices of relatively new existing and brand new houses are probably close to equilibrium at present, and that the 'discount' is arrived at by comparing apples with pears.

Interestingly enough, he found that the annual ageing percentage for business properties is also 1,5% (Rode, 1988:4).

It can be concluded from the preceding analysis that the interplay of forces will affect the demand for buildings in the normal manner, i.e. rising prices/costs of houses will depress the demand. The relationship that exists between changes in quantities demanded and changes in prices is known as the price elasticity of a commodity. The price elasticity of housing can therefore be defined as the percentage change in the quantity of housing demanded, relative to the change in price. Researchers have studied this relationship over many years by making use of cross-sectional data or time series analysis.

Hillebrandt (1985:49) cited studies by Holmans (1970), Whitehead (1974) and Clark and Jones (1971) who found values ranging from -0,26 to -0,6 and concluded: "The price elasticity of demand for the dwelling (excluding land) is likely to be considerably less than for housing as a whole by reason of the high proportion of the cost of the land." These findings corresponded with the results yielded by the study conducted by Wilkinson (1973) who found the price elasticity for total floor area in the Leeds region of the U.K. to be -0,57 (Ball & Kirwan, 1977:343). In the comprehensive study undertaken by Rosenthal of owner-occupied housing in the U.K., price elasticities of around -0,5 to -0,6 were recorded (Rosenthal, 1989:774). Referring to the response in demand for industrial buildings to a change in price, Hillebrandt (1985:63) suggested that "... capital costs will in many cases be a relatively small part of total costs. Hence the demand curve for industrial buildings is likely to be relatively inelastic".

The price elasticity value of less than one (with negative sign) implies that the demand for buildings should decrease less than proportionately in the event of a rise in the prices/building costs of properties. Yet, the concept of the price elasticity assumes that all other variables, excepting those of price and quantity, remain constant. In addition, it is known that total demand for buildings can rise strongly despite sharp increases in building costs (Kilian & Snyman, 1987:7). It is clear, therefore, that other economic forces affect the quantity demanded more than the price effect. This comports with the findings in Chapter 2, especially those of Chirinko (1993: 1889, 1906), who argued that price variables tend to be small and unimportant relative to quantity variables. The most important of these demand variables, interest rate levels, was discussed in Section 3.3.3.3.1. It was shown that despite rising building costs and rising house prices, a decrease in the mortgage rate reduced the effective monthly cost of home-ownership.

In concluding this sub-section that deals with financial factors that influence the demand for buildings, it is appropriate to recall that the critical factor to consider is the level of interest rates. It was also shown that, in the case of residential building, the effective price of a house is determined by the amount of the monthly mortgage repayment instalment. Interest rate fluctuations, the availability of finance and their destabilising effects on the South African building industry are illustrated in the next chapter of this study.

3.3.3.4 **The role of the public sector**

The public sector influences the demand for construction in either of two ways, viz. by direct or indirect means. However, the results of its actions are similar.

3.3.3.4.1 **Direct effects**

The public sector is the largest single client of the construction industry. In the United Kingdom one author has put this demand at about half of all new work (Hillebrandt, 1985:11). In South Africa the contribution of public sector demand to total demand for all building and civil engineering construction has fluctuated between almost 35% in the early fifties and roughly 60% during the early eighties. By 1990 total public sector demand had dropped to about 45% of total demand in the construction industry (calculated from data published in Supplement to Quarterly Bulletin of the South African Reserve Bank, June 1991).

Therefore, it is clear that the public sector can influence the overall demand for construction work to a significant extent if it were to expedite or retard its own construction programmes for the provision of infrastructure (e.g. hospitals, offices, harbours, airports, etc.). Such action on the part of the public sector would depend on the availability of funds and general economic stabilisation policy. Many authors have studied the role of the construction industry as a so-called "regulator of the economy" (Campbell et al., 1974:20; Hillebrandt, 1985:17-19; Kilian, 1976:156; Lea, 1973:115; Rosen, 1979:115). One author (Rosen) actually referred to the housing industry as "the balance wheel of the economy." General stabilisation policy of government depends, to a large extent, on its macroeconomic objectives and how these change during the course of socio-economic development. The macroeconomic policy objectives relate to the following broad categories:

* economic growth, i.e. the creation of jobs;

* price stability, i.e. the combating of inflation and the protection of the domestic purchasing power of the local currency;

* balance of payments stability, i.e. the protection of both total foreign currency reserves and the external value of the local currency; and the

* distribution of income, i.e. the eradication of poverty and promotion of a more equitable income distribution within the country.

It is appropriate to consider why the government targets the public non-residential sector for special treatment in its Keynesian contra-cyclical policies. In his comprehensive study of the South African building industry, Kilian (1976:156) asserted that public non-residential investment probably bears the brunt of all stabilising measures of the public authorities in the latter's effort to stabilise the general economy, especially when government's own expenditure has to be curtailed.

Kilian (1976:156) also stated that: "... government has few alternatives when the need arises for curtailing its own expenditures in the short term". For instance, current expenditures are not easily curtailed; public residential investment fills a need not to be lightly postponed; public civil engineering construction works are usually large and are contractually committed. These projects form the necessary infrastructure for the next growth phase. He argued that the only way major savings could be made was through the postponement of investment in public non-residential buildings such as schools, hospitals, office blocks, police stations, etc. The effects of cutbacks in public spending on buildings could be more immediate than raising investment in public buildings. Consequently investment in public non-residential buildings is, in the main, still an instrument of public stabilising policy.

It is also appropriate to consider whether public stabilisation policies are effective or not. This issue is pertinent because of time lags that arise between the implementation of policy changes and their desired effects on the overall economy. In the United Kingdom the success of such contra-cyclical policies are very much in doubt. Lea (1973:118) asserted that there can be a "... minimum delay of more than six months". Campbell et al. (1974:20) found that lags can be up to two years or longer. They stated that there are long time lags between decisions to decrease or increase public expenditure and the consequential decreases or increases in construction activity. They concluded that changes in construction programmes are an unsuitable method of managing the economy in the short term.

In addition, the fact that different construction sectors use different mixes of resources make cuts or increases in construction expenditure an even less effective method of managing the economy. They emphasised that, unfortunately, the use of construction as a regulator may be more acceptable politically than other devices with more immediate effects. Thus, if it is considered desirable for the economy as a whole that construction expenditure should be suddenly curtailed or increased, the better the appreciation of the lags and the mixes of resources required, the less damage will there be to construction and the more efficiently will the desired economic changes be achieved.

Campbell et al. (1974:20) found that these lags are not uniform. According to them, it is apparent that lags are longer after decisions to 'go' than after decisions to 'stop'. The minimum lag before the start of construction work is unlikely to be much less than two years if time is to be allowed for such factors as land acquisition, design, planning approval, financial sanctions and tendering arrangements. This period can easily be extended by, for example, a complex design, public inquiry, or problems with cost yardsticks.

Whilst it is difficult to achieve the desired effects for stabilising total demand on the macro-level, it may be impossible to achieve these objectives on the microeconomic level. Hillebrandt (1985:18) cited an example where cancellation of projects may relieve pressure on skills and materials required at the beginning phases of projects. Yet, if a shortage of electricians is being experienced such government action will have no effect for some time as electricians are usually employed at the end of any project.

Kilian (1976:187) reviewed the experience in South Africa and found that government contra-cyclical policies were implemented quite successfully until the mid-sixties. Yet he found it "... rather unsettling to note that public investment has consistently deviated in the same direction as that of the private sector since 1966. In absolute terms construction became progressively more unstable, although the opposite is true in relative terms". Evidence to support this finding is provided in Chapter 4 of this study. The impact of the South African government's Reconstruction and Development Programme is also considered at that point.

3.3.3.4.2 **Indirect effects**

The public sector can influence the construction sector indirectly via its monetary policy stance. High interest rates are the preferred means whereby the monetary authorities endeavour to dampen inflation. As was shown in Section 3.3.3.3.1 the interest rate is of critical importance to the fortunes of the construction industry. High mortgage rates increase the effective cost of housing, and non-residential projects may not be viable at high interest rates deemed to be appropriate by the monetary authorities.

In summary, it is appropriate to stress that the effects of government action are similar whether they be direct or indirect. Reducing its own demand for construction reduces employment and can force individual contractors, who specialise in public projects, into liquidation. Similarly, high interest rate levels reduce the demand for buildings, thereby contributing to the demise of contracting firms and lower employment levels in the construction industry.

The preceding sub-sections have dealt with the determinants of demand. It was shown that fluctuations in demand factors can influence the overall demand for construction and can contribute to instability. In the next sub-section the method of price determination - which represents one of the special characteristics of the construction industry - is discussed.

3.3.4 The method of price determination

A complex system of pricing has evolved in the construction industry. It is characterised by keenly competitive pricing and high risks involved.

The principle that the system of a priori pricing is unique to the construction industry, especially given the complexity of the product and the long construction time, was stated forcefully by Flanagan and Norman (1989:129): "Simple economic propositions on price determination do not apply in the building industry. Perfectly competitive conditions are conspicuous by their absence, oligopoly or (contestable) monopoly are much more relevant market structures". They argued that risk and uncertainty are endemic both in the projection of work load (demand) and of costs (supply). The competitive processes by which building projects are awarded are price guided, but in ways that generally are not treated in the simple economics textbooks. Furthermore, competitive tendering, negotiated tenders, etc. are rarely considered in economic analysis of 'the price system'.

They stressed that this does not mean to say that price determination in the building industry is somehow 'outside' economics. What it does imply is that rather more complicated economic models are needed that take explicit account of the imperfectly competitive environment in which clients and contractors operate (Flanagan & Norman, 1989:129).

Fine (1975:211) showed that in a competitive environment contractors are unlikely to realise their mark-ups as profits. Phrased differently, he found that contractors' ex ante profits are rarely equal to their ex post profits and, in most cases, are actually lower. In a simulation model in a competitive environment of two competitors' pricing policies, he finds that each will be worse off if they follow the same mark-up policy as in a non-competitive environment. He concluded: "In a competitive environment a higher mark-up must be used than in a non-competitive environment if profits are to be maintained at the same level" (Fine, 1975:211).

However, in a competitive environment the contractor might be reluctant to increase the profit mark-up for fear of losing the contract. Fortunately for the contractor, certain conditions prevail in a competitive environment that work in the contractor's favour. Examples are:

* an increase in labour productivity that is attributable to decreasing job security;
* building materials are more readily available;
* larger discounts on materials can be negotiated with builders' merchants; and
* contract price adjustment provisions that are included in building contracts may "over-compensate" the contractor during recessions.

These issues are discussed in greater detail in Section 4.8 of this study.

Various authors, including Hillebrandt and Cannon (1990:69-77), as well as Fine (1975:202-221), have stressed the importance of the risks attached to contracting. Hillebrandt (1985:155-157) has provided a comprehensive list of such risks and uncertainties that face the contractor when tendering. This list is reproduced below in toto as Kilian and Snyman (1990:43) found that clients who object to the system of contract price adjustment provisions (CPAP) invariably assume that "inflation risk" is the only risk facing the contractor. This assumption is clearly fallacious and represents further evidence of the "unwarranted assumptions" referred to earlier by Turin (1975). Therefore, in various studies, Kilian, Snyman and Sher (Kilian, 1982:5-10; Kilian, Snyman & Sher, 1988:1; Kilian & Snyman, 1990:10-13) found it necessary to explain the underlying philosophy and principles of CPAP and how the assessment of risk influences the bidding policies of contractors.

Hillebrandt (1985:153) distinguished between risk and uncertainty. Risk arises when the assessment of the probability of a certain event is statistically possible. Risk is therefore insurable. Uncertainty arises when the probability of the occurrence or non-occurrence of an event is indeterminate. Uncertainty is not insurable. Hillebrandt (1985:154) also emphasised that, given better information, some events may be moved from the category of uncertainty to that of risk. Hillebrandt's (1985:155-157) list of contracting risks follows.

3.3.4.1 **Labour costs**

(a) Bad morale, go-slows or strikes lead to poor productivity. These factors can be regarded as uncertainty and are uninsurable.

(b) Labour costs can be raised because of inadequate pre-planning of operations. This can be seen as uncertainty, but with adequate data could become risk.

(c) Faulty workmanship due to an untried labour force can raise labour costs. This can be regarded as uncertainty but could become risk with adequate training of labour.

(d) Inadequate estimates for local wage costs (that include extra travelling time) can raise labour costs. This can be regarded as uncertainty and is uninsurable.

(e) Inflation in wage costs can raise labour costs. This can also be regarded as uncertainty, but may be partially shifted to the client in a fluctuating-clause contract.

3.3.4.2 **Materials costs**

(a) Changes in materials prices over time can be seen as uncertainty, but can be shifted to the client in a fluctuating-clause contract or hedged by buying materials in advance of requirements and storing. In this case it becomes certainty, but at a cost, i.e. storage costs.

(b) Shortages of materials or late deliveries can be seen as uncertainty, but these events can also be overcome by advance buying or better planning.

3.3.4.3 **Sub-contracting costs**

Should the sub-contracts not perform as is required this can be seen as uncertainty. The only redress for the contractor is from the sub-contractor himself.

3.3.4.4 **Bill of quantities items**

(a) Should an arithmetical error occur this can be regarded as uncertainty, but this is usually checked by the client's quantity surveyor and adjustment or withdrawal may be allowed.

(b) Variations in the quantities of the bill may occur. If the items are correctly priced this should not be too serious, but an item may be under- or overpriced in error or in an attempt by the contractor to anticipate an over- or underestimate in the quantities, and weight the bill accordingly. However, there is a danger that the estimator may have anticipated wrongly and this would fall in the category of uncertainty.

(c) The bill item unit of measure may be different from the supplier's unit of measure. Such is the case, for example, where the supplier provides backfill material by weight and the client pays by volume. This could be regarded as uncertainty.

(d) There is a likelihood of mistakes when using complex bills. Authors have shown that there is considerable variability in estimating, but they have also shown that this variability can be assessed and expressed mathematically. This can be regarded as risk.

3.3.4.5 **Soil conditions**

Soil conditions may be different from those expected. This may, in certain circumstances, be the responsibility of the client; if not, this can be classified as uncertainty. The wise contractor could ask for a drill sample to be reassured.

3.3.4.6 **Management costs**

Inadequate quality of management may prevail. This is not important with tried management personnel, although a person may be a good manager on, say, a technically complex project and not on one where labour unrest develops. The greatest problem arises in a rapidly expanding firm where the management quality is to some extent unknown. Such uncertainty is uninsurable.

3.3.4.7 **Weather and seasons**

Bad weather can seriously hamper the progress of a job. It can be insured against or it can be, to some extent, overcome at a cost by winter building precautions. This can be seen as risk and is therefore insurable.

3.3.4.8 **Actions of designers**

(a) Should the architect or engineer not supply detailed drawings on time this represents uncertainty. Yet, it can be shifted to the client, except to the extent that the cost of disruption of the contract cannot be proved for a claim. For instance, on one large London site the disruption caused by lack of drawings was a main factor in starting a chain of events, including serious labour troubles, which ultimately shut the site.

(b) If the architect or engineer changes his or her mind this represents uncertainty, but with the proviso in (a) above, this event can be shifted to the client.

3.3.4.9 **Catastrophes**

Fire, floods and earthquakes are risks which can be insured against.

3.3.4.10 **Overrunning of time**

If the contract is not completed on time and a penalty clause involved, this can be regarded as uncertainty, according to Hillebrandt (1985:157).

In practice, and given that contracting is known to be a high-risk business, contracting firms make profits on some contracts and losses on others. Lea (1973:118) reported on an Ashridge Management College study, undertaken in 1972, which found that most contracting firms said that they made a loss on about one in ten of their contracts. However, the analyses made in that study suggested that this was too low a figure and that around one in five would be a truer reflection of the firms examined.

These findings correspond with those of Fine who reported that in both divisions of a large U.K. contracting organisation, one job in five lost money at site level (Fine, 1975:213). Given the multitude of risks and uncertainties facing the contractor, of which the competitive tendering environment is of critical importance, Fine (1975:221) concluded: "Estimating is like witchcraft; it involves foretelling situations about which little is known".

The South African experience proves to be similar to that of the U.K. According to the Census of Construction 1985 contractors' average profit on turnover was usually less than 6%. The following schedule provides net profit as a percentage of gross output (turnover).

Table 3.2

Contractors' net profit as a percentage of gross output, 1972-1985

Census years	Percentage net profit on gross output (turnover)	Comment on stage of the business cycle
1972	4,1	Recession
1974	5,8	Upturn/peak
1976	5,4	Recession
1978	5,6	Recovery/Upturn
1980	5,6	Boom
1982	6,2	Recession
1985	4,1	Recession

Source: Census of Construction (1985:1).

The preceding sub-sectors have dealt with competition and the risk involved in the fixing of prices in the field of contracting. It is appropriate to investigate how contractors deal with these issues.

In their analysis of how contractors deal with the risks and uncertainties inherent in contracting, Flanagan and Norman (1989: 129-152) studied the competitive tendering system and showed that different contractual arrangements give rise to different allocations of risk between the client and the contractor. Traditionally, building work has most commonly been awarded on the basis of competitive tenders without negotiation. Such tenders can be regarded as "sealed bid auctions" and are quite common in the case of oil exploration rights or construction contracts. However, in an attempt to shift the risk, many contractors prefer to negotiate construction contracts with clients. The price level will then depend, to a large extent, on the allocation of power, knowledge and risk between the negotiating parties.

Flanagan and Norman subscribed to the general principle "... that the greater the risk imposed on the contractor, the greater the price the client must accept. In other words, the client has to trade off price and risk in the choice of contractual arrangement". They stated that as the industry in the U.K. has become more competitive in recent years, there has been a move to management fee and design-build forms of contract (Flanagan & Norman, 1989:145).

In South Africa a comparison of open competitive tenders and negotiated contracts was undertaken by Chapman and Webb (1983:31) and covered the period 1977 to 1981. They found that the number of negotiated contracts per quarter had increased over time.

Many of the risks and uncertainties discussed above can be linked to the course of the building cycle as this has a direct bearing on the costs of contracting. It also has a direct influence on the recovery of costs in terms of the system of contract price adjustment provisions, implemented in South Africa during 1976. These important aspects will be discussed in greater detail in Section 4.8 of this study.

3.4 Interrelationship between the construction industry and the overall economy

Before concluding this conceptual framework of the study it is appropriate to consider the interrelationship that exists between the construction industry and the overall economy. The key to this relationship was described by Hillebrandt (1985:12).

Hillebrandt stated that three characteristics, i.e.the size, the investment-goods industry and the dependence on government as a client, provide the key to the interrelationship between the industry and the economy. Size is important because changes in output of the construction industry affect the size of the national product both directly and indirectly. It also means that what is happening to the construction industry must be a matter of national concern. It is much too big to ignore. It is also too important to ignore. As a provider of about half the country's fixed investment, if the output of the industry is down, total investment is down, and investment is of vital concern in considering the health of the nation. Finally, because it provides an investment good this means that it is subject to severe fluctuations in demand.

The latter two of these characteristics, investment-goods industry and dependence on government, have been dealt with in previous sub-sections of this chapter. It is appropriate at this point to consider the size of the construction industry. Hillebrandt (1985:10) stated that not only in the U.K., but internationally the construction industry is an important industry and accounts for about 3% to 10% of gross domestic product. In the majority of countries the construction industry accounts for between 50% and 60% of gross fixed capital formation. Citing 1983 data, Hillebrandt (1985:10) stated that the value of the final product of the construction industry amounted to between 9% and 10% of gross domestic product in the United Kingdom.

In South Africa construction (contractors) contributed 3,7% in 1985 and 3,2% to gross domestic product at factor cost in 1990 (data derived from South African Reserve Bank Quarterly Bulletin, September 1991). These percentages correspond with those of Hillebrandt (1985:10) who found that the contribution of construction to gross domestic product in developing countries is less than in developed countries. South Africa could be classified as a developing country in this context. Furthermore, being labour intensive, the construction industry contributes a significant proportion to the economically active population. According to the 1990 South African Labour Statistics, construction comprised 5,3% of all economically active persons in 1980, rising to 6,4% in 1985. By comparison, the manufacturing sector comprised 16% on average, the mining sector 9% and the electricity, gas and water sector just about 1%, on average, during those years.

The true significance of the construction sector can be gauged when it is expressed as a percentage of gross domestic fixed investment. According to the Supplement to the Quarterly Bulletin of the South African Reserve Bank, June 1991, investment in residential and non-residential buildings, as well as in construction works, constituted 56% of gross domestic fixed investment in 1970, 49% in 1980 and 47% in 1990. These data also correspond with those of Hillebrandt, cited above.

Whilst the size of the construction industry is important, it is also appropriate to consider the interaction between the construction industry and the overall economy. Hillebrandt (1985:12-13) distinguished four levels at which this interaction takes place:

* in demand and output;
* in employment and incomes;
* in the balance of payments; and
* in the level of prices.

These are, in turn, all interrelated. For instance, a decrease in employment causes a fall in incomes. Incomes, as shown in an earlier sub-section of this chapter, form a determinant of demand. Therefore, a reduction of demand will lead to a drop in output which will, in turn, lead to a drop in employment. In similar vein, a rise in incomes will normally lead to a rise in imports generally. (The building industry has a low import propensity). This could lead to an imbalance in the balance of payments and corrective measures would then be required of the government. Hillebrandt (1985:13) concluded:

> It is unfortunate for the construction industry that the ways in which it is easiest and least painful for the government to inject a new factor into the economic cycle have been found to be raising the rate of interest and restricting credit, so that it becomes more difficult and more expensive to borrow money; reducing purchasing power through an increase in taxation; and reducing its own spending, **especially capital spending which is easier to postpone than current expenditure. The construction industry is affected directly or indirectly by all these measures** (emphasis added).

3.5 The costs of instability

In previous sections of this chapter reference has often been made to the disruptive effects of demand instability. It is implicitly implied that stability is a desirable objective. What factors underlie this belief? Manski and Rosen (1978:208) note that it is generally accepted that the costs of producing and marketing a commodity, and the price paid for it, are higher when demand is unstable then when it is stable. Instability of demand is consequently considered to be a problem, and policies to stabilise demand are put forth (Barnicke, 1974; Kilian, 1976, 1977; Kilian & Snyman, 1979).

This preoccupation with instability stems from the fact that demand fluctuations have cost-raising effects. Instability is costly to society and can be costly to the individual firm, depending on how management deals with demand fluctuations. Whereas these disruptive effects have been mentioned in previous sections of this chapter, a brief summary at this point is appropriate. Instability can lead to under- or over-employment of labour resources; on the one hand unemployment has undesirable social cost implications, on the other hand labour shortages usually lead to wage inflation. Bottlenecks in labour supplies adversely affect the productivity of labour with concomitant cost-raising effects.

Suppliers of building materials are forced to adjust production schedules to cope with unstable demand conditions. Profitability may suffer because of the cost-raising effects of labour retrenchments in time of recession and the retraining of additional labour in times of strong economic growth. In order to smooth production levels, suppliers often have to carry large inventories. Much working capital is tied up in this manner, with cost-raising effects on building costs generally. Finally, instability of demand can lead to insolvencies of firms in the construction industry. Such events impose their own costs on individuals and society at large.

In conclusion, demand instability has cost-raising effects on building costs generally. To cover their higher costs, profit-maximising contracting firms have to charge more for their product (i.e. buildings and construction works) than would be the case if costs could be reduced across the board. In the case of housing, the cost-raising effects of instability have undesirable socio-economic implications. In a country like South Africa, with its large housing backlog and its rapidly expanding population, inefficient use of available economic resources cannot be tolerated.

3.6 **Summary**

This chapter has focused on various aspects of the theoretical foundations of the construction industry. This conceptual framework is important because it explains why contracting is different to manufacturing. Also, the special characteristics of the construction industry have been discussed to provide a better understanding of the construction process and the economic behaviour of the construction firm. It was shown that the physical nature of the final product of the construction industry has an effect on the structure of the construction industry and the way in which this industry organises itself.

Those factors that influence demand were discussed. It was shown that the level of interest rates is the most important of these determinants. In the case of housing, it was stressed that the effective cost thereof is dependent upon the mortgage rate level which represents the cost of borrowed funds. Therefore, the effective cost of a house to the purchaser is determined by the amount of the monthly mortgage bond instalment. It was also argued that this amount is more important to a prospective homeowner than the price of the house. Thus, interest rate levels are of critical importance in the context of the demand for buildings.

Other determinants, e.g. the availability of funds, incomes and subsidies, etc. were also discussed. The important role played by the public sector was analysed and it was pointed out that the public sector represents the largest single client in the construction industry. Furthermore, it was shown that the public sector uses the construction industry in general, and the public non-residential sector in particular, as a regulator or balance wheel of the economy. Such action is taken in terms of the macroeconomic objectives of the public sector and general economic stabilisation policies.

The method of price determination was discussed and it was shown that the system of a priori pricing in the construction industry is accompanied by a multitude of risks and uncertainties. The competitive tendering system and the fluctuations of the building cycle are central to the issue.

Finally, emphasis was placed on the interrelationship that exists between the construction industry and the overall economy. It was shown that interaction takes place at all levels and in virtually all aspects of economic life. One consequence of this interaction is instability. A summary of the costs of instability rounded off this chapter. It was shown that instability imposes certain costs on society and on the individual firm, depending on how management deals with such instability.

The broader topic of instability, as experienced in the South African building industry, is dealt with in the next chapter. The interrelationships between certain variables are considered; e.g. rising exports can boost the current account of the balance of payments; rising domestic liquidity can lead to lower interest rates and building societies can find themselves flush with deposits; greater availability of housing finance and lower mortgage rates can make housing more affordable and can lead to rising levels of effective demand for housing; this can be reflected in increases in key economic indicators, a number of which are used in this study to devise a leading indicator for the South African building industry.

* * * * * * *

Chapter 4

Instability in the South African building industry

4.1 Introduction

A number of researchers have studied the issue of instability in the South African construction industry (Backeberg, 1941; Bester, 1970; Kilian, 1976; Kilian & Snyman, 1979; Snyman, 1991). The most comprehensive of these studies was commissioned by the Building and Construction Advisory Council and was completed by Kilian in 1976. This study, conducted under the auspices of the Bureau for Economic Research at the University of Stellenbosch, included analysis of post-war cycles in the South African construction industry. Recommendations were made to improve stability in the building and construction industry. One of the recommendations was that the central government should sponsor research to find reliable methods of medium-term forecasting of construction activity on a regional and national basis (Kilian, 1976:203). To date this sponsorship has not materialised.

As was stated in Chapter 3, instability of demand for building work brings about severely disruptive effects on the operations of contractors, sub-contractors, workers, building materials manufacturers and merchants, as well as architects and quantity surveyors. These effects influence productivity of labour, profitability and cash flow of firms, job security of workers and the availability of labour and building materials. Consequently, it is important to measure the instability of demand for building so that participants can be advised when and in which direction demand conditions will change (the "timing" aspects), how strong these fluctuations will be (the "amplitude") and how long they will last (the "duration"). This also implies the forecasting of upper and lower turning points of the building cycle. A leading indicator, specific to the building industry, can be a major contribution, along with other forecasting models. A composite leading indicator is devised in this study for the South African building industry. This is accomplished in Chapters 8 and 9 in terms of the conceptual framework set out in the previous chapter and the analysis of building cycles in the current chapter.

A macroeconomic overview of building cycles in South Africa is essential if one is to fully appreciate the need for reliable forecasting and a composite leading indicator. To analyse the macroeconomic aspects of the cycles, use will be made of data emanating from the South African Reserve Bank and the Central Statistical Service. This empirical analysis of instability will focus on a number of the theoretical concepts developed in the previous chapter, e.g. interest rate fluctuations, the availability of capital, net migration patterns, the acceleration principle and the important role played by the public sector.

It will also emphasise the importance to the contractor of being able to interpret trends in the building cycle when tendering on new work. Knowledge of the interaction between the building cycle and building costs is critical for the financial well-being of the contractor. Finally, an assessment is made of the importance and relevance of the survey indicators used in this study to develop a leading indicator.

4.2 **Macroeconomic overview of the South African construction industry**

It is appropriate to review briefly the development of the South African economy for a meaningful interpretation of the fluctuations identified in the building and construction industry. The South African economy was based to a large extent on mining and agriculture up to the nineteen-fifties. Manufacturing grew rapidly during the sixties. The inflation rate was relatively stable, and did not exceed 3% to 4% p.a. However, the oil price shocks of 1973 and 1979 contributed to the rise in inflation evident since the late sixties. A severe recession lasted from September 1974 to December 1977 (Smit & Van der Walt,1982). A strong rise in the gold price boosted consumption spending in the early eighties. A sharp drop in the gold price during 1981/1982 accompanied the recession that followed. During the mid-eighties a structural change took place in the economy. Trade sanctions were already in place and these were followed by financial sanctions. The repayment of foreign debt curtailed long-term growth prospects. A stringent monetary policy was followed. The prime interest rate was raised to 25% in August 1984. A debt standstill was announced in September 1985. Interest rates remained relatively high during subsequent years. This had a severely negative effect on investment in the building and construction industry during the period 1985 to 1987. A revival in the industry in 1988 was followed by a protracted downswing which lasted until the end of 1993.

The total construction industry comprises investment in buildings and civil engineering construction works. As a result of the diversity of the industry, the only common measure reflecting activity levels is to express investment in constant money terms. In this study the values are given at constant 1985 prices. The analysis starts with totals and the breakdown into the sectoral components then follows. The levels of investment are depicted in Graph 1, covering the period 1946 to 1993. It is evident that the growth was rapid during the sixties and early seventies. A marked decline is evident in the period 1975 to 1978. This period coincided with a protracted recession in the South African economy which was accompanied by political unrest (e.g. the Soweto uprisings in June 1976). A rise in the gold price during 1979/80 contributed towards a strong revival in the South African economy and the construction industry. The rise culminated in a peak during 1981. The graph also clearly shows the dramatic drop in overall investment in the total construction industry during the years 1982 to 1987. Little improvement is evident in the subsequent period to 1993. In real terms, the level of investment at that point was comparable to that of the early seventies.

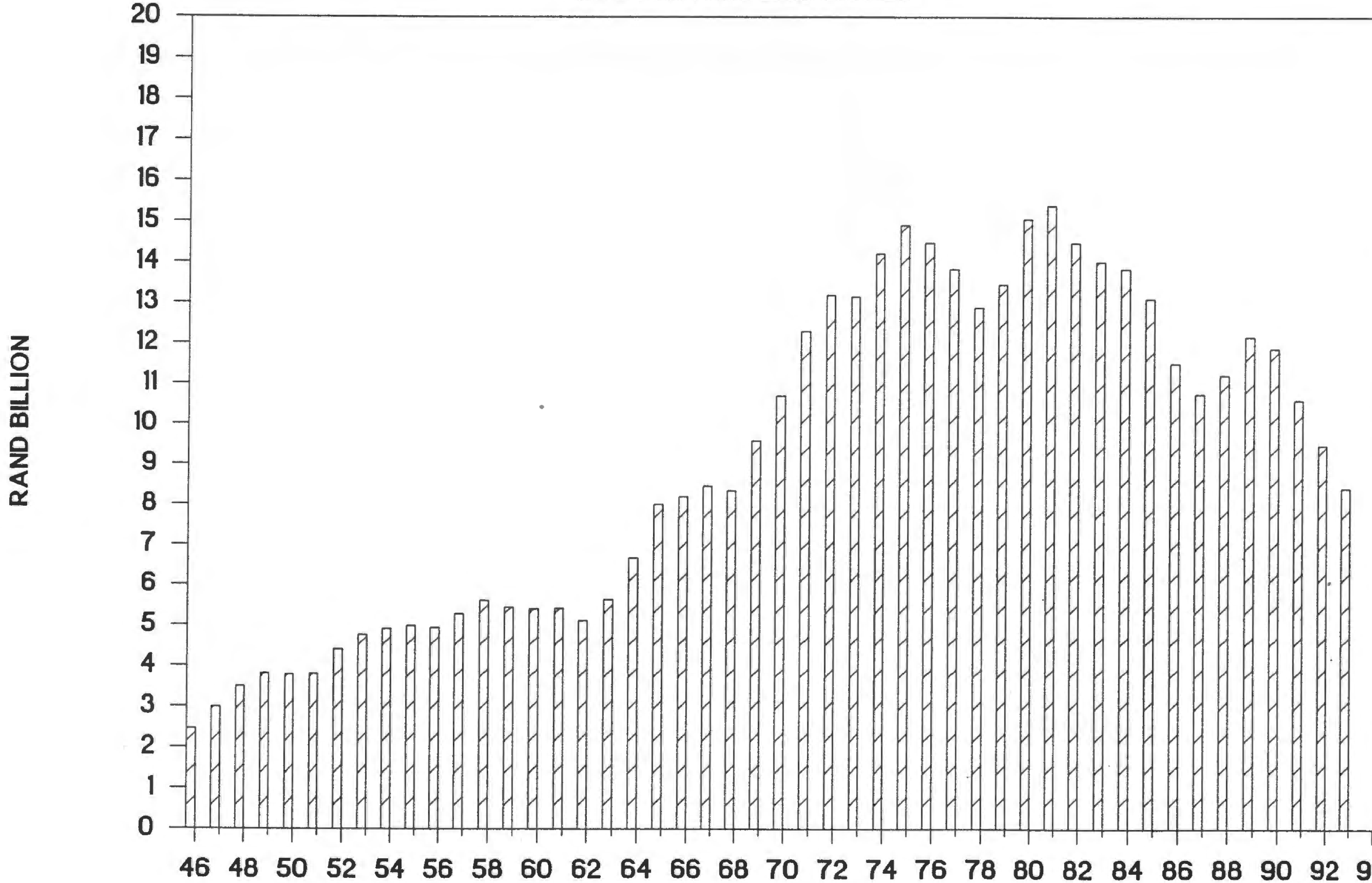
Graph 2 provides the data of total investment in buildings. From visual comparison with Graph 1 it is evident that the peaks and troughs are more pronounced than when considering the data for total construction. A notable feature of the performance of the building industry is the very rapid growth recorded in the period from the early sixties to middle seventies. Compared with the peak attained in 1974, the downswing to 1978 was particularly severe. The rebound in investment in buildings that culminated in an all-time peak in 1984 was very strong. In contrast, the period 1985 to 1987 were years of severe contraction. By 1993 investment levels were again on a par with those of the early seventies. The latter finding indicates that the total building industry has shown virtually no real growth during the past two decades.

Graph 3 depicts the deviation from the long-term trend line of investment in total buildings, expressed in millions of constant rand, as well as in percentage terms. The trend line was calculated by the fitting of an exponential function on the annual data. The absolute deviations were calculated by deducting the trend-line data from the actual annual data. These percentage deviations were calculated by dividing the actual data by the trend-line values. It is evident that two Kuznets-type cycles can be identified in the period 1946 to 1978. The first such medium-term cycle recorded a trough in 1962, the second in 1978/79.

GRAPH 1

TOTAL BUILDING & CONSTRUCTION INDUSTRY

AT CONSTANT 1985 PRICES

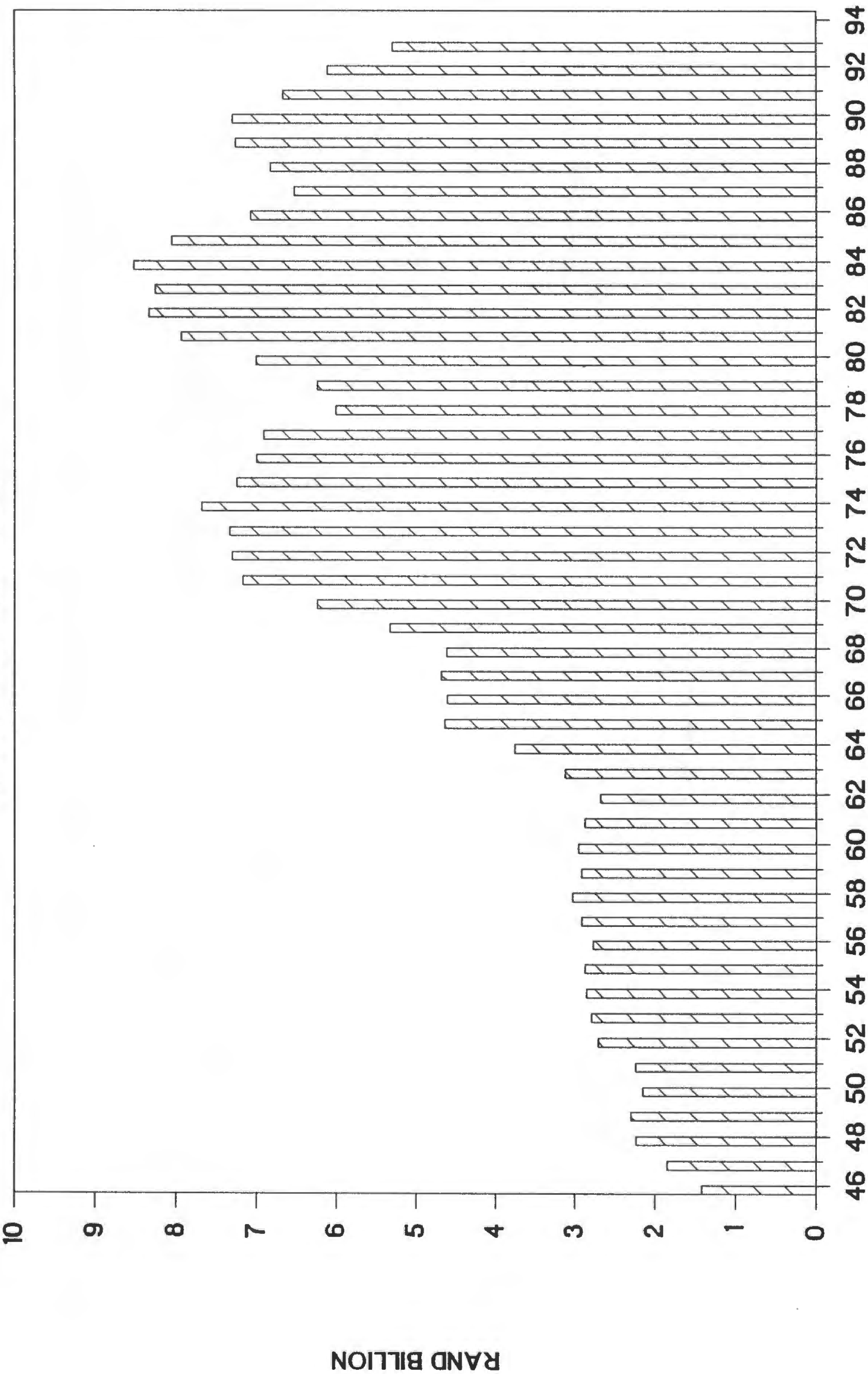


Source: SARB QB March 1994

GRAPH 2

TOTAL INVESTMENT IN BUILDINGS

AT CONSTANT 1985 PRICES

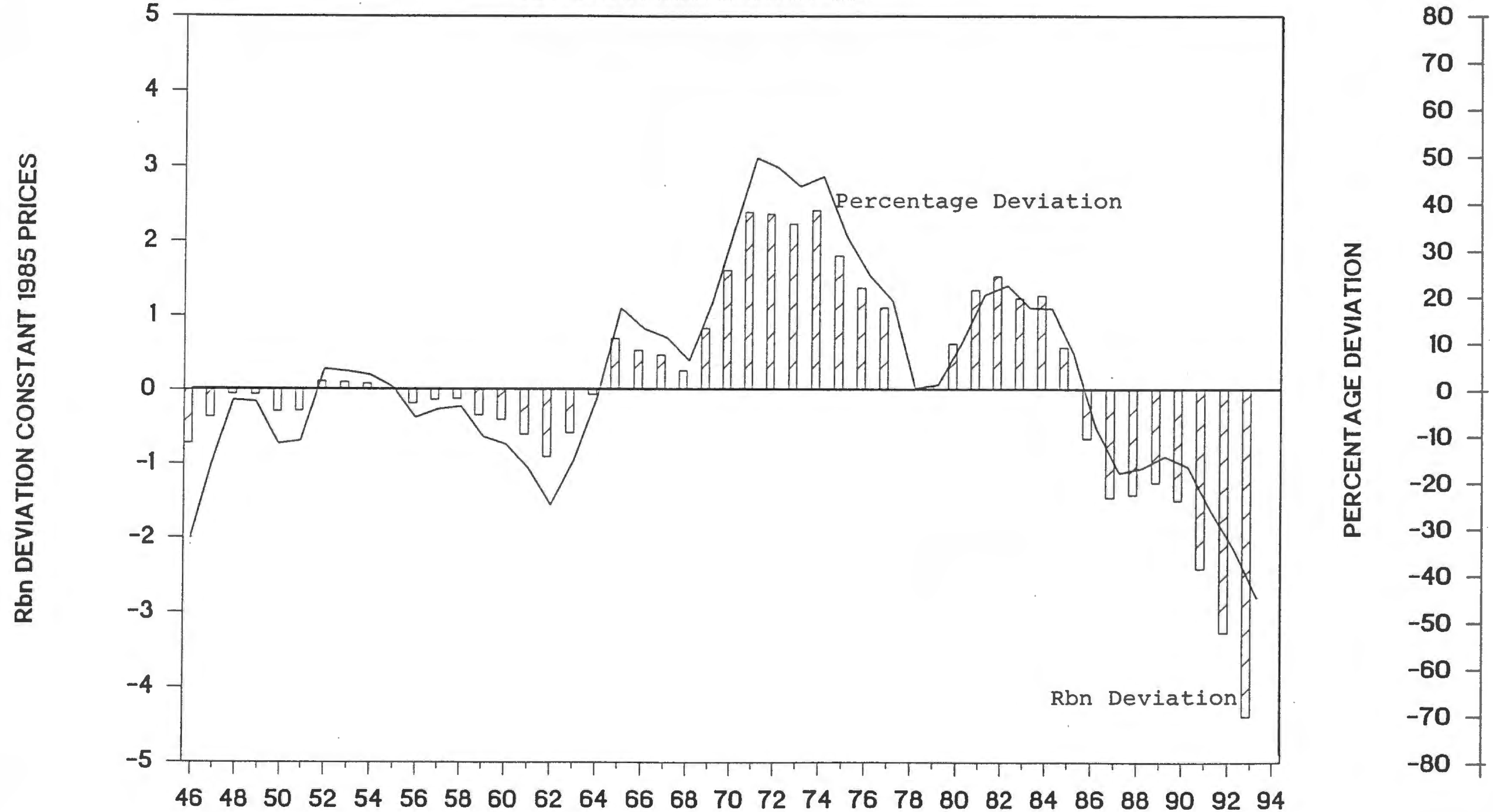


Source: SARB QB March 1994

GRAPH 3

TOTAL INVESTMENT IN BUILDINGS

DEVIATION FROM GROWTH LINE



Source: SARB QB March 1994

It is also evident that an upswing phase started in the early eighties, only to be interrupted by government action in 1984. This took the form of the "economic austerity package" of August 1984 and included the raising of the prime overdraft rate to 25%. This package was implemented to curb consumer spending after a large deficit arose on the balance of payments. Finally, it is evident that the building industry was operating below its long-term growth potential during the late eighties. This is evident from the large negative absolute deviation, as well as the negative percentage deviation of some 25%. The situation worsened during the early nineties.

The investment levels of civil engineering works are depicted in Graph 4. Three features stand out, viz. the dramatic and sustained rise in the period 1963 to 1975; the high levels of investment recorded during subsequent years up to 1981 and, finally, the severe slump that set in during the eighties. The periods of growth were characterised by large infrastructural projects such as the Verwoerd Dam, the Sishen-Saldanha railway line, the Richards Bay harbour works, the erection of two new oil-from-coal projects (SASOL II and III) and the expansion of the electricity grid. Current investment levels are again comparable to those attained in the early seventies. This finding corresponds with one mentioned previously, viz. that a decade of growth (the seventies) was followed by almost a decade of contraction (the eighties).

From this point on reference will no longer be made in this study to the civil engineering sector of the total construction market. Emphasis will henceforth be on the building industry. The reasons for this approach were given in Section 3.2.3 of this study.

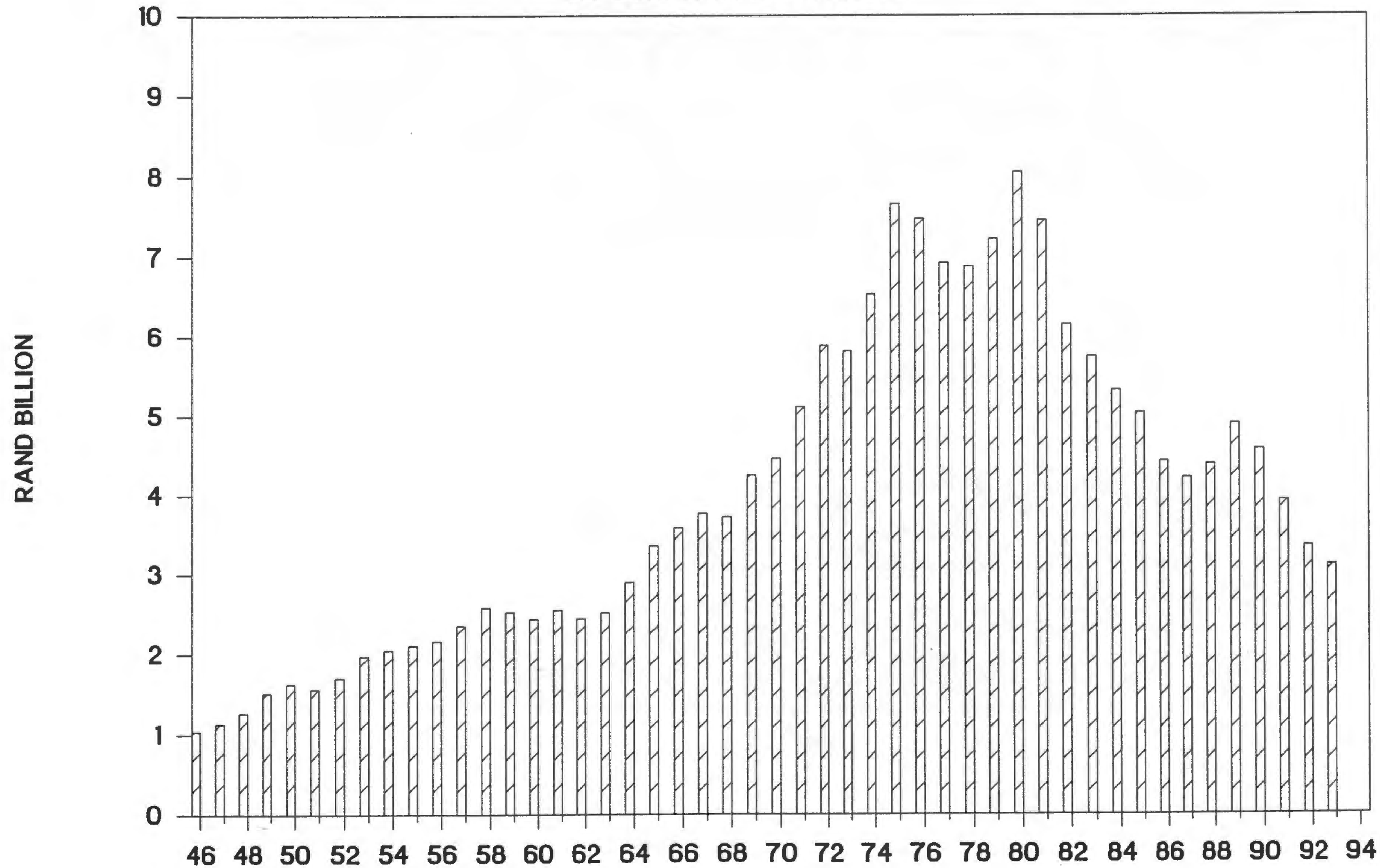
Traditionally, the building industry can be divided into four major sectors, viz. investment in:

* private residential buildings;
* public residential buildings;
* private non-residential buildings; and
* public non-residential buildings.

GRAPH 4

TOTAL CONSTRUCTION WORKS (CIVIL ENG.)

AT CONSTANT 1985 PRICES



Source: SARB QB March 1994

These sectors differ as to their relative size and long-term growth rates. To illustrate this aspect, the accompanying Table 4.1 provides the compound rate of growth during the period 1946 to 1993, as well as the relative size of each sector.

It is evident from the table that the residential and non-residential sectors each comprise about half of total investment in buildings. Furthermore, it can be seen that the public non-residential sector has gained in importance from 1950 to 1980. The rapid rise in investment in public non-residential buildings was attributable to the growth in the parastatal organisations, such as SASOL, ISCOR, ESKOM, ARMSCOR, etc. Finally, the table shows that public residential investment has decreased in importance since 1980. This was the result of a change in public housing policy. These aspects are considered in greater detail in the following sections.

Graph 5 depicts the levels of investment in private residential buildings. The total is comprised of dwelling houses, flats, townhouses, private hostels, private nurses' homes, private boarding homes, private retirement villages and additions and alterations to the above categories. It is evident that growth was rapid in the sixties and early seventies. Equally significant is the severe downturn in the period 1974 to 1978. The revival in the housing market in subsequent years culminated in a peak during 1984. After 1984 there is evidence of a gradual decline in investment levels, attributable, in large part, to a period of high interest rates. This occurred despite a severe housing backlog among low-income groups.

Graph 6 depicts the deviations from the long-term trend line of investment in private residential buildings in percentage terms, as well as in millions of constant rand. As was the case in Graph 3, the long-term trend line was calculated by the fitting of an exponential function on the annual data. The absolute deviations were calculated by deducting the trend-line values from the actual annual data. The percentage deviation was calculated by dividing the actual data by the trend-line values. A number of medium-term cycles are evident. In their analysis of medium-term cycles in the housing market Kilian and Snyman (1984:13-14) found clear evidence of the existence of two Kuznets-type cycles of approximately 16 to 20 years duration in the period 1946 to 1978. Troughs were recorded in the years 1962 and 1978. An upswing started in 1979 and lasted until 1984. In August 1984 the government announced an "economic austerity package" that included a rise in the prime overdraft rate

Table 4.1

Composition of major sectors of building industry and long-term growth rates (1946 to 1993)

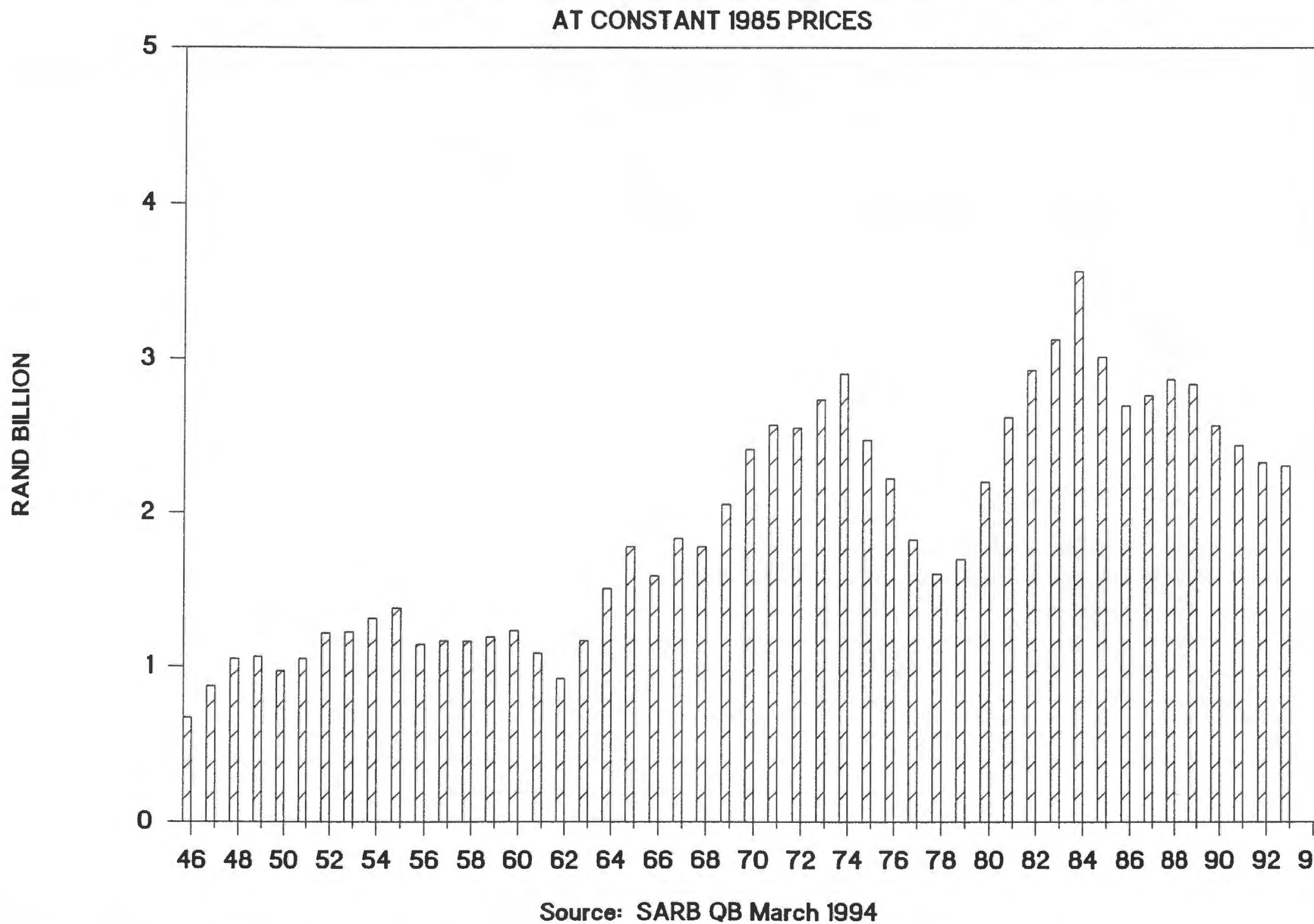
	Long-term growth rate per annum*	As percentage of investment in residential or non-residential buildings					As percentage of total investment in buildings				
		1950	1960	1970	1980	1990	1950	1960	1970	1980	1990
Residential:											
Private	2,70%	85	81	79	67	83	45	42	39	31	35
Public	3,37%	15	19	21	33	17	8	9	10	16	7
Total	2,85%	100	100	100	100	100	53	51	49	47	42
Non-Residential:											
Private	3,26%	69	59	53	48	60	32	29	27	25	35
Public	4,33%	31	41	47	52	40	15	20	24	28	23
Total	3,72%	100	100	100	100	100	47	49	51	53	58
Grand Total	3,25%						100	100	100	100	100

Source: Compiled from data published in Supplement to the Quarterly Bulletin of the South African Reserve Bank, June 1991 and Quarterly Bulletin of the South African Reserve Bank, March 1994.

* An exponential growth function was fitted to the data (least squares method).

GRAPH 5

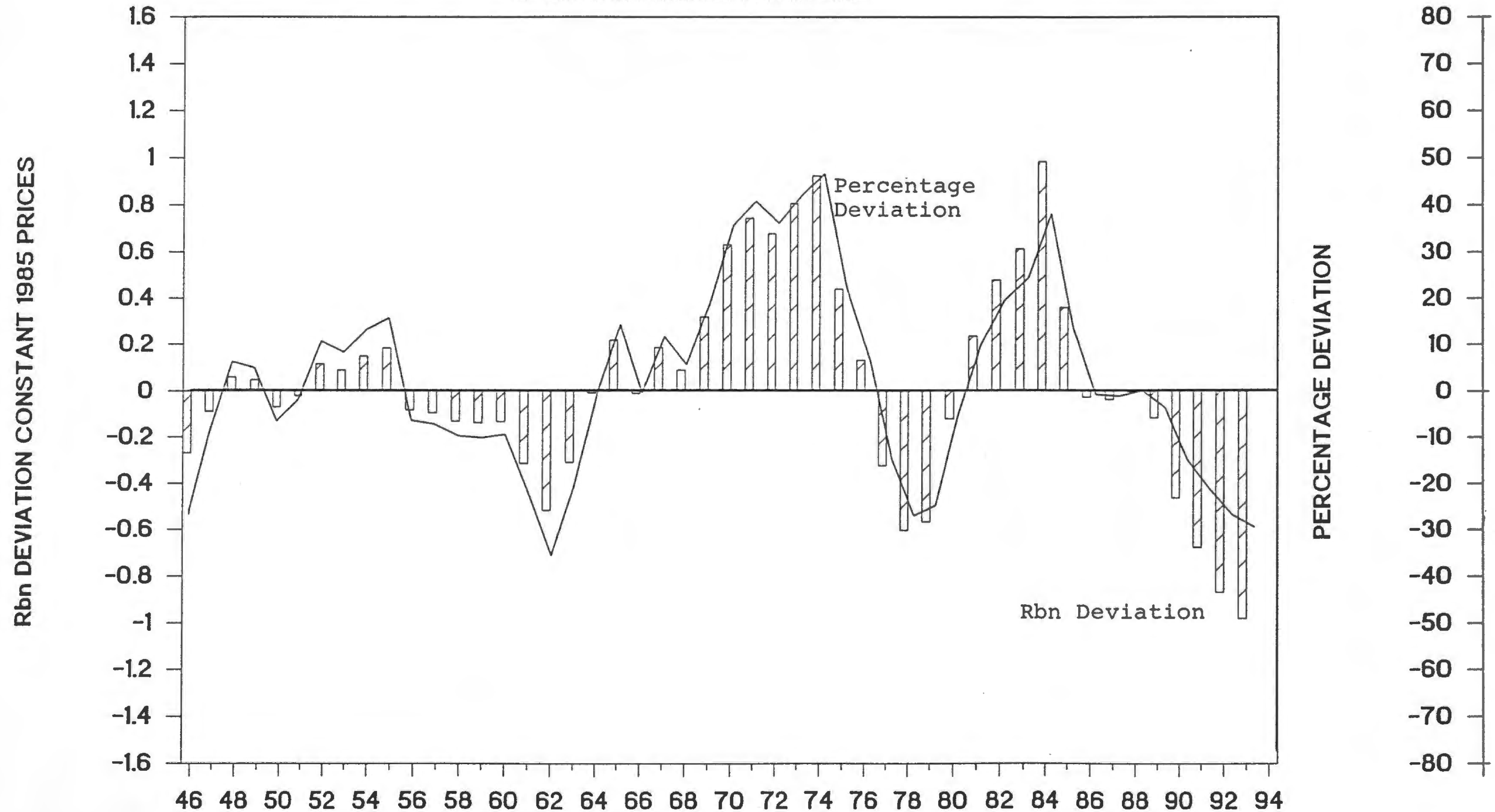
TOTAL PRIVATE RESIDENTIAL INVESTMENT



GRAPH 6

INVESTMENT IN PRIVATE RESIDENTIAL BLDGS

DEVIATION FROM GROWTH LINE



Source: SARB QB March 1994

to 25%. In consequence, the housing industry entered a severe recession. This lasted until 1993.

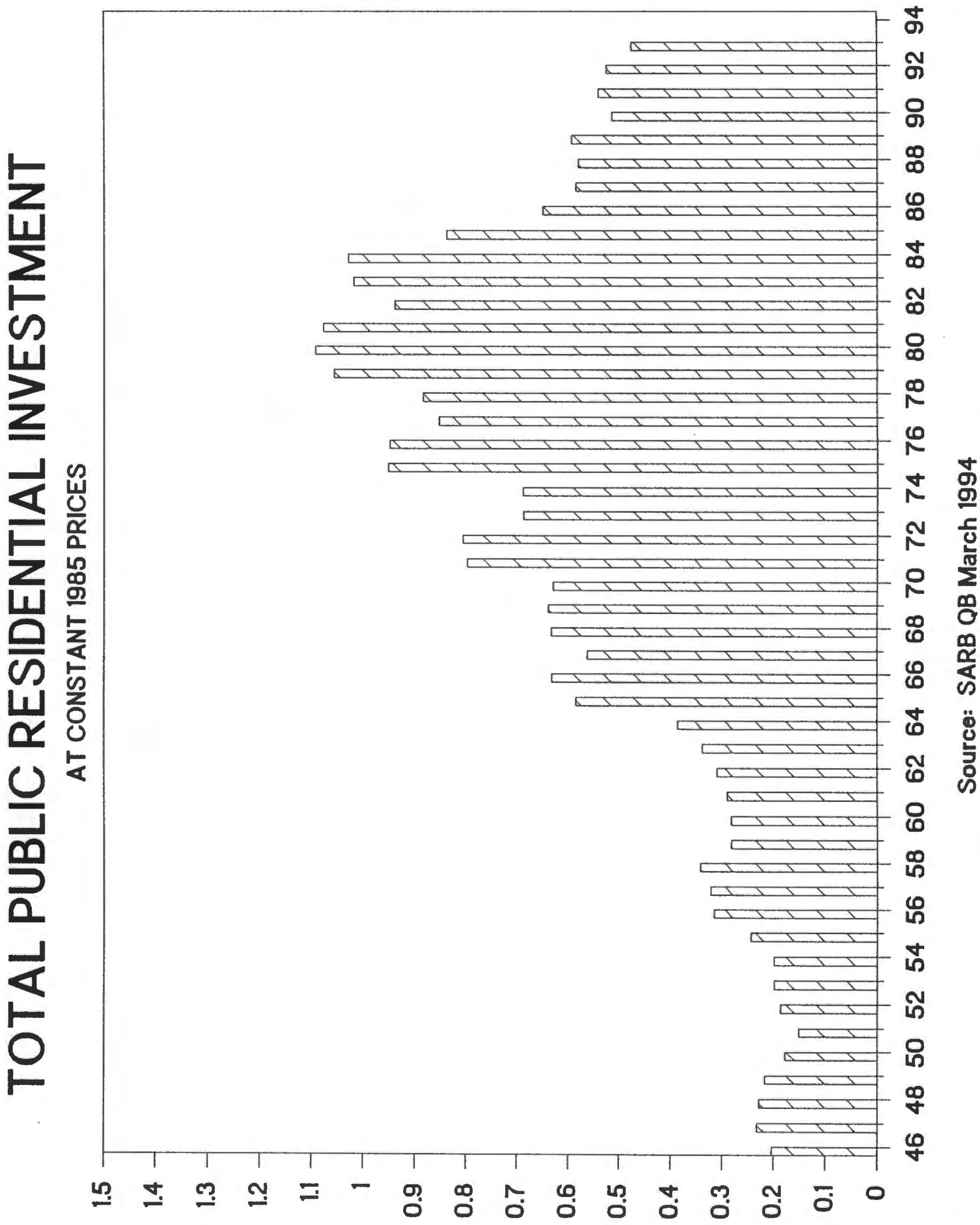
The levels of investment in residential buildings by the public authorities and public corporations during the period 1946 to 1993 are depicted in Graph 7. It is evident that investment in this market sector culminated in a peak during the early eighties. Changes in macroeconomic policies led to a severe trimming of capital expenditure levels in subsequent years. More specifically, changes in public housing policies took the form of a reduction of public expenditure on low-income housing projects. Mortgage interest subsidies, such as the First-Time Homeowners' Subsidy Scheme, replaced direct government-sponsored mass housing schemes for low-income earners. By coupling the mortgage interest subsidies to sources of private housing finance, the private sector had an increased role in providing low-income housing. Thereafter, comparable levels of public investment in housing returned to those prevailing in the late sixties.

Graph 8 depicts the deviations in investment in public residential buildings from the long-term trend line, expressed in millions of constant rand and in percentage terms. It is evident that no clear cyclical pattern emerges. Also evident is the significant negative deviation from the trend line during the mid- and late eighties, approaching 55%.

Graph 9 illustrates the levels of total investment in residential buildings by both the private and public sectors. Pronounced cycles are evident, especially the periods of sharp growth in the sixties and early eighties, as well as the sharp contractions in the mid-seventies and mid-eighties. A sideways movement is evident during the late eighties, followed by a reduction in the early nineties.

Graph 10 depicts the deviation from the long-term trend line of investment in total residential buildings, expressed in millions of constant rand, as well as in percentage terms. The private sector is much larger than public sector housing. Therefore, the pattern that emerges more closely resembles that of private residential investment. As a result, there are distinct similarities between Graph 6 and Graph 10. Two Kuznets-type cycles are evident in the period to 1978. The early eighties were characterised by a strong revival which subsequently gave way to reduced levels of investment during the late eighties, attributable, in the main,

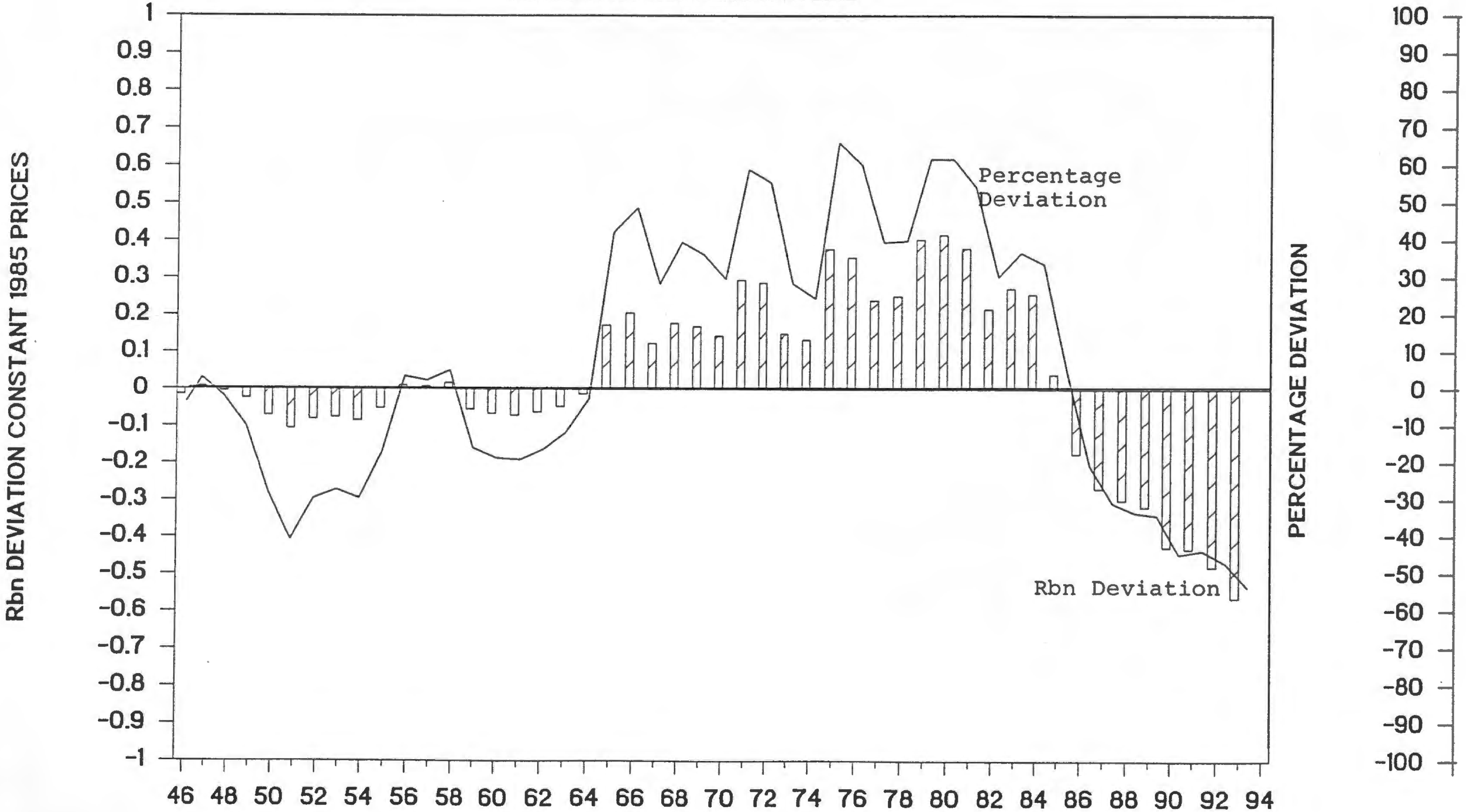
GRAPH 7


TOTAL PUBLIC RESIDENTIAL INVESTMENT
AT CONSTANT 1985 PRICES
RAND BILLION
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
Source: SARB QB March 1994

GRAPH 8

INVESTMENT IN PUBLIC RESIDENTIAL BLDGS

DEVIATION FROM GROWTH LINE

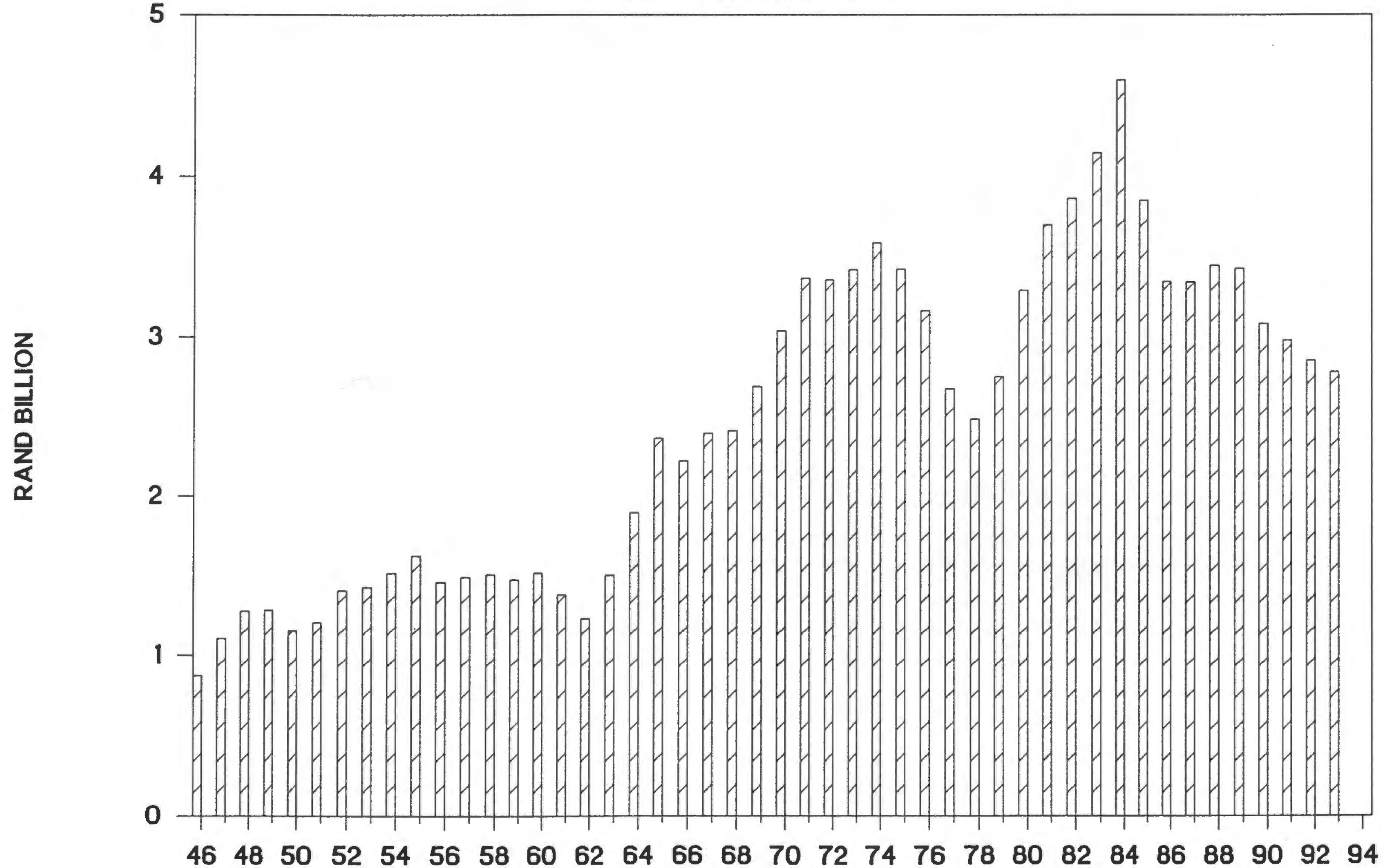


Source: SARB QB March 1994

GRAPH 9

TOTAL RESIDENTIAL INVESTMENT

AT CONSTANT 1985 PRICES

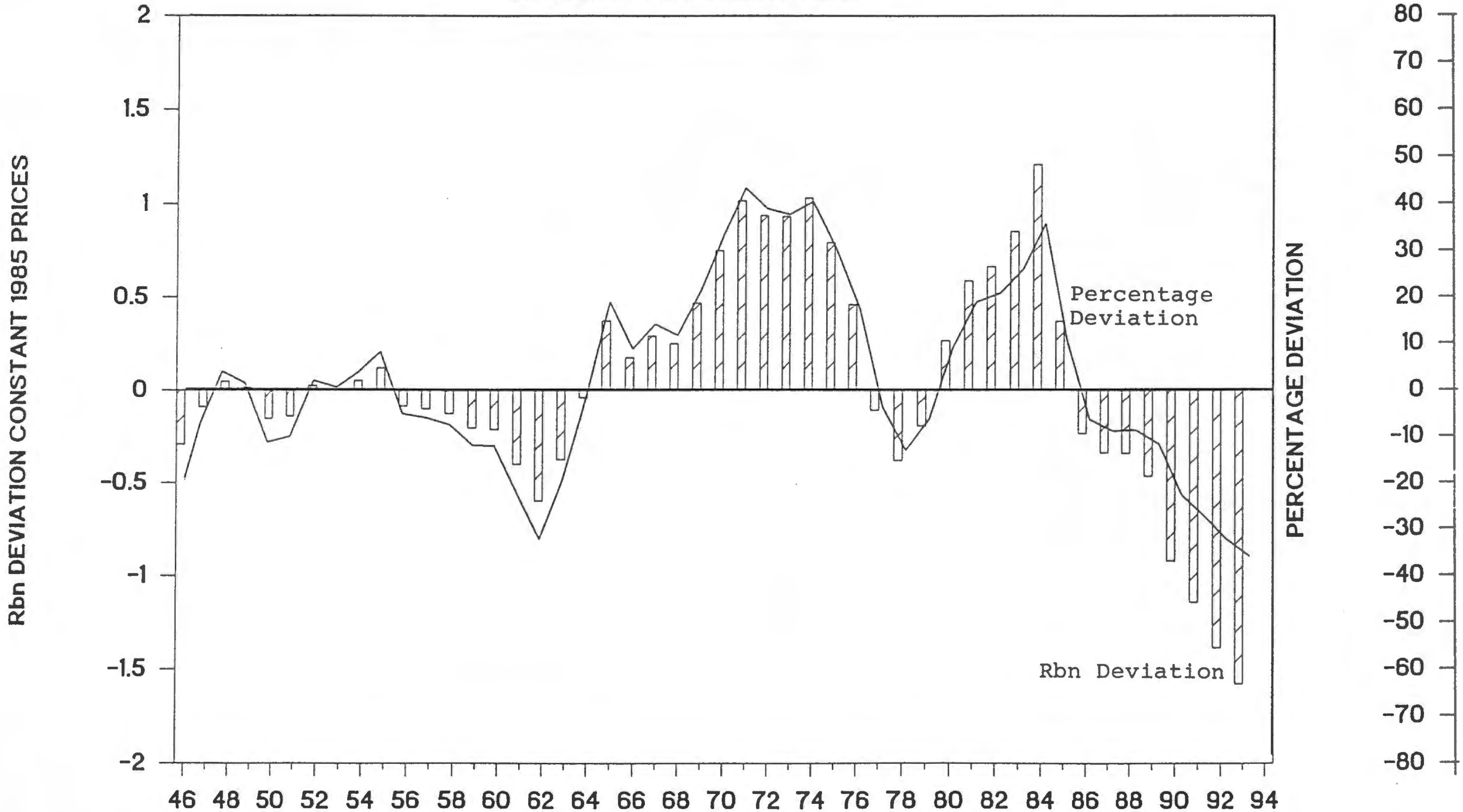


Source: SARB QB March 1994

GRAPH 10

INVESTMENT IN TOTAL RES BUILDINGS

DEVIATION FROM GROWTH LINE



Source: SARB QB March 1994

to a protracted period of high interest rates.

The levels of investment in the private non-residential sector are depicted in Graph 11. This sector comprises investment in office, shopping and industrial space, as well as additions and alterations to these categories. Also included are barns, stables, workshops, churches, private hospitals and clinics, gymnasiums, private schools and non-residential buildings in the mining and forestry sectors. A salient feature of the private non-residential sector is the pronounced instability, especially evident in the period since the early seventies. This aspect will be discussed in greater detail in Section 4.6 of this chapter.

Graph 12 depicts the deviations from the long-term trend in investment in private non-residential buildings, expressed in millions of constant rand and in percentage change terms. It is evident that two Kuznets-type cycles can be identified in the period to 1978. The first medium-term cycle recorded a trough in 1962, the second in 1979/80. An upswing period lasted a mere three years in the early eighties. Thereafter, the deviation was negative. This shows that the private non-residential building sector operated below its long-term growth potential, judging by the large percentage deviation in, especially, the years 1987 and 1993.

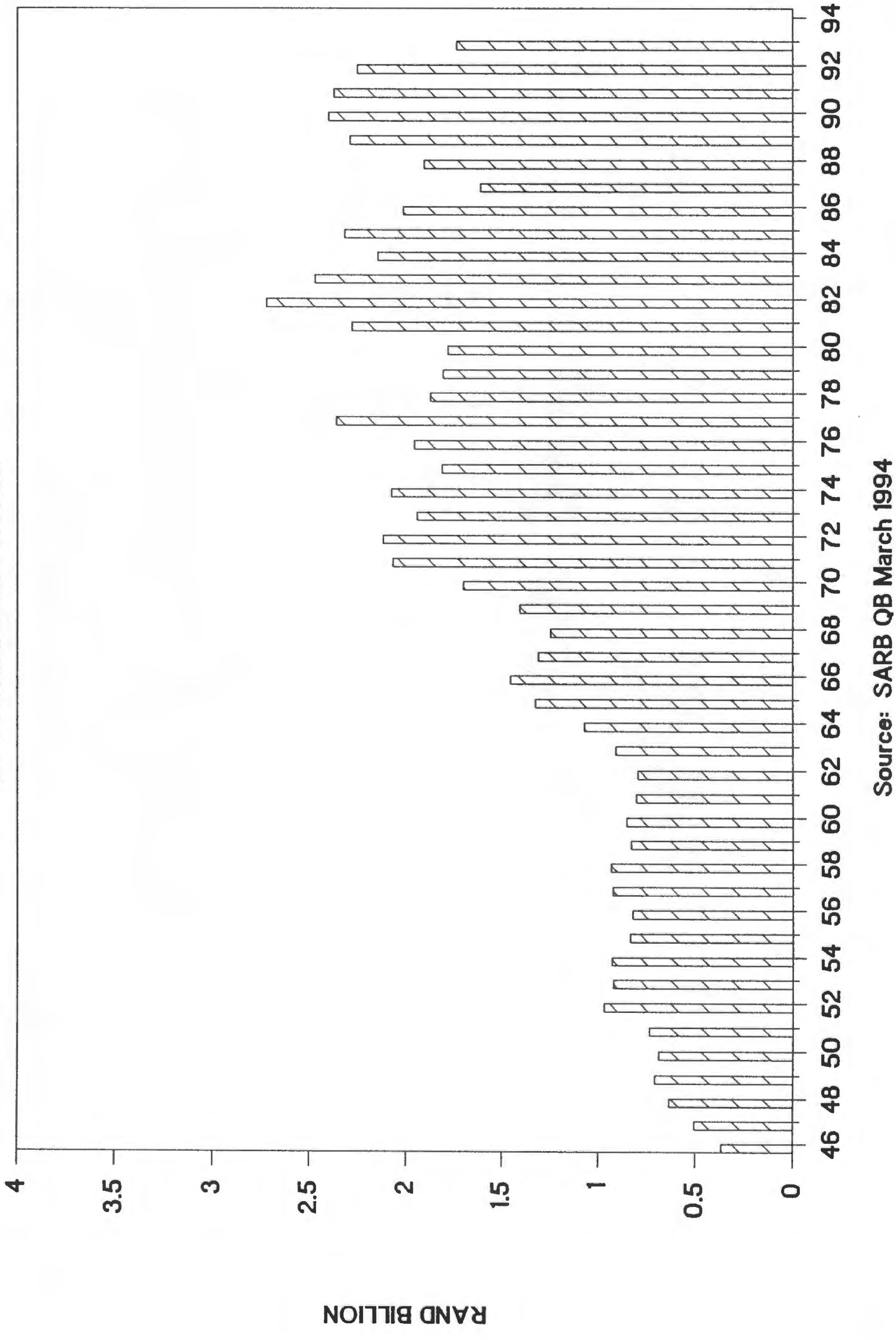
Graph 13 illustrates the levels of investment in non-residential buildings by the public authorities and the public corporations. Especially evident is the sharp rise during the early seventies and the subsequent gradual downward movement up to the year 1993. The latter finding is the result of a re-appraisal of priorities regarding public expenditure on non-residential buildings. This re-appraisal of public capital expenditure was instituted in the mid-seventies by the Minister of Finance who was faced with a large deficit on the current account of the balance of payments that culminated in the devaluation of the rand in September 1975. The deficit on the current account was, in turn, largely attributable to the financing requirements of large infrastructual projects which coincided in the early seventies. More recently, the cutbacks in expenditure were necessitated by poor overall economic conditions. The role of the public sector in building and its contribution to stability/instability is discussed in greater detail in Section 4.7 of this chapter.

Graph 14 depicts the deviation from the long-term trend line in investment in public non-residential buildings, expressed in millions of constant rand and in percentage terms. One

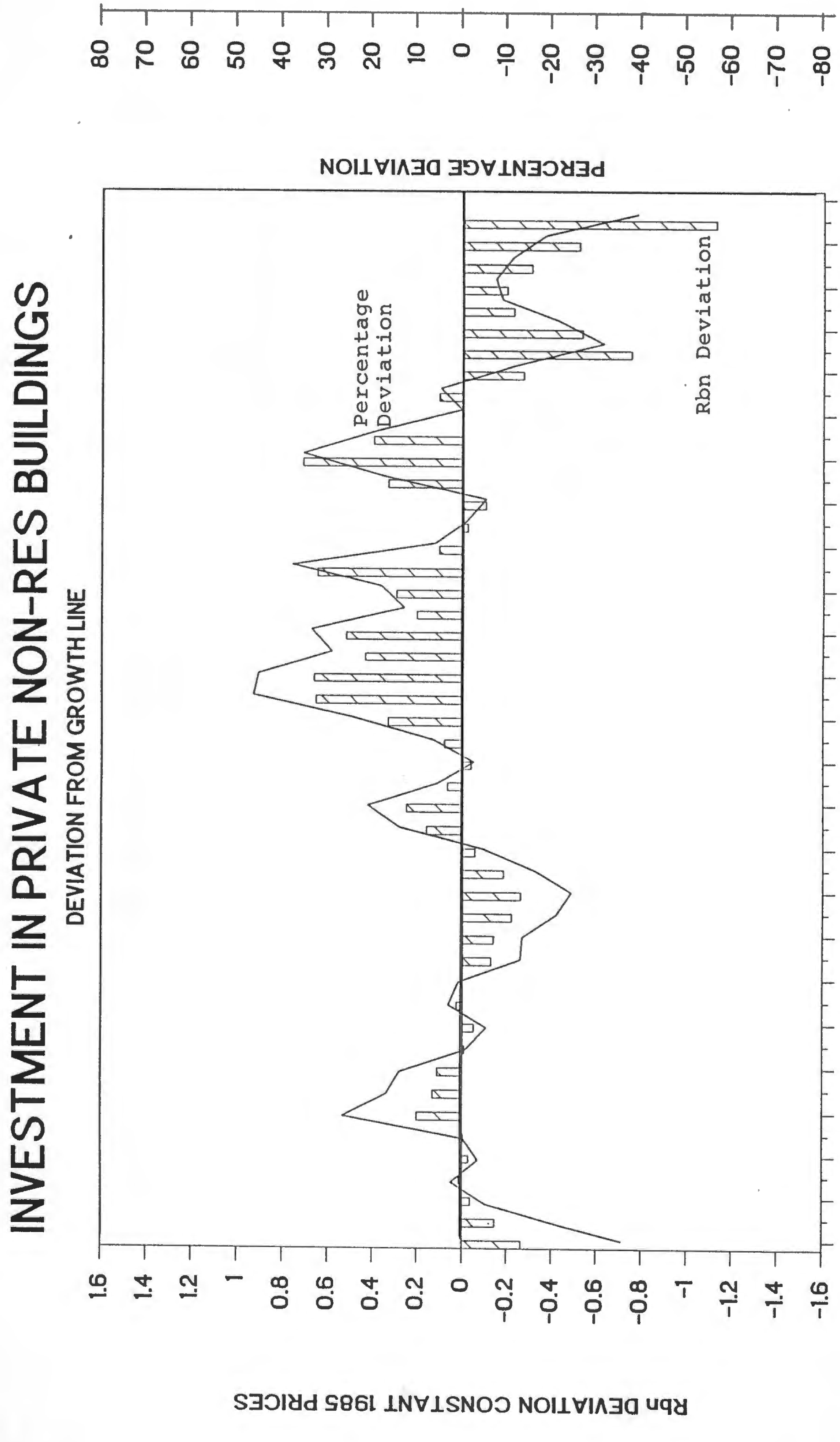
GRAPH 11

TOTAL PRIVATE NON-RES INVESTMENT

AT CONSTANT 1985 PRICES



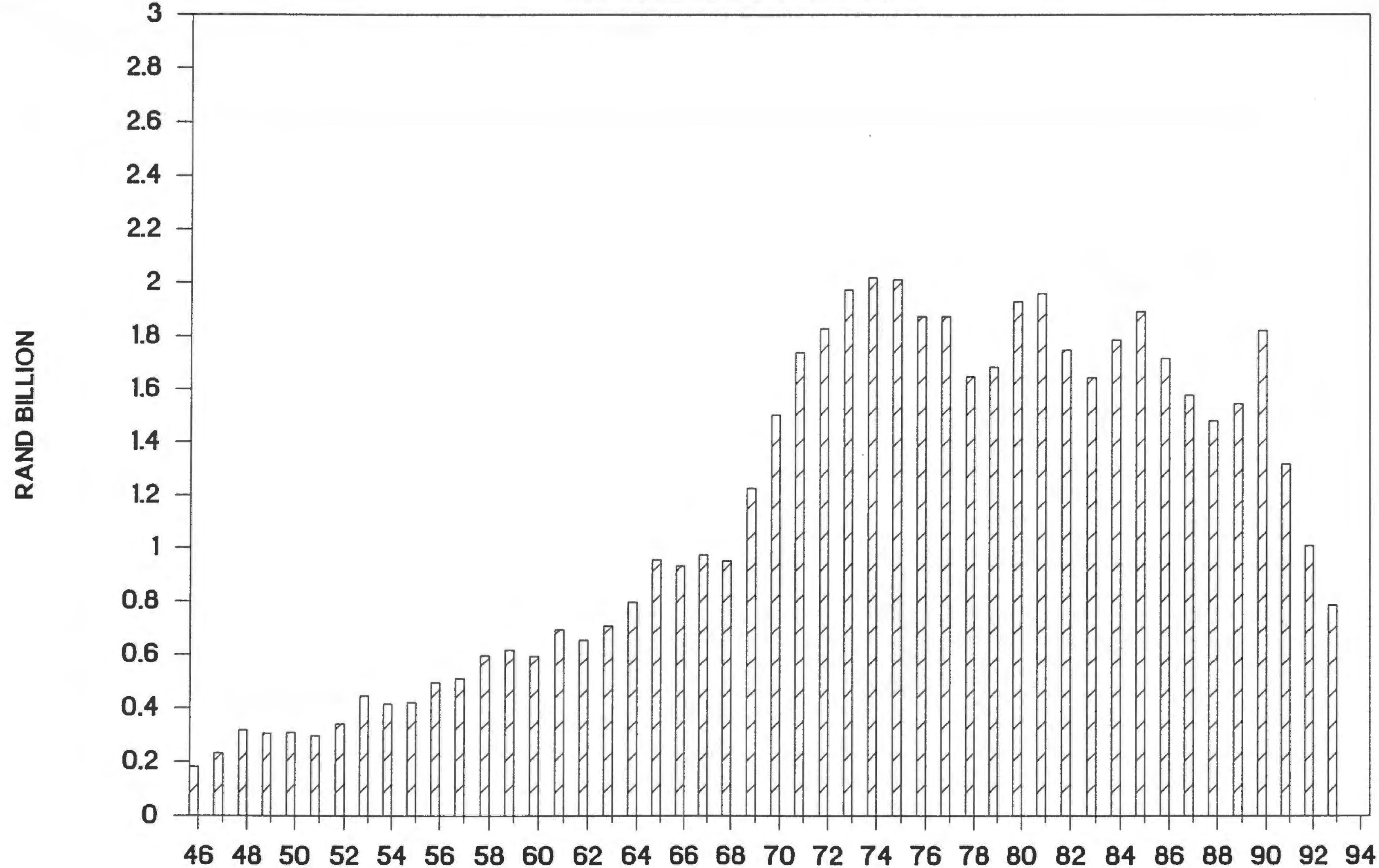
GRAPH 12


INVESTMENT IN PRIVATE NON-RES BUILDINGS
DEVIATION FROM GROWTH LINE
Percentage Deviation
Rbn Deviation
Rbn DEVIATION CONSTANT 1985 PRICES
PERCENTAGE DEVIATION
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
Source: SARB QB March 1994

GRAPH 13

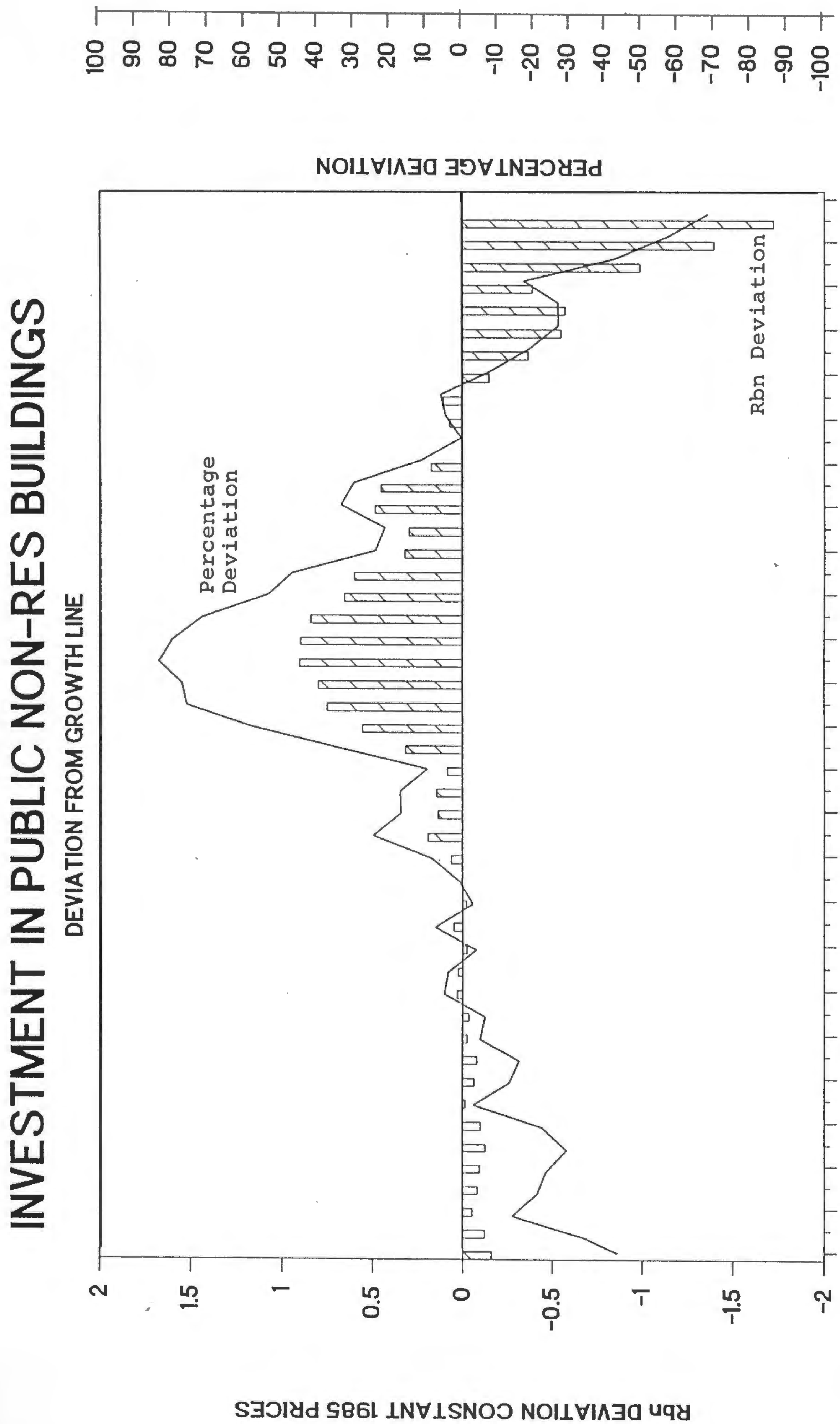
TOTAL PUBLIC NON-RES INVESTMENT

AT CONSTANT 1985 PRICES



Source: SARB QB March 1994

GRAPH 14



Source: SARB QB March 1994

can see the large positive deviations during the late sixties and early seventies. Also evident are the large negative deviations during the eighties and early nineties. This resulted from a re-appraisal of the government's capital spending priorities referred to above.

Graph 15 depicts the total investment levels of both the private and public non-residential sectors. Instability is a prominent feature, especially evident since the mid-seventies.

Graph 16 depicts the deviation from the long-term trend line of investment in total non-residential buildings, expressed in millions of constant rand and in percentage terms. It is evident that the fifties and sixties were more stable periods for investment than was the case in the seventies (when the deviation was positive) and the eighties and early nineties, when marked negative deviations were recorded.

In summary, this macroeconomic overview of investment in buildings in post-war South Africa clearly indicates pronounced cycles in the private sector of the market. In addition, the data show that public sector investment in buildings grew rapidly during the sixties and early seventies and levelled off during the eighties. The reasons are examined in subsequent sections. The following section focuses on the destabilising effects of fluctuations in interest rates.

4.3 **Instability in the housing industry and fluctuations in mortgage rates**

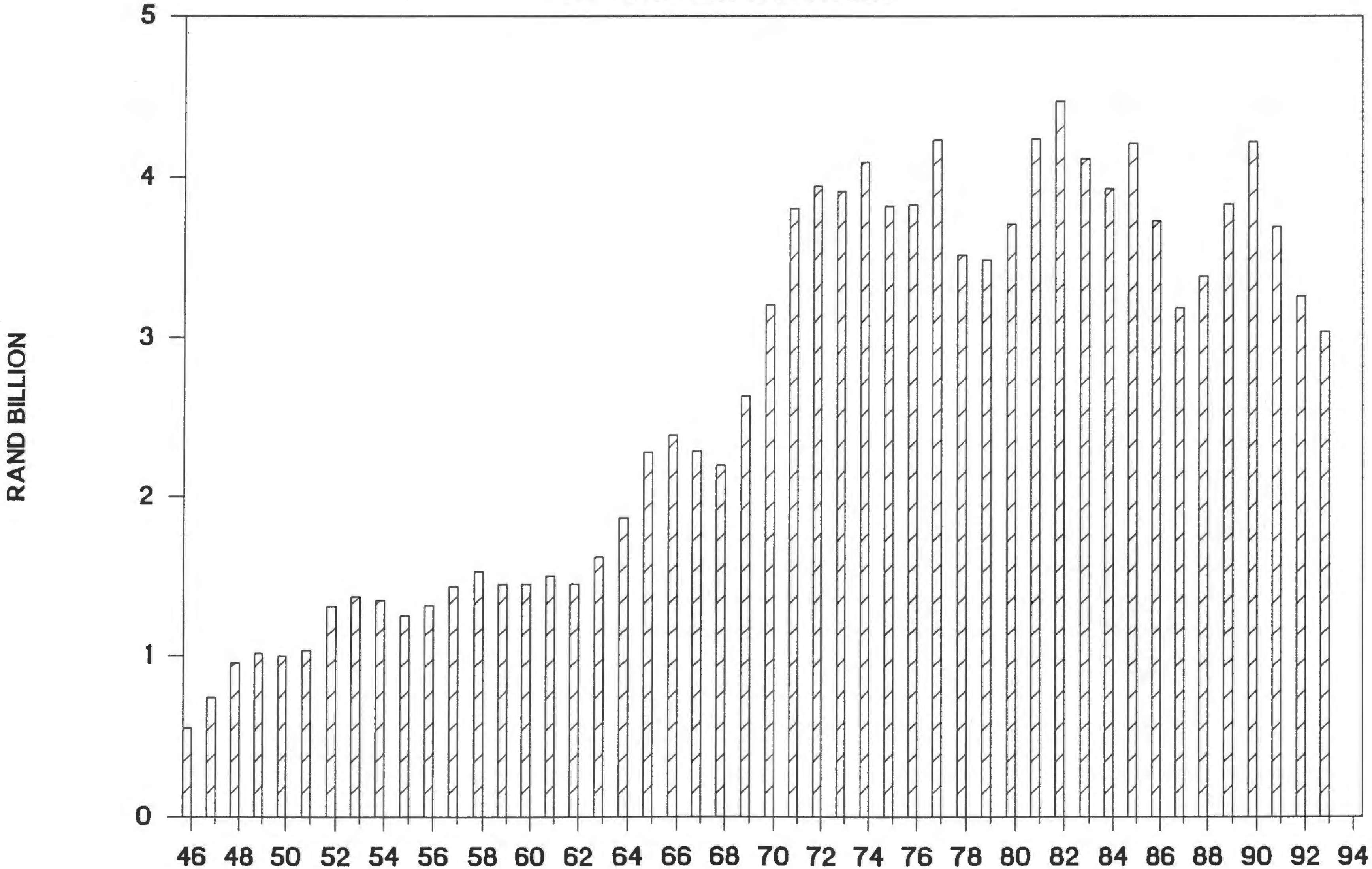
Sections 3.3.3.3.1 and 3.3.3.3.2 of this study contain discussion of the importance of interest rates and the availability of capital for the housing market. It was stressed that the amount of the monthly mortgage repayment constitutes the effective cost of housing.

Fluctuations in mortgage rates have a direct bearing on the amount of the monthly mortgage instalment. When the mortgage rate drops, more people can afford to build or buy a house out of their given income. Consequently, more building plans are submitted for approval. This relationship is illustrated in Graph 17 for the period 1970 to 1993. On the left hand scale of the graph the annual percentage change of the number of house plans passed is given. The monthly data have been smoothed with a six-month moving average to partially eliminate irregular fluctuations in the data. One can observe that the annual percentage

GRAPH 15

TOTAL NON-RESIDENTIAL INVESTMENT

AT CONSTANT 1985 PRICES

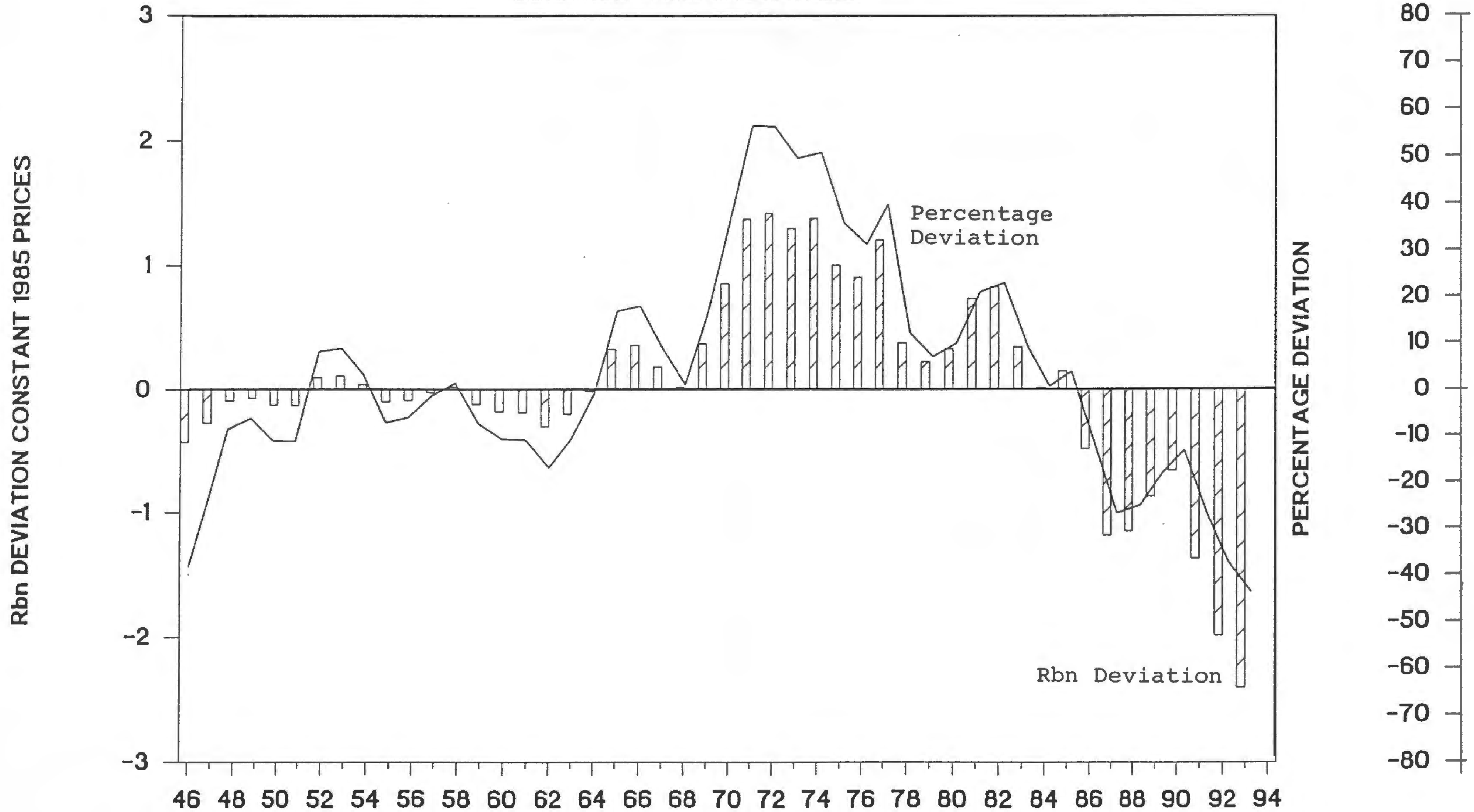


Source: SARB QB March 1994

GRAPH 16

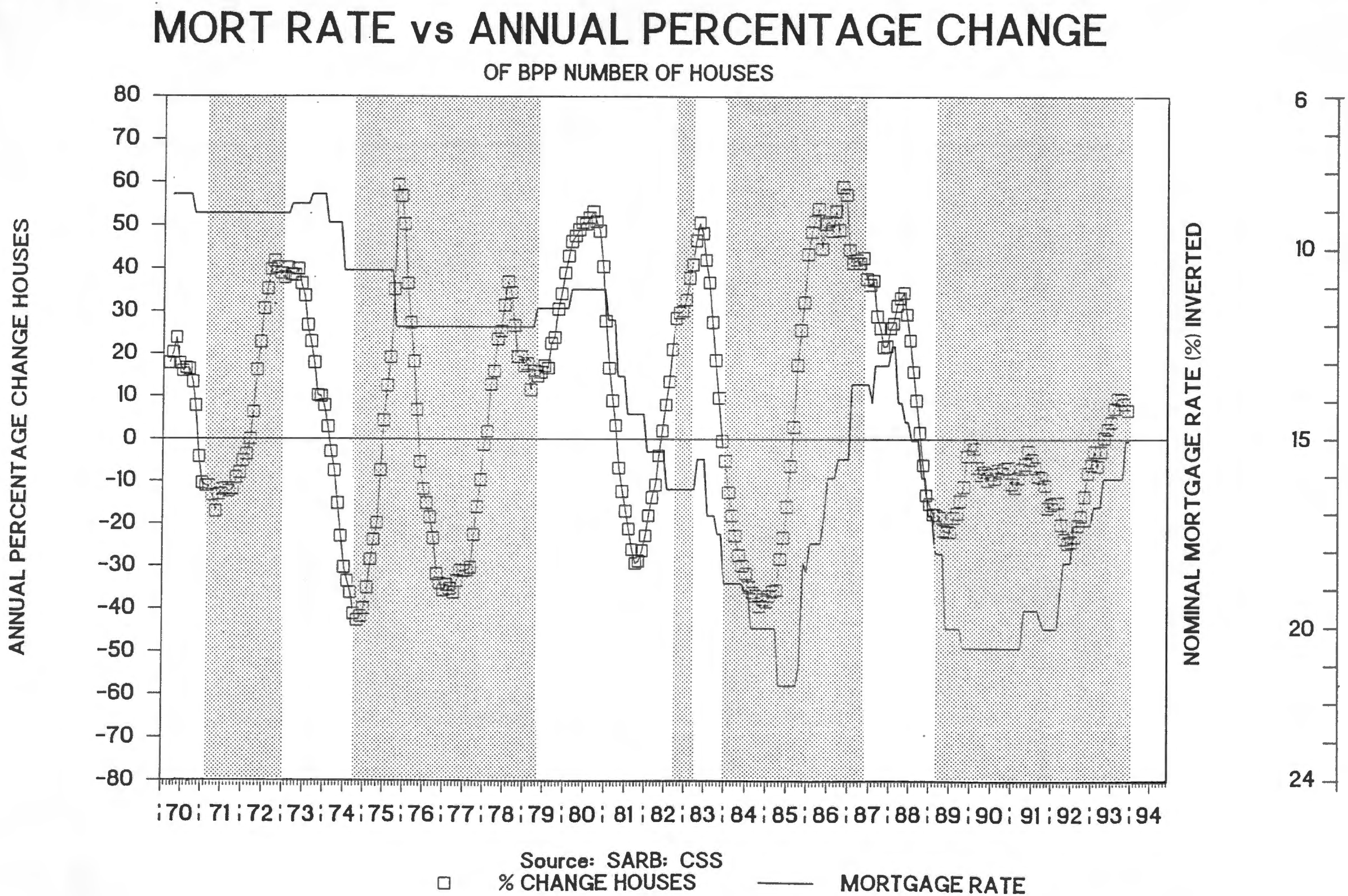
INVESTMENT IN TOTAL NON-RES BUILDINGS

DEVIATION FROM GROWTH LINE



Source: SARB QB March 1994

GRAPH 17


MORT RATE vs ANNUAL PERCENTAGE CHANGE
OF BPP NUMBER OF HOUSES
ANNUAL PERCENTAGE CHANGE HOUSES
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
NOMINAL MORTGAGE RATE (%) INVERTED
6
10
15
20
24
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94
Source: SARB: CSS
% CHANGE HOUSES
MORTGAGE RATE

change exhibits a fairly regular cyclical pattern.

Superimposed on the percentage change of the number of house plans passed is the course of nominal mortgage rates. This is read off the right hand scale of the graph and has been **inverted** to illustrate more clearly the coincidence in the turning points of these two key economic indicators. For instance, the percentage point rise in the mortgage rate during early 1974 led to a 20% to 40% decrease in the number of house plans passed in subsequent months. This finding coincides with the assertion made by Stevens (1990:58-59) that at low interest rate levels one finds a disproportionately large effect on loan values and housing demand (also refer to Section 3.3.3.3.1 for discussion of this aspect in greater detail).

It can be observed that mortgage rates rose sharply during 1975. They remained stable until late in 1978. This sharp rise resulted in a severe drop in house plans passed, which remained negative until about 1978. The anticipated drop in mortgage rates in 1979 already gave rise to a revival in plans passed during late 1978. House plans continued to rise until mid-1981. Sharp mortgage rate increases during 1980/1982 led to a severe drop in house plans during that period. This effect was exacerbated by the shortage of loanable funds from building societes. This shortage of housing funds resulted from speculative investments made by building societies in the bond markets (Snyman, 1980a). A small reduction in the mortgage rate during 1983, assisted by freely available mortgage funds, led to a quite significant rebound in the percentage movement of house plans passed. By that time commercial banks had entered the housing finance market and boosted the supply of funds. When mortgage rates rose to almost 22% after the "economic austerity package" of August 1984 was implemented, the housing industry entered a severe recession.

However, the industry started to revive again in 1986 when mortgage rates dropped sharply. House plans passed grew continuously during 1986 to 1988. The trend became negative in 1989 when mortgage rates rose again from a level of 12% to 21%. Many homeowners were forced to vacate their homes at such high mortgage rate levels. Rising mortgage bond foreclosures (Finance Week, 26 July - 1 August 1990) resulted from the destabilising effects of mortgage rate fluctuations. Not only did a high interest rate affect the market for existing houses negatively, it also severely curtailed virtually all new housing development.

It is also evident that interdependence exists between the course of the building cycle and that of interest rates. In Graph 17 the shaded areas represent the downswing phase of the building cycle as determined by the South African Reserve Bank (this represents the reference cycle for the construction sector, refer Section 8.4 of this study). Observe that the 1973/74 upswing in the building cycle was accompanied by a drop in the mortgage rate. Conversely, the 1975/78 downswing in the building cycle coincided with a rise in the mortgage rate. The 1979/80 upswing phase corresponds with a drop in the mortgage rate during those years. A brief downswing of the building cycle in the year 1982 followed several increases in the mortgage rate during 1981/82. A small drop in the mortgage rate during 1983, coinciding with an upswing in the building cycle, was of short duration. Subsequent sharp increases in the mortgage rate during 1984/85 coincided with a protracted downswing phase of the building cycle in the period 1984 to 1986. One can conclude that these variables, i.e. the mortgage rate, the course of the building cycle and that of house plans passed, are economically interdependent. Interest rates and house plans passed are included in the analyses in subsequent chapters.

In summary, the foregoing analysis shows conclusively that the South African housing industry is extremely responsive to mortgage rate fluctuations. Therefore, should it be possible to predict fluctuations in the cost of finance (interest rates), it could assist participants in the housing industry to respond appropriately.

4.4 **Instability in the housing industry and fluctuations in the availability of finance**

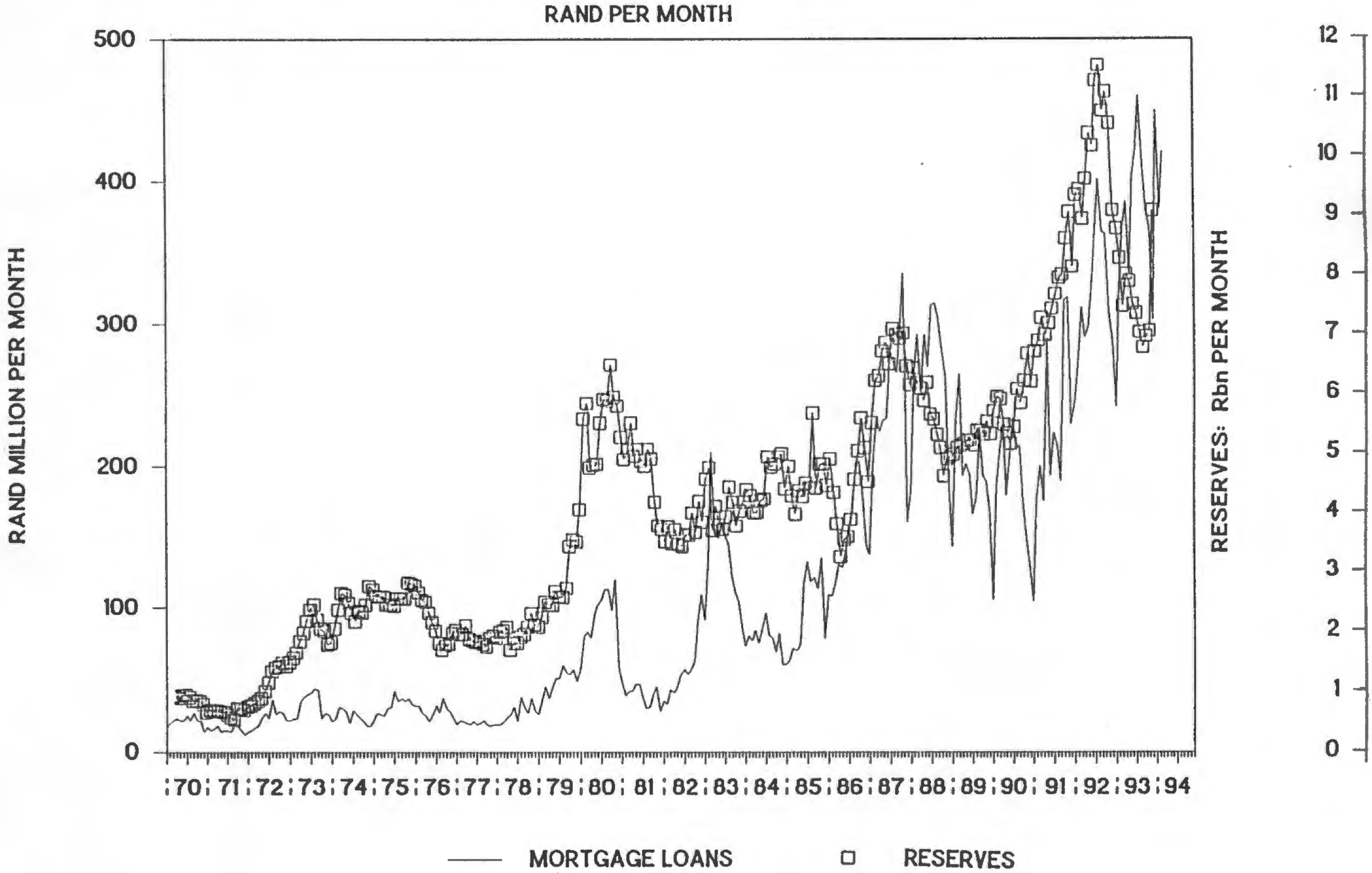
Section 3.3.3.3.2 dealt with the theoretical aspects of the fluctuations in housing finance. This section presents the practical effects of fluctuations in three interrelated economic variables, viz. total reserves, building society finance and the movements of house plans passed.

One can start by observing the relationship between gross gold and foreign exchange reserves and building loans granted by building societies during the period 1970 to 1993. The movements in these two key economic indicators are depicted in Graph 18. The correlation, without lagging the data, yielded a value of 0,126. The upper portion of the graph represents the absolute changes, whilst the lower portion depicts the annual percentage changes in the

GRAPH 18

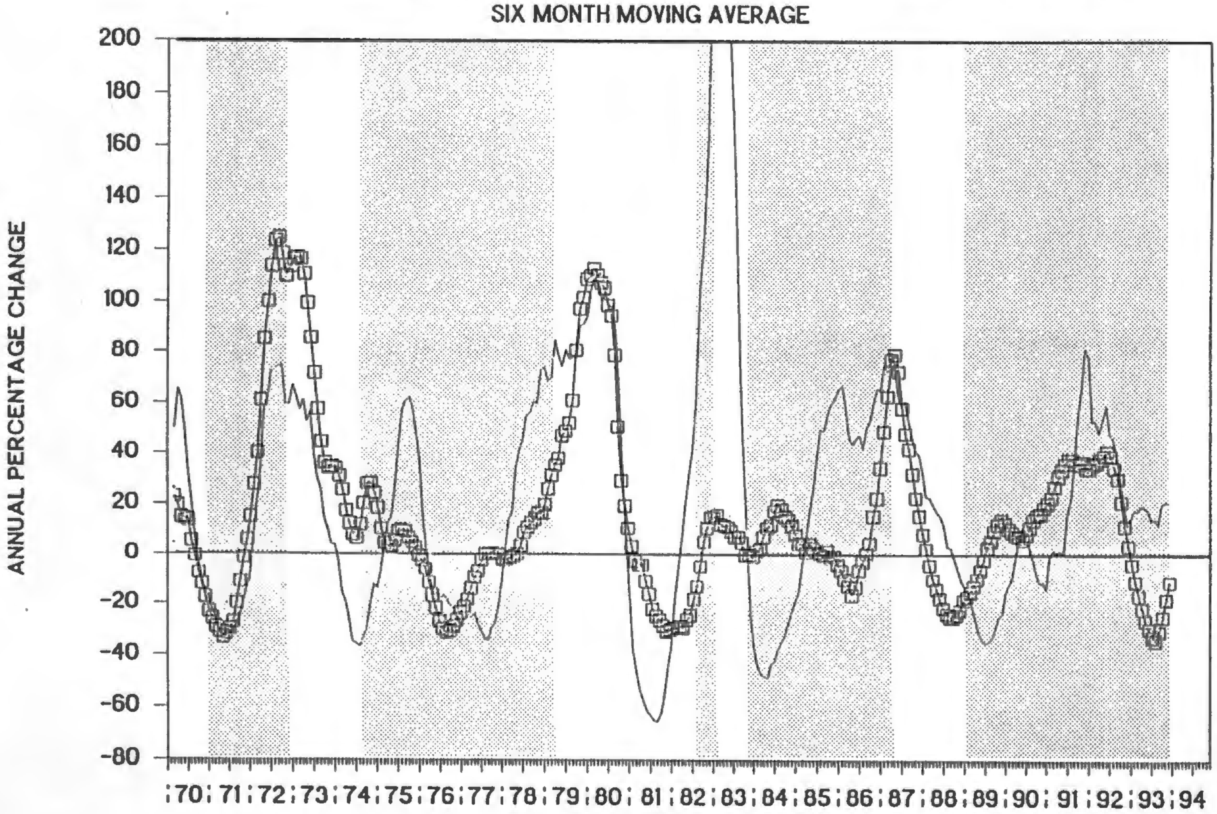
TOTAL RESERVES & MORTAGE LOANS GRANTED

RAND PER MONTH



COMPARISON ANNUAL PERCENTAGE CHANGE

SIX MONTH MOVING AVERAGE



basic data. These data have been smoothed with a six-month moving average to partially eliminate the irregularity in the basic data.

In the upper portion of the graph it is evident that when total reserves rose in 1979/80, building loans granted by building societies followed suit. The revival in reserves in the period 1982/83 was accompanied by a rebound in the level of building loans. In similar vein, the sharp revival in total reserves in the period 1986 to 1987 was mirrored by the significant improvement in building loans. During 1991/93 the latter indicator responded to the revival in total reserves.

In the lower portion of Graph 18 it is evident that the fluctuations in building loans are more volatile than those of total reserves. Yet, the timing of the turning points in the percentage movements are in a number of cases quite similar. Thus, one can conclude that domestic liquidity (represented here by total reserves) is important to the well-being of the housing industry (represented here by building loans granted by building societies). Greater availability of housing funds enables more people to become homeowners.

It is also evident that the movements in these variables bear some relation to the course of the building cycle. The latter is depicted in the lower portion of Graph 18 by shaded areas that represent the downswing phases of the cycle as determined by the South African Reserve Bank (Section 8.4 of this study). In general, downswing phases of the building cycle coincide with negative changes in reserves and building loans, e.g. during 1971, 1976/77, 1986 and 1993.

One can observe that increases in reserves and building loans presage an upswing phase of the building cycle. For instance, the sharp improvement in reserves and building loans during 1972 preceded the upswing in the building cycle of 1973/74. Similarly, reserves and building loans rose in 1978, prior to the 1979/82 revival in the building cycle. Also, the upswing in the building cycle during 1988 was preceded by a significant improvement in reserves and building loans during 1987. One can conclude that these variables are economically interdependent, and that they tend to lead upper and lower turning points in the reference cycle.

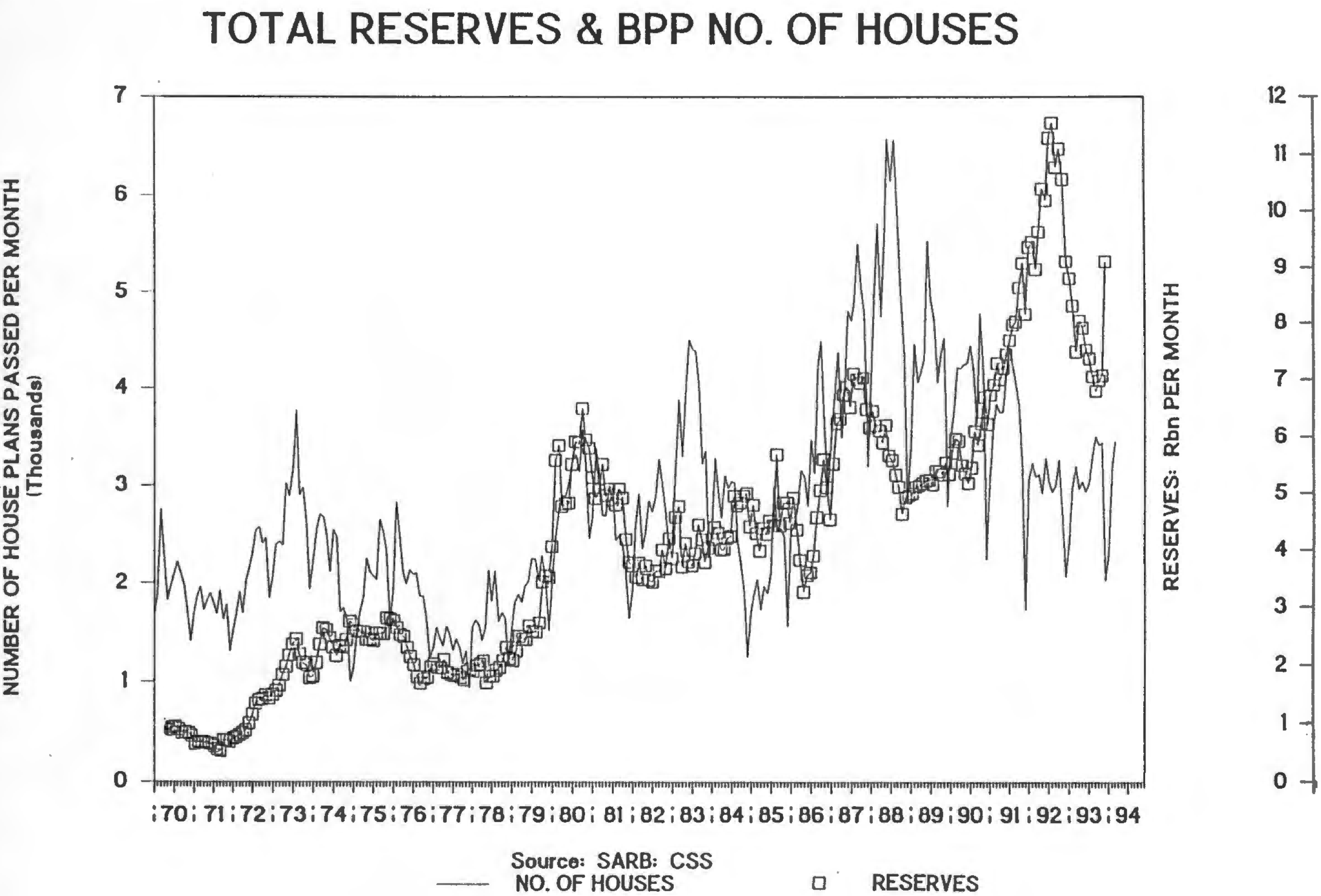
Next, the relationship is considered between total reserves and the number of house plans approved. The value of the correlation between these two variables, without lagging the data, is 0,446. It is evident in Graph 19 that in both absolute terms (the upper portion of the graph) and percentage change terms (lower portion) the number of house plans approved responded to increases or decreases in total reserves. This relationship is seen in the years 1972/73, 1976/77, 1979/81 and 1987/88. The relationship is not close in 1984/86 because of the distorting effects on total reserves of the "economic austerity package" of August 1984 and the foreign debt moratorium announced in September 1985.

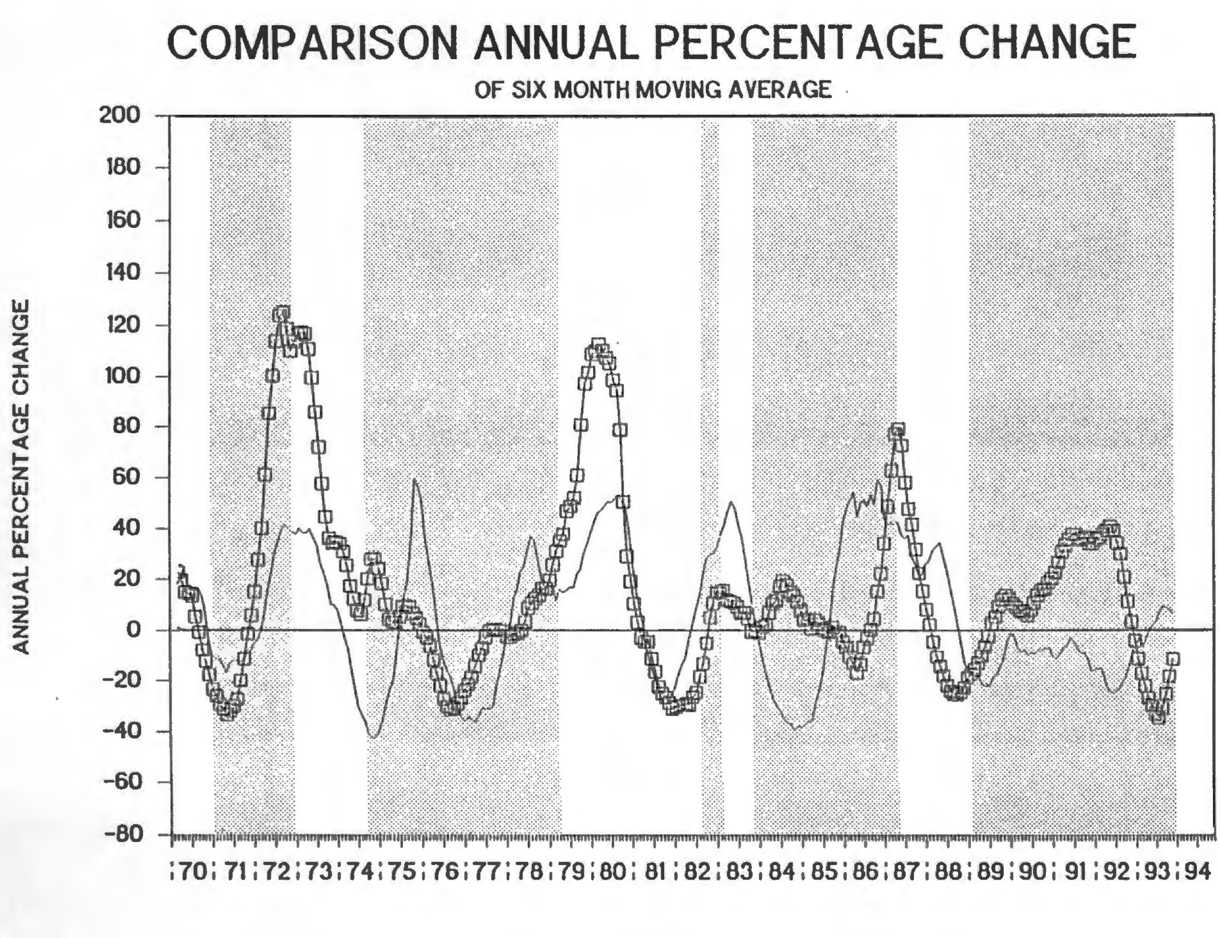
The shaded areas in the lower portion of Graph 19 represent the downswing phases of the building cycle as determined by the South African Reserve Bank (Section 8.4 of this study). It is evident that increases in reserves and house plans passed generally coincide with upswing phases of the building cycle. It is also evident that negative changes in reserves and house plans passed correspond to downswings in the building cycle. Yet, the graph also shows that percentage improvements in the reserves and house plans passed presage the upswing phases of the building cycle. Instances worth mentioning are 1971, 1977, 1986. Observe that an improvement in reserves led the upswing phase of the building cycle by a year or more. One can conclude that these variables are economically interdependent, and that they tend to lead turning points in the reference cycle.

Finally, the relationship is examined between building loans granted by building societies and the number of houses for which plans were passed. The value of the correlation between these two variables, without lagging the data, is 0,634. In the period 1970 to 1993 the absolute movements, as depicted in the upper portion of Graph 20, are closely related. Their percentage movements are also quite similar and these are depicted in the lower portion of the graph. In addition, it is evident that the turning points virtually coincide.

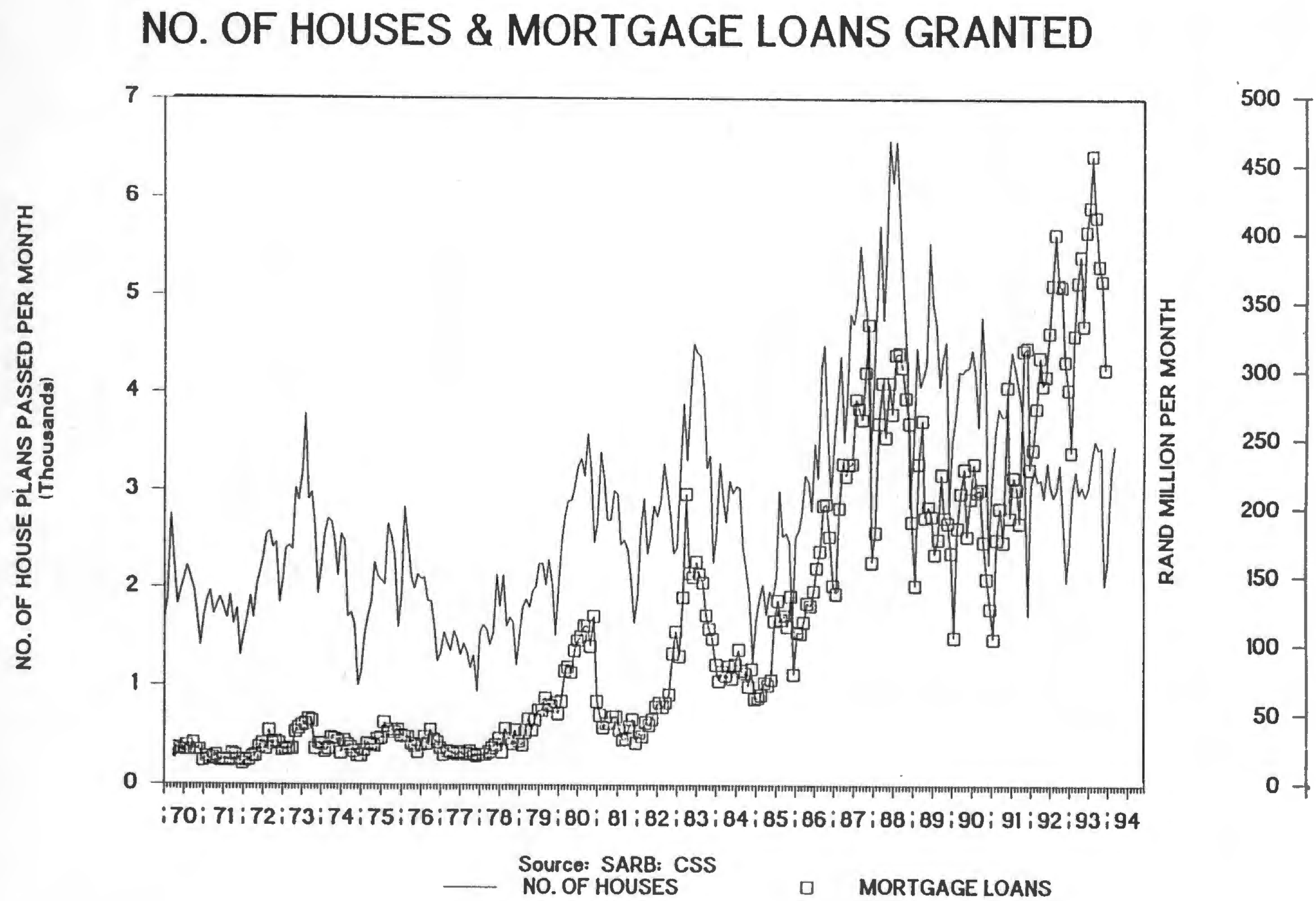
As was indicated in previous paragraphs, an economic interdependence is also evident between these two variables and the course of the building cycle. The latter is depicted in the lower portion of Graph 20 by shaded areas that represent the downswing phases of the cycle, as determined by the South African Reserve Bank (Section 8.4 of this study). For instance, negative changes in building loans and house plans passed usually coincide with downswings in the building cycle. Furthermore, percentage improvements in these indicators

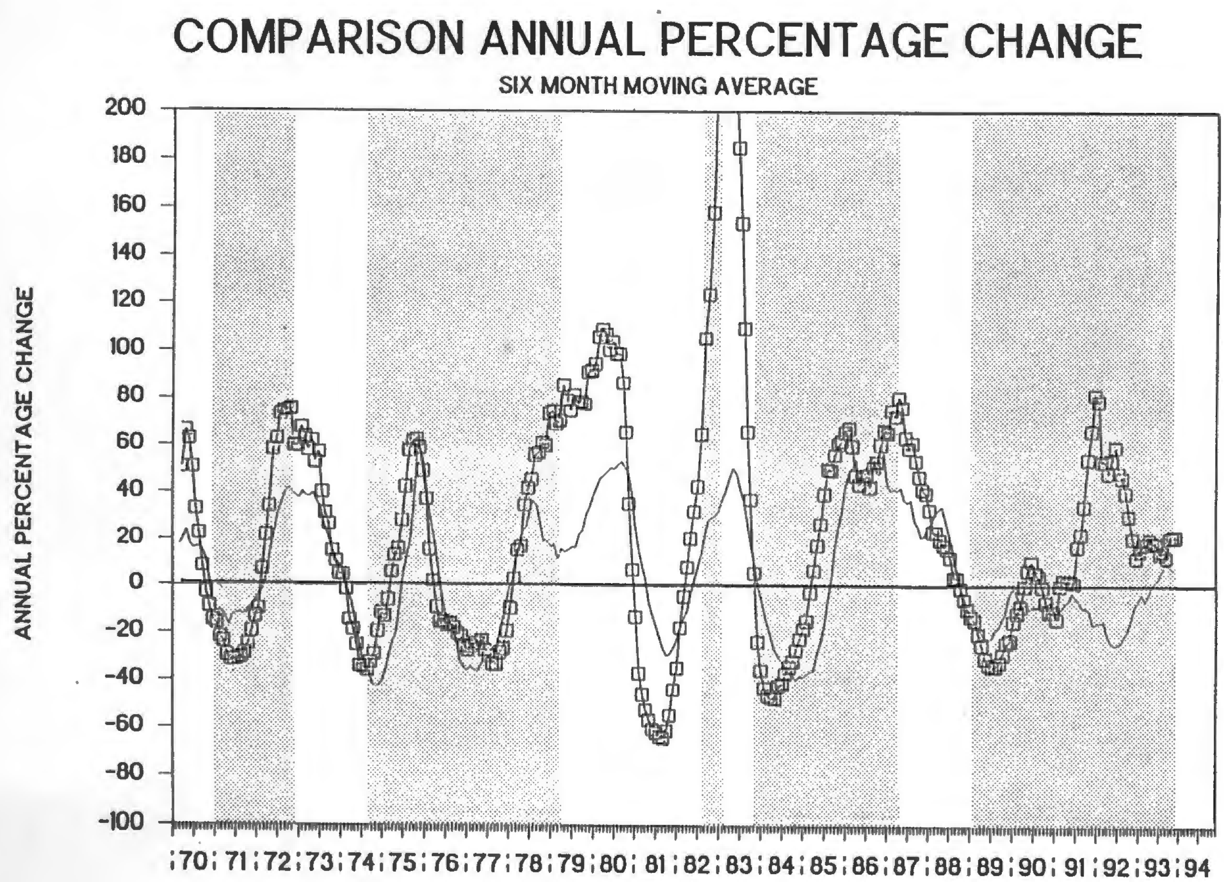
GRAPH 19


TOTAL RESERVES & BPP NO. OF HOUSES
NUMBER OF HOUSE PLANS PASSED PER MONTH (Thousands)
RESERVES: Rbn PER MONTH
0
1
2
3
4
5
6
7
8
9
10
11
12
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94
Source: SARB: CSS
NO. OF HOUSES
RESERVES


COMPARISON ANNUAL PERCENTAGE CHANGE
OF SIX MONTH MOVING AVERAGE
ANNUAL PERCENTAGE CHANGE
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94

GRAPH 20


NO. OF HOUSES & MORTGAGE LOANS GRANTED
NO. OF HOUSE PLANS PASSED PER MONTH (Thousands)
RAND MILLION PER MONTH
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350
400
450
500
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94
Source: SARB: CSS
NO. OF HOUSES
MORTGAGE LOANS


COMPARISON ANNUAL PERCENTAGE CHANGE
SIX MONTH MOVING AVERAGE
ANNUAL PERCENTAGE CHANGE
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94

presage the upswing in the building cycle, e.g. 1971, 1977, 1985. Similarly, percentage reductions presage the downswing in the building cycle, i.e. 1970, 1973, 1980 and 1983. These indicators therefore lead the upper and lower turning points of the reference cycle.

The economic relationship that exists between total reserves, building loans and the number of house plans passed can be explained in the following terms. A rise in exports (not matched by a rise in imports or an outflow on the capital account of the balance of payments) can lead to an improvement in domestic liquidity. The latter usually leads to a reduction in interest rate levels, should market forces prevail. The improved domestic liquidity manifests itself in increases in deposits at building societies and a concomitant rise in building loans granted. Given that the mortgage rate has decreased in line with other interest rates, this implies a reduction in the effective cost of housing. As loans are readily available, the latent housing demand is transformed into effective demand. Consequently, a larger number of prospective homeowners have their new house plans approved by local authorities. Similarly, homebuilding firms start to replenish their stock of new houses.

Given that the supply of housing is responsive to increases in effective demand, overall activity levels in the housebuilding industry improve. Consequently, there is a greater demand for artisans, labourers, building materials and site management. Idle resources in the building industry are used more efficiently. During strong upswing phases of the cycle bottlenecks appear, thereby increasing building costs. However, should mortgage rates rise and housing finance become scarce, the converse sequence of events is set in motion, with severely destabilising effects on the homebuilding industry. Similar reasoning can be applied to the non-residential sector.

The above analysis clearly indicates the importance of reliable forecasting methods to predict changes in the work loads of building contractors and sub-contractors, as well as merchants and manufacturers of building materials. Interest rates and the availability of finance are critically important variables in this context.

4.5 Instability in the housing industry and fluctuations in net migration

The demographic factors that influence housing demand were discussed in Section 3.3.3.1 of this study. These factors usually exert their influence in the long term. However, a factor that can influence the demand for housing in the short term is that of net migration. Net migration is the difference between immigration and emigration and can be positive or negative. South Africa is a developing country and has attracted many immigrants from various parts of the world in the post-war period. Net migration is usually positive, yet four periods can be identified when emigration exceeded immigration. These periods occurred in:

* 1950, following the political unrest that started in Munsieville near Krugersdorp in 1949;
* 1960, following the unrest in Sharpeville during March 1960;
* 1977/78, following the unrest in Soweto during June 1976; and in
* 1986/87, following the unrest in Uitenhage in the Eastern Cape during March 1985.

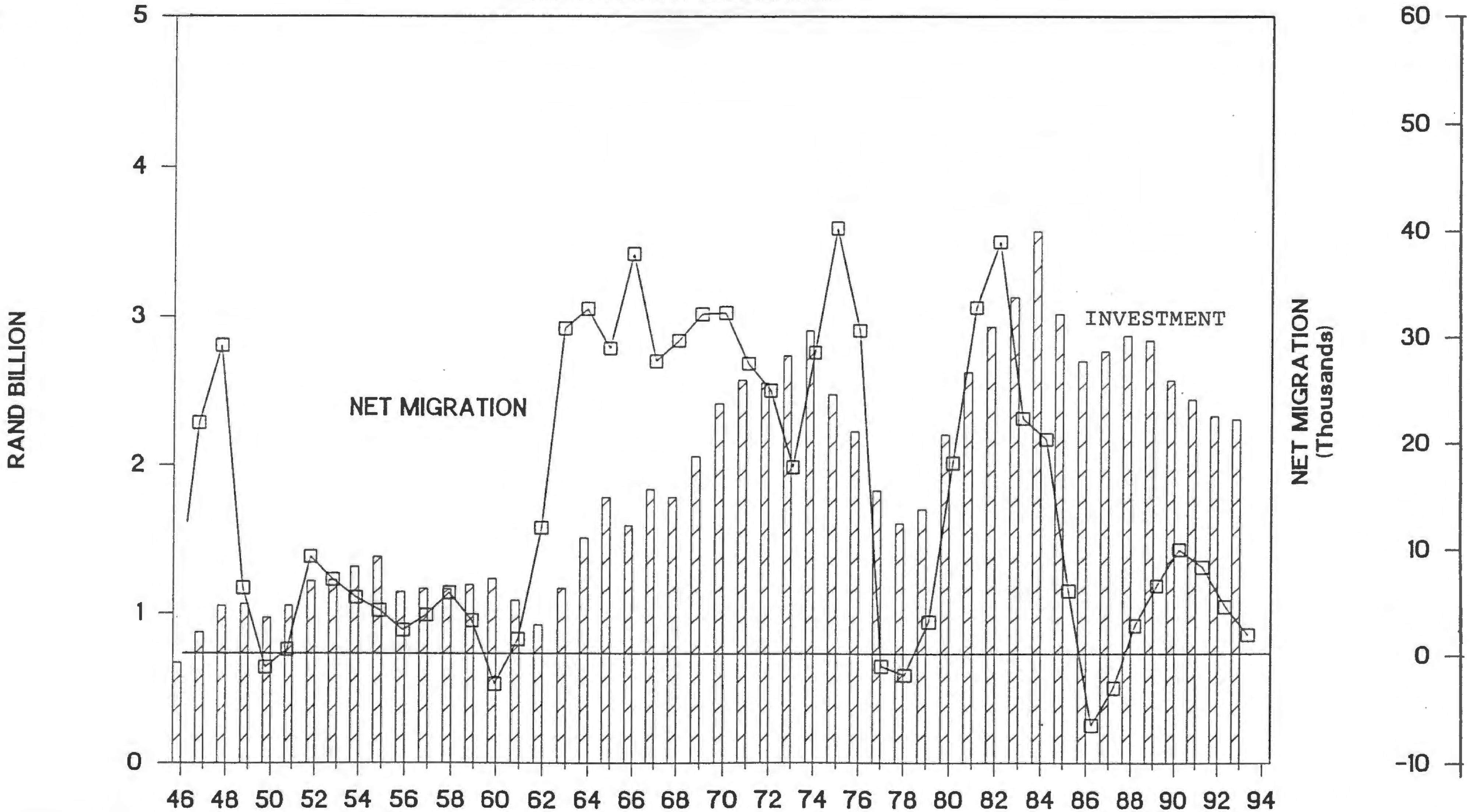
The course of net migration is depicted in Graph 21 and is compared to levels of investment in the private residential market during the period 1946 to 1993. It is evident that a close relationship exists between these two economic variables. For instance, the sharp increase in private housing during the sixties and early seventies was accompanied by a strong rise in net migration during those years. In similar vein, the nadir in the housing investment cycle was recorded in 1978 and this was accompanied by negative net migration. The rebound in private housing during the years 1979 to 1984 was also matched by a strong revival in net migration.

However, the quite strong revival in net migration in the period 1988/90 has not been matched by an equivalent improvement in private housing investment. This finding must be attributed to the existence of other, stronger economic forces that are at play and dominate the effects of positive net migration. It was shown in Section 4.3 of this chapter that interest rates remained at very high levels during 1989/90. Consequently, their depressing effects on private housing demand overshadowed the economic effects of positive net migration.

GRAPH 21

NET MIGRATION vs PRIVATE RES INVESTMENT

AT CONSTANT 1985 PRICES



Source: SARB; CSS

The survey indicators used in this study to devise a composite leading indicator for the South African building industry do not include a quantitative variable reflecting migration patterns. There are a number of reasons for this approach. Firstly, anticipations data are included in the qualitative survey indicators used in this study. To the extent that contractors' and subcontractors' perceptions of the future are influenced by migration patterns, migration is included in the analysis. Secondly, immigrants have a choice when seeking accommodation; they can either build a house or purchase/rent an existing house. Consequently, there need not necessarily be a one-on-one relationship between changes in net migration and activity levels in the new housing market. Nevertheless, a reasonably close long-term relationship does exist between positive or negative net migration and private housing investment, as illustrated in Graph 21. As was indicated above, this relationship has broken down in recent years or has been overshadowed by abnormally high interest rates.

In summary, net migration has played a role in private housing investment. Yet, in recent years, its effects have been overshadowed by stronger economic forces such as high mortgage rates.

4.6 Instability in investment in the private non-residential sector, the acceleration principle and interest rates

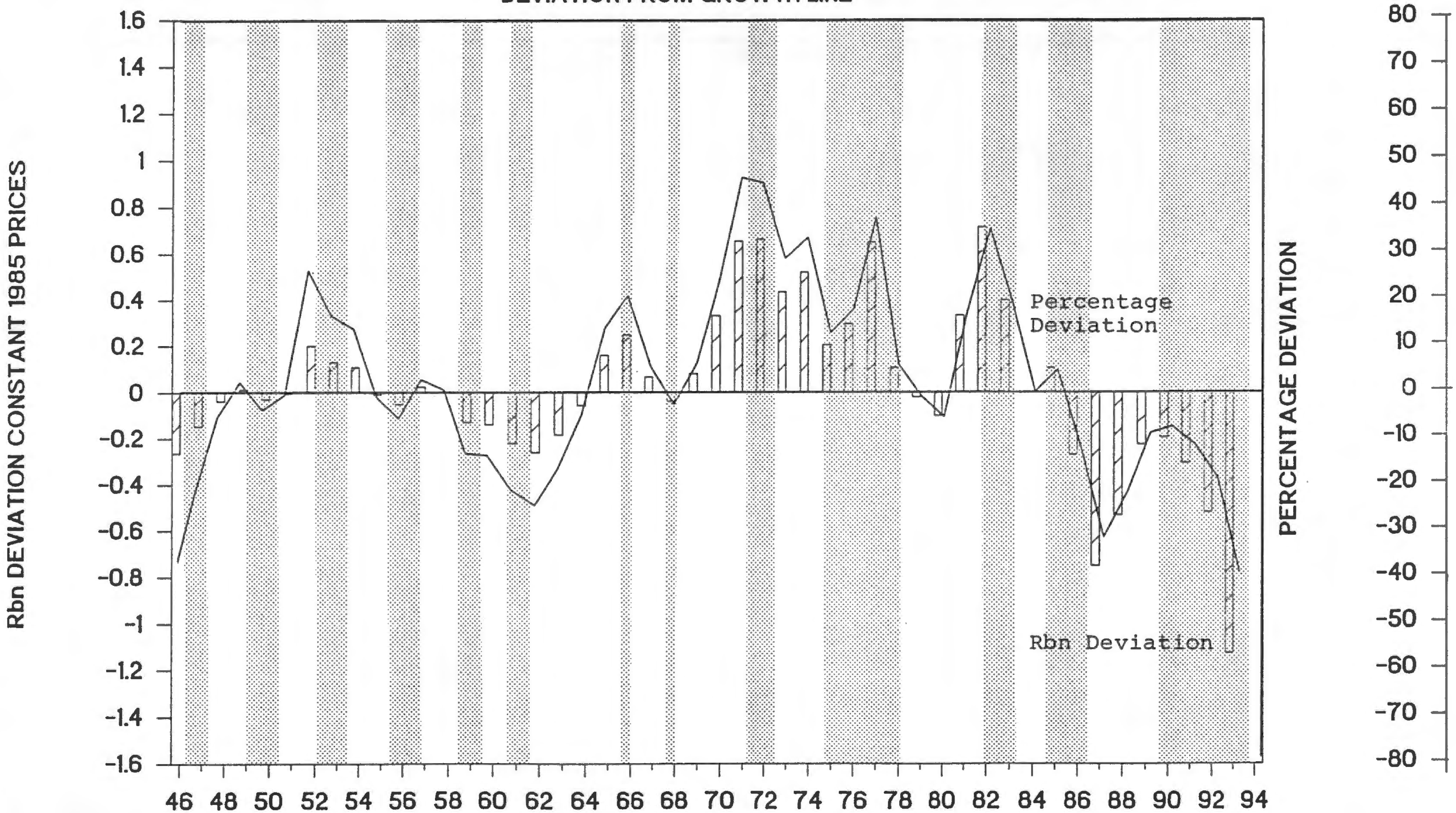
The physical nature of the product of the building industry was considered in Section 3.3.1 of this study. One of the important features relates to the long life span (durability) of buildings. The interrelationship between instability, the low rate of depreciation of buildings, the stock, and additions to the stock of buildings, was discussed in detail in that section. It was shown that the accelerator can have destabilising effects on the demand for buildings generally, and commercial and industrial buildings specifically. Commercial and industrial buildings together constitute the bulk of the private non-residential sector.

To illustrate the high degree of volatility of investment in private non-residential buildings, reference is made to Graph 22. It depicts three sets of data. Firstly, the absolute deviation from the long-term trend line of investment in private non-residential buildings during the period 1946 to 1993, expressed in millions of constant rand. Secondly, the percentage deviation from the long-term trend line which was calculated by fitting an exponential

GRAPH 22

INVESTMENT IN PRIVATE NON-RES BUILDINGS

DEVIATION FROM GROWTH LINE



Source: SARB QB March 1994

function on the annual data. Finally, it shows the different phases of the business cycle in the overall economy, represented in this graph by shaded areas that depict the downswing of the cycle. It was decided to use the reference cycle turning points in the overall economy instead of the building cycle as the latter are available only from 1970. The upper and lower turning points in the macroeconomy were determined by Smit and Van der Walt (1970, 1973, 1982, 1989) of the South African Reserve Bank.

It is evident from Graph 22 that this sector of the building industry exhibits marked fluctuations in the post-war period. The absolute deviations from the long-term trend line increased in the seventies and eighties. In percentage terms the deviations were also greater than those recorded during the fifties and sixties. Kilian (1976:157) has ascribed this volatility to a number of specific factors.

Firstly, he mentions the operation of the acceleration principle that is related to the durability and the stock of buildings. This implies that any adjustment in under- or over-supply requires more time for balance to be achieved in the market. Secondly, the long periods involved in the planning of non-residential buildings and the indivisible and irreversible nature of this form of investment. This also implies that large amounts of capital are usually involved in the erection of large non-residential building projects. Finally, the lagged effects of fluctuations in interest rates. Whilst it is known that the yield on most investment is sensitive to fluctuations in interest rates, it seems that investment in non-residential buildings is not particularly sensitive to interest rate movements. This seems to contradict the findings in Chapter 2 which show that the demand for buildings is interest-elastic. Therefore, this aspect deserves more detailed discussion.

During the early seventies a positive deviation in investment occurred, despite increases in interest rates in 1970 and 1971 (Smit & Van der Walt, 1973:35). Indeed, the first half of the seventies was worthy of the term "building boom". Actual investment remained above the long-term trend line for a number of years. It is also important to note that investment in private non-residential buildings continued to grow throughout the recessionary years 1952/1953, 1965, 1971/72, 1976/77 and 1982.

The explanation for this could be that by the time that large private property investors realise that interest rates are about to rise, their projects are well advanced. To cancel or postpone such large building projects at that stage might entail large financial loss. This results in a situation where the real short-term viability of a large building project (i.e. the yield to be obtained from rental revenues) is affected by the rise in interest rates. Yet, because the building process continues throughout the recession, it creates the impression that property investors are insensitive to interest rate and business cycle fluctuations. Nevertheless, one can conclude that for these specific reasons this sector of the building market is less sensitive to general business cycle fluctuations than is the case with private housing where the response to increases in interest rates is severe and immediate. This finding is corroborated by Kilian (1976:142).

In summary, whilst investment in private non-residential buildings is volatile, fluctuations are dampened because of the indivisibility and irreversibility of large projects, together with the long planning periods involved in the erection of non-residential buildings.

4.7 Instability and the role of the public sector

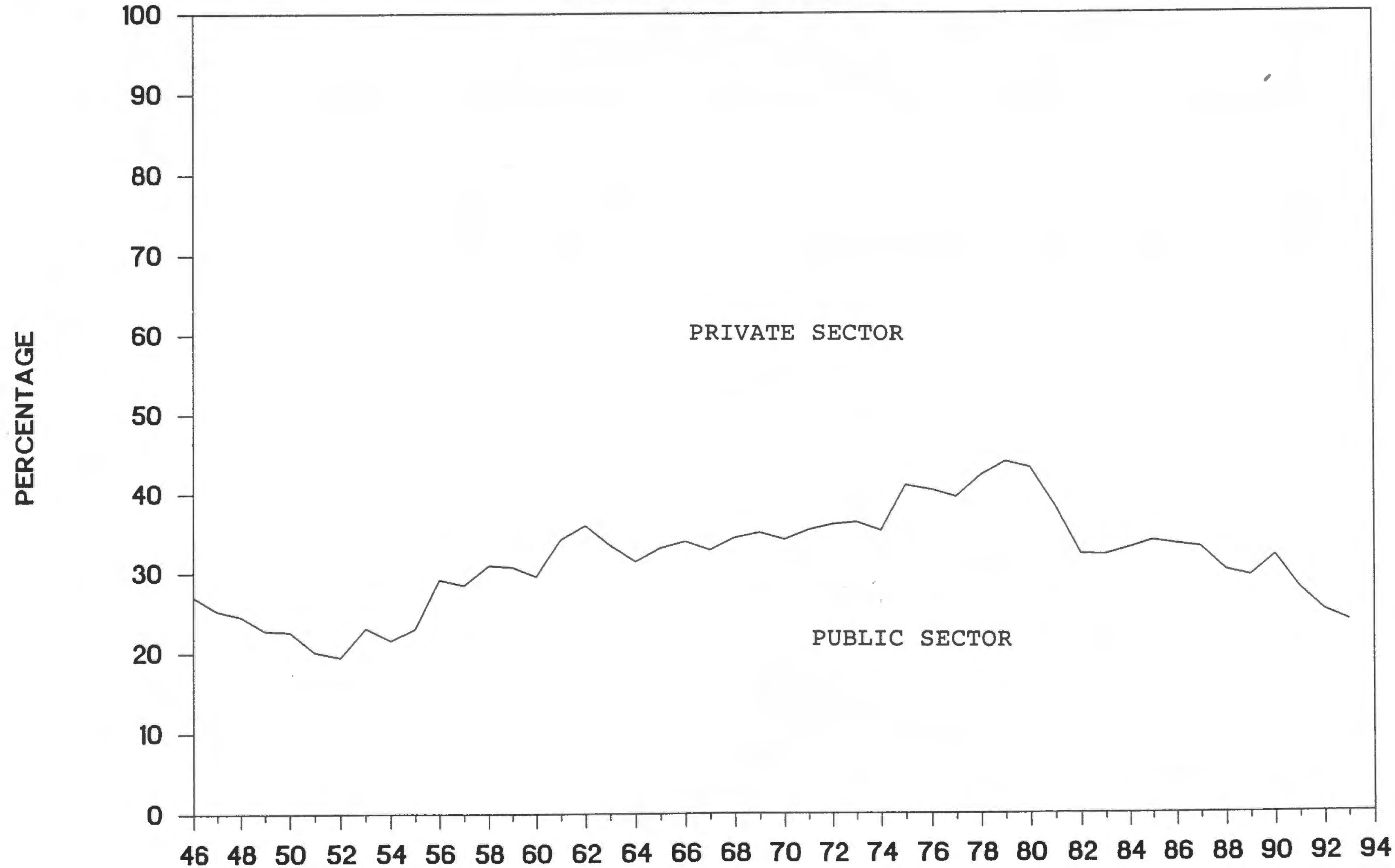
The theoretical aspects of contra-cyclical government expenditure were considered in Chapter 3. Briefly, this means that government increases its own expenditure in recessions and reduces it in economic upswing phases in order to stabilise the overall demand on economic resources. Pro-cyclical expenditure implies that public spending increases or decreases in the same direction as that of the private sector. Increased instability would result in such a situation.

It was shown in Table 4.1 that the public contribution to total building is large. It was also found that the public non-residential sector of the building market represents the only feasible area where government can apply contra-cyclical policies with any success. Graph 23 depicts the percentage that the total public sector contributes to total building. It is evident that this percentage decreased immediately after the war, rose during the fifties, sixties and seventies and attained a peak of roughly 40% by the late seventies. The relative share of the public building sector decreased to approximately 30% of the total during the eighties. Due to the privatisation of the parastatal organisations, such as SASOL, ISCOR, ESKOM, ARMSCOR,

GRAPH 23

PERCENTAGE CONTRIBUTION TO TOT INV BLDG

PUBLIC & PRIVATE SECTORS



Source: SARB QB March 1994

etc. this trend could continue in the nineties.

Graph 24 depicts the contribution of public residential investment to total investment in residential buildings. It is evident that a haphazard pattern emerges. The most notable feature is the sharp rise to almost 40% of the total during the year 1979. However, the percentage contribution usually fluctuated around the 20% level. Two observations are appropriate. Firstly, as Kilian (1976:129) pointed out, because the contribution of public housing is relatively small, any contra-cyclical expenditure in this sector would necessarily have a small effect on the total demand for building work. Secondly, given the time lags that exist between announcement and implementation of contra-cyclical housing expenditure, the success thereof cannot be guaranteed.

The following example illustrates this. During 1976/77 South Africa experienced a severe recession. To alleviate unemployment, increased public expenditure on low-income housing was announced in 1977. The Secretary for Community Development declared in Circular Minute No. 21 of 1977: "I am pleased to draw the attention of all local authorities to a statement on 10 November 1977 wherein the Honourable Minister of Finance announced that the Government has decided to make an amount of R250 million immediately available for the erection of low-cost housing..." .

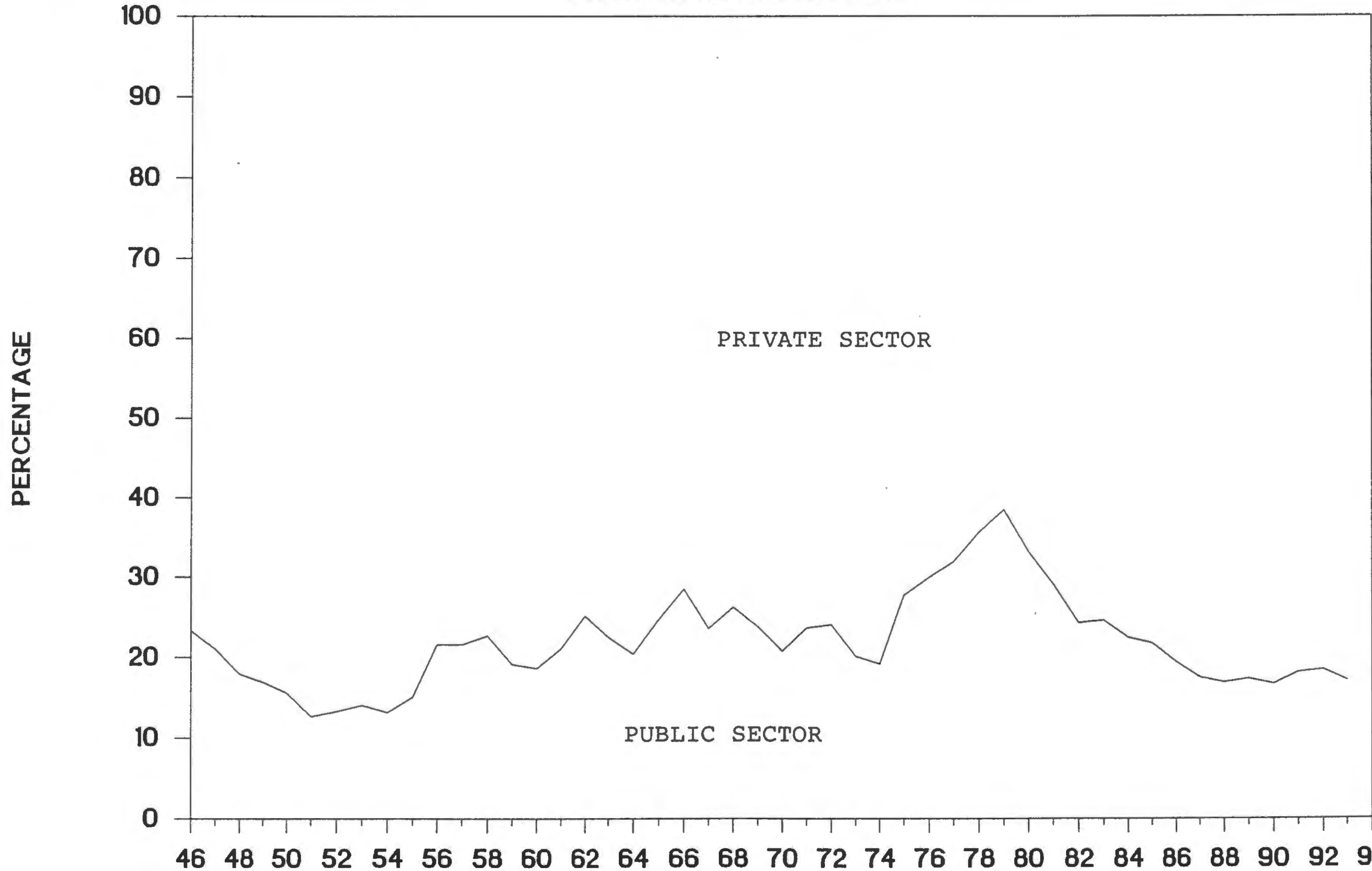
Yet, it took roughly two years to implement the housing initiatives. This resulted in pro-cyclical public spending in the housing industry as the private sector had also started to rebound by 1979. Given that public investment in housing is sensitive in a socio-political sense and cannot therefore be used effectively in a contra-cyclical manner, consideration is given to the possibilities offered by raising or lowering investment in public non-residential buildings.

Graph 25 depicts the percentage contribution of investment in public non-residential buildings to total non-residential investment in buildings. It is evident that the relative share of the public sector rose from roughly 30% of total non-residential investment to 52% by 1980. Reference to Table 4.1 indicates that this was equivalent to 28% of all building. Therefore, should expenditure be implemented contra-cyclically, then the effects on total demand in the building industry could be significant. It is appropriate therefore to investigate whether such

GRAPH 24

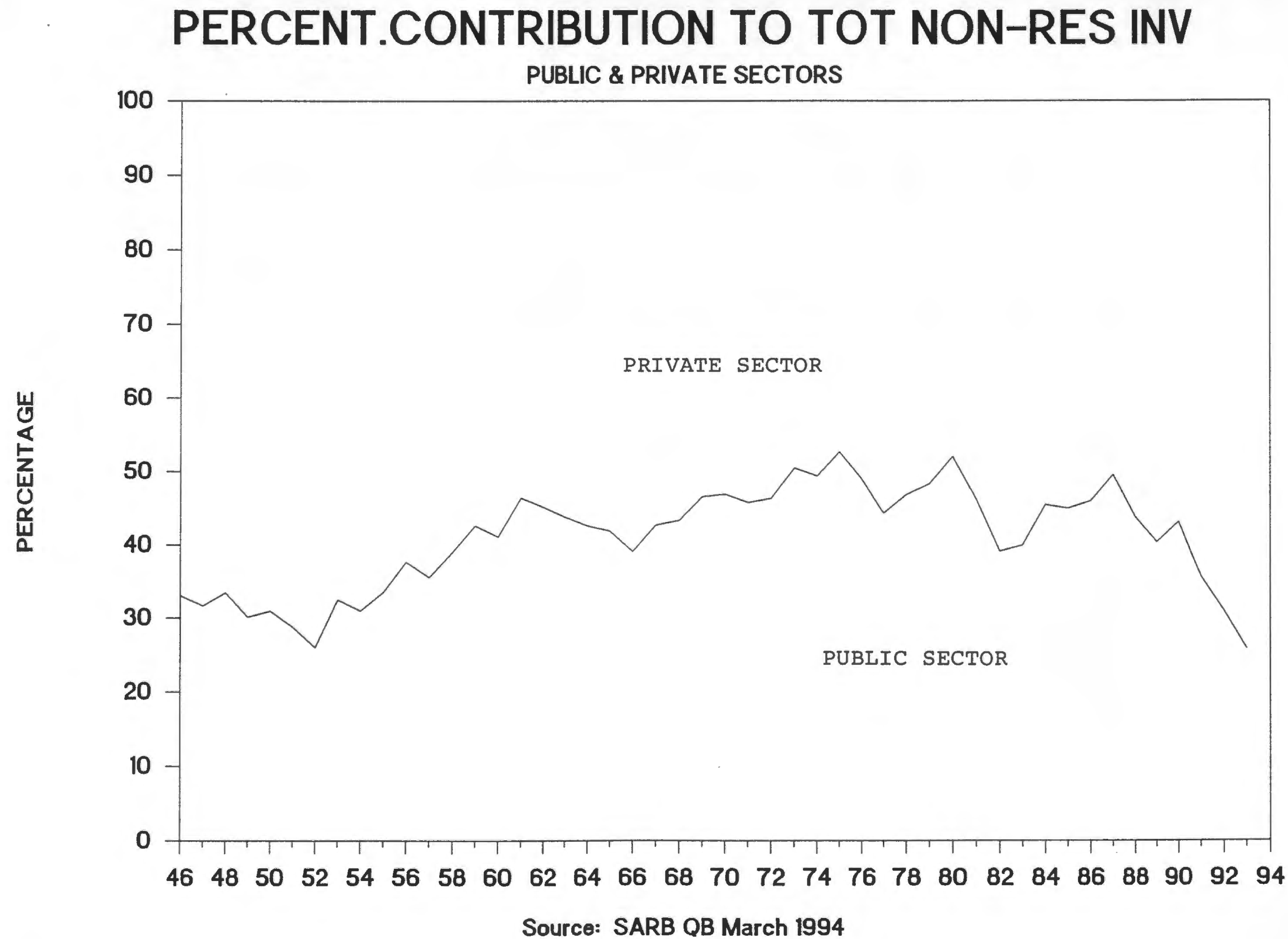
PERCENTAGE CONTRIBUTION TO TOT RES INV

PUBLIC & PRIVATE SECTORS



Source: SARB QB March 1994

GRAPH 25


PERCENT.CONTRIBUTION TO TOT NON-RES INV
PUBLIC & PRIVATE SECTORS
PERCENTAGE
PRIVATE SECTOR
PUBLIC SECTOR
100
90
80
70
60
50
40
30
20
10
0
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
Source: SARB QB March 1994

contra-cyclical policies were implemented successfully during the post-war period in South Africa.

Graph 26 depicts three sets of data that relate to this issue. The absolute deviations from the long-term trend line are represented by the vertical bars and are expressed in millions of constant rand. Secondly, the percentage deviation from the long-term trend line has been superimposed on the absolute deviations. Thirdly, the shaded areas represent the downswing phases of the business cycle in the overall economy as was determined by Smit and Van der Walt (1970, 1973, 1982, 1989) of the South African Reserve Bank.

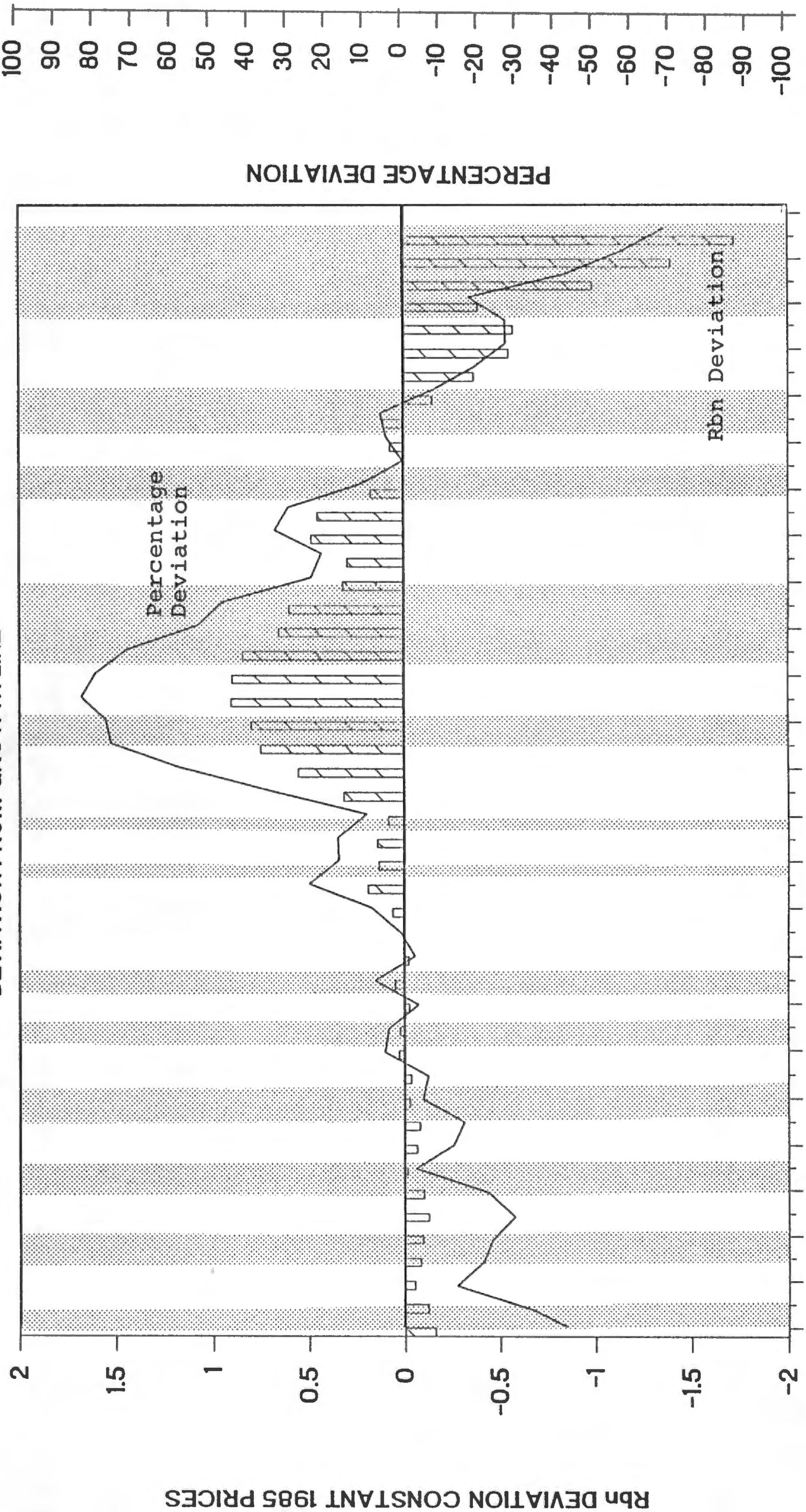
It is evident that the percentage deviation became positive during the recession of 1953, i.e. contra-cyclical policies were implemented successfully during this period. During the 1954/55 economic upswing phase, public non-residential investment was curtailed successfully. Public non-residential investment rose during the 1956 recession, as well as the economic contraction of 1958. During the upswing phase that lasted until early 1960 the level of public investment in non-residential buildings was also successfully curtailed. Investment rose again during the 1961 recession, was held in check during the upswing period 1962/64, but rose pro-cyclically towards the end of the upswing phase that ended in early 1965. Public investment again rose pro-cyclically during the upswing phase 1968/70, as well as during the 1973/74 upswing period. The line reflecting the percentage deviations shows a consistent negative trend during the eighties and early nineties. This indicates that actual investment in public non-residential buildings has been well below the potential long-term trend line.

The preceding analysis indicates that the implementation of contra-cyclical stabilisation policies were successful during the fifties and early sixties. Public investment in non-residential buildings rose in recessions and declined in economic growth phases. However, in subsequent years expenditure patterns became pro-cyclical and actually contributed to instability in the building industry in South Africa. This finding corresponds with the conclusion reached in an earlier study undertaken by Kilian (1976:187) who used similar statistical methods as those applied in the current study. Kilian argued that the lack of economic management on the part of the authorities first appeared when building control was imposed on the private sector in December 1964 (Kilian, 1976:129).

GRAPH 26

INVESTMENT IN PUBLIC NON-RES BUILDINGS

DEVIATION FROM GROWTH LINE



Source: SARB QB March 1994

In summary, the above analysis shows that contra-cyclical spending on public non-residential buildings was implemented successfully until 1965; thereafter it became pro-cyclical. In this context it is appropriate to consider the probable economic effects of the Reconstruction and Development Programme (RDP) of the South African government which came to power in April 1994. The provision of low-income housing features prominently in this social upliftment programme. According to the Reconstruction and Development Programme (1994:22) an urban housing backlog of 1,3 million units existed in 1990. Approximately one million units should be constructed over five years and such a "... mass housing programme can help generate employment, skills and economic activity, both directly and indirectly, and should help ensure peace and stability" (RDP, 1994:22-23).

Such an ambitious home building programme will have far reaching effects on the building industry. It will place tremendous pressure on the resources of the industry, especially labour and materials. It will require vast financial resources. This programme could also have an impact on certain findings of this chapter. For instance, an infusion of public money in the building industry will boost activity levels and reverse the downward trend evident in investment in public buildings. Furthermore, an infusion of public money could reduce the cyclical influence of interest rate movements in the building industry. This could have an impact on the leading indicator developed in this study. To minimise this statistical effect it is appropriate that the leading indicator be constructed from a number of relevant economic indicators. This finding emphasises the importance of the development of a composite indicator.

4.8 Instability and its effects on price determination in the building industry

The method of price determination in the building industry was considered in Section 3.3.4. It was found that contractors operate in a competitive environment and are subject to a large variety of risks and uncertainties when tendering. Many of these risks can be related to fluctuations in the building cycle. For instance, when there is sufficient building work available skilled labour becomes scarce. Similarly, when there is a sudden upsurge in the demand for building materials, manufacturers are unable to supply timeously.

The labour and materials bottlenecks that occurred during the seventies, eighties and early nineties are illustrated in Graph 27. The indicators in this graph represent the percentage of respondents who report shortages of labour and materials. This percentage can vary between nil and one hundred percent. Also shown in the graph are shaded areas that represent the downswing phases of the building cycle as determined by the South African Reserve Bank. (This is the reference cycle for the building sector and is considered in more detail in Section 8.4 of this study).

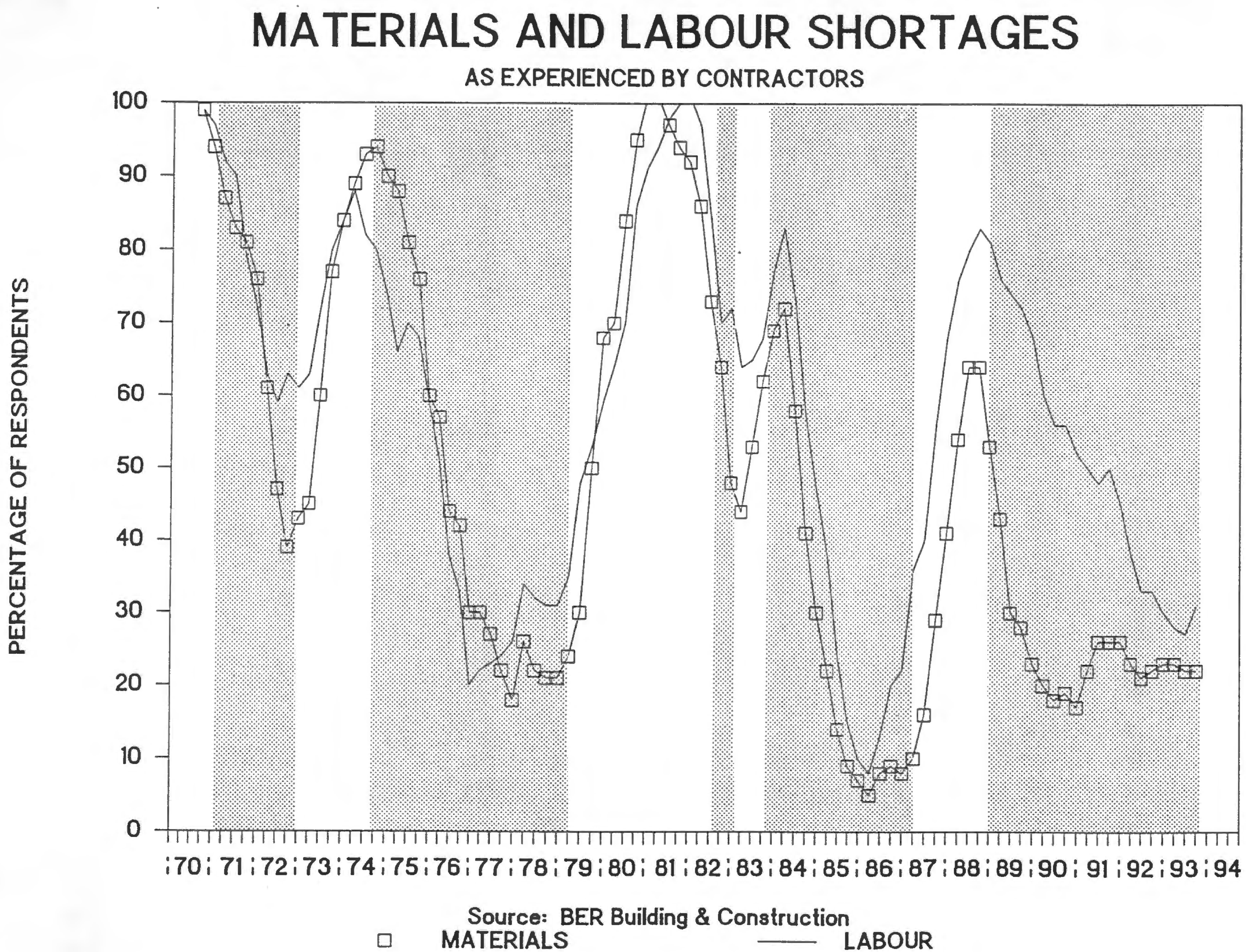
It is evident that these qualitative indicators are cyclically sensitive. One can observe that during the downswing phases of the building cycle the percentages of respondents reporting labour and materials shortages decline. Conversely, during upswing phases labour and materials bottlenecks intensify. A recurring pattern emerges over the years. Whilst it is known that bottlenecks have severely negative effects on the productivity of labour, it is not easy to measure such productivity fluctuations on a macro level. Nevertheless, they affect building costs directly, as will be shown in the following paragraphs.

Graph 28 depicts two composite building cost indicators that are widely used in the South African building industry. The first of these is a composite index of input costs, viz. skilled and unskilled wages, building materials prices and plant and equipment prices. Known as Work Group 24.1 of the Contract Price Adjustment Provisions, it has been in operation in the South African building industry since 1976 (Haylett, 1977:131). This index of input costs is also referred to as the Haylett Formula.

The other building cost indicator depicted in Graph 28 is that of the Bureau for Economic Research, University of Stellenbosch. This index is known as the BER Building Cost Index and is an analysis of twenty-two rates, extracted from accepted tenders (Brook, 1974, 1985; Bezencon & Jacobs, 1983; Kilian, 1980; Segalla, 1991; Snyman, 1980b). This tender price index measures in-place costs. Consequently, all productivity changes are reflected in this index.

It is evident in the upper portion of Graph 28 that these building cost indicators do not rise uniformly. Closer scrutiny reveals that the BER Building Cost Index rises more rapidly than the Haylett Formula index during long upswing periods of the building cycle. During

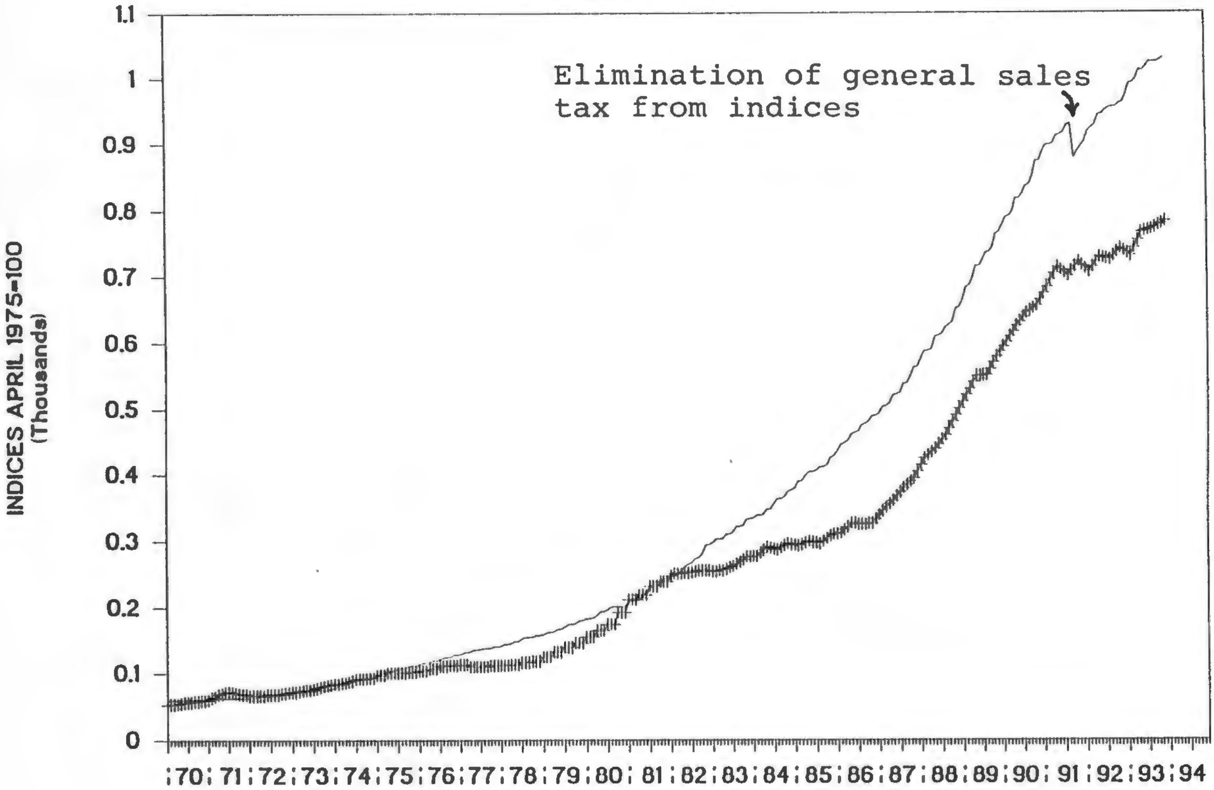
GRAPH 27


MATERIALS AND LABOUR SHORTAGES
AS EXPERIENCED BY CONTRACTORS
PERCENTAGE OF RESPONDENTS
100
90
80
70
60
50
40
30
20
10
0
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94
Source: BER Building & Construction
MATERIALS
LABOUR

GRAPH 28

BER BCI AND CPAP (HAYLETT) COMPARISON

INDICES 1975-100

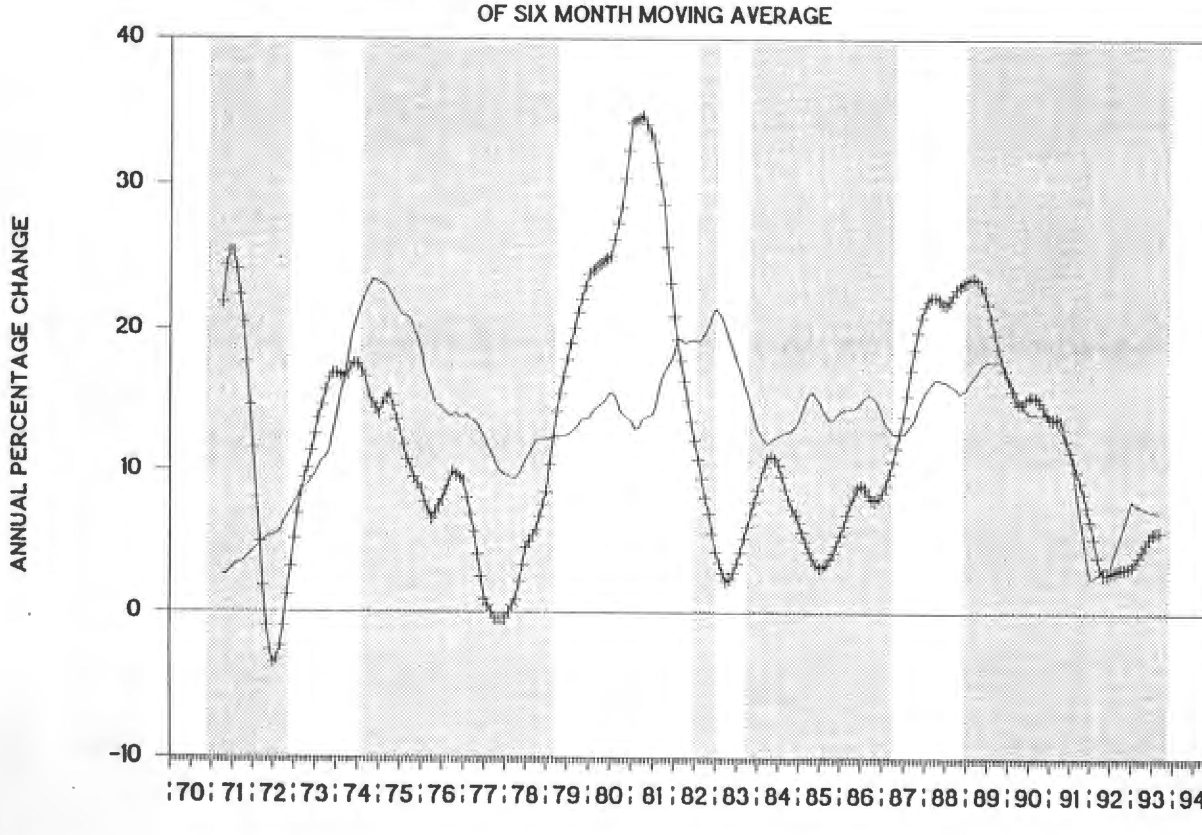


Source: BER: CSS

— Contract Price Adjustment Provisions (Haylett Formula)
\+ Bureau for Economic Research building cost index

ANNUAL PERCENTAGE CHANGE

OF SIX MONTH MOVING AVERAGE



recessions the converse obtains.

Fluctuations in these indicators are depicted in the lower portion of Graph 28. These data have been smoothed with a six-month moving average. The annual percentage changes of the smoothed data are shown. A number of interesting features emerge concerning the interrelationship between the course of input costs (Haylett Formula index) and that of tender prices.

Firstly, it is evident that tender prices rise more rapidly during upswing phases of the building cycle. This can be attributed to a widening of contractors' profit margins, as well as declining labour productivity and smaller discounts on building materials.

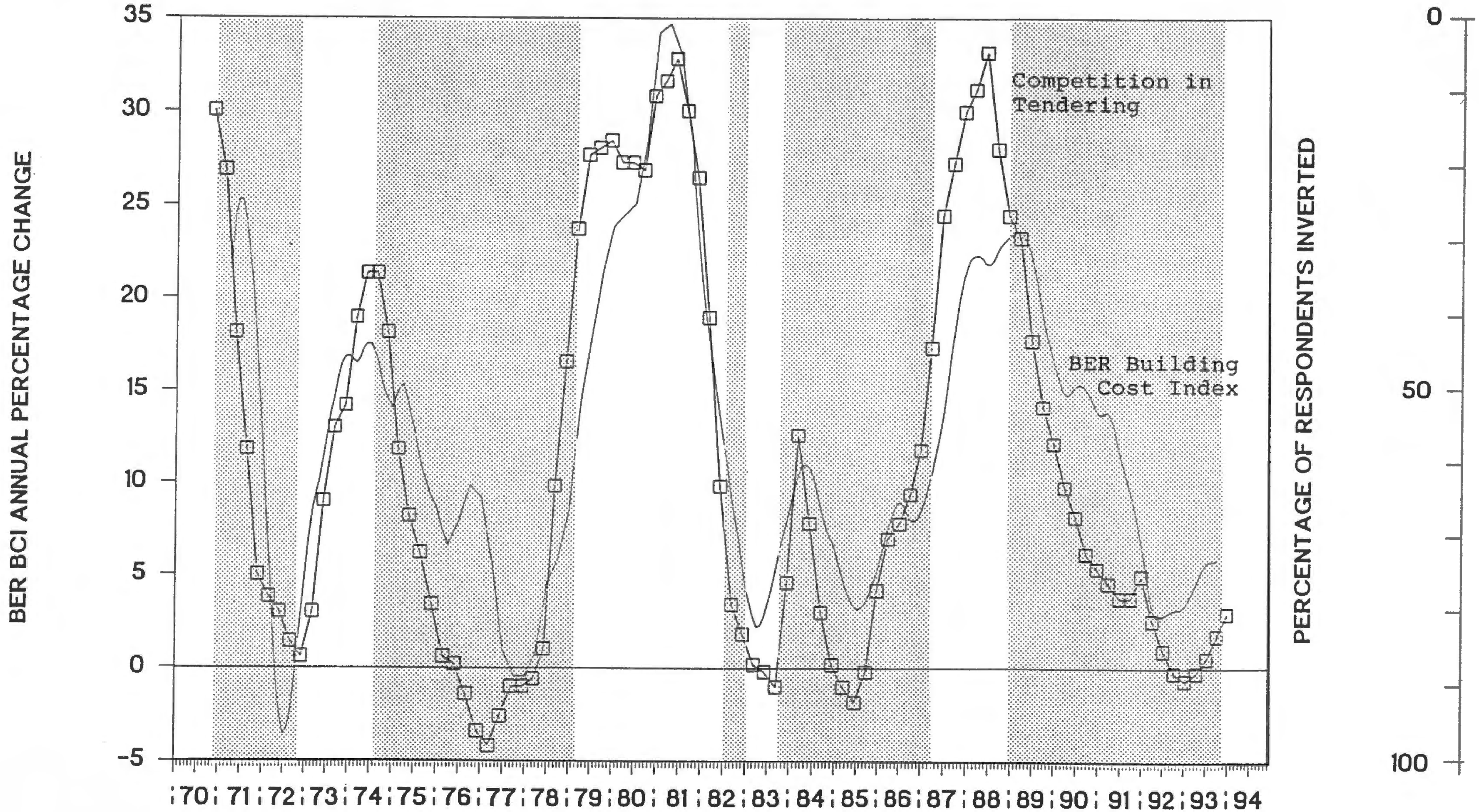
Secondly, it is evident that tender prices rise more moderately during the downswing phases of the building cycle. This can be ascribed to the trimming of contractors' profit margins and a rise in labour productivity. The latter is, in turn, attributable to a decrease in job security that accompanies a drop in building work.

Thirdly, two periods are worthy of further discussion. These periods occurred towards the end of the building recessions of 1971/72 and 1974/78. In absolute terms the annual percentage change was negative and this occurred despite the high rates of increase recorded in input costs. During the 1982 recession tender prices rose by a mere 4%, despite the 20% increase in input costs. It is appropriate to pose the question: "How is it possible that tender prices can be kept in check during a recession when input costs continue to rise rapidly?"

The answer to this pertinent question must be sought in a powerful economic force, i.e. competition in tendering. The economic interrelationship between the degree of competition in tendering and the fluctuations in tender prices is illustrated in Graph 29. It depicts the annual percentage change in tender prices as derived from the BER Building Cost Index. Superimposed on the cyclical course of tender prices is the degree of competition in tendering. The latter indicator forms part of the set of qualitative data that is used in this study to devise a composite leading indicator for the South African building industry. The line depicts the net percentage of BER respondents who report that competition in tendering has become keener during the survey quarter. **For ease of comparison, this percentage has**

GRAPH 29

BER BCI & COMPETITION IN TENDERING



Source: BER Building & Construction

been inverted. A number of features are worthy of further discussion.

Firstly, one can see that the degree of competition in tendering rises during the downswing phase of the building cycle. As building work becomes scarcer, competition in tendering intensifies.

Secondly, it is evident that the degree of competition in tendering declines in upswing phases of the building cycle. As building work becomes more plentiful, competition in tendering slackens.

Thirdly, it is clear that the turning points of these two indicators occur at almost identical points in time.

Therefore, one can conclude that fluctuations in the building cycle and competition in tendering play a crucial role in the method of price determination in the South African building industry. Whilst competition represents a potent economic force in the building industry, it can also lead to insolvency among building contractors should sufficient provision not be made for the risks and uncertainties already discussed, many of which can be traced back to instability of demand for building.

It is clear that to survive in a competitive environment a building contractor needs to assess these risks and uncertainties. In particular, a contractor needs to acquire knowledge of the probable course of the building cycle when tendering on a long-term contract. As has been shown above, should the contractor put in too low a tender price at the start of an upswing phase of the building cycle, real on-site costs may rise much more rapidly than the recovery which the builder can claim under the price revision (Haylett) clauses in the building contract. The contractor may then be faced with a loss on such an "underpriced" project. This aspect deserves detailed discussion.

Reference to Graph 28 indicates that tender prices rise rapidly during an upswing phase of the building cycle when demand is buoyant (Snyman, 1989:39). This can be attributed to a number of factors. A list follows:

4.8.1 Labour rates, building materials prices and plant prices accelerate during economic growth phases.

4.8.2 Discounts on building materials prices are reduced, thereby raising the effective price paid by the builder.

4.8.3 Due to the perennial shortage of skilled labour the flow of work is interrupted, bottlenecks are experienced on site, labour piracy is commonplace and management is over-extended. Consequently, labour productivity declines, with a concomitant rise in actual labour costs (as separate from wages).

4.8.4 As contractors are forced to meet completion dates they are obliged to employ more people. However, in the short-term, the supply of skilled labour is at a premium (refer again to Graph 27). Many unskilled workers are then pressed into skilled jobs. The inevitable result is that the average level of skills and the quality of building work tends to decline.

4.8.5 Given the oligopolistic nature of the market for building materials, as well as the long lead times for new investment to create additional production capacity, acute shortages of building materials develop in the short-term (refer again to Graph 27).

4.8.6 Given the abundance of new building work, contractors avail themselves of the opportunity to widen their profit margins to recoup past losses and/or maximise current profits. However, there is no certainty that contractors actually achieve their desired mark-ups due to costs incurred as a result of bottlenecks that arise during periods of strong growth. Table 3.2 shows that contractors' percentage profit to turnover remained virtually constant over time.

4.8.7 Probably the most important factor to influence the course of tender prices is the degree of competition in tendering. This has been discussed in detail in preceding paragraphs (also refer to Graph 29).

It is also evident in the lower portion of Graph 28 that upswing periods of the building cycle are accompanied by periods when tender prices rise more rapidly than input costs, as expressed by the compensatory Haylett Formula. Such periods occurred during 1973, 1979/81 and 1987/89 and fell within the building cycle upswing phases. These periods are known colloquially in the building industry as periods of "under-recovery".

However, this phrase is a misnomer because in terms of the Haylett Formula the contractor is compensated fairly for increases in input costs. Yet, real on-site costs rise more rapidly because of the factors enumerated above. Therefore, provision has to be made for these special factors in the contractor's bid at tender stage. No compensatory formula can safeguard the contractor against decreasing labour productivity that results from a shortage of skilled labour or materials once the building contract has been signed. As such occurrences are related to fluctuations in the building cycle it becomes clear why it is important that contractors take cognisance of the probable course of the building cycle when tendering on new work. A composite leading indicator for the South African building industry can fill this need. Such an indicator is devised in this study.

Scrutiny of Graph 28 reveals still more interesting features. It is evident that input costs, as expressed by the Haylett Formula, rise more rapidly than tender prices during downswing phases of the building cycle. Such instances were experienced during 1972, 1974/78, 1982 and 1984/86.

These periods are colloquially known as periods of "over-recovery". Again, it should be pointed out that this phrase is a misnomer as contractors are compensated fairly for increases in input costs in terms of the Haylett Formula. Yet, tender prices rise more slowly than input costs because competition in tendering forces contractors to pass on any savings they may make to clients in the form of relatively lower tender prices. Such savings become possible as a result of increased labour productivity, larger discounts on building materials, the elimination of bottlenecks and improved management that accompanies scarcity of building work.

In summary, this section has stressed the importance of the building cycle in the determination of tender prices in the South African building industry. It was shown that it is imperative that contractors take due cognisance of the probable course of the building cycle when bidding on new work. Failure to do so may result in financial loss. Therefore, the need for reliable forecasting is clear.

4.9 The relevance of the qualitative survey variables and the quantitative time series analysed in this study

In this section an assessment is made of the relevance of the qualitative survey variables and the quantitative time series used in this study. The statistical analyses to determine their suitability as leading indicators are undertaken in Chapters 8 and 9.

It is appropriate to recall that the analysis undertaken in Chapters 3 and 4 has shown that demographic, income and financial variables play an important role in the building industry. The analysis also indicated that of these factors, the most important are financial/liquidity variables related to the cost and the availability of finance. Also important, in the context of price determination, are variables that relate to the degree of competition in tendering and to bottlenecks in the supplies of labour and materials.

Therefore, it is appropriate to pose the question: Are the survey indicators used in the current study relevant, i.e. do they capture information on variables that influence building contractors' and sub-contractors' behaviour? Or, to phrase the question differently, do these survey indicators capture information on variables that are influenced by the building cycle? The answer to this question is important because these may be the survey variables to be used to devise a composite leading indicator for the South African building industry.

As will be shown in subsequent chapters, the survey indicators cover a wide spectrum of contractors' and sub-contractors' economic activities. Each of these aspects is discussed below.

4.9.1 Qualitative indicators

4.9.1.1 Value and volume of work done

Survey variables provide information on fluctuations in the work load of contractors and sub-contractors. The responses to the survey questionnaires therefore reflect changes in effective building demand.

4.9.1.2 **Degree of competition in tendering**

Information on the degree of competition in tendering is captured in the survey indicators. As has been shown above, this variable is crucial for the determination of tender prices.

4.9.1.3 **Bottlenecks in the supplies of labour and building materials**

Survey indicators capture information on the availability of supplies of skilled and unskilled labour, as well as various building materials. It was shown above that these variables are also important in the context of the determination of tender prices.

4.9.1.4 **Financial constraints**

Survey indicators capture information on the cost of finance (the interest rate level), as well as the availability of finance. As has been shown in Chapters 2, 3 and 4, these key variables play a crucial role in determining effective building demand.

4.9.1.5 **Prevailing and expected business conditions**

The survey indicators capture information on the perception of building contractors' and sub-contractors' current and expected business conditions. Included in these survey variables are perceptions of future work load levels, the future course of interest rates, the availability of capital, government policies, profitability, and other factors that are not easily quantified.

4.9.2 **Quantitative time series**

The analyses in Chapters 3 and 4 have indicated that the level of effective building demand is influenced by a number of economic factors. These factors have an impact on the business environment in which contractors and sub-contractors operate. Changes in these determining factors could alter the economic behaviour of participants in the building industry. The factors that shape contractors and sub-contractors economic behaviour are given below. These factors, and the quantitative economic indicators representing their movement over time, are included in the empirical analyses undertaken in Chapter 9.

4.9.2.1 **Cost of capital**

The analyses in Chapters 2, 3 and 4 have shown that the cost of capital is an important determinant of the effective demand for building. In the analysis undertaken in Chapter 9 an appropriately chosen interest rate represents the fluctuations in the cost of capital (credit).

4.9.2.2 **Availability of capital**

Fluctuations in the availability of capital are represented by mortgage loans granted for new dwellings by financial institutions. The level of gross gold and foreign reserves reflects the general domestic liquidity situation.

4.9.2.3 **Activity-related economic indicators**

Fluctuations in the work load of contractors and sub-contractors are represented by variables such as the number of house plans passed or the total value of residential plans passed. These indicators represent intentions to build and fluctuations in these indicators should therefore presage real building activity levels.

4.9.2.4 **Price, cost and profit variables**

Fluctuations in the prices of inputs in the building process are represented by price indices that reflect the input costs, as well as profit margins and output prices of builders.

4.9.2.5 **Competitive market conditions**

The tendering environment is an important factor in the shaping of prices, costs and the profitability of construction activities. An indicator providing information on the average number of tenders received per building project represents changing market conditions.

In summary, the above qualitative and quantitative indicators represent a wide spectrum of economic activities of builders. They are examined in Chapters 8 and 9.

4.10 Summary

This chapter has focused on instability in the South African building industry. In the macroeconomic overview it was found that the level of investment in buildings rose rapidly during the sixties and early seventies. The performance of the building industry during the eighties and early nineties has been lacklustre. It was found that investment in the private sector of the market has recorded evidence of two Kuznets-type cycles in the post-war period up to 1978-79. An upswing in building started in the early eighties, only to be interrupted by government action in August 1984. At that point the prime overdraft rate was raised to 25%. A protracted economic recession followed. In 1988 a revival in the building industry was recorded. A protracted recession followed and lasted until the end of 1993.

The analysis also indicated that the investment in public non-residential buildings grew rapidly during the sixties and early seventies as government invested heavily in infrastructure. In the public housing sector a sharp increase was evident until the early eighties. However, public housing policy changed and this led to a continued decrease in public housing during the late eighties and early nineties.

The analysis showed that the private housing market is very responsive to changes in mortgage rates and the availability of housing finance. Migration patterns were also shown to have an influence on housing demand.

Instability in the private non-residential sector was found not to be as great as one might have expected, despite the operation of the acceleration principle. This finding can be attributed to the long planning periods involved in the erection of non-residential buildings. The indivisible and irreversible nature of large non-residential building projects also plays a role. Therefore, it appears as if the private non-residential sector is fairly insensitive to changes in interest rates and the business cycle. Nevertheless, the lagged effects of changes in interest rates are evident in the investment data.

The analysis also indicated that the government successfully managed to spend contra-cyclically in the public non-residential sector during the fifties and early sixties. Since about 1965 government spending on public non-residential buildings has been pro-cyclical. It has actually contributed to instability in the building industry.

Finally, an assessment was made of the relevance of the qualitative and quantitative indicators that are used in this study to devise a composite leading indicator for the South African building industry. It was shown that a number of these indicators are included in the analyses in Chapters 8 and 9. These economic indicators reflect various aspects of the economic behaviour of builders and are consistent with the economic theory underlying the South African building industry.

The next chapter deals with the history and development phases of business survey data in an international context.

* * * * * * * *

Chapter 5

Business surveys: History and development from an international perspective

5.1 Introduction

In this study a leading indicator is devised for the South African building industry from qualitative BER survey data compiled according to the research method devised and developed by the Ifo Institute for Economic Research, Munich, Germany. This survey method is known as the Konjunkturtest. It is appropriate, therefore, to assess this survey method from an international perspective.

In the initial sections of this chapter the nature of qualitative data and the historical development of business surveys are described. The unique benefits of business surveys are spelt out. The methodological development phases in the use of qualitative data are discussed according to the framework of two specialists in this specialised field of economic analysis.

5.2 The nature of qualitative data

The term "qualitative data" in this study pertains to information of a subjective nature as derived from business surveys. These business surveys concern evaluations of, inter alia:

* work load, production or sales;
* incoming orders;
* orders placed;
* stocks of raw materials;
* stocks of finished goods;
* capacity utilisation; and
* business climate (business mood).

Questionnaires are usually structured in such a way as to gather information on the current state of certain variables (e.g. production or demand), relative to an earlier corresponding period, for instance, the previous quarter or the corresponding quarter in the previous year.

The responses are trichotomous for most variables indicating, for example, an increase, no change or decrease in the particular variable. Furthermore, questions are posed which gather information on the judgement of the business situation, e.g. stocks, which are either too large, sufficient or too small. In addition, these business surveys gather information on expectations regarding the future course of such variables. Therefore, a common feature of most business surveys is that respondents are required to provide a short-term forecast (e.g. 3 months) of the expected development of certain variables.

The concept "qualitative" can best be described by contrasting it with a "quantitative" measure. To give an example of a quantitative measure, production, when it is measured in units, is an expression of the physical number of units produced. Likewise, incoming orders can be expressed in either monetary or physical units. The information thus gathered is quantitative data, because it is measured on an interval or ratio scale.

By contrast, subjective evaluations and judgements made by individuals of variables such as production and incoming orders, are expressions of qualitative information because such responses are measured on a nominal or ordinal scale. Regarding the change in the variable (increase, no change, decrease) and the evaluation (good, satisfactory, bad), questionnaires are not structured to gather information on "how much" but "whether". Piatier (1975:37) referred to this survey technique as "statistique sans chiffres" (statistics without figures). Strigel (1981:25) explained this apparent contradiction by observing that "... the determination of that frequency distribution of positive and negative evaluations of qualitative anticipations is also a statistical method".

Qualitative data are therefore characterised by subjective assessments and opinions of certain variables; hence the common usage of the term "opinion survey" in this branch of economic diagnosis. Stutz (1957:37) explained the idea in rather basic terms when he referred to "a crosscut through the heads of businessmen".

Strigel (1981:58) points out that such qualitative information exists originally on the micro-level and expressed the above idea in somewhat different terms "... the entrepreneur's evaluation (should) be most strongly influenced by those variables which occupy the front of his mind on each specific occasion, and which thereby affect his respective decision".

However, Strigel (1981:25) also mentions that "... these data can as well be aggregated and converted into time-series so that they can be compared with respective time-series of quantitative statistics". It is appropriate to describe the origins of the statistical method that forms the basis of the survey indicators used in this study.

5.3 The origins and historical development of qualitative data sources

Strigel (1981:9) mentioned that statistics of a qualitative type have been in existence in German agriculture for more than 100 years. In 1927 a start was made in the U.S.A. with surveys of a qualitative nature by the Regional Shippers Advisory Boards of the Association of American Railroads. Hupkes (1961:3) noted that already in 1928 Wageman had foreseen the possibility of continuously collecting data directly from individual firms to be used for the purpose of business forecasting. Hupkes (1961:13) also notes that Haberler thought this to be a "very questionable procedure".

Ziegler (1980:1) pointed out that in 1931 the American National Association of Purchasing Agents introduced a business tendency survey among its members, which - although it was interrupted during World War II - still exists today.

However, according to Strigel (1981:11), it was only after the Second World War that trade cycle surveys came into their own. In 1948, Katona began the first consumer survey in the United States of America. At the beginning of the 1950's, new activity in this field of economic research was recorded in Europe, particularly in the Federal Republic of Germany, in France and in Italy. Piatier (1979:1) observed that the first three surveys were undertaken in 1949 by Dr. Karl Wagner in Munich, Professor G. Tagliacarne in Rome and himself in Paris. An interesting aspect worth mentioning is the fact that they worked independently, without even knowing one another. They met in 1950 and found that already their pre-occupation with survey data was remarkably similar, viz. as an aid to short-term forecasting.

The interest in this field of research was such that these economists, representing three European institutions: Ifo Institute for Economic Research, Munich; Italian Chambers of Commerce, Rome; National Institute for Statistics, Paris, founded an international committee for studies on business survey methods in Paris during 1952, called CIMCO. In 1960 the name of this organisation was changed to "Centre for International Research on Economic Tendency Surveys" (CIRET). For several years (1960 to 1966) there was a small research centre under the direction of Professor H. Theil at the Econometric Institute of the Netherlands School of Economics in Rotterdam. Professor O. Anderson continued this work at the University of Mannheim and later at the University of Munich, Germany. In 1971 these activities were merged with the CIRET Information and Documentation Centre at the Ifo Institute for Economic Research, Munich. CIRET is affiliated to the Ifo Institute through a small secretariat.

By 1980 more than 1500 titles of papers and research documents were available in the CIRET archives in Munich. The most comprehensive survey of the empirical literature pertaining to business surveys was compiled by M. Ziegler in 1968, and already comprised 110 pages. She supplemented this bibliography in 1980 with a synopsis of papers presented at CIRET Conferences (Ziegler, 1968, 1980). The most important task of the CIRET Secretariat, as described by Strigel (1981:15), is "... the scientific preparation of the international conferences and workshops that take place every two years, as well as the collection of information material and the coverage of reports on economic surveys throughout the world". Strigel (1981:12) has observed that by 1980 there were at least 150 trade cycle surveys in existence, and he presented a table of the world-wide distribution amongst countries. Of those 39 countries included in that table, all conduct business surveys amongst executives, whilst of these countries 18 also undertake consumer surveys.

According to Strigel (1990:83), by 1988 CIRET had about 500 members or correspondents in 48 countries. In a CIRET circular of 1993 it was mentioned that the organisation has 480 members and correspondents in 55 countries. Finally, in this overview of the historical development, mention should be made of the efforts of the Commission of the European Economic Committees to harmonise the existing business surveys in all member countries and the work initiated by the Organisation for Economic Co-operation and Development (OECD) using qualitative data as leading indicators.

5.4 The benefits of business surveys

An investigation has revealed that the literature on qualitative business surveys in South Africa is not extensive. In fact, in the space of four decades, fewer than fifty works can be cited, aimed at examining the theoretical and statistical-methodological aspects in this specialised field of economic research.

Strigel (1981:21) observed that this situation also existed initially in Germany. He stated that: "This was a typical case of the often deplored practice without theory. The blame for this is not only the fact that practitioners (i.e. empiricists) often are not very good theoreticians or else they are not at all theoreticians (the opposite is also true, unfortunately), but also the fact that information gathering is often subject to pressure from deadlines which do not leave sufficient time frame for the time-consuming theoretical considerations". Though this is undoubtably true, business surveys have nevertheless gained acceptance in Europe. Referring to Germany, Strigel (1981:26) wrote: "... Ifo surveys were ... sponsored by the pure pragmatism of it: the need for information at the moment gave the deciding push. It is even more noteworthy that this concept was able to establish itself and prove to be capable of being developed".

The acceptance and respectability which has been achieved by on-going business surveys in Europe and South Africa (as opposed to ad-hoc opinion polls) could be ascribed in large part to the following unique benefits of this method of business cycle diagnosis, as explained by Strigel (1981: 27-30). A list follows.

5.4.1 Broader information

Additional information is gathered to supplement the quantitative statistics. Qualitative survey data can provide "... clues to the analyst as to the reaction to be anticipated from the economy" (Strigel, 1981:27).

5.4.2 Efficiency

Due to the inherent simplicity of the questionnaires, respondents can complete and return them with the minimum loss of time. An acceleration in the collection and processing of data enables the results to become available sooner than in the case of most official quantitative statistics. The information lead can be especially beneficial when forecasting turning points in the business cycle.

5.4.3 Fuller picture of trends

A synchronisation of data becomes possible; e.g. information relating to the production and distribution sectors become available simultaneously and can be combined immediately with one another. The researcher is therefore presented with a more complete picture of economic trends.

5.4.4 Awareness of limitations

The fact that data collection and data analysis are undertaken by the same institution has certain benefits. One such advantage is that the researcher is constantly aware of the limitations of the survey results.

5.4.5 Faster adaptation

The reaction speed to important changes in the economic process can be enhanced by the adaptability of the survey method. Questionnaires can be readily adapted to ascertain the effect of economic policy changes.

5.4.6 Greater trust

A final advantage lies in the fact that an "information community" is set up. There is continual feedback on information between surveying organisation and individual firm. Often it is the case that the individual firm will provide frank answers to questions posed by a private research organisation with whom it has established a position of trust.

5.5 Synopsis of the main streams in the theoretical and empirical development of qualitative business surveys

The nature of qualitative data has been explained, as well as the historical origins of the survey method and the unique benefits of such business surveys. It is appropriate now to provide a framework to serve as a background for the evaluation of the survey data undertaken in subsequent chapters.

Two specialists, Strigel and Aiginger, have - on separate occasions - identified the main streams in the business survey literature, Strigel (1981:13-14) in order to "... trace a common trend in the development of data evaluation" and in the case of Aiginger (1977:5-7) to "... establish a framework for (his) own empirical results".

The following synopsis describes the main streams in the theoretical and empirical development of qualitative business surveys. Aiginger distinguishes five phases, Strigel seven stages. The phases are presented side-by-side with the stages, to make the similarities and the differences clear. It is worth mentioning that many of these phases overlap. Refer to Table 5.1.

Table 5.1

Synopsis of the theoretical and empirical development of qualitative business surveys

Aiginger (1977)	**Strigel (1981)**
Phase 1: Descriptive	**Stage 1: Descriptive**
The Ifo Institute for Economic Research in Munich started to conduct business surveys in 1949. Thereafter descriptive work dominated the literature. Papers set out to justify the use of "qualitative" surveys in the eyes of a sceptical audience. Notable authors were Langelutke (1955), Marquardt & Strigel (1959) in Germany; Piatier (1951/51) in France and Schumann (1957) in South Africa.	Surveys are introduced to obtain additional information on cyclical development. Business institutes and magazines, such as Business Week or Fortune, attempt to use the survey findings to enlarge their supply of information. Extensive analyses were constrained by the too short time series. No substantial analytical treatment was possible.
Phase 2: Quantification	**Stage 2: Quantification and accuracy testing**
The next step concerned the "quantification problem", i.e. the quantification of qualitative survey data and the related problem of the indifference	The survey coverage improves. The problem of quantifying qualitative data is recognized and dealt with. The first analyses of the accuracy of anticipations

interval in surveys (what percentage of firms report "no change?). According to Aiginger (1977), Anderson (1952) proved that qualitative answers under certain conditions can be interpreted as if there were a connection between the frequency of plus, minus and no-change on the one hand, and the actual quantitative change in the variables surveyed on the other hand.

data are carried out by Theil (1955). The so-called "endogenous tests" are undertaken, i.e. ex ante and ex post responses are compared with each other. This is followed by comparisons with official statistics, the so-called "exogenous tests" (Tompkinson & Common, 1983; Keating, 1983; Gluch & Hofman, 1986; Ziegler, 1986; Schmid, 1986; Strigel, 1990).

Phase 3: Accuracy testing
Empirical investigations of the business test variables were undertaken, mainly with respect to consistency and rationality. Endogenous and exogenous tests were carried out (Jochems & De Wit, 1960).

Note: Stage 2 in Strigel's classification encompasses both Aiginger's second and third phase.

Phase 4: Business cycle analysis
During the fourth phase the question was asked what role the business test series could play in macroeconomic forecasting. The correlation coefficient was introduced as the standard measure of their quality, and average leads and lags became an indicator of their prognostic applicability (Gerstenberger, Lindlbauer, Nerb & Strigel, 1971; Langmantel, 1987).

Stage 3: Business cycle analysis
The data base of the time series grows longer and can be seasonally adjusted (if necessary). The behaviour of these time series is examined at cyclical turning points (Söffner, Lindlbauer & Ruderer, 1975). Thus, the short-term forecasting capabilities of the time series are examined (Persson, 1975, 1977; Klein & Moore, 1981a, 1981b; Bennett, 1984; Klein & Moore, 1986; Stalder, 1989).

Phase 5: Econometric modelling
By the beginning of the seventies the survey time series were at last sufficiently long for them to be used in econometric

Stage 4: Econometric modelling
Attempts are made to incorporate ex post data and anticipations data (qualitative and quantitative) in econometric models

models and in systems of cyclical indicators. The tendency to replace large "structural models" with smaller "forecasting models" certainly promoted the use of survey variables. The lack of theoretical penetration apparent in the system of cyclical indicators and the realisation that objective theories were not able to explain all cyclical events in the seventies furthered the increased use of subjective data. In June 1975, for example, the Industry Committee of the OECD decided to include survey results into their "Main Economic Indicators" on an equal basis with quantitative time series (Leyland, 1977).

(Poser, 1975; Naggl, 1983, 1985). At the same time experiments are made with combined indicators (e.g. business climate, consumer sentiment), and by means of factor analyses (Kloek & Bannink, 1961; Liberatori & Pinca, 1975; Van der Linden, 1977; Fellberg, 1979; Goldrian, 1976; Langmantel, 1987).

Stage 5: Behavioural studies

The data are subsequently employed to carry out extensive studies of the behaviour of businessmen and consumers (Nerb & Strigel, 1977; Klein, 1990).

Stage 6: Early Warning system

Concepts for a cyclical early warning system are developed on the basis of the available data and empirically tested. The difference between this stage and Stage 3 is that whereas in Stage 3 individual survey indicators were analysed almost in isolation, the concept of devising an integrated qualitative and quantitative cyclical analysis system took hold (Strigel, 1972, 1977; Leyland, 1977; Klein & Moore, 1983; Strigel, 1990; Oppenländer, 1993).

Stage 7: International co-ordination
In this final stage, which has yet to be fully developed, existing international experience will have to be screened and evaluated to arrive at a conclusive opinion on the optimum formulation of survey questions and the best possibilities for using trade cycle surveys (Klein & Moore, 1983; Strigel, 1990).

It is evident that this synopsis indicates that Aiginger and Strigel agree in principle in their classification of the development stages of qualitative business surveys. This structure provides a useful framework for subsequent analysis of survey data.

Since Aiginger (1977) and Strigel (1981) devised their classification system a number of new developments have taken place in this field of research. One such development relates to the structural stability of economic relationships containing qualitative survey data. Smit (1987:59) asserted that a considerable degree of success had been achieved by those who had used such survey data in business cycle analysis, particularly in econometric modelling (Naggl 1983, 1985; Smit, 1983, 1986). Yet in subsequent research conducted by Smit (1987:74) he found that econometric equations in South Africa had to a large extent become structurally unstable after 1980. He found no evidence to support claims that functions based on or containing qualitative data were more or less stable than the traditional equations. Possible reasons given for the breakdown of stable relationships are changes in monetary policy, government spending, high interest rates, inflationary expectations, political moves, new technology developments, and the like, that cause existing relationships to shift. One should refer to Evans (1983:4) and Makridakis (1984:3), as quoted in Smit (1987:59-60). Structural analysis became a recurring theme in subsequent CIRET Conferences (Zarnowitz, 1991; Chow & Ong, 1993).

Whereas business surveys had - prior to the mid-eighties - focused primarily on business conditions in the manufacturing industry, on price expectations, on consumer sentiment and on surveys of investment intentions, new developments took place during the late eighties and early nineties. Surveys of innovation activities were developed and research findings were presented at CIRET Conferences. Examples of papers are: Scholz (1991), König (1991), Defays (1993), and Scholz and Kaminski (1993).

5.6 **Summary**

This chapter contains an assessment of the survey method that forms the basis of the qualitative building survey data from which a composite leading indicator for the South African building industry is compiled. This research method is based on subjective evaluations of economic variables and is often referred to as the Konjunkturtest, devised and developed by the Ifo Institute for Economic Research, Munich, Germany. The European countries have shown a preference for business surveys whilst the trend in the U.S.A. has been towards the gathering of quantitative data (Smit, 1986). Indicators compiled from qualitative data have certain benefits when compared to quantitative data sources. Many researchers have worked in this specialised field of economic analysis since World War II and their work can be categorised in terms of various development stages. The Aiginger-Strigel reference framework provides a useful perspective on international trends in the usage of business surveys. New developments in the field of business surveys relate to structural analysis and surveys of innovation intentions. The next chapter deals with business surveys as they developed in South Africa.

* * * * * * *

Chapter 6

The South African experience with business surveys

6.1 **Introduction**

In this chapter qualitative business surveys undertaken in South Africa by the Bureau for Economic Research, University of Stellenbosch, are placed in historical perspective. Development of the South African literature in this specialised field of research is categorised in terms of the Aiginger-Strigel framework presented in Chapter 5.

The Bureau for Economic Research was formed at the University of Stellenbosch in 1944 and started preparations for the publication of a quarterly opinion survey in 1953, based upon the method known as the Konjunkturtest of the Ifo Institute for Economic Research in Munich, Germany. The origin of the <u>BER Opinion Survey Report</u> was described by Schumann in 1956 in the following terms:

> When the Business Opinion Survey was initiated by the Bureau for Economic Research about two years ago, mainly on the recommendation of Mr. E. van den Bogaerde who had read an article by Professor Piatier of Paris in Kyklos, we had to take a great risk with regard to the indispensable co-operation of business firms, the possibility of obtaining the necessary funds and the dependability and general usefulness of the surveys and forecasts (Schumann, 1956:37).

Although no specific reference was provided concerning Piatier's article, it is likely that it was the article entitled "New methods for the study of the business cycle and economic forecasting" (Piatier, 1951/52).

Using the Aiginger-Strigel framework as a basis, the subsequent development of the South African literature pertaining to qualitative business surveys can be traced. It should be mentioned that some of the quoted references could be classified under more than one heading. However, in this study they are categorised according to the main objective of the researcher.

6.2 The descriptive and quantification stage

The first comprehensive study of the background and functioning of the BER Opinion Survey was undertaken by Schumann and Van den Bogaerde in 1955, just two years after the Konjunkturtest had been introduced at the Bureau for Economic Research (Schumann & Van den Bogaerde, 1955). Two years later Schumann (1957) delivered a paper on the Opinion Survey Method at an international congress held in Munich, West Germany. A paper by Hupkes (1959) delivered at the 4th CIRET Conference, held in Munich in 1959, was also of a descriptive nature. Two papers by Hupkes that dealt with investment intentions surveys and the availability of ex ante data could also be classified under this heading (Hupkes, 1963, 1967).

In a later study, commissioned by the Human Sciences Research Council, the Bureau for Economic Research examined the methodology underlying the BER Opinion Survey with the objective of incorporating improvements, where necessary (BER, 1972). One of the aspects covered in that report concerned the viability of an econometric model for the Republic of South Africa. Smit (1983c) showed that the quantification method of Carlson-Parkin is highly inaccurate when applied to qualitative BER survey data. An overview of opinion survey data was undertaken for the Human Sciences Research council by Stuart in 1984. This represented part one of a study that was completed in 1987. By the late eighties the methodology regarding the various surveys of the BER had been well documented by Spangenberg (1985), Stuart (1987) and Mocke (1990).

6.3 The analytical stage: Accuracy testing

Scarcely two years after the BER Opinion Survey first appeared, the first evaluation of the available data was undertaken by Van der Berg and Verburgh (1956) and published in the South African Journal of Economics. This study made several suggestions which were incorporated in subsequent survey issues, e.g. weighting of the firms, revisions of questions posed and reclassification of respondents into different economic sectors. A research report by Hupkes in the early sixties was a continuation of the investigation started by Van der Berg and Verburgh (Hupkes, 1961).

In the mid-seventies Bouwer (1967) completed an "endogenous accuracy test" by comparing ex ante with ex post data. He based this test on data both for individual firms and for the various groupings of respondents to the BER Opinion Survey. Bouwer found that business people are prone to underestimate changes in economic conditions, yet the survey data could definitely be used as cyclical indicators to complement quantitative economic indicators. He recommended that the weighting system of participants' responses be revised on a regular basis to improve the accuracy of the survey data.

The annual forecasts of the Bureau for Economic Research - that were based on both qualitative and quantitative data - were subjected to an "accuracy test" by Stacey in the late sixties (Stacey, 1968). He found that forecasts (i.e. levels) based on BER Opinion Survey data were not better that a simple mechanical rule, yet the survey data tended to give a better indication of the direction of change in economic conditions than when a simple mechanical rule was applied. He concluded that more accurate forecasts could be obtained by using BER Opinion Survey data to supplement an econometric model for South Africa.

The first attempt to conduct an "exogenous test" was undertaken by Van Schaik (1974) who compared certain of the BER Opinion Survey variables with corresponding official quantitative time series. Van Schaik found that during the sixties the BER Opinion Survey data did not correlate well with corresponding official time series. He recommended regular revisions of the weighting system of participants' responses to improve the accuracy of the survey data. He also found that regular revisions of the official data complicated comparisons with qualitative data.

In 1977 De Vries and Stuart undertook an evaluation of the annual forecasts of the Bureau for Economic Research in a paper delivered at the 13th CIRET Conference, Munich (De Vries & Stuart, 1977). Although the paper dealt with an evaluation of the BER's quantitative annual forecasts, these forecasts were partially based on the Bureau's qualitative business surveys. They found that survey respondents were too conservative in their approach to economic changes. The authors concluded that the BER forecasts were far from exceedingly good, yet they did not seem to be particularly poor. They suggested that all forecasters should combine forces to produce better results. More emphasis should be placed on predicting changes and growth rates than actual levels.

During the eighties Stuart (1983, 1984, 1987) analysed the qualitative data of the Bureau for Economic Research, concentrating on consumer surveys. He covered methodological aspects of the Konjunkturtest, the usefulness of the results, consumer attitudes, turning point analyses, principal component analyses and the possibility of constructing composite indices from survey data. Stuart found that the survey data could be used as leading indicators for forecasting purposes. He recommended that researchers pay more attention to studying consumer behaviour per sé.

More recently, Mocke (1990) undertook an endogenous test of qualitative building data. He found that turning points were accurately predicted by respondents. In the same study an exogenous test was performed by comparing certain official quantitative data with qualitative building data. Mocke concluded that certain building indicators of the Central Statistical Service and the South African Reserve Bank were quite well correlated with their corresponding BER survey indicators.

De Jager (1993) undertook an exogenous test of BER consumer survey data from which separate indices for white and black consumers are compiled. He found that the economic situation index among whites - lagged by two quarters - is the best indicator of growth in gross domestic product. Secondly, he found that attitudes among black consumers appear to be almost completely insignificant as an indicator of economic activity and employment as reflected by official statistics. However, it was stated that, ideally, a common South African consumer confidence index for whites and blacks should be constructed. This provides ample justification for research institutes like the BER to continue with survey based research.

6.4 The business cycle analysis and forecasting stage

This development phase was ushered in by Schumann (1965) who presented a paper at the 7th CIRET Conference on opinion surveys and national economic budgeting in South Africa. Stuart (1979b, 1982) concentrated on consumer surveys and their role in forecasting. He found that survey results could be useful in predicting the course of consumer durable spending. Smit and Kotze (1984) used qualitative BER data to construct a model to forecast Van Coller's (1980) coinciding indicator three months in advance. Van Coller's coinciding indicator was to serve as a proxy for the business cycle. The authors found that their model generally presented a reasonably accurate picture of the business cycle over the sample period, 1975 to 1982. Smit (1986) combined quantitative and qualitative data by means of the Kalman filter technique and this led to improved forecasts of the three models he investigated.

Smit (1991) investigated whether business survey data could assist decision-making in derivative financial markets, especially the markets in futures and options. He examined theories about price determination in these markets and identified those variables where relationships with survey data would prove exceedingly valuable. Smit concluded that market inefficiencies exist and argued that a special business survey in financial markets could provide additional useful information to market participants.

6.5 **The factor analysis, econometric modelling and leading indicator stage**

The first principal component analysis of BER Opinion Survey data was undertaken by Stuart (1979a, 1980). He investigated the inter-correlation of responses to questions and came to the conclusion that it would be possible to construct an indicator of business sentiment from the first principal component of the manufacturing, retail and wholesale data.

In comprehensive studies Smit (1982, 1983a, 1983b) analysed the statistical relationships between qualitative survey data and official quantitative time series, and he investigated the value of opinion survey data in econometric models. He constructed econometric expenditure models of the South African economy based on qualitative data inputs. Smit covered gross domestic product, imports, public fixed investment, general government consumption expenditure, private fixed investment, private consumption expenditure, exports and changes in inventories. The major conclusion he came to was that it is possible to simulate quantitative expenditure components with the aid of qualitative survey data. These simulation exercises proved to be reasonably successful. This raised the possibility of making early quantitative forecasts of the effects of exogenous shocks on the economy (e.g. political instability) via their influence on the opinions of business people and consumers. This possibility exists because qualitative data becomes available before official quantitative statistics.

More recently, Smit (1987) has analysed the structural stability of econometric functions containing qualitative survey data and found that econometric equations (with or without qualitative data) had, to a large extent, become structurally unstable in South Africa after 1980. In this regard, refer to Section 5.5 that deals with structural studies in an international setting.

Pellisier (1992) undertook a factor analysis of the information contained in the BER Manufacturing Surveys. He analysed the quarterly data available for the period 1980 to 1991. He concluded that information conveyed in the BER Manufacturing Surveys were twofold. Firstly, that real basic manufacturing as reflected in production, sales, orders, and stocks of finished goods are largely influenced by demand. Secondly, that supportive manufacturing financial management is reflected in prices, costs, and stocks of raw materials.

In their preliminary work Mocke and Stuart (1991) tested the usefulness of BER building survey data as leading indicators of economic conditions in the South African building industry. An analysis of the survey data indicated close statistical relationships with certain official time series. Examples of these time series are: the value of residential and non-residential plans passed, as well as the value of residential buildings completed, published by the Central Statistical Service; the value of total residential investment, compiled by the South African Reserve Bank. They concluded that survey data could be applied as leading indicators of activity in the building industry, yet they did not actually construct such an indicator.

Pellisier and Smit (1993) proposed a method of constructing sectoral leading indicators for real production volume indices utilising qualitative manufacturing survey data. Factor analytic, Granger causality tests and regression analyses were undertaken in a logical and structured way to utilise the leading indicator potential of survey data on a sectoral level. The results hold promise and work on this research project is continuing.

6.6 **Behavioural studies**

Many of the references provided in previous sections of this chapter could readily be classified under this heading. This by virtue of the fact that researchers implicitly try to determine behavioural patterns of economic agents when conducting business cycle analysis, factor analytic studies or when compiling leading indicators. For example, Stuart (1980) found that business people behave purposefully and that they tend to project their perceptions of business conditions into the future. In this sense, all the studies quoted here deal with economically-based human behaviour, where economic indicators represent "human behaviour".

To illustrate, reference can be made to the research undertaken by Pellisier and Stuart (1993) who used business survey data to test for rationality in business behaviour and to develop economic indicators. Therefore, their contribution could equally well have been classified under the heading "factor analysis stage" (Section 6.5). Nevertheless, inclusion at this point is justified as their primary aim is to explain the behaviour of business people in the wholesale and retail trade sectors. The authors undertook principal component analyses and found that wholesalers and retailers behave purposefully. For instance, during periods of prosperity, the actions of both wholesalers and retailers are largely a function of the level of their sales. The authors concluded that the three principal components which were extracted from the survey data could be used as economic indicators. Whereas Pellissier and Stuart (1993) use the term "rationality" to describe "meaningful" behaviour, the author prefers to use the term "purposeful" behaviour. This is in accordance with Carlson (1991) who suggested that in this context the term "purposeful" be used instead to avoid confusion with the Rational Expectations Hypothesis of Lucas and Sargent (1981).

Stuart (1993) considered the use of survey data in a rapidly changing environment and applied his analysis to South Africa, a country witnessing major economic and political changes. He argued that extrapolation of past trends into the future is an exercise in futility. Stuart concluded that to obtain the best possible results, surveys should be used in conjunction with other forecasting techniques.

A recent new development is worth mentioning. Boshoff (1991) has endeavoured to apply value systems forecasting as an aid to business cycle forecasting. He argued that the methodology of business cycle forecasting rested mainly on historical economic relationships with societal influences of a non-economic nature being taken as a constant. Boshoff maintained that opinion surveys cannot really predict possible underlying structural shifts, such as those that are caused by political developments in South Africa. Therefore, when forecasting consumer patterns the researcher cannot rely on income or historical data alone. He argued that structural shifts in value systems and consumer motivation should also be taken into account and recommended that surveys should be undertaken to establish such shifts in value systems.

Boshoff (1993) argued that business cycle forecasting can be improved by political forecasting using survey methods. He maintained that entrepreneurial and consumer expectations surveys should be augmented by societal change expectations. Presumably this calls for research into consumer behaviour, a desirable objective identified earlier by Stuart (1987).

In summary, this literature study shows that a number of development stages in the Aiginger-Strigel framework can be identified in business survey research in South Africa. The integrated early warning system and international co-operation stage, foreseen by Strigel, has not yet been reached in this country. Yet it is true to say that the need for an integrated economic early warning system exists in South Africa. As participants in the affairs of CIRET, South African researchers are striving for closer international co-operation. This overview of the literature on business surveys in South Africa also shows that much work remains to be done. For example, whereas sectoral research is well developed, regional survey data is lacking. In accordance with international experience, South Africa needs to develop surveys that cover investment intentions, innovation activities, financial markets and surveys that capture shifts in value systems. These activities pose formidable challenges to researchers in this field.

6.7 The position of this investigation in the Aiginger-Strigel framework

It seems useful to categorise the current study in the theoretical framework discussed above. The appropriate position is in the "leading indicator stage" as the objective of this investigation is to analyse qualitative building data and to construct a leading indicator for the South African building industry. As shall be indicated in subsequent chapters, the information content of the qualitative building data is established, turning points in the qualitative time series are determined and the difficult task of the construction of a leading index for the South African building sector is undertaken.

6.8 The BER surveys as source of qualitative building information

It was shown in Section 5.4 that qualitative business surveys can complement quantitative statistical sources. In some instances it is also true that business surveys can provide information in cases where no official quantitative statistics exist.

Aware of the benefits to be derived from qualitative data as a useful tool in business cycle analysis and probably motivated by Strigel's (1981:26) "need for information", the National Development Fund for the Building Industry, established by the Building Industries Federation of South Africa, approached the Bureau for Economic Research, University of Stellenbosch, to conduct "... a current quarterly survey (of) short-term tendencies" in the building industry in South Africa (Schumann, 1969:3). This survey was to be based, in the main, on the opinion survey method and was entitled BER Building Survey. Questionnaires were sent to four groups of respondents, viz. building contractors and developers, sub-contractors, manufacturers and merchants of building materials. Survey results were published for the various regions, as well as for the nationwide totals. Since the inception of the survey, the questionnaires have been revised on a number of occasions. Major revisions occurred with the publication of the eighth, the twelfth, the twenty-fourth, the forty-sixth and sixty-ninth issues of the report.

During the year 1986 the name of the publication was changed from the BER Building Survey to Building and Construction. Other changes were made. For instance, contractors and sub-contractors were sub-divided into those specialising in residential and non-residential work. Questionnaires were added for architects and quantity surveyors. Manufacturers and merchants of building materials were henceforth omitted from this publication. Certain time series relating to the availability of building materials were discontinued, i.e. those variables covering reinforcing steel, timber, glass and roofing materials. Also in 1986 the National Development Fund for the Building Industry terminated its sponsorship of BER surveys of qualitative building data. Survey samples have been subject to periodic scrutiny. From the third quarter of 1987 the regional survey results were no longer published. Henceforth, only the national totals, as well as the data for the residential and non-residential sub-sectors were published.

Information on the sample size and weighting of responses has been provided by Mocke (1990: 40-42). He stated that during 1989 roughly 2060 questionnaires were received from respondents to the surveys on building conditions. The results of contractor and sub-contractor respondents were weighted on the basis of annual turnover. This was done on the underlying assumption that larger firms influence developments in the industry to a greater extent than smaller firms. Yet Stuart (1984:22) questioned this assumption on the grounds that small enterprises are exposed to changes in economic variables sooner than their larger competitors. The responses to the surveys are gathered acccording to the following regions, yet they are not published on a regional basis for fear that inadequate sample size might affect the reliability of the regional survey results:

* Western Province;
* Eastern Province;
* Northern Cape and the Orange Free State;
* Durban/Pinetown;
* Remainder of Natal;
* Witwatersrand;
* Pretoria;
* Remainder of Transvaal; and
* Other.

In the construction of the survey questionnaires and the presentation of the results the following principles (Marquardt & Strigel, 1960) were adhered to:

6.8.1 The completion of the questionnaires, provided it is done by the executive of the firm, should take but a few minutes.

6.8.2 Questions must be clear and simple, and should avoid going beyond the executive's range of knowledge of conditions in the firm.

6.8.3 The questions should not be directed to aggregates, but should apply to a definite article or product handled by the firm.

6.8.4 Answers should be indicated by means of a cross - various alternatives being provided for. The questions should not require special computations or consultations of records.

6.8.5 The answers should be regarded as strictly confidential. A relationship of trust between the firm and the institute should be established.

6.8.6 The results of the test should be presented in a way that appeals to people in business, and they should receive these results as soon as possible.

In rounding off this discussion of the historical development of qualitative BER building data, it is appropriate to mention that use is often made of graphs to highlight trends in the survey indicators.

6.9 **Literature studies and international study tours undertaken**

When this investigation was started, there was a dearth of literature on the methodological aspects surrounding business surveys in South Africa. This was particularly true of business surveys pertaining to the building industry. Therefore, a number of literature studies of South African and international bibliographic databases were undertaken for this research. References were updated as research on the topic progressed. To complement the data searches the author undertook a number of international study tours and participated in CIRET conferences where survey methodologies were discussed with specialists in the field. These data searches yielded worthwhile results and have been adequately covered in previous sections of this chapter.

6.10 **Choosing the research method to establish the information content of the qualitative building data**

The foregoing sections indicate that, although a fair amount has been written on business surveys as they pertain to the manufacturing, wholesale and retail sectors, as well as consumer behaviour, very few data sources are available which pertain specifically to the South African building industry. Therefore, a choice had to be made as to which research approach would be adopted to establish the information content of the qualitative building data.

One possibility considered was to present the various time series derived from various issues of the BER surveys in graphical form against the background of the different phases of the business cycle in South Africa. This approach has the advantage that the responses by the various groups of respondents to building surveys can be observed visually over time. Inter-group and inter-indicator comparisons become possible. However, the graphical approach has a disadvantage in that visual comparisons involve a large number of time series. In all, there are 58 time series to be considered (29 for contractors and 29 for sub-contractors). Thus, there is much duplication and repetition of time series which have much in common. The commonality stems from certain similarities in the various questions posed to a particular group of respondents and also from the fact that the responses often tend to move together over time. It was decided that such a graphical approach would not serve the purpose of parsimony in economic research. Instead, it was decided to undertake a principal component analysis to establish whether the survey responses are indicative of purposeful business behaviour and whether the survey results are useful as cyclical economic indicators (refer Chapter 7).

6.11 A description of the basic survey questionnaire

The survey questionnaire gathers information on the business conditions of building contractors and developers, as well as sub-contractors. They share the same questionnaire in view of the similar nature of their activities. Architects and quantity surveyors were not covered in this study as the temporal data base of their responses was inadequate to yield meaningful results.

This section explains the nature of the variables included in subsequent analyses. It will be recalled that most of the questions are phrased in such a way as to render a response indicating an "increase, an unchanged position or a decrease" in the particular variable. There are, however, other possibilities. For example, certain questions seek a reply of the nature: "satisfactory" or "unsatisfactory". This is especially true in the case of the existence of specific building materials bottlenecks or the evaluation of prevailing business conditions.

The possible responses were treated in one of the following ways. A list of these possibilities follows.

6.11.1 **Increase, no change, decrease**

In these cases a "net percentage change" was calculated by subtracting the percentage of respondents reporting a decrease from the percentage respondents reporting an increase in the particular variable. This "test balance" was converted, according to the method used by Van Schaik (1974), to yield a new variable:

e.g. Transformed value of variable

$$= \frac{\text{Increase (80) - Decrease (10) + 100}}{2}$$

$$= \frac{\text{Net percentage (70) + 100}}{2}$$

$$= \frac{70 + 100}{2}$$

$$= 85{,}0$$

In the case of the business sentiment (business mood) questions, a value in excess of 50 recorded by such a converted response is generally seen as reflecting "optimism" and "pessimism" in the case of values falling below the neutrality level of 50.

6.11.2 **Serious, slightly, not at all**

Certain of the questions trace whether a specific bottleneck has become more severe or has decreased in intensity. The question is couched in terms to render a response of the nature: "serious, slightly or not at all".

In this analysis it was the objective to establish whether such constraints had worsened or improved. The percentage of respondents reporting "no shortage" was deducted from the percentage of respondents indicating a "serious shortage". The trend in this test balance indicator, established during successive surveys, is therefore indicative of an improvement or a deterioration in the particular bottleneck.

6.11.3 **Keener, the same, less keen**

The respondent is required to indicate whether competition in tendering has become "keener, remained the same, or become less keen". In this case, a test balance was derived by subtracting the percentage of respondents who reported less keen competition from the percentage reporting keener competition in tendering.

6.11.4 **Satisfactory or unsatisfactory**

Whereas the preceding responses relate to "changes-over-time," it is also desirable to gather evaluations of business conditions at a "moment-in-time". Therefore, in questions requiring judgements of such a nature, two possibilities exist. When dealing with the sentiment indicator of prevailing business conditions, the percentage of respondents indicating "satisfactory" conditions was accepted for the purpose of this investigation. This had the advantage that responses would probably be pro-cyclical, i.e. "satisfactory" responses would most likely rise during upswing phases of the business cycle.

In cases where respondents are reporting on the supply position of certain building materials, the "unsatisfactory" category was chosen for analysis. This implies that the greater the percentage of respondents reporting an "unsatisfactory" supply situation, the more severe the bottleneck becomes. This would most likely occur during the upswing phase of the business cycle.

Tables 6.1 and 6.2 provide a synopsis of:

* the question posed to the respondent;
* the codes to be used in the analyses of the survey results;
* the date when each question was first incorporated into the questionnaire; and
* whether or not the response was included in the principal component analysis undertaken in Chapter 7 (certain variables were discontinued in the fourth quarter of 1985).

Table 6.1

Summary table of questions posed to building contractors and developers on a quarterly basis

Code	Question		Available as from	Number	Included in principal component analysis (1970:4 to 1990:2)	Included in principal component analysis (1980:2 to 1990:2)
BCD 1	Compared with the same quarter a year ago, the value of work was better, the same or worse?	: Estimated	1970:4	8	Yes	Yes
BCD 2	ditto	: Expected	1970:4	8	Yes	Yes
BCD 3	Compared with the same quarter a year ago, the volume of work was better, the same or worse?	: Estimated	1980:2	46	No	Yes
BCD 4	ditto	: Expected	1980:2	46	No	Yes
BCD 5	Compared with the previous quarter, the value of work was better, the same or worse?	: Estimated	1970:4	8	Yes	Yes
BCD 6	ditto	: Expected	1980:2	46	No	Yes
BCD 7	Compared with the previous quarter, the volume of work was better, the same or worse?	: Estimated	1970:4	8	Yes	Yes
BCD 8	ditto	: Expected	1980:2	46	No	Yes
BCD 9	Were tender prices (building contractors only) keener, the same, less keen?		1970:4	8	Yes	Yes
BCD 10	To what extent do the following hamper your activities, seriously, slightly or not at all?					
	Shortage of skilled labour	: Artisans	1970:4	8	Yes	Yes
BCD 11	ditto	: Foremen	1970:4	8	Yes	Yes
BCD 12	ditto Shortage of unskilled labour	: Blacks	1970:4	8	No	No
BCD 13	ditto	: Other	1970:4	8	No	No
BCD 14	ditto Inadequate supplies of materials		1970:4	8	Yes	Yes
BCD 15	ditto Inadequate finance facilities		1970:4	8	Yes	Yes
BCD 16	ditto Cost of financing		1980:2	46	No	Yes
BCD 17	ditto Insufficient demand for building		1980:2	46	No	Yes
BCD 18	Is the supply of materials satisfactory or unsatisfactory? Bricks: Stocks		1970:4	8	Yes	Yes
BCD 19	ditto Bricks: Face		1970:4	8	Yes	Yes
BCD 20	ditto Cement		1970:4	8	Yes	Yes
BCD 21	ditto Steel reinforcing		1970:4	8	No	No
BCD 22	ditto Timber		1970:4	8	No	No
BCD 23	ditto Glass		1970:4	8	No	No
BCD 24	ditto Roofing materials		1970:4	8	No	No
BCD 25	ditto Plumbing materials		1970:4	8	Yes	Yes
BCD 26	ditto Other		1970:4	8	No	No
BCD 27	Do you find prevailing business conditions to be satisfactory or unsatisfactory?		1970:4	8	Yes	Yes
BCD 28	Compared with a year ago, do you find business conditions to be better, the same or worse?		1969:1	1	Yes	Yes
BCD 29	Compared with a year ago, expected business conditions are expected to be better, the same or worse?		1980:2	46	No	Yes

Table 6.2

Summary table of questions posed to sub-contractors on a quarterly basis

Code	Question		Available as from	Number	Included in principal component analysis (1970:4 to 1990:2)	Included in principal component analysis (1980:2 to 1990:2)
SBC 1	Compared with the same quarter a year ago, the value of work was better, the same or worse?	: Estimated	1970:4	8	Yes	Yes
SBC 2	ditto	: Expected	1970:4	8	Yes	Yes
SBC 3	Compared with the same quarter a year ago, the volume of work was better, the same or worse?	: Estimated	1980:2	46	No	Yes
SBC 4	ditto	: Expected	1980:2	46	No	Yes
SBC 5	Compared with the previous quarter, the value of work was better, the same or worse?	: Estimated	1970:4	8	Yes	Yes
SBC 6	ditto	: Expected	1980:2	46	No	Yes
SBC 7	Compared with the previous quarter, the volume of work was better, the same or worse?	: Estimated	1970:4	8	Yes	Yes
SBC 8	ditto	: Expected	1980:2	46	No	Yes
SBC 9	Were tender prices (building contractors only) keener, the same, less keen?		1970:4	8	Yes	Yes
SBC 10	To what extent do the following hamper your activities, seriously, slightly or not at all? Shortage of skilled labour	: Artisans	1970:4	8	Yes	Yes
SBC 11	ditto	: Foremen	1970:4	8	Yes	Yes
SBC 12	ditto Shortage of unskilled labour	: Blacks	1970:4	8	No	No
SBC 13	ditto	: Other	1970:4	8	No	No
SBC 14	ditto Inadequate supplies of materials		1970:4	8	Yes	Yes
SBC 15	ditto Inadequate finance facilities		1970:4	8	Yes	Yes
SBC 16	ditto Cost of financing		1980:2	46	No	Yes
SBC 17	ditto Insufficient demand for building		1980:2	46	No	Yes
SBC 18	Is the supply of materials satisfactory or unsatisfactory? Bricks: Stocks		1970:4	46	No	Yes
SBC 19	ditto Bricks: Face		1970:4	46	No	Yes
SBC 20	ditto Cement		1970:4	46	No	Yes
SBC 21	ditto Steel reinforcing		1970:4	46	No	No
SBC 22	ditto Timber		1970:4	46	No	No
SBC 23	ditto Glass		1970:4	46	No	No
SBC 24	ditto Roofing materials		1970:4	46	No	No
SBC 25	ditto Plumbing materials		1970:4	46	No	Yes
SBC 26	ditto Other		1970:4	46	No	No
SBC 27	Do you find prevailing business conditions to be satisfactory or unsatisfactory?		1970:4	8	Yes	Yes
SBC 28	Compared with a year ago, do you find business conditions to be better, the same or worse?		1969:1	1	Yes	Yes
SBC 29	Compared with a year ago, expected business conditions are expected to be better, the same or worse?		1980:2	46	No	Yes

6.12 Summary

The historical development of the business survey method in South Africa was traced in this chapter. The different methodological development phases of qualitative data sources were discussed in the South African context, according to the Aiginger-Strigel framework. The current investigation of qualitative building data was placed in this development framework in the "leading indicator" category. The development of the BER surveys of building data was described with reference to a set of principles which should be considered when constructing the questionnaires and when presenting the results to interested parties. It was decided to undertake a principal component analysis of the responses to the quarterly surveys, to establish whether the behaviour of people in business is purposeful and whether these building variables are useful as cyclical indicators. In this overview attention was focused on the subjective nature of qualitative data. It was explained that questionnaires relating to certain variables are usually drawn up to gather information on the tendency of such variables, relative to a previous period, (increase, remain the same, decrease). In addition, evaluations or judgements (satisfactory/ unsatisfactory) are gathered regarding variables such as prevailing business conditions or materials shortages.

The principal component analysis referred to above is undertaken in Chapter 7.

* * * * * *

Chapter 7

The information value of the BER surveys of building contractors and sub-contractors: A principal component analysis

7.1 Introduction

The objective of this chapter is to evaluate the information value (informative content) of the responses to the quarterly BER surveys of contractors and sub-contractors. In Section 7.2 the method of analysis and its uses are briefly discussed. It is explained that a principal component analysis is undertaken in this study to determine whether the survey variables are useful for cyclical analysis, i.e. do the survey data indicate purposeful behaviour on the part of business people. Section 7.3 provides the principal component analysis of responses to questionnaires sent to contractors and sub-contractors during the period 1970:4 to 1990:2. Section 7.4 provides the equivalent data for the period 1980:2 to 1990:2. These analyses provide the following information:

* summary table of average, standard deviation and coefficient of variation of the variables included in the analysis;

* intercorrelations of variables in tabular form and same briefly discussed; and the

* analysis of the composition of the (uncorrelated) components of the responses of contractors and sub-contractors, i.e. the identification of principal components and their interpretation.

Finally, the conclusions are presented in the form of a summary table.

7.2 A description of the method of analysis and its uses

Factor analysis can be defined as "a device for ordering and simplifying correlations between related variables" (Child, 1970: 8). In more general terms, the method has been described as follows:

> The single most distinctive characteristic of factor analysis is its data-reduction capability. Given an array of correlation coefficients for a set of variables, factor-analytic techniques enable us to see whether some underlying pattern of relationship exists such that the data may be 'rearranged' or 'reduced' to a smaller set of factors or components that may be taken as source variables accounting for the observed interrelations in the data (Kim, 1975: 469).

Various types of factor analysis are in use. Principal component analysis is described by Kim (1975:36) as "... a relatively straightforward method of transforming a given set of variables into a new set of composite variables or principal components that are orthogonal (uncorrelated) to each other." The distinction between factor analysis and principal component analysis is that "... in factor analysis some account is taken of the presence of unique variance whereas in component analysis the intrusion of unique variance is ignored" (Kim, 1975:470).

The method first found application in the field of psychology and education, but has also been applied successfully in other fields of research, such as econometrics, sociology, medicine, biology, geology and politics (Child, 1970: 6). In areas of business administration the technique has been used, in the main, in studies related to marketing, production and finance (Balsley, 1970:257).

Pellisier (1993) has shown that the main reason for undertaking factor analyses in business and economics is to derive a set of uncorrelated variables for further research. This is especially true in cases where the use of highly intercorrelated variables may yield misleading results in regression analyses. He stated: "With some BER survey variables cross correlating in excess of 0,9, any regression analysis of the global results will be distorted by multicollinearity and autocorrelation" (Pellisier, 1992:22).

Various researchers involved in business surveys have undertaken such factor analyses or principal component analyses and presented their research findings at CIRET Conferences (Kloek & Bannink, 1961; Liberatori & Pinca, 1975; Van der Linden, 1977; Fellberg, 1979; Stuart, 1979a, 1980, 1982; Pellisier, 1992; Pellisier & Stuart, 1993).

On the question of the use of factor analysis, Kim (1975:469) has identified three common applications:

* **exploratory uses** - the exploration and detection of patterning of variables with a view to the discovery of new concepts and a possible reduction of data;

* **confirmatory uses** - the testing of hypotheses about the structuring of variables in terms of the expected number of significant factors and factor loadings; and

* uses as a **measuring device** - the construction of indices to be used as new variables in later analysis.

The findings of the empirical research undertaken by Kloek and Bannink (1961), Liberatori and Pinca (1975), as well as Van der Linden (1977), were summarized by Fellberg (1979: 3) in the following terms: "(They) ... established components with the aid of principal component analysis, which represents a reduction of the original variables, ... (but) do(es) not curtail their informative value. The good agreement of these components with the economic cycles again showed the usefulness of qualitative test data, the correlation of the variables studied, as well as their forecasting properties and cyclical sensitivity". Fellberg's (1979) own investigation pointed to the suitability of the business climate as a general indicator of the turn of business in Germany.

Stuart (1980: 19) set out to determine whether a synthetic indicator of business sentiment can be constructed from questions posed to respondents in the groups, manufacturers, wholesalers and retailers. His study was based on the <u>BER Opinion Survey Report</u> data and the research findings proved to be affirmative. Although he found that the business sentiment data corresponded well with the responses to certain questions on business conditions, he advocated that neither the business mood nor the questions on business conditions should be excluded from the questionnaire. The rationale for the retention of both sources of data was the fact that the responses to the questions on business conditions provided valuable information additional to the business mood data (Stuart, 1980: 8).

It can be argued that all the abovementioned works have applied factor analysis - as described by Kim (1975) - for purposes of confirmation and for measurement. The current investigation of the BER survey data of contractors and sub-contractors is of an "exploratory and confirmatory" nature, i.e. to reduce the multitude of qualitative data and to establish the information content of the data. Specifically, this analysis is undertaken to determine whether the survey data indicate purposeful behaviour on the part of business people and whether these variables are useful as cyclical indicators. The purpose was not to use the results of the analysis as a measuring device from which indices could be constructed for cyclical analysis because in this study the same NBER scoring system is applied to both qualitative and quantitative data. This is done to weight the variables appropriately for inclusion in a composite leading indicator.

Two principal component analyses are conducted for each group of building contractors and sub-contractors. This is necessary because the questionnaires were expanded to include additional questions as from the second quarter of 1980. Therefore, two temporal data bases exist, a "long one" (1970:4 to 1990:2) and a "short one" (1980:2 to 1990:2). The former consists of 15 time series for building contractors. The expanded data base for the shorter time span consists of 22 time series for building contractors. In the case of sub-contractors it is 11 and 22 time series respectively.

7.3 The principal component analysis of responses to the BER surveys of building contractors and sub-contractors (1970:4 to 1990:2)

7.3.1 Building contractors and developers

This principal component analysis covers the data for the period from the fourth quarter of 1970 to the second quarter of 1990, i.e. 79 observations. All computations were carried out at the University of Stellenbosch Business School with the aid of the Statgraphics programme designed for personal computers. These analyses were conducted without rotating the axes. Table 7.1 presents a summary schedule of the fifteen variables which were included in the analysis. The codes and their meanings are the same as those given in Tables 6.1 and 6.2. It can be seen that the average of those variables which pertain to the value and volume of work (i.e. BCD 1, BCD 2, BCD 5, BCD 7), all lie between 48 and approximately 52. Because the responses can only vary between zero and 100 this implies that during the period under review, building contractors on the average took a neutral stance toward their work load. The coefficient of variation is quite high, which is probably attributable to the cyclical

Table 7.1

Building contractors and developers: A summary of the quarterly survey data (1970:4 to 1990:2)

(79 observations for each of the 15 time series)

Time series	Variable	Average	Standard deviation	Coefficient of variation
BCD 1	Value of work: estimated (year-on-year)	52,18	18,81	36,1%
BCD 2	Value of work: expected (year-on-year)	50,14	18,65	37,2%
BCD 5	Value of work: estimated (quarter-on-previous quarter)	50,53	14,69	29,1%
BCD 7	Volume of work: estimated (quarter-on-previous quarter)	48,48	14,50	29,9%
BCD 9	Competition in tendering (inverted)	0,016	0,00818	51,1%
BCD 10	Shortages: artisans	41,89	20,70	49,4%
BCD 11	Shortages: foremen	36,86	16,69	45,3%
BCD 14	Shortages: materials	33,32	20,77	62,3%
BCD 15	Inadequate finance facilities (inverted)	0,0386	0,0306	79,3%
BCD 18	Shortages: stock bricks	24,33	25,58	105,1%
BCD 19	Shortages: face bricks	36,10	28,30	78,4%
BCD 20	Shortages: cement	14,53	19,79	36,2%
BCD 25	Shortages: plumbing materials	17,89	18,11	101,2%
BCD 27	Prevailing business conditions	30,52	21,97	71,9%
BCD 28	General business conditions: estimated (year-on-year)	36,73	25,14	68,5%

nature of the building industry. The variable representing materials shortages (BCD18) exhibits a high coefficient of variation which indicates that this variable is subject to strong cyclical influences.

The responses to the questions relating to labour shortages, as experienced by contractors, also exhibit relatively strong cyclical influences. This finding corresponds with the well known phenomenon in the building industry, viz. a general dearth of skilled labour is experienced, especially during strong economic upswing phases of the business cycle. The same reasoning can be applied to materials bottlenecks (BCD 14), as well as inadequate finance facilities (BCD 15).

Table 7.1 also shows that the questions which pertain to unsatisfactory supplies of various building materials (BCD 18, BCD 19, BCD 20, BCD 25), likewise, elicit responses indicative of strong cyclical tendencies.

Two subjective assessments of prevailing business conditions and those compared with a year ago (BCD 27 and BCD 28, respectively) indicate a value smaller than 50, i.e. the neutrality value. This implies that contractors were generally pessimistic during the period covered by the analysis. The unstable nature of the building industry is reflected in the high values of the coefficient of variation, i.e. 71,9% and 68,5% respectively. This finding makes economic sense as the period of investigation included a number of strong upswing phases and several severe economic recessions in the South African building industry.

The intercorrelations of the variables are summarized in the correlation matrix Table 7.2. The objective of this procedure is to establish whether perceptions of and expectations about a variable are highly correlated or not. Stuart (1979: 5) has pointed out that: "Should this be the case it suggests that businessmen are to a large degree projecting their perceptions into the future, or are slow to pick up turning-points, or a combination of these two alternatives". Indeed, this appears to be the case, judging by the high correlation between BCD 1 and BCD 2, i.e. the estimated and expected value of work done during the survey quarter, compared with the corresponding quarter a year ago. The variables pertaining to the value and volume of work done during the survey quarter, compared with the previous quarter, also exhibit a high correlation, i.e. BCD 5 and BCD 7, respectively. The series mentioned above all

Table 7.2

Correlation matrix of the responses to questions put to building contractors and developers (1970:4 to 1990:2)

	BCD 1	BCD 2	BCD 5	BCD 7	BCD 9	BCD 10	BCD 11	BCD 14	BCD 15	BCD 18	BCD 19	BCD 20	BCD 25	BCD27	BCD 28
BCD 1	1,0000	0,8533	0,8050	0,8154	0,6376	0,7548	0,7468	0,7166	0,3036	0,6031	0,6462	0,5559	0,5807	0,7064	0,6960
BCD 2		1,0000	0,7901	0,7829	0,6667	0,6649	0,6945	0,6387	0,3630	0,6766	0,6273	0,5271	0,6064	0,6780	0,7954
BCD 5			1,000	0,9810	0,5294	0,6590	0,6707	0,5849	0,3141	0,5492	0,5971	0,4433	0,6088	0,6722	0,6803
BCD 7				1,0000	0,5540	0,6514	0,6589	0,5821	0,3348	0,5347	0,5974	0,4290	0,5716	0,6841	0,6992
BCD 9					1,0000	0,4802	0,4684	0,4875	0,4327	0,6092	0,5677	0,2266	0,4388	0,5883	0,7471
BCD 10						1,0000	0,9112	0,8790	0,0645	0,7064	0,7768	0,6630	0,7114	0,7412	0,4662
BCD 11							1,0000	0,8286	0,0766	0,6957	0,7259	0,5949	0,7146	0,6776	0,4874
BCD 14								1,0000	0,0622	0,7863	0,8398	0,7439	0,7529	0,6044	0,3765
BCD 15									1,0000	0,2497	0,2640	-0,1662	-0,0526	0,2845	0,6284
BCD 18										1,0000	0,8872	0,5595	0,7072	0,5552	0,5514
BCD 19											1,0000	0,5348	0,7049	0,6615	0,5521
BCD 20												1,0000	0,6575	0,2884	0,1273
BCD 25													1,0000	0,5270	0,3684
BCD 27														1,0000	0,7334
BCD 28															1,0000

correlate fairly highly with the degree of competition in tendering (BCD 9), the latter having a positive sign on account of the fact that this variable has been inverted for purposes of analysis.

Turning to the variables associated with labour supplies (BCD 10, BCD 11), it can be observed that skilled labour bottlenecks correlate quite highly with the series pertaining to the work load of contractors (BCD 1, BCD 2, BCD 5, BCD 7). The correlations between labour bottlenecks and building materials bottlenecks (BCD 14) are high. Inadequate finance facilities, BCD 15, correlates poorly with labour bottlenecks, but is of the correct positive sign as this financial variable has been inverted for the purposes of analysis.

The variable reflecting contractors' subjective evaluation of prevailing business conditions (BCD 27) is highly correlated with the series pertaining to their work load and to most of those variables associated with materials and labour bottlenecks. This finding is indicative of the important role that the availability of building work, labour and materials play in shaping the opinions of building contractors. It is interesting to note the high correlation of 0,7334 between contractors' perceptions of prevailing business conditions (BCD 27) and those relative to a year ago (BCD 28). Finally, it should be noted that a high correlation also exists between the business mood of contractors (BCD 28) and competition in tendering. As the competition in tendering variable (BCD 9) has been inverted for purposes of analysis the sign is correctly given as positive. This implies that as the degree of competition in tendering increases, so the business mood deteriorates and vice versa.

The next step is to analyse the composition of the orthogonal (uncorrelated) components of the responses of contractors. It can be observed in Table 7.3 that two principal components have been identified with eigen values in excess of one and a third principal component with an eigen value just below one. These first two components explain 76,6% of the variance in the data set.

The first component, PC1, explains 62,9% of the variance and loads heavily on most of the variables. As it is clear that this component loads heavily on the amount of work done and the existence of bottlenecks that are, in turn, related to the level of building activity, it would seem appropriate to refer to the first component as a "work load" factor. The following

Table 7.3

Principal component analysis of the responses of building contractors and developers (1970:4 to 1990:2)

Principal components		PC1	PC2
Variance explained		62,9%	13,7%
Total variance explained: 76,6%			
Time series	Variable		
BCD 1	Value of work: estimated (year-on-year)	0,89103	0,10249
BCD 2	Value of work: expected (year-on-year)	0,88085	0,19201
BCD 5	Value of work: estimated (quarter-on-previous quarter)	0,84490	0,17839
BCD 7	Volume of work: estimated (quarter-on-previous quarter)	0,84292	0,21216
BCD 9	Competition in tendering (inverted)	0,70454	0,37465
BCD 10	Shortages: artisans	0,87931	-0,29382
BCD 11	Shortages: foremen	0,86422	-0,25315
BCD 14	Shortages: materials	0,85569	-0,38459
BCD 15	Inadequate finance facilities (inverted)	0,30823	0,76512
BCD 18	Shortages: stock bricks	0,82518	-0,13136
BCD 19	Shortages: face bricks	0,85381	-0,13201
BCD 20	Shortages: cement	0,62738	-0,57809
BCD 25	Shortages: plumbing services	0,77336	-0,37750
BCD 27	Prevailing business conditions	0,80419	0,18669
BCD 28	General business conditions: estimated (year-on-year)	0,73979	0,59748

reasoning is proffered: the value and volume of work done during the quarter is high and the large work load is expected to be maintained during the forecast quarter (BCD 1, BCD 2, BCD 5 and BCD 7); bottlenecks in the supplies of materials and labour are prevalent (BCD 10, BCD 11, BCD 14, BCD 18 to 20, BCD 25); in view of the greater availability of work, the degree of competition in tendering decreases (BCD 9); the greater demand for building work exerts pressure on the available finance facilities (BCD 15); as a result of vigorous building activity, contractors assess prevailing business conditions to be satisfactory (BCD 27) and better than a year ago (BCD 28).

Component PC2 explains a further 13,7% of the variance in the data and loads most heavily on the variable pertaining to inadequate finance facilities (BCD 15), as well as on their business mood (BCD 28). This suggests that PC2 is indicative of a financial constraint. As the inadequate finance facilities variable has been inverted for the purposes of analysis, this implies that the business mood of contractors deteriorates when finance becomes less freely available. It is therefore reasonable to refer to component PC2 as a "financial" factor.

In summary, it has been found that the first two principal components account for 76,6% of the variance in the data set. The "work load" factor alone explains over 60% of the variance and this component should therefore be regarded as the most important factor that shapes the business perceptions of building contractors.

7.3.2 **Sub-contractors**

By virtue of the similarity in the nature of the activities of contractors and sub-contractors much of what applies to contractors is also applicable to sub-contractors. The period covered by this investigation of the responses of sub-contractors also spans 79 quarters, i.e. from the fourth quarter of 1970 to the second quarter of 1990. There are, however, fewer variables to examine, as contractors and sub-contractors only received the same questionnaire for completion as from the second quarter of 1980. This means that the questions relating to specific materials shortages, as experienced by sub-contractors, were not available before the second quarter of 1980, and were therefore excluded from the analysis. In all, eleven variables (with a sufficiently long data base) were included in this principal component analysis.

Firstly, it is necessary to scrutinise the averages and the standard deviations of the variables considered (Table 7.4). Those which pertain to the work load of sub-contractors indicate average values between 50,17 and 54,21, i.e. SBC 1, SBC 2, SBC 5 and SBC 7. As was the case with contractors, the percentage deviation from the average is quite large. The significance of the average values being in excess of 50 (i.e. the neutrality level) lies in the fact that sub-contractors were, on balance, in the optimistic zone of their work load frequency distribution during the period under review. The relatively high values of the coefficient of variation are again indicative of the unstable nature of the building industry, as was pointed out in the previous section relating to contractors' responses.

As was the case with contractors, the reciprocal of the variable associated with competition in tendering (SBC 9, inverted in this analysis) exhibits a high average value, that is indicative of the stringent tendering environment that prevailed during the period under review.

Insofar as skilled and unskilled labour is concerned, similar findings as in the case of contractors prevail, viz. that the bottlenecks caused by the non-availability of artisans and foremen were quite serious during the period under review.

Materials bottlenecks (SBC 14) appear to be relatively less serious with a lower average value than in the case of shortages of artisans (SBC 10). The same holds for the reciprocal of the variable reflecting inadequate finance facilities (SBC 15). The remaining variables, SBC 27 and SBC 28, represent the subjective evaluations by sub-contractors of their prevailing business conditions and those relative to a year ago. Values around 40 were recorded, indicating that, on balance, sub-contractors were pessimistic in their perceptions of business conditions during the period 1970:4 to 1990:2. The high values recorded by the coefficients of variation reflect the unstable nature of the building activities of sub-contractors.

The correlation matrix, Table 7.5, is to be considered next in our assessment of the intercorrelations between the variables in the set of data. The high correlation (0,8649) between the estimated and expected value of work (SBC 1 and SBC 2, respectively) is a reflection of the fact that sub-contractors' perceptions of their prevailing work load are projected into the future. The very high correlation coefficient of 0,9388, pertaining to SBC

Table 7.4

Sub-contractors: A summary of the quarterly survey data (1970:4 to 1990:2)

(79 observations for each of the 11 time series)

Time series	Variable	Average	Standard deviation	Coefficient of variation
SBC 1	Value of work: estimated (year-on-year)	54,21	22,27	41,1%
SBC 2	Value of work: expected (year-on-year)	50,17	21,58	43,0%
SBC 5	Value of work: estimated (quarter-on-previous quarter)	52,96	18,18	34,3%
SBC 7	Volume of work: estimated (quarter-on-previous quarter)	51,15	18,42	36,0%
SBC 9	Competition in tendering (inverted)	0,01384	0,00294	21,2%
SBC 10	Shortages: artisans	37,81	20,53	54,3%
SBC 11	Shortages: foremen	24,18	13,99	57,9%
SBC 14	Shortages: materials	27,94	16,86	60,3%
SBC 15	Inadequate finance facilities (inverted)	0,05501	0,0561	102,0%
SBC 27	Prevailing business conditions	42,52	27,38	64,4%
BCD 28	General business conditions: estimated (year-on-year)	40,18	26,24	65,3%

Table 7.5

Correlation matrix of the responses to questions put to sub-contractors

(1970:4 to 1990:2)

	SBC 1	SBC 2	SBC 5	SBC 7	SBC 9	SBC 10	SBC 11	SBC 14	SBC 15	SBC 27	SBC 28
SBC 1	1,0000	0,8649	0,6919	0,6963	0,6991	0,6879	0,6430	0,5910	0,3102	0,8003	0,8208
SBC 2		1,0000	0,5947	0,6261	0,7024	0,6447	0,6044	0,5510	0,4006	0,8012	0,8705
SBC 5			1,0000	0,9388	0,4372	0,4457	0,4333	0,4682	0,3410	0,5585	0,5951
SBC 7				1,0000	0,4584	0,4565	0,4816	0,4585	0,2878	0,5930	0,6398
SBC 9					1,0000	0,5815	0,5971	0,4804	0,2331	0,6351	0,7030
SBC 10						1,0000	0,8756	0,6005	0,1053	0,7745	0,5526
SBC 11							1,0000	0,5459	0,0403	0,7272	0,5369
SBC 14								1,0000	0,1404	0,6434	0,4353
SBC 15									1,0000	0,3688	0,4103
SBC 27										1,0000	0,7982
SBC 28											1,0000

5 and SBC 7, is worthy of note. This means that the estimated value and volume of work done during the survey quarter, compared with the previous quarter, exhibits a very close relationship. It would therefore seem as if sub-contractors do not draw much of a distinction between the value and volume of work done when asked to respond to a question which is designed to trace short-term changes in output.

The degree of competition in tendering (SBC 9) has been inverted for purposes of the analysis and therefore correlates positively with all other variables. The indicator of inadequate finance facilities (SBC 15) has also been inverted in this analysis. As was the case with contractors, this implies that the degree of competition in tendering decreases as the work load of sub-contractors rises. Furthermore, the positive correlation indicates that the bottleneck which arises from inadequate finance facilities intensifies as the work load of sub-contractors rises.

The variables associated with labour and materials bottlenecks all exhibit close positive correlations with each other (SBC 10, SBC 11 and SBC 14). This relationship also holds for their work load variables (SBC 1, SBC 2, SBC 5 and SBC 7). The latter implies that the labour and materials bottlenecks become more severe as the availability of work improves.

Turning to the variables reflecting their subjective assessments of prevailing business conditions (SBC 27 and SBC 28), it is evident that they correlate highly with certain work load variables (SBC 1, SBC 2). This suggests that the level of building work plays a major role in determining their overall business sentiment.

Finally, the composition of the uncorrelated components are examined. Table 7.6 indicates that the first two components collectively explain 73,8% of the total variance in the set of data. The first principal component, PC1, accounts for 62,2% of the variance and loads heavily on the variables associated with the work load of sub-contractors, as well as those connected with materials and labour bottlenecks and, especially, their subjective assessment of prevailing business conditions. The degree of competition in tendering also exhibits a heavy factor loading. As this variable has been inverted for the purposes of the analysis, it yields the correct (positive) sign. The possible sequence of events in the interpretation of the factor loadings is similar to that of contractors: an improved work load leads to a decrease

Table 7.6

Principal component analysis of the responses of sub-contractors (1970:4 to 1990:2)

Principal components		PC1	PC2
Variance explained		62,2%	11,6%
Total variance explained: 73,8%			
Time series	Variable		
SBC 1	Value of work: estimated (year-on-year)	0,92171	0,04049
SBC 2	Value of work: expected (year-on-year)	0,90101	0,09133
SBC 5	Value of work: estimated (quarter-on-previous quarter)	0,75331	0,37826
SBC 7	Volume of work: estimated (quarter-on-previous quarter)	0,77362	0,33255
SBC 9	Competition in tendering (inverted)	0,76881	-0,11368
SBC 10	Shortages: artisans	0,79812	-0,45644
SBC 11	Shortages: foremen	0,77218	-0,48449
SBC 14	Shortages: materials	0,69029	-0,25086
SBC 15	Inadequate finance facilities (inverted)	0,37790	0,67363
SBC 27	Prevailing business conditions	0,90453	-0,09051
SBC 28	General business conditions: estimated (year-on-year)	0,86613	0,18988

in the degree of competition in tendering; this is accompanied by a shortage of skilled labour, as well as building materials bottlenecks. Inadequate finance facilities (inverted in this analysis) constrain sub-contractors' building activities. Their subjective evaluation of their business mood is closely allied to their assessment of their work load and it would, therefore, be reasonable to infer that PC1 represents a "work load" factor.

The second of the principal components to be identified with an eigen value larger than 1, loads most heavily on SBC 15, i.e. the variable representing inadequate finance facilities. It explains a further 11,6% of the variance in the data set. It seems reasonable therefore to describe the second principal component as a "financial" factor that shapes business perceptions of sub-contractors.

In conclusion, it can reasonably be stated that because the "work load" and the "financial" factor explains 73,8% of the variance, these two principal components are the most important factors shaping sub-contractors' perceptions of their business conditions.

7.3.3 **Summary of results (1970:4 to 1990:2)**

The results of the analyses are summarised in the following table.

Table 7.7

Summary table of the principal components identified in the responses of contractors and sub-contractors (1970:4 to 1990:2)

Principal component	**Contractors**		**Sub-contractors**	
	Variance explained	Component identified	Variance explained	Component identified
PC1	62,9%	"Work load"	62,2%	"Work load"
PC2	13,7%	"Financial"	11,6%	"Financial"
Total variance explained (with eigen values greater than one)	76,6%		73,8%	

The principal component analysis of the responses to the quarterly surveys indicates that respondents in the group building contractors and sub-contractors behave purposefully as can be expected of business people. They are, however, prone to project their perceptions of current business conditions into the future. This finding is borne out by the high correlations obtaining in all cases between their business sentiment at the time of surveying and their expectations of their business activities during the ensuing quarter. These high correlations imply a tendency among respondents to "forecast the present", which highlights the importance of independent economic forecasting.

The analysis also indicates that certain key variables, such as the work load of contractors and sub-contractors, as well as financial considerations that pertain to the availability of finance, play a crucial role in shaping their perceptions of business conditions.

These findings lend credence to the survey results and suggest that the responses exhibit a certain internal reliability. This assertion is underscored by the finding that the responses to most questions put to respondents display strong cyclical tendencies. The latter is obviously a reflection of the marked cyclical influences which are exerted on the participants in the building industry and is, in turn, indicative of the instability of building activity. It can therefore be concluded that these survey indicators are suitable for further cyclical analysis undertaken in Chapter 8.

7.4 The principal component analysis of responses to the BER survey of building contractors and sub-contractors (1980:2 to 1990:2)

7.4.1 Building contractors and developers

The principal component analysis covers the data for the period from the second quarter of 1980 (when the questionnaire was expanded to include additional questions) up to the second quarter of 1990. It includes 22 variables and comprises 41 observations.

Table 7.8 provides the averages, standard deviations and coefficients of variation of the responses of building contractors and developers. It will be recalled that all responses vary between nil and one hundred with the level of 50 indicating neutrality. A comparison of both

Table 7.8

Building contractors and developers: A summary of the quarterly survey data (1980:2 to 1990:2)

(41 observations for each of the 22 time series)

Time series	Variable	Average	Standard deviation	Coefficient of variation
BCD 1	Value of work: estimated (year-on-year)	52,16	20,86	40,0%
BCD 2	Value of work: expected (year-on-year)	49,83	20,19	40,5%
BCD 3	Volume of work: estimated (year-on-year)	50,10	20,05	40,0%
BCD 4	Volume of work: expected (year-on-year)	47,63	20,60	43,3%
BCD 5	Value of work: estimated (quarter-on-previous quarter)	50,83	12,44	24,5%
BCD 6	Value of work: expected (quarter-on-previous quarter)	48,34	16,87	34,9%
BCD 7	Volume of work: estimated (quarter-on-previous quarter)	49,63	12,71	25,6%
BCD 8	Volume of work: expected (quarter-on-previous quarter)	47,56	17,03	35,8%
BCD 9	Competition in tendering (inverted)	0,017665	0,010504	59,5%
BCD 10	Shortages: artisans	43,00	21,86	50,8%
BCD 11	Shortages: foremen	36,73	17,23	46,9%
BCD 14	Shortages: materials	31,17	21,44	68,8%
BCD 15	Inadequate finance facilities (inverted)	0,039844	0,024742	62,1%
BCD 16	Cost of finance	49,39	17,51	35,5%
BCD 17	Insufficient demand for building (inverted)	0,026017	0,032797	126,1%
BCD 18	Shortages: stock bricks	22,61	26,18	115,8%
BCD 19	Shortages: face bricks	37,95	32,06	84,5%
BCD 20	Shortages: cement	9,07	17,45	192,4%
BCD 25	Shortages: plumbing materials	16,15	14,45	89,5%
BCD 27	Prevailing business conditions	39,20	24,24	61,8%
BCD 28	General business conditions: estimated (year-on-year)	41,80	27,64	66,1%
BCD 29	General business conditions: expected (coming quarter, compared to corresponding quarter a year ago)	42,49	23,05	54,3%

the long data base (1970:4 to 1990:2) and the shorter data base (1980:2 to 1990:2) indicates that the average values of work done, as well as the volumes of work done are similar. They fall just above or just below the neutrality level of 50. The average values of materials shortages (BCD 18 to BCD 26) are less than 50, yet show high coefficients of variation. This finding is indicative of strong cyclical influences. The variable relating to shortages of cement (BCD 20) yielded an average of 9,07 (as compared to the earlier 14,53), and a coefficient of variation of 192,4%. The coefficient of variation is much higher than in the case of the longer data base which yielded a figure of 36,2% (refer Table 7.1). This represents the most important difference in a comparison of the longer and shorter data bases. This finding can be explained if it is kept in mind that the lower average value represents a lower average percentage of respondents who perceive cement shortages as being "unsatisfactory". This is corroborated by industry reports that show that substantial surplus productive capacity existed during the eighties in the cement industry in South Africa.

The intercorrelations of the variables included in the shorter data base are summarised in the correlation matrix in Table 7.9.

It is evident from Table 7.9 that the correlations between the estimated and expected values and volumes of work are high (BCD 1 to BCD 8), irrespective of whether the comparison is with the previous quarter or the corresponding quarter a year ago. This is indicative of the fact that businessmen are prone to project their perceptions of current events into the future. It is also a finding that corroborates the results of the correlation analysis undertaken with the longer data base(1970:2 to 1990:2) presented in Table 7.2.

These variables also correlate fairly highly with the variable depicting competition in tendering (BCD 9). As BCD 9 has been inverted for the purposes of analysis it displays the correct positive sign. This implies that competition in tendering becomes more stringent when work loads in the building industry decline.

The variables representing labour shortages (BCD 10 and BCD 11) and materials shortages (BCD 14) are all highly correlated. This finding corroborates the results of the earlier analysis of the longer data base. It also underscores the importance of the ready availability of labour and materials for building contractors.

Table 7.9

Correlation matrix of the responses to questions put to building contractors and developers (1980:2 to 1990:2)

	BCD 1	BCD 2	BCD 3	BCD 4	BCD 5	BCD 6	BCD 7	BCD 8	BCD 9	BCD 10	BCD 11	BCD 14	BCD 15	BCD 16	BCD 17	BCD 18	BCD 19	BCD 20	BCD 25	BCD 27	BCD 28	BCD 29
BCD 1	1,0000	0,8670	0,9866	0,8228	0,9161	0,8817	0,9127	0,8472	0,7499	0,7649	0,7997	0,7650	0,5088	-0,6369	0,5575	0,6801	0,6845	0,5612	0,7104	0,8547	0,9143	0,7618
BCD 2		1,0000	0,8692	0,9699	0,8169	0,9521	0,8246	0,9505	0,7708	0,5812	0,6658	0,6484	0,5593	-0,7753	0,5365	0,6987	0,6034	0,5147	0,5823	0,7418	0,9263	0,9314
BCD 3			1,0000	0,8271	0,9191	0,8742	0,9216	0,8421	0,7529	0,7411	0,8007	0,7479	0,4908	-0,6304	0,5517	0,6761	0,6817	0,5401	0,7073	0,8531	0,9082	0,7656
BCD 4				1,0000	0,7711	0,9516	0,7863	0,9451	0,7591	0,5372	0,6118	0,6225	0,5375	-0,7657	0,5382	0,6860	0,5885	0,4980	0,5814	0,7212	0,8925	0,9339
BCD 5					1,0000	0,8196	0,9836	0,7799	0,7432	0,7351	0,7882	0,7051	0,3846	-0,5893	0,5563	0,5957	0,6240	0,4720	0,6698	0,8032	0,8396	0,6998
BCD 6						1,0000	0,8234	0,9804	0,7744	0,6081	0,6586	0,6826	0,5897	-0,7871	0,5525	0,7364	0,6508	0,5018	0,6247	0,7539	0,9095	0,9089
BCD 7							1,0000	0,7881	0,7343	0,7081	0,7566	0,6842	0,3892	-0,6174	0,5344	0,5847	0,6165	0,4785	0,6587	0,7973	0,8492	0,7162
BCD 8								1,0000	0,7597	0,5656	0,6436	0,6479	0,5460	-0,7636	0,5434	0,7074	0,6230	0,5264	0,5907	0,6957	0,8925	0,9122
BCD 9									1,0000	0,5300	0,5557	0,6408	0,4277	-0,6595	0,8660	0,7165	0,5735	0,4326	0,7497	0,6202	0,7745	0,7540
BCD 10										1,0000	0,9173	0,9285	0,1631	-0,2759	0,5906	0,6964	0,8277	0,6893	0,8217	0,8858	0,5810	0,4046
BCD 11											1,0000	0,8418	0,1689	-0,2508	0,5350	0,6654	0,7451	0,5927	0,6954	0,8732	0,6670	0,5013
BCD 14												1,0000	0,2892	-0,3856	0,6949	0,8439	0,9268	0,7608	0,8816	0,8472	0,6065	0,4988
BCD 15													1,0000	-0,7524	0,1468	0,3755	0,3131	0,0514	0,2229	0,4304	0,6425	0,6776
BCD 16														1,0000	-0,4159	-0,5206	-0,4206	-0,2261	-0,4068	-0,4829	-0,7643	-0,8552
BCD 17															1,0000	0,6478	0,5734	0,5409	0,8087	0,5474	0,4840	0,4835
BCD 18																1,0000	0,8906	0,5277	0,7249	0,6991	0,6674	0,6438
BCD 19																	1,0000	0,6100	0,7935	0,7585	0,5841	0,4924
BCD 20																		1,0000	0,7045	0,5295	0,3762	0,3323
BCD 25																			1,0000	0,7741	0,5500	0,4692
BCD 27																				1,0000	0,7714	0,6436
BCD 28																					1,0000	0,9224
BCD 29																						1,0000

The variable depicting inadequate finance facilities (BCD 15) is fairly highly correlated with the cost of finance (BCD 16). As BCD 15 was inverted for the purposes of analysis and BCD 16 (representing interest rates) was not inverted, the correlation has the correct negative sign.

Materials shortages (BCD 18 to BCD 20, as well as BCD 25) all record fairly high correlations with work load variables (BCD 1 to BCD 8). It is interesting to note the high correlation of 0,9224 between variables BCD 28 and BCD 29, i.e. the perceptions of contractors regarding current business conditions and those expected in the coming quarter. This finding supports the assertion that business people are prone to project their current business conditions into the future.

The following step is to analyse the composition of the orthogonal (uncorrelated) components of the responses of building contractors. These are presented in Table 7.10.

Three principal components have been identified with eigen values in excess of one. These three principal components explain 86,6% of the variance in the data set.

It is evident that the first component loads heavily on all variables that represent the work load of building contractors and developers, as well as on related variables such as the labour and materials shortages and business mood. It is appropriate to refer to the first component as a "work load" factor. A similar reasoning is proffered as in Section 7.3.1 of this chapter. Briefly, building activity is high (BCD 1 to BCD 8) and these are reflected in labour and materials shortages (BCD 10 to BCD 14), coupled with a decrease in the degree of competition in tendering (BCD 9). Finance facilities (BCD 15) are inadequate and interest rates (as represented by the cost of finance variable, BCD 16) decline. Specific materials, especially bricks, are in short supply. The assessment of prevailing business conditions (BCD 27) is more favourable and the overall business mood (BCD 28) improves. Expectations exist that business conditions will improve further in the next quarter (BCD 29).

The second principal component explains a further 11,9% of the variance in the data and loads most heavily on the variables that pertain to finance, i.e. BCD 15 and BCD 16. These variables relate to inadequate finance facilities and to the cost of finance. It is appropriate

Table 7.10

Principal component analysis of the responses of building contractors and developers (1980:2 to 1990:2)

Principal components		PC1	PC2	PC3
Variance explained		69,8%	11,9%	4,9%

Total variance explained: 86,6%

Time series	Variable	PC1	PC2	PC3
BCD 1	Value of work: estimated (year-on-year)	0,94592	0,03164	-0,21493
BCD 2	Value of work: expected (year-on-year)	0,92361	0,27666	-0,02607
BCD 3	Volume of work: estimated (year-on-year)	0,94152	0,03930	-0,22300
BCD 4	Volume of work: expected (year-on-year)	0,89950	0,29230	0,03059
BCD 5	Value of work: estimated (quarter-on-previous quarter)	0,89542	0,00764	-0,27613
BCD 6	Value of work: expected (quarter-on-previous quarter)	0,93565	0,25357	0,00579
BCD 7	Volume of work: estimated (quarter-on-previous quarter)	0,89297	0,04176	-0,27499
BCD 8	Volume of work: expected (quarter-on-previous quarter)	0,91008	0,26391	0,02924
BCD 9	Competition in tendering (inverted)	0,83921	0,08177	0,35748
BCD 10	Shortages: artisans	0,79713	-0,52580	-0,17845
BCD 11	Shortages: foremen	0,81243	-0,39025	-0,31751
BCD 14	Shortages: materials	0,85261	-0,46040	0,07699
BCD 15	Inadequate finance facilities (inverted)	0,52150	0,57903	0,07063
BCD 16	Cost of finance	-0,70755	-0.55872	-0,21747
BCD 17	Insufficient demand for building (inverted)	0,68979	-0,27581	0,51607
BCD 18	Shortages: stock bricks	0,81736	-0,17800	0,28926
BCD 19	Shortages: face bricks	0,79450	-0,37659	0,11577
BCD 20	Shortages: cement	0,62190	-0,45772	0,12105
BCD 25	Shortages: plumbing services	0,80135	-0,42872	0,24688
BCD 27	Prevailing business conditions	0,88300	0,19712	-0,22237
BCD 28	General business conditions: estimated (year-on-year)	0,91018	0,32046	-0,13068
BCD 29	General business conditions: expected (coming quarter, compared to corresponding quarter a year ago)	0,84071	0,47745	0,08594

to refer to the second principal component as a "financial" factor. As the inadequate finance facility variable, BCD 15, has been inverted for purposes of analysis whilst the cost of finance variable, BCD 16, has not been inverted, the negative sign before the BCD 16 value implies that finance facilities become more inadequate as interest rates rise. This implies further that building contractors view their financial constraints as important in their overall operations.

The third principal component loads most heavily on the "insufficient demand for building work" variable (BCD 17). It explains a further 4,9% of the variance in the data and can be classified as an "insufficient building demand" factor. It is not readily apparent how this factor differs from a "work load" component.

In summary, the first two principal components explain 81,7% of the variance in the data with the shorter data base (1980:2 to 1990:2). It is evident from this analysis that their work loads and the financial constraints under which they operate are the most important factors that shape the perceptions of building contractors and developers.

7.4.2 **Sub-contractors**

This analysis includes 22 variables and comprises 41 observations.

Firstly, the average values and standard deviations are examined, as well as the coefficients of variation. It is evident from Table 7.11 that the values of the work load variables (SBC 1 to SBC 8) lie just above or just below the neutrality value of 50. This implies that during the period under review (1980:2 to 1990:2) sub-contractors were, on average, not overly pessimistic or optimistic regarding their work loads. When the data in Table 7.11 are compared to the results in Table 7.4 (that pertains to the longer data base) it is evident that the results are quite similar. The exception is the sharp reduction in the value of the coefficient of variation of the variable SBC 15, viz. inadequate finance facilities. It fell from 102% to 42,5%. This reduction in cyclicality is probably attributable to the fact that monetary policies were generally more stringent during the eighties than during the seventies.

Table 7.11

Sub-contractors: A summary of the quarterly survey data (1980:2 to 1990:2)

(41 observations for each of the 22 time series)

Time series	Variable	Average	Standard deviation	Coefficient of variation
SBC 1	Value of work: estimated (year-on-year)	53,45	24,00	44,9%
SBC 2	Value of work: expected (year-on-year)	51,67	21,69	42,0%
SBC 3	Volume of work: estimated (year-on-year)	50,22	23,80	47,4%
SBC 4	Volume of work: expected (year-on-year)	48,10	22,07	45,9%
SBC 5	Value of work: estimated (quarter-on-previous quarter)	51,02	16,19	31,7%
SBC 6	Value of work: expected (quarter-on-previous quarter)	48,54	18,03	37,2%
SBC 7	Volume of work: estimated (quarter-on-previous quarter)	50,50	16,57	32,8%
SBC 8	Volume of work: expected (quarter-on-previous quarter)	47,22	18,13	38,4%
SBC 9	Competition in tendering (inverted)	0,013637	0,002982	21,9%
SBC 10	Shortages: artisans	39,95	19,21	48,1%
SBC 11	Shortages: foremen	27,34	13,22	48,4%
SBC 14	Shortages: materials	26,51	11,20	42,3%
SBC 15	Inadequate finance facilities (inverted)	0,041514	0,017641	42,5%
SBC 16	Cost of finance	42,42	16,13	38,0%
SBC 17	Insufficient demand for building (inverted)	0,027981	0,037874	135,4%
SBC 18	Shortages: stock bricks	30,56	38,00	124,3%
SBC 19	Shortages: face bricks	33,44	37,24	111,4%
SBC 20	Shortages: cement	10,32	24,30	235,5%
SBC 25	Shortages: plumbing materials	23,44	17,50	74,7%
SBC 27	Prevailing business conditions	46,83	29,07	62,1%
SBC 28	General business conditions: estimated (year-on-year)	42,94	28,70	66,8%
SBC 29	General business conditions: expected (coming quarter, compared to corresponding quarter a year ago)	42,88	23,94	55,8%

The average values of the shortages of labour and materials (SBC 10 to SBC 14) all fall below the neutrality level of 50, indicating that, on balance, bottlenecks were not too serious. Nevertheless, the coefficients of variation fall between 42% and 48%, indicating a cyclical behavioural pattern. Severe cyclicality is evident in the case of specific building materials, e.g. stock and face bricks, cement and plumbing materials.

Regarding the variables relating to business conditions (SBC 27 to SBC 29) it is evident that the average values all fall below the neutrality level of 50. This indicates that sub-contractors were, on balance, pessimistic about their estimated and expected business conditions. The coefficients of variation show high values between 55,8% and 66,8%, indicating perceptions that are cyclical in nature.

Secondly, the intercorrelations between the variables are examined as presented in the correlation matrix Table 7.12. It is evident that the correlation between variables relating to the work loads of sub-contractors are generally high. This underscores a previous finding, viz. that sub-contractors are prone to project their assessment of current events into the future. As was the case with contractors, competition in tendering amongst sub-contractors is fairly highly correlated with the work load variables (SBC 1 to SBC 8). As the degree of competition in tendering has been inverted for the purposes of analysis, the sign is correctly given as positive, i.e. competition increases as work loads decline.

Shortages of artisans (SBC 10) and foremen (SBC 11) are highly correlated. The same holds for labour and materials shortages, yet to a lesser extent. However, it is not easy to explain the low correlations that exist between materials shortages generally (BCD 14) and shortages of specific materials, e.g. stock and facebricks, as well as cement.

The cost of finance (SBC 16) is negatively correlated with most variables. This implies that as interest rates rise, activity levels (SBC 1 to SBC 8) decline. Brick shortages are fairly highly correlated with sub-contractors' perceptions of current business conditions (SBC 27) and less so with future business conditions. Estimated (SBC 28) and expected business conditions (SBC 29) are highly correlated which suggests that sub-contractors project their perceptions into the future.

Table 7.12

Correlation matrix of the responses to questions put to sub-contractors
(1980:2 to 1990:2)

	SBC 1	SBC 2	SBC 3	SBC 4	SBC 5	SBC 6	SBC 7	SBC 8	SBC 9	SBC 10	SBC 11	SBC 14	SBC 15	SBC 16	SBC 17	SBC 18	SBC 19	SBC 20	SBC 25	SBC 27	SBC 28	SBC 29
SBC 1	1,0000	0,9005	0,9798	0,9107	0,8311	0,8209	0,8556	0,8120	0,7704	0,6906	0,7039	0,6472	0,4513	-0,3866	0,5543	0,5324	0,5248	0,3024	0,4948	0,8646	0,8997	0,7710
SBC 2		1,0000	0,8606	0,9600	0,6791	0,8923	0,7174	0,8998	0,7766	0,5861	0,6047	0,5731	0,3894	-0,5055	0,4929	0,4762	0,4562	0,2713	0,4546	0,7551	0,9002	0,8500
SBC 3			1,0000	0,8941	0,8484	0,7497	0,8716	0,7397	0,7776	0,6689	0,6799	0,6571	0,4496	-0,3512	0,5542	0,4686	0,4715	0,2614	0,4116	0,8569	0,9206	0,4748
SBC 4				1,0000	0,7203	0,8746	0,7496	0,8844	0,8115	0,5581	0,5821	0,5977	0,4098	-0,4692	0,4877	0,4659	0,4218	0,2560	0,3961	0,7474	0,9204	0,8829
SBC 5					1,0000	0,5941	0,9821	0,5902	0,5776	0,4994	0,6105	0,6962	0,2500	-0,1760	0,2898	0,3340	0,3151	0,1635	0,3286	0,6719	0,7362	0,5575
SBC 6						1,0000	0,6407	0,9879	0,6764	0,4137	0,4720	0,4627	0,4090	-0,5010	0,4015	0,4660	0,4312	0,2417	0,4212	0,6448	0,7572	0,7636
SBC 7							1,0000	0,6395	0,5877	0,5081	0,6155	0,7040	0,2471	-0,2045	0,3092	0,3489	0,3203	0,1658	0,3501	0,6946	0,7642	0,5879
SBC 8								1,0000	0,6891	0,4191	0,4714	0,4770	0,3955	-0,5158	0,3756	0,4767	0,4312	0,2401	0,4232	0,6422	0,7647	0,7650
SBC 9									1,0000	0,5576	0,5754	0,5001	0,4173	-0,4534	0,5082	0,4635	0,4873	0,2779	0,5023	0,7158	0,8585	0,8003
SBC 10										1,0000	0,8743	0,5942	0,3324	-0,2732	0,5577	0,6410	0,6831	0,7280	0,6064	0,8577	0,6177	0,4554
SBC 11											1,0000	0,7272	0,2990	-0,1814	0,3407	0,6217	0,6718	0,7042	0,6234	0,8572	0,6078	0,4437
SBC 14												1,0000	0,0362	-0,0987	0,1404	0,3063	0,3068	0,3649	0,3152	0,6660	0,5989	0,3850
SBC 15													1,0000	-0,6606	0,6538	0,6060	0,5717	0,0813	0,3006	0,4857	0,4348	0,4086
SBC 16														1,0000	-0,4791	-0,5774	-0,4937	-0,1203	-0,3880	-0,3501	-0,4746	-0,5634
SBC 17															1,0000	0,5095	0,4941	0,1470	0,3408	0,5710	0,5343	0,4596
SBC 18																1,0000	0,9275	0,5319	0,7707	0,6227	0,4562	0,4434
SBC 19																	1,0000	0,5987	0,7777	0,6685	0,4599	0,4349
SBC 20																		1,0000	0,5122	0,5370	0,2539	0,1971
SBC 25																			1,0000	0,5587	0,3767	0,2992
SBC 27																				1,0000	0,8343	0,6793
SBC 28																					1,0000	0,9228
SBC 29																						1,0000

Finally, the composition of the principal components is examined. Table 7.13 shows that four principal components have been identified with eigen values in excess of one. These four components collectively explain 86% of the variance in the set of data.

The first principal component loads heavily on the variables associated with the work loads of sub-contractors, as well as on the business confidence variables (SBC 27 to SBC 29). It explains 59,6% of the variance in the data. It is appropriate to refer to the first principal component as a "work load" factor. A similar result was found in the analysis undertaken with the longer data base (Table 7.6).

The second principal component loads most heavily on the variables pertaining to specific materials shortages and explains another 11,9% of the variance in the set of data. It can be construed as a "materials bottleneck" factor.

The third principal component explains a further 9,9% of the total variance and can be classified as a "financial" factor because it loads most heavily on the financial variables SBC 15 and SBC 16. These variables represent the availability of finance and the cost of finance.

A fourth principal component explains another 4,6% of the total variance. It loads most heavily on the variables representing the level of inadequate building demand. It is appropriate to classify this principal component as an "insufficient building demand" factor.

In conclusion, it is evident that the first four principal components explain 86% of the variance in the set of data. The first three of these components show that work loads, materials bottlenecks and financial considerations are the most important factors that shape sub-contractors' perceptions of business conditions.

Table 7.13

Principal component analysis of the responses of sub-contractors (1980:2 to 1990:2)

Principal components		PC1	PC2	PC3	PC4
Variance explained		59,6%	11,9%	9,9%	4,6%
Total variance explained: 86,0%					
Time series	Variable				
SBC 1	Value of work: estimated (year-on-year)	0,95406	-0,18624	0,04386	0,08574
SBC 2	Value of work: expected (year-on-year)	0,91359	-0,23865	-0,10711	-0,17654
SBC 3	Volume of work: estimated (year-on-year)	0,93021	-0,24055	0,06049	0,18421
SBC 4	Volume of work: expected (year-on-year)	0,91596	-0,29324	-0,10048	-0,12378
SBC 5	Value of work: estimated (quarter-on-previous quarter)	0,76596	-0,35414	0,27022	0,21932
SBC 6	Value of work: expected (quarter-on-previous quarter)	0,82833	-0,23940	-0,20638	-0,32900
SBC 7	Volume of work: estimated (quarter-on-previous quarter)	0,79150	-0,36371	0,24868	0,18134
SBC 8	Volume of work: expected (quarter-on-previous quarter)	0,82958	-0,24054	-0,20273	-0,35461
SBC 9	Competition in tendering (inverted)	0,83309	-0,10226	-0,10890	-0,05468
SBC 10	Shortages: artisans	0,76843	0,38976	0,32967	0,14103
SBC 11	Shortages: foremen	0,78320	0,29146	0,45946	0,03974
SBC 14	Shortages: materials	0,65303	-0,18814	0,58506	0,05128
SBC 15	Inadequate finance facilities (inverted)	0,52820	0,28230	-0,56953	0,38790
SBC 16	Cost of finance	-0,51723	-0,22858	0,67913	0,12437
SBC 17	Insufficient demand for building (Inverted)	0,59467	0,22330	-0,37181	0,47019
SBC 18	Shortages: stock bricks	0,68473	0,61034	-0,12973	-0,04441
SBC 19	Shortages: face bricks	0,67907	0,64964	-0,05007	-0,03354
SBC 20	Shortages: cement	0,44403	0,56500	0,44628	-0,30378
SBC 25	Shortages: plumbing materials	0,60977	0,53610	0,08068	-0,21102
SBC 27	Prevailing business conditions	0,91233	0,12906	0,17830	0,14848
SBC 28	General business conditions: estimated (year-on-year)	0,92020	-0,25017	-0,07316	0,03884
SBC 29	General business conditions: expected (coming quarter, compared to corresponding quarter a year ago)	0,82093	-0,24264	-0,27297	-0,15272

7.4.3 Summary of results (1980:2 to 1990:2)

This section yields the following summarised results.

Table 7.14

Summary table of the principal components identified in the responses of contractors and sub-contractors (1980:2 to 1990:2)

Principal component	Contractors		Sub-contractors	
	Variance explained	Component identified	Variance explained	Component identified
PC1	69,8%	"Work load"	59,6%	"Work load"
PC2	11,9%	"Financial"	11,9%	"Materials shortages"
PC3	4,9%	"Insufficient building demand"	9,9%	"Financial"
PC4			4,6%	"Insufficient building demand"
Total variance explained (with eigen values greater than one)	86,6%		86%	

When comparing the results of the principal component analysis with the longer data base (Table 7.7) and the shorter data base (Table 7.14 above) it is evident that more factors were identified in the latter case. This is probably the result of the fact that more variables were analysed during the period 1980:2 to 1990:2 than during 1970:4 to 1990:2. A broader spectrum of economic activities of contractors and sub-contractors were analysed, allowing for more influences that shape their perceptions of business conditions.

7.5 Summary

The principal component analysis of the responses to successive surveys indicates that respondents in the group building contractors and sub-contractors behave purposefully as can be expected of business people. This means that the behaviour of people in business has a certain logic. There is an expectation of gain in some way from decisions taken, paths pursued, and energies expended. They are, however, prone to project their perceptions of prevailing business conditions into the future. This finding is borne out by the high correlations obtaining in all cases between their business sentiment at the time of surveying and their expectations of their business activities during the ensuing quarter. These high correlations imply a tendency among respondents to "forecast the present", which emphasises the importance of independent economic forecasting.

The analysis also indicates that certain key variables, such as the work load of contractors and sub-contractors, as well as financial considerations that pertain to the cost and the availability of finance, play a crucial role in shaping their perceptions of business conditions.

These findings lend credence to the survey results and suggest that the responses exhibit a certain internal reliability. This assertion is underscored by the finding that the responses to most questions put to respondents display strong cyclical tendencies. This is a reflection of the marked cyclical influences which are exerted on the participants in the building industry, and is, in turn, indicative of the instability of building activity. It can be concluded from this analysis that these survey indicators are suitable for further cyclical analysis undertaken in Chapter 8.

* * * * * * * * *

Chapter 8

Devising a composite leading indicator for the South African building industry by applying NBER methodology to BER business survey data

8.1 Introduction

Various researchers have developed leading indicators for the overall South African economy (Van Coller, 1980; Van der Walt, 1982; Barr, 1983). In the international sphere, Flôres (1991) evaluated the reliability and time consistency of the level of quarterly activity forecasts produced by the Brazilian construction engineering survey. Van Miltenburg and Romijn (1993) developed a composite leading indicator for the Dutch construction industry by closely following the NBER methodology. In South Africa, Mocke (1990) and Mocke and Stuart (1991) compared building survey variables with official data and found that certain time series compared favourably. Despite the need for a composite leading indicator of building activity, no such indicator exists for the South African building industry.

In Chapter 3 of this study it was argued that the task of forecasting the building cycle is difficult given the diversity of building projects, regional disparities and cyclical instabilities that result from macroeconomic policy variations. To assist the business cycle analyst in forecasting the upper and lower turning points of the building cycle, a composite leading index is devised in this study by applying the NBER scoring system to business survey data emanating from the Bureau for Economic Research (BER), University of Stellenbosch. However, the cyclical performance of the composite leading indicator cannot be viewed in isolation. It is necessary to compare the cyclical turning points of the composite leading index with those of a reference cycle. For this purpose, use is made of the historical diffusion index of construction activities, as compiled by the South African Reserve Bank (SARB), Pretoria.

The scoring methodology of the National Bureau of Research (NBER), U.S.A., is discussed briefly in Section 8.2. Section 8.3 focuses on the issues surrounding "measurement without theory". Section 8.4 deals with the SARB sectoral reference cycle and in Section 8.5 the

NBER scoring system is applied to qualitative BER survey data.

8.2 NBER methodology

The system of leading, coinciding and lagging indicators developed by the National Bureau for Economic Research in the U.S.A. is called the "NBER methodology." This methodology consists of a scoring system for the assessment and selection of economic indicators. It is also known as the "business cycle indicators approach". Development of this methodology can be traced back to the early works of writers such as Wesley C. Mitchell and Arthur F. Burns (1946). More recently, Geoffrey H. Moore and Julius Shiskin (1967), and Victor Zarnowitz and Charlotte Boschan (1975) have refined the scoring system for the selection of indicators. This method of business cycle research is currently being used in most developed countries for the analysis of economic conditions and prospects (Smit & Van der Walt, 1982: 51; Boschan & Banerji, 1990:206-225).

Fiedler (1990:137) has stated that the "... central idea of the indicator approach is to find a batch of statistical time series that (a) conform well to the business cycle and (b) show a consistent timing pattern as leading or coincident or lagging indicators". He warns further that "Such a description of the indicator approach to business cycle analysis is grossly oversimplified, almost a caricature - the sort of thing that led to the accusation that the cyclical indicators are 'measurement without theory'. In fact, the indicator approach is quite complex both in theory and practice".

A comprehensive review of the scoring system and indicator performance was undertaken in 1975 by Zarnowitz and Boschan and published in the Business Conditions Digest of the Department of Commerce, U.S.A. (Zarnowitz and Boschan, 1975a, 1975b). The methodology, as applied in the U.S.A. and South Africa, was comprehensively dealt with by Klein & Moore (1983) and Van der Walt (1982), respectively. Therefore, a detailed discussion of the methodology falls outside the scope of the current investigation. Nevertheless, a summary thereof is appropriate at this stage. Certain aspects of the NBER methodology will require a more detailed assessment in Section 8.5 when the scoring system is applied to BER survey data and to relevant quantitative time series in Chapter 9.

It is evident from a literature study that six criteria are applied when assessing and selecting the indicators and that six basic steps are followed in the calculation of the composite index.

8.2.1 Six criteria applied in the scoring system

Zarnowitz and Boschan (1975a: 171) have identified the following criteria.

8.2.1.1 Economic significance

How well understood and how important is the role in business cycles of the variable represented by the data? Two factors are important in this context. Firstly, the role of the economic process is considered. Secondly, a distinction is made between broad coverage and narrower coverage. Gross domestic product can be considered as an indicator with broad coverage. Industrial production represents a narrower coverage of economic activities. Normally, indicators that provide broad coverage and represent significant economic processes are given higher scores than those variables that provide narrower coverage and represent less important economic processes (Zarnowitz & Boschan, 1975a:171).

8.2.1.2 Statistical adequacy

How well does the given series measure the economic variable or process in question? Scores are awarded according to the quality of the reporting system; the coverage of process (e.g. size of sample); coverage of time period (e.g. one week per month or full month); availability of estimates of sampling and reporting errors; frequency of revisions; length of time series; comparability over time; other considerations that may be handled by judgmental evaluation (Zarnowitz & Boschan, 1975a:171-172).

8.2.1.3 Timing at revivals and recessions

How consistently has the series led (or coincided, or lagged) at the successive business cycle turns? Four phases can be identified. Firstly, the identification of the specific cycles evident in the time series. Secondly, the determination of the reference dates to be used. Thirdly, the matching of the specific cycle turning points with the corresponding reference dates.

Finally, scoring of the cyclical timing performance of an indicator, based, in the main, on the probability that the observed number of timing comparisons of a given type will be equalled or exceeded by chance (Zarnowitz & Boschan 1975a:172).

8.2.1.4 Conformity to historical business cycles

How regularly have the movements in the specific indicator reflected the expansion and contractions in the economy at large? Three aspects are considered. Firstly, scores are awarded by relating movements of the number of business cycle phases that are matched by the specific cycle movements to the total number of phases covered. Secondly, scores are awarded by considering the number of "extra" specific cycles that can result in "false signals". Indicators with "false signals" are penalised. Thirdly, account is taken of the amplitude of cyclical fluctuations in the time series. Ceteris paribus, larger movements will be more distinctive and this is regarded as a positive feature in a business cycle indicator (Zarnowitz & Boschan, 1975a:173).

8.2.1.5 Smoothness

How promptly can a cyclical turn in the series be distinguished from directional changes associated with shorter (mainly irregular) movements? Large erratic variations can obscure cyclical movements in an indicator. Smoothing techniques can be applied, but this is always achieved at a loss in currency (Zarnowitz & Boschan, 1975a:173).

8.2.1.6 Currency or timeliness

How frequently are the statistics reported and how promptly are they available (i.e. what is the lag of release?). "Real-time" series (e.g. interest rates) or monthly series (e.g. house plans passed) are awarded a higher score than data of a quarterly or annual nature (Zarnowitz & Boschan, 1975a:173). The lag of release in the case of survey data used in this study is usually about two to three weeks and represents one of the major advantages of such data. In contrast, official quantitative time series are often published three months or more after the period to which they refer.

8.2.2 **Six basic steps in the calculation of the composite index**

Van der Walt (1982b: 51) has identified the following procedures.

8.2.2.1 For each series, adjusted for seasonal and irregular influences, symmetrical percentage changes or differences for consecutive monthly time-spans are computed.

8.2.2.2 These changes are standardised in order to prevent the more volatile series from dominating indices.

8.2.2.3 The standardised changes are weighted according to predetermined weights for each series. (The NBER scoring system is applied in this study to determine these weights).

8.2.2.4 The average changes of the weighted series are also standardised.

8.2.2.5 The weighted changes are cumulated and transformed to an index with a specific base year.

8.2.2.6 The trend in the index is made equal to the average long-term secular movement in aggregate economic activity. The specific turning points in the index are determined after the trend in the index has been eliminated.

8.2.3 **The NBER weighting system**

The 1975 Zarnowitz and Boschan review for the Bureau of Economic Analysis of the U.S. Department of Commerce provided the following weighting system of the principal characteristics of the six criteria:

Table 8.1

Weighting system to select suitable economic indicators

	Zarnowitz-Boschan (1975)	Snyman (1994)
Economic significance	16,7	16,7
Statistical adequacy	16,7	16,7
Timing	26,7	26,7
Conformity	16,7	16,7
Smoothness	13,3	13,3
Currency	10,0	9,9
	-------	-------
Total	100,1*	100,0
	===	===

* Note: The weights do not add up exactly to 100 because of rounding (Zarnowitz & Boschan, 1975a:172).

It is clear that the consistency of timing is judged to be the most critically important of these selection criteria.

In an international setting various researchers have allocated different weights to those given above. The following summary has been compiled from data extracted from the research results of Van der Walt (1982:262-271), Dryden (1983:16-17) and Van Coller (1980:46). Refer to Table 8.2.

8.2.4 **Advantages of a composite index**

It is appropriate to enquire why a composite index is constructed from Fiedler's "batch of statistical time series". Van der Walt (1983:57) argued that the great advantage of the combination of chosen indicators in a composite business cycle indicator is that the latter will probably provide a more reliable indication of business cycle changes than the individual series. In particular, the timing of changes will probably show a more stable relationship with that of the general business cycle. Errors of measurement and other random deviations

Table 8.2

International comparison of weighting system for selection of indicators, according to specific criteria

Criterion	Maximum scores according to studies conducted by								
	Moore-Shiskin (1966) for U.S.A.	Zarnowitz-Boschan (1975) for U.S.A.	Bush-Cohen (1968) for Australia	Beck-Bush-Hayes (1973) for Australia	O'Dea (1975) for Great Britain	Van Coller (1980) for South Africa	Van der Walt (1982) for South Africa	Dryden (1983) for OECD countries	Snyman (1994) for South African building industry
Economic significance	20	16,7	15	10	15	23	15	16,67	16,7
Statistical adequacy	20	16,7					10	16,67	16,7
Timing	20	26,7		20	30	50	25	16,67	26,7
Conformity	20	16,7	45	50	25		30	16,67	16,7
Smoothness	10	13,3	15	20	15	12	10	16,67	13,3
Currency	10	10,0	25		15	15	10	16,67	9,9
	100	100,1*	100	100	100	100	100	100,02*	100

*Note: The weights do not add up exactly to 100 because of rounding.

in individual series will possibly cancel out when indicators are combined. The composite indicator will, therefore, be a more even series than the individual components.

Dryden (1983:14), in an overview of the OECD system of leading indicators, argued that the aggregation technique is used to reduce the risk of "false signals". Such signals could occur in directional changes of the leading index which do not correspond to any later movement of the reference series. Secondly, the aim is to provide a single synthetic index which has better qualities as a leading indicator than any of its individual components, and which conveniently summarises likely future short-term cyclical tendencies.

In summary, researchers are agreed that it is advisable to rely on potentially useful leading indicators as a group, to "increase the chances of getting true signals and reduce those of getting false ones" (Zarnowitz & Boschan, 1975a:173; Boschan & Banerji, 1990:219).

8.2.5 **Coverage of economic process**

To provide a comprehensive coverage of general economic processes, the NBER distinguished nine major types (Zarnowitz & Boschan, 1975a:171; Van der Walt, 1982:256):

* employment and unemployment;
* production and income;
* consumption, saving and distribution;
* fixed capital investment;
* inventory and inventory investment;
* prices, costs and profits;
* money and credit;
* foreign trade and payments; and
* government activities.

In this study of the building industry, variables that are included in the data set that is analysed in Chapters 8 and 9 cover the following economic aspects:

* production (i.e. building activity variables);

* employment (i.e. labour-related variables);
* money and credit (i.e. interest rates and the availability of long-term credit);
* prices, costs and profits (i.e. building cost indices and tender price indices); and the
* tendering environment (i.e. competition in tendering).

It is appropriate to recall that the principal component analysis of 58 survey variables undertaken in Chapter 7 showed that business behaviour is purposeful. Secondly, two principal components were identified that play a crucial role in shaping respondents' perceptions of business conditions. These are "work load" (i.e. production) and "financial" (i.e. money and credit) variables.

8.2.6 **Periodic revisions undertaken of the NBER scoring system**

The most recent comprehensive revision of the NBER system of leading, coinciding and lagging indicators was undertaken in 1975 by Zarnowitz and Boschan. This followed the 1966 review by Moore and Shiskin. It is appropriate, therefore, to consider whether there have been any significant changes in the methodology since the 1975 review.

Referring to the U.S. Bureau of Economic Analysis, Auerbach stated that a "... revision was done in March 1979, when, at the time of introduction of the new money stock classifications, the obsolete M1 money supply series was dropped from the index and M2 substituted in its place, with all twelve series having their respective weights adjusted" (Auerbach, 1982:590). The main reason for the substitution of the M2 series for M1 in the index was the erratic performance of M1 in the U.S.A. during the seventies.

More recently, however, Cagan has shown that, like M1 in the seventies, volatility and clarity of turning points of M2 had deteriorated in the eighties. He ascribed these changes in behaviour to the developments in the U.S. financial system that began in the late sixties and accelerated during the seventies (Cagan, 1990:85-86).

Lawrence Klein (1990:97), reflecting on the position in 1988, has summarised the eleven time series included in the official U.S. leading index (one series, new business formation, was omitted in April 1988):

* average work week in manufacturing (hours);
* initial claim for unemployment insurance;
* manufacturers' new orders;
* vendor performance;
* contracts and orders for plant and equipment;
* building permits for new houses;
* the change in trade inventories;
* the change in prices of basic materials;
* an index of stock market prices;
* the change in money supply (M2); and
* the change in outstanding business and consumer credit.

Cagan (1990:96) pointed out that a revised version of the U.S. composite leading index used by the Center for International Business Cycle Research substituted corporate profits after taxes and the ratio of price to unit labour costs for new business formation and real M2. The latest official version used by the U.S. Department of Commerce currently consists of eleven leaders and includes Consumer Expectations, based on work undertaken by the University of Michigan Survey Research Centre, U.S.A.

Besides the (infrequent) substitution of time series in the construction of the leading index, changes are made to index weights and standardisation factors. Auerbach stated that "The index weights and standardisation factors are updated more frequently then the twelve series are determined" (Auerbach, 1982: 591). These index weights should not be confused with the weighting system of the six principal criteria discussed in Section 8.2.3 of this investigation. Whilst the latter weighting system is used to select a particular time series from a large number of available economic time series according to the NBER scoring system, the final index weights referred to above are only then applied in the construction of the composite leading index once the identity of included series is determined.

Apart from those changes detailed above, no other evidence could be found of comprehensive changes in the composition of the official leading index of the Bureau of Economic Analysis, U.S. Department of Commerce, Washington, D.C.

This does not mean, however, that the U.S. system of leading indicators is not subject to regular scrutiny. Indeed, in recent years new avenues of research and appraisal have opened up. In Auerbach's (1982: 594) evaluation referred to above he found that "... the extensive effort devoted to assigning and updating weights for the series included has essentially no effect on the resulting index; it is indistinguishable from one with equal weights". However, he added that "In fairness, it should be noted that the scoring procedure also influences the choice of series to be included in the index" (Auerbach, 1982:591). This contribution therefore indicated that the greatest value of the NBER scoring system lies in identifying suitable time series for inclusion in the leading index.

In 1984 Neftci discussed the apparent asymmetry of the business cycle: the long, gradual expansion versus the short, steep contraction (Neftci, 1984). More recently, Diebold and Rudebusch of the Federal Reserve Board have assessed the ability of the composite U.S. index of leading indicators to predict business cycle turning points. Coupling their work to that of Neftci (1984) they suggested that "... leading economic indicators might usefully be specialised during expansions for the predictions of peaks and during contractions for the prediction of troughs. In other words, the use of two indexes, an 'expansion index', and a 'contraction index,' constructed with different components and component weights, could enhance predictive performance" (Diebold & Rudebusch, 1989:386-387). They also found that "... the probability of a turning point is roughly independent of the age of the regime" (Diebold & Rudebusch, 1989: 376). In other words, the probability that a turning point of the business cycle will occur is not necessarily an increasing function of the duration of a cyclical phase. This also was the principal finding of an investigation by Du Toit who tested this hypothesis with reference to the South African business cycle (Du Toit, 1977:29).

A recent study by Boschan and Banerji (1990:206) stressed the importance of amplitude standardisation in the construction of a composite index. They argued that an array of different standardisation procedures had developed in different countries to address the special problems that arose in different applications of the aggregation method. This resulted in the construction of composite indices in different countries where the composites are not comparable to each other. The authors therefore suggested a unified approach, flexible enough to meet the demands of each situation. Their recommended universal approach ensures amplitude-stationarity of each indicator included in the composite. A computer programme to perform the calculations has been developed, and research to test different composite indices is continuing at the Center for International Business Cycle Analysis, U.S.A.

In summary, it should be mentioned that despite periodic changes to the time series, the index weights and standardisation factors, the basic NBER methodology (i.e. the system of scoring) has remained unchanged since the comprehensive 1975 revision. In particular, the weighting system of the six scoring criteria has not been altered. These selection criteria are applied in this study in Section 8.5.

8.3 An overview of the debate concerning "measurement without theory"

The empirical business cycle research undertaken in this study concerns leading economic indicators and is based on methods developed by the National Bureau of Economic Research (NBER), U.S.A. The methodology of the NBER was devised by Burns and Mitchell (1946) who published a book entitled Measuring Business Cycles. Their approach has been criticised for being based on nontheoretical foundations. It is appropriate, therefore, to review this debate, more or less in chronological order.

In 1947 Tjalling C. Koopmans (who later became an Economics Nobel Laureate for his work in the field of econometrics) reviewed the work of Burns and Mitchell. At the time Koopmans was a member of the Cowles Commission, a body set up to develop the methodological foundations of the Keynesian paradigm. Koopmans (1947) criticised their empirical approach on three grounds. These concern the lack of theoretical basis, limited policy options and inadequate statistical methods.

Koopmans' (1947:190-193) **first argument** relates to his claim that the methodology developed by Burns and Mitchell (1946) is not based on a firm theoretical footing. He argues: "... even for the purpose of systematic and large scale observation of such a many-sided phenomenon, theoretical preconditions about its nature cannot be dispensed with ..." (Koopmans, 1947:190). Choices governing the selection of individual economic indicators have to be made on the basis of their economic relevance. Which indicators are relevant can only be determined with the help of some notions as to the generation of economic fluctuations, and as to their impact on society. A systematic argument needs to be put forward to show that the best use has been made of available data in relation to the most important aspects of the phenomena studied.

Koopmans (1947:191) argues that there is a lack of guidance from theoretical considerations relating to the choice of economic measures computed, compared to those variables selected for examination by Burns and Mitchell (1946). Though the Burns-Mitchell leading indicator approach concerns "cyclical behaviour" it concerns the economic performance of indicators in the aggregate. He asserts that it would be more appropriate to study the behaviour of economic agents, such as consumers, workers, entrepreneurs, dealers, etc. He claims that it is their modes of action and response in a social and technological environment which ultimately determine the levels and fluctuations of economic variables. Koopmans (1947:191) warns that:

> This shift of attention from underlying human responses to their combined effects is a decisive step. It eliminates all benefits, ... that might be received from economic theory - by which I mean in this context the theoretical analysis of the aggregate effects of assumed patterns of economic behavior of groups of individuals. It also divorces the study of fluctuations from the explanation of the levels or trends around which the variables fluctuate, since such theoretical analysis is needed to bring out the common features in both groups of problems.

Koopmans (1947:191-192) argues that by rejecting the help of economic theorising a gap is created. It follows that there is a need for some organising principle to determine on which aspects of the observed variables should be concentrated. He claims that Burns and Mitchell (1946) fill the gap (caused by the barring of explicit formal theory) with methodological quasi-theory concerned with delineating the object of study. The argument then centres on issues like the precise determination of turning points in the economic indicators, whether or not the movement of an indicator is a specific cycle, or the distinction between long and short cycles. He claims that the Burns-Mitchell approach is obsessed with seeing, counting and measuring business cycles, above all else (Koopmans, 1947:192).

A final aspect of Koopmans' (1947:192-193) first critical argument concerns the nature of reference cycles and the matching of specific cycles with reference cycles in the economy. Should the variable be treated in a positive or an inverted form? Answers sometimes appear to be arbitrary, according to Koopmans (1947:192). Furthermore, he claims that a reference cycle "... implies the assumption of an essentially one-dimensional basic pattern of cyclical fluctuation, a background pattern around which the movements of individual variables are arranged in a manner dependent on their specific nature as well as on accidental circumstances". This assumption is based on the empirical observation of many time series without reference to the underlying economic behaviour of individuals (Koopmans, 1947:193).

Koopmans' (1947:193-196) **second argument** deals with the applicability of the Burns-Mitchell (1946) approach to forecasting and economic policy objectives. He argues that the authors' scientific strategy, in which measurement and observation precede, are largely independent of any attempts toward the explanation of economic fluctuations. According to Koopmans (1947:195), the approach therefore has severe limitations for policy purposes. He maintains that prediction is actually the most important objective of the analysis of economic fluctuations. Yet Burns and Mitchell appear unconcerned with prediction of the effects of stated hypothetical measures of economic policy on the level and movements of economic variables (Koopmans, 1947:193). He asserts that the criterion of social usefulness of scientific analysis of the problem of economic fluctuations should provide guidance to economic policy. Yet, he acknowledges the constraints faced by economists who are not able to perform experiments to determine "causes and effects" by varying causes one at a time and studying the separate effect of each cause. Whilst economists can not employ methods used so fruitfully in the natural sciences, they nevertheless possess elaborate and well-established theories of economic behaviour. Examples are the utility-maximising behaviour of consumers and the profit-maximising behaviour of business firms (Koopmans, 1947:194).

Koopmans (1947:194) argues that such theory underlying consumers' and investors' economic behaviour is an indispensable element in understanding in a quantitative way the formation of economic variables. According to such theory the relevant economic variables are determined by the simultaneous validity of an equal number of "structural" equations (of behaviour, of law or rule, of technology). Problems of identification and isolation arise because so many relations are simultaneously valid and this complicates the measurement of the structural equation. The search for behavioural equations will help in understanding or analysing different situations, e.g. problems of secular trend, cyclical problems in other countries or different situations expected to arise in a future period within the same country.

Koopmans (1947:195) sounds a warning to economists and econometricians:

> Behavior patterns are subject to change: gradually through changing habits and tastes, urbanization and industrialization; gradually or unevenly through technological change; abruptly through economic policies or the economic effects of political events. While one particular behavior pattern may be deemed fairly stable over a certain period, a much greater risk is involved in assuming that a whole system of structural equations is stable over time.

He concludes his second critical argument by observing that Burns and Mitchell (1946) do not provide a clear awareness of the problems of determining the identifiability and measurement of structural equations as a prerequisite to the practically important types of prediction. He observes that: "Measurable effects of economic actions are scrutinized, to all appearance, in almost complete detachment from any knowledge we may have of the motives of such actions" (Koopmans, 1947:195).

In summary, there is no explicit discussion at all of the problem of prediction, its possibilities and limitations, with or without structural change, and no discussion of what the methods and research results of Burns and Mitchell (1946) may have on questions of economic policy. Hence, conclusions relevant to the guidance of economic policies cannot be drawn (Koopmans, 1947:196).

The **third argument** raised by Koopmans (1947:197-200) deals with the statistical treatment of the variables in the analyses of Burns and Mitchell (1946). The presence of random variability in economic data gives rise to certain methodological requirements. In dynamic economics the presence of random variability is either essentially a stochastic process or needs to be treated as such because of the great number of factors at work. Hence, methods of statistical inference need to be applied in the analysis and interpretation of economic data (Koopmans, 1947:197).

Koopmans (1947:198) observes that explicit dynamic economic theories constructed in his time had in common a complete system of structural equations which, as to their form, are stochastic difference equations. These difference equations describe responses to time lags, i.e. past values affect current actions of individuals. These stochastic difference equations may possess a tendency for the variables to evolve in cyclical movements. Koopmans (1947:198) argues that because of the random disturbances (or shocks) in individual equations, it is necessary to hypothesise in what manner randomness enters into the formation of economic variables. He claims that it is for this reason that "... the form of each structural equation should be specified and/or determined to the point where at least a conceptual isolation of the random influences at work is attained" (Koopmans, 1947:199).

Burns and Mitchell (1946) do not discuss randomness in terms of a definite distributional hypothesis, although they recognise that random factors are one of the determinants of economic variables. The authors apply variance tests to durations, amplitude and time lags in the economic variables, yet these tests are not rigorous, according to Koopmans (1947:199). Also, these tests are not particularly powerful in discerning structural change under the welter of random variation. They fail to take into account the influence of measurable exogenous variables. By treating the basic cyclical measures as cumulative random shocks the authors lose the additional information about the individual structural equations, and the disturbances therein, which are contained in the more numerous original data (Koopmans, 1947:199).

Burns and Mitchell (1946) calculate averages of the economic variables and, according to Koopmans (1947:200), these averages are unstable. Furthermore, the authors locate turning points without allowance for secular trend, and great variability exists between cycles. Consequently, much of the information contained in the original data is wasted. Finally, Koopmans (1947:200) observes that research into the aggregate consumption function stood on firmer ground than the investment schedule at the point at which he passed judgement on the methods of Burns and Mitchell. He is in favour of continued research into an explanation of cyclical fluctuations. Such studies must embrace both theoretical and statistical analysis. The explanation of the means to influence cyclical fluctuations "... must necessarily proceed from detailed studies of individual relationships" (Koopmans, 1947:200).

The debate relating to "measurement without theory" was taken up by Vining in 1949. He defended empiricism as a fundamental part of scientific procedure and admitted that the analysis by Burns and Mitchell was limited and strictly tentative. However, he claimed that

Koopmans' alternative unit - the individual economising agent - was possibly even more fundamentally limited in the study of many aspects of aggregate trade fluctuations (Oppenländer, 1993:8). In his response Vining asserted that it was conceivable that "... the aggregate has an existence apart from its constituent particles and behaviour characteristics" (Vining, 1965:207). Therefore, business cycles should be studied within a socio-economic context which also take into account the psychological and sociological determinants of economic behaviour (Oppenländer, 1993:8).

Secondly, Vining refuted the argument that the work of economists should contain some "social usefulness" and be able to evaluate economic policy effects, stressing that economics had not advanced far enough to provide solutions for political problems (Vining, 1949:207).

Thirdly, Vining (1949:213-214) argued that the analyses undertaken by Koopmans were insufficient "... as statistical economics is too narrow in scope if it includes just the estimation of postulated relations" (Oppenländer, 1993:9). Koopmans' approach neglected at the same time all the other interdependencies and determinants of economic behaviour.

"A Reply" by Koopmans and "A Rejoinder" by Vining followed in 1949 and provided fairly philosophical justifications for their different points of view (Koopmans, 1965:218; Vining, 1965:226). In 1957 Koopmans softened his approach when he stated that "... in regard to nonlinear models that recognize ceilings and floors to the movements of some variables, the theory of statistical inference might show such measures to be reasonably efficient summaries of a large part of the relevant information contained in the series. If this were to be the case, the intuitions that led to the adoption of such measures would be vindicated" (Koopmans, 1965:231).

During 1985, in a book dealing with international economic indicators and growth cycles in market-oriented countries, Philip A. Klein and Geoffrey H. Moore responded to Koopmans' initial criticism in a lengthy footnote (Klein & Moore, 1985:25). The authors claim that the exchange between Koopmans and Vining could have been avoided, or at least shortened, had it started with a proper understanding of where Mitchell had begun. They stress that Mitchell's first major work on business cycles had been published in 1913 and in 1927 he wrote that, for theoretical uses, there needed to be a systematic record of cyclical alternations of prosperity and depression, covering all countries in which they appeared (Klein & Moore, 1985:4). The authors mention that from the very beginning Mitchell seemed to have understood the necessity of acquiring information about economic instability (i.e. business cycles) before attempting to develop theoretical explanations for these phenomena. The statistical collection and analysis was to be but part of an overall plan that was directed toward explaining these cycles of reality (Klein & Moore, 1985:4).

The authors mention also that Mitchell died before the theoretical volume that was to follow Measuring Business Cycles could be written. Yet they emphasise that only after considering all the extant theories, as well as attempting an analysis of the essential character of modern industrial economics, and a review of the history of business cycles in the United States, England, France and Germany in the years up to 1913, did Mitchell conclude that to advance knowledge of the subject "we must know the facts" (Klein & Moore, 1985:25). They conclude that the material set out in Measuring Business Cycles, initially criticised as "measurement without theory," had long since been accepted and forms the basis of much current cyclical analysis in the United States (Klein & Moore, 1985:6).

A few years earlier Auerbach addressed the issue in his article "The Index of Leading Indicators: 'Measurement without Theory', Thirty-five Years Later" (Auerbach, 1982:589-595). In this review he summarises and evaluates the cyclical behaviour of twelve individual time series, as well as the composite index of leading indicators and concludes that "... the index serves a useful function" (Auerbach, 1982:595).

At the twenty first CIRET conference, held during October 1993, the issue was again debated by Oppenländer and Moore and Cullity. Oppenländer (1993:9) asserts that the indicator approach does not close the induction gap that exists between Koopmans' "one time and space-specific theoretical system" and Vining's broader framework. Yet, it narrows the gap because it "... offers the opportunity to consider a wider range of explaining variables simultaneously which allows for a much more comprehensive view..." of economic fluctuations. He suggests that certain economic forecasting models can be improved when climate indices are applied. One example of such indices that serve as leading indicators is the "Business Climate" as developed by the Ifo Institute for Economic Research, Munich, Germany. He states that "... the future is actually contained in the present ..." and that it is exactly this phenomenon which is captured by the "Business Climate" indicator (Oppenländer, 1993:13). According to Oppenländer this indicator combines managers' judgements about the present situation, as well as their expectations about future developments and structural changes and thus implicitly bridges the gap between present and future (Oppenländer, 1993:17). He concludes by asserting that economists should join forces in research and work towards a comprehensive approach of what economic agents actually do. In support, P. Klein (1990:13) quotes L. Klein (1990:97-106), a leading econometrician, who clearly recognises the complementary nature of work on business cycle indicators and the development of econometric models.

In their paper Moore and Cullity (1993:2) mention that Koopmans' criticism of the Burns-Mitchell study focused on the NBER's methodology of cyclical analysis, rather than any of its substantive findings. They point out that Burns and Mitchell had devised a system of measurement and that their research was based on a descriptive definition rather than a causal theory of business cycles. Their research program was to be "... guided by hypotheses about the phenomena of business cycles, but not to be committed in advance to any particular one. The elaboration of a theoretical structure could wait until a later stage, when it could be more soundly based on knowledge of the facts" (Moore & Cullity, 1993:2-3). They argue that the painstaking studies undertaken by Burns and Mitchell should at least narrow the "margins of uncertainty" and this could be compared to Oppenländer's "narrowing of the induction gap" referred to earlier. Moore and Cullity also mention that Burns once suggested in 1954 that "... The cold fact is that discussions of business cycle methodology, carried on in the abstract, are merely intellectual exercises in which experience, philosophical insight, and temperament mix in varying proportions" (Moore & Cullity, 1993:3). Burns asserts that to appraise different methodological approaches responsibly, it is essential to scrutinise the actual findings or results to which the different approaches lead.

Moore and Cullity argue that the pragmatic approach to empirical studies in macroeconomics was a hallmark of the NBER studies and that they believe that it has yielded significant practical returns. Contrary to popular belief, the leading indicators are based on economic theory and the authors illustrate this with an example. They mention that the average workweek was not selected as a leading indicator simply because it had been observed to advance or decline several months before the corresponding movements in the number employed, but also because it is known that changes in the workweek are usually easier to make, often less expensive, and more reversible than hiring or firing employees (Moore & Cullity, 1993:5). To substantiate their claim, they quote a suggestion made in 1983 by Philip Klein when dealing with the theoretical basis for business cycle indicators. Klein states that "... it is not coincidence that indicators found consistently to be 'most reliable' point to precisely the same factors as have efforts to explain instability" (P. Klein, 1983b:893). Klein stressed that the importance of monitoring a number of indicators as a way of measuring a complex multi-variate phenomenon, not 'without theory' but with an adequately complex theory, rather than the simplified abstraction, emerges forcefully from Mitchell's original approach (P. Klein, 1983:893).

Moore and Cullity also mention that Vaccara and Zarnowitz (1977) have found the leading composite index to be a "valuable, but not foolproof" tool for predicting both the degree and the direction of changes in aggregate economic activity (Moore & Cullity, 1993:12). Moore and Cullity (1993:11) conclude that the evidence demonstrates that the tendency for leading indicators to lead at business cycle turns has survived for at least a hundred years and for more than twenty business cycles in the case of the U.S.A. They (1993:17) assert that the NBER methodology has "... withstood the test of time and space, and had become one of the tools most widely used in short-term forecasting".

The foregoing debate has been dealt with in some detail as the current study is concerned with the development of a leading indicator for the South African building industry. As both qualitative and quantitative indicators are used in this analysis, it is especially appropriate to quote Burns on the technique to be adopted: "The critical question is never whether a method is quantitative, or qualitative, mathematical or historical, elegant or pedestrian, theoretical or statistical... the merit of a technique cannot be judged in the abstract..." Instead, "... it is essential to scrutinize the actual findings or results to which the different approaches lead" (quoted in Moore & Cullity, 1993:3). By combining both qualitative and quantitative data in a composite leading index the current study fits neatly into the mould foreseen by Oppenländer (1993:17) when he advocated that climate indices (or business mood indicators) be incorporated with quantitative leading indices to enhance short-term economic forecasting models.

In summarising these arguments some perspective is required. It should be acknowledged that Koopmans' (1947) criticisms came at a time before the virtual explosion of applied economic research and econometric modelling that followed in the fifties and continued right up to the present. In the field of investment, for instance, the groundwork for studies of the determinants of investment was laid by authors such as Meyer and Kuh (1957), Duesenberry (1958), Eisner and Strotz (1963) and Jorgenson (1967). In Chapter 2 an overview of their research is provided, augmented by more recent contributions by other authors, such as Zarnowitz (1985), Mankiw (1990), Pindyck (1991) and Chirinko (1993).

8.4 South African Reserve Bank reference cycle for the construction sector

It is the task of the Business Cycle Analysis Section in the Economic Department of the South African Reserve Bank to monitor and date the business cycle in South Africa (Smit & Van der Walt, 1970, 1973, 1982; Van der Walt, 1983, 1989). In doing so, many economic indicators are analysed, from a statistical and from an economic behavioural point of view. Firstly, each time series is assessed according to the amplitude of its cyclical component to establish the cyclical sensitivity of the individual time series.

Van der Walt (1983:53) argued:

> Secondly, it has to be determined in which cyclically sensitive time series the timing of changes shows a consistent relationship with that of the general business cycle. In order to do so, the specific turning points of the chosen cyclically sensitive time series have to be compared with the reference turning points of the general business cycle. In this way, it can be established which time series will serve as fairly accurate indicators of business cycle changes.

In dealing with the determination of the reference turning points of the business cycle, Van der Walt (1982: 50-51) stated that these turning points:

> were determined by diffusion and composite business cycle indices. Both the historical and current diffusion indices were based on 325 seasonally adjusted time series, covering all final and intermediate economic processes in the different sectors of the economy as defined by the Standard Industrial Classification of All Economic Activities. Because these series cover all the economic processes ..., the diffusion indices provide a comprehensive review of the cyclical developments of an economy. The diffusion indices are, therefore, used complementary to the composite indices which are based on a limited number of selected business cycle indicators.

It is appropriate to mention that an alternative method of determining turning points of the business cycle - the cluster of turning points method - is no longer used. With reference to their study of growth trends and business cycles in the South African economy, 1972 to 1981, Smit and Van der Walt stated that:

> The cluster of turning points method, based on a large number of series, was not applied in this study because the cyclical developments during the past decade emphasised the need not only to analyse specific turning points in a series, but mainly the changing growth phases. A general shortcoming of this method is that the distribution of turning points is too widely spread in the vicinity of a particular reference turning point so that the demarcation of a homogenous distribution to determine the median values cannot be determined. Other countries and international organisations have not used this method in recent years, but have developed and applied the economic indicator system, in particular composite indicators, in business cycle analyses (Smit & Van der Walt, 1982:49).

Returning to the chosen method of using diffusion indices to establish turning points of the business cycle, it is necessary to briefly review the methodology surrounding the construction of diffusion indices. These cyclical aspects have been dealt with extensively by Smit and Van der Walt in various studies of the South African business cycle (Smit & Van der Walt, 1976, 1973, 1982; Van der Walt, 1982, 1983, 1989).

Van der Walt (1982: 52) defined a diffusion index:

> ... as a measure of dispersion of the increases in a number of time series as at a particular date. In general two types of diffusion indices are used, namely the historic and the current. In the case of the historic index, the turning points and the period during which the cyclical component remains unchanged are determined for each series. The value of the index for a particular period is obtained by expressing the number of time series which increases, as a percentage of the total number of series considered. In the case of each series which remains unchanged, ½ is added to the number of series which increase. The current diffusion index is calculated without determining specific turning points. It is based on the actual change of individual time series from which the trend and seasonal components have been eliminated.

In their assessment of the advantages and disadvantages of historical and current diffusion indexes, Smit and Van der Walt (1970: 23) asserted that:

> Notwithstanding ... shortcomings, which are to a certain extent theoretical, it has been found in practice that the diffusion index is a fairly reliable indicator of the course of economic activity. In fact, Moore states that '... this conglomerate is one of the best historical indexes of the cyclical position of our economy that has ever been devised.' It is also known that the cyclical movement of the diffusion index is clearly displayed, the maxima and minima thereof are reached before the corresponding reference peaks and troughs, the 50 per cent values thereof more or less coincide with the reference peaks or troughs, and the maxima and minima of the diffusion index give a reasonable indication of the amplitudes of the cycles in economic activity. The fact that the diffusion index leads general activity, means that it can be used for the forecasting of turning points as well as the intensity of up- and downswings.

These aspects have been dealt with in some detail at this point because - as will become clear at a later stage - the SARB reference cycle used in this investigation, i.e. the historical diffusion index of construction activities, displays exactly those characteristics explained above. Equally important is the finding that the composite leading index devised in this study from business survey data, corresponds closely with the cyclical fluctuations evident in the SARB reference cycle for the construction sector.

Graph 30 depicts the course of the SARB reference cycle used in this study, i.e. the historical diffusion index of construction activities for the period 1970 to 1990. This diffusion index has been constructed from several time series that relate to construction (Smit & Van der Walt, 1982: 56). A list follows:

Average salary and wage per worker

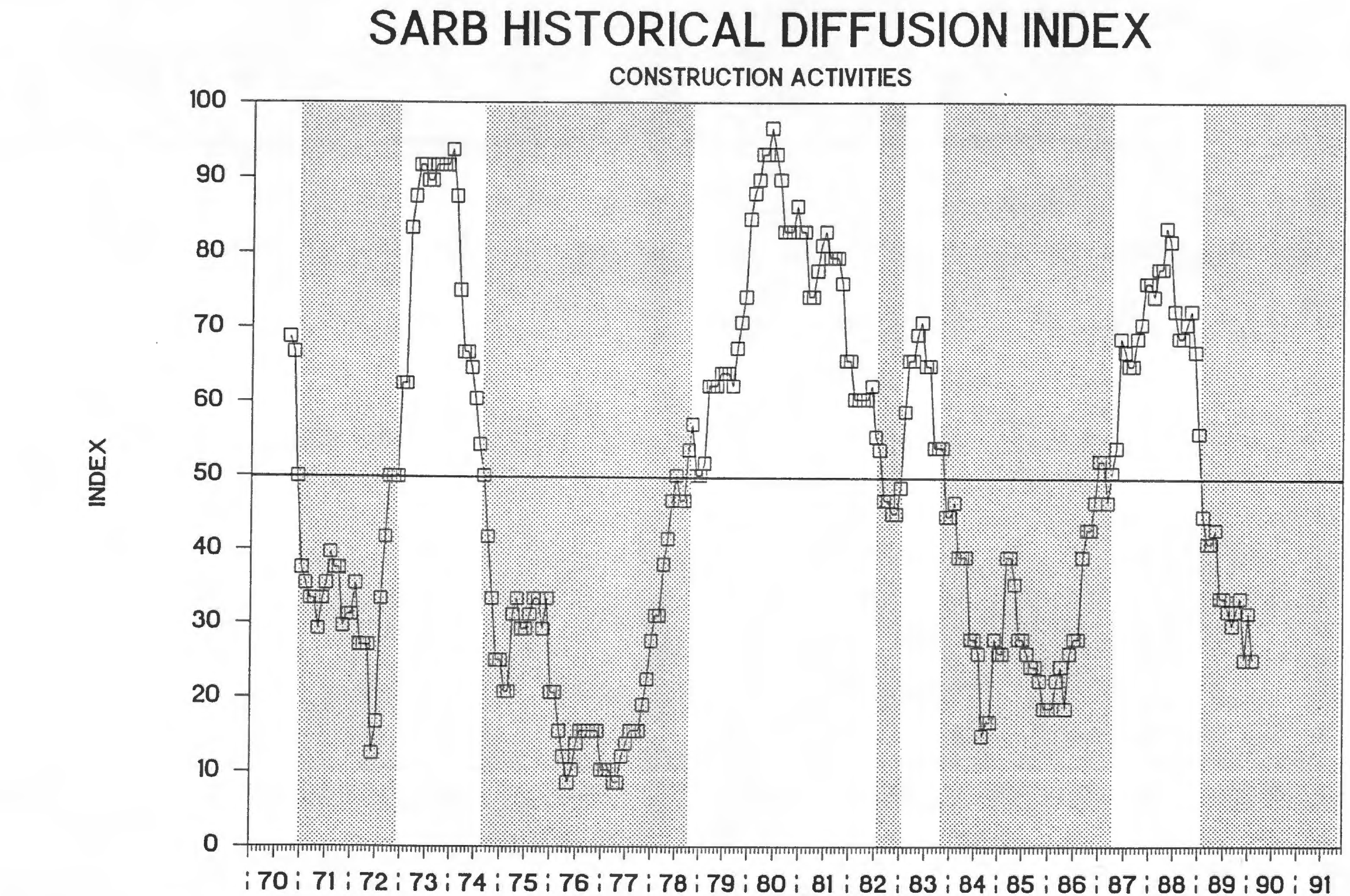
Buildings completed:

- Non-residential buildings
- Residential buildings
- Total

Building plans passed:

- Non-residential buildings
- Residential buildings

Graph 30



Note: The shaded areas represent contractions in the construction index, as recorded by the 50% point in the diffusion index.

Total

Employment - private construction

Fixed investment in buildings and constructions

Gross domestic product:

Gross operating surplus

Other

Hours worked:

Overtime as percentage of ordinary hours, production workers

Total

Investment in inventories

Labour turnover per 100 production workers - number of engagements

Physical volume of production:

Building bricks and tiles

Cement

Private sector:

Non-residential buildings

Residential buildings

Tender value of construction contracts:

Work in progress:

Other constructions

Residential buildings

Work not yet commenced:

Other constructions

Residential buildings

Wholesale prices of building and construction materials

Wholesale sales of building and construction materials.

Van der Walt (1982: 53) stated that the turning points of the business cycle are determined at those dates when the historical diffusion index reaches the 50 per cent level (Van der Walt, 1982: 53). For the purposes of this investigation and further analytical work, the turning points of the building cycle are determined at those dates when the SARB historical diffusion index of construction activities reaches the 50 per cent level. Based upon the data provided by the Business Cycle Analysis Section of the Economic Department of the SA Reserve Bank, these turning points are as set out in the following table:

Table 8.3

SA Reserve Bank sectoral reference cycle represented by historical diffusion index of construction activities

TROUGHS		PEAKS	
Year	**Month**	**Year**	**Month**
		1970	12
1972	12	1974	9
1978	10	1982	8
1983	1	1983	11
1987	4	1989	1

Source: Economic Department, South African Reserve Bank, Pretoria.

From these data the duration of the downswing and upswing phases of the economic cycle in the building sector can be derived. Refer to Table 8.4.

Table 8.4

Duration of downswing and upswing phases of SA Reserve Bank sectoral reference cycle represented by the historical diffusion index of construction activities

DOWNSWING PHASE		UPSWING PHASE	
Turning Point	**Months**	**Turning Point**	**Months**
		1970:12	-
1972:12	24	1974:9	21
1978:10	49	1982:8	46
1983:1	5	1983:11	10
1987:4	41	1989:1	21

A few brief comments that relate to economic conditions prevailing during the period 1970 to 1991 are appropriate. As was the case in the overall economy, the building industry experienced a recession in 1971/72. The gold price started to rise in 1973 and by 1974 had reached $200 per fine ounce. This led to a significant improvement in gold mining taxes; consequently, government expenditure rose sharply. Also, oil prices rose rapidly on account of the October 1973 oil shock. During the year 1975 the expenditure on large infrastructural projects, such as the Sishen-Saldanha railway line and the Richards Bay minerals export harbour coincided with sharply higher oil prices and a sharp drop in the gold price. The South African currency was devalued by 17,9% in September 1975 as a result of a large deficit that had developed on the current account of the balance of payments.

The years 1976 and 1977 proved to be difficult years for the South African economy. Political unrest and a cutback of expenditure on public sector capital projects gave rise to a prolonged recession that was also severely felt in the building industry. By 1978 economic conditions had started to improve. The period from 1979 to 1981 saw vigorous growth in the economy and, especially, in the building industry. The sharp rise of the gold price to above $600 a fine ounce contributed largely to general prosperity. The 1982/83 recession in the building industry was shortlived and lasted a mere five months, according to data provided in Table 8.4.

The 1983 upswing phase in the building industry lasted just ten months and was followed by a protracted downswing that lasted 41 months (refer to Table 8.4). The latter period coincided with three significant events, viz. the economic "austerity package" of 2 August 1984, the then State President's "Rubicon Speech" on 15 August 1985, and the debt standstill scarcely a month later. The upswing phase 1988/89 was not quite as vigorous as that of 1980 and the amplitude of the historical diffusion index depicted in Graph 30 indicates this quite clearly. In the building industry the widespread use of the First-Time Homeowners' Subsidy Scheme contributed greatly to increased demand in the private housing market. At time of writing (March 1994) no definitive lower turning point had yet been determined for the downswing phase of the building cycle that started in February 1989.

In all, the data provided by the SA Reserve Bank indicate that, according to the accepted definition, four full cycles occurred during the period 1970 to 1993. This definition states that "... the minimum duration of an upswing or a downswing is six months, while that of a full cycle from one trough to the following or from one peak to the following is fifteen months" (Van der Walt, 1982:55; Zarnowitz & Boschan, 1975a:172). The SARB sectoral reference cycle also includes the upper turning point of the expansion phase that ended in December 1970. Therefore, during these two decades nine turning points are identified, viz. five upper turning points and four lower turning points.

Given this background information on the sectoral reference cycle, the following sections of this chapter deal with the application of the NBER methodology to qualitative survey data that pertain to the South African building industry.

8.5 NBER methodology applied to BER survey data on the building industry

Section 8.2 briefly discussed the NBER methodology as applied in the United States of America. Commenting on their own scoring system, Zarnowitz and Boschan (1975a:171) stated that the NBER system "... disciplines and systematises the judgement of both reviewer and user of the indicators. It is an effort to insure that all the important aspects of the evaluation problem are considered in a consistent and, to a significant extent, replicable way. Clearly, any scoring plan, no matter how carefully conceived, will include some subjective or arbitrary elements about which judgements could differ considerably, but these are largely matters of detail which seem unlikely to impair seriously the value of the system as a whole".

Essentially, this investigation integrates two research approaches, viz. the Konjunkturtest of the Ifo Institute for Economic Research, Munich, Germany, and the NBER Methodology as applied by the Centre for International Business Cycle Research, Columbia University, New York and the Bureau for Economic Analysis, U.S. Department of Commerce, Washington, D.C. The former research approach is qualitative, the latter quantitative in nature.

It is understandable therefore that in devising a composite leading index for the South African building industry using, inter alia, qualitative data sources and a scoring system that was designed for assessing quantitative data, a measure of subjectivity will prevail.

However, this should not pose a problem as the NBER scoring system is followed closely, and differences that do exist are attributable to the differences in the nature of the basic data that are used. For example, in the classic NBER scoring system all economic indicators are seasonally and trend adjusted. The BER survey data used in this investigation does not require sophisticated statistical manipulation because the Konjunkturtest, as applied by the BER, was designed to yield a cyclical indicator that varies within the range 0 to 100. Furthermore, in this investigation it is shown that most of the qualitative economic time series that are analysed according to the NBER scoring system, prove to be leading indicators. Phrased differently, by using such qualitative survey data one gains an advantage in that the researcher's data is "almost tailor-made for the job." Having available a set of indicators from a reputable source (the BER) therefore simplifies the task of the researcher. This advantage has a bearing on the selection criteria applied in the scoring system and these aspects are now discussed.

8.5.1 Economic significance

This represents the first of the six criteria of the scoring system discussed in Section 8.2.1. In the context of this investigation it means the coverage of the economic activities of building contractors and sub-contractors. It was pointed out in Chapter 7 that virtually all aspects of their building operations are covered in the survey responses. The following list summarises their economic activities:

* value and volume of work done;
* financial constraints, such as the availability and cost of capital;
* degree of competition in tendering;
* bottlenecks in the supplies of labour and building materials; and an
* assessment of prevailing and expected business conditions.

Furthermore, it should be recalled that the principal component analysis undertaken in Chapter 7 of this study indicated that for contractors and sub-contractors alike, two factors governing their economic behaviour stood out, viz. their work load and financial considerations.

One can conclude that, as a whole, the survey responses reflect various important and significant aspects of the economic behaviour of building contractors and sub-contractors. It seems to make sense to allocate equal weights to the different variables. Variables were therefore not scored individually.

8.5.2 **Statistical adequacy**

This criterion deals with the question whether the survey data are compiled by scientific method and according to statistically accepted standards. In this respect the survey data used in this investigation would all rate equally highly as the data are based on the accepted Konjunkturtest method of research and are compiled by a reputable research organisation, the Bureau for Economic Research, University of Stellenbosch. The BER also monitors the survey sample on a regular basis as has recently been shown by Mocke (1990).

As all survey data used in this investigation emanate from the same reputable source, it does not make sense to score each variable individually, especially in light of the fact that the principal component analysis undertaken in Chapter 7 has shown that the basic survey data reflect purposeful business behaviour.

8.5.3 Currency of data

The data used in this investigation are available on a quarterly basis. Judged superficially, this might imply low scores when applying the currency of data criteria. However, the survey data becomes available within roughly two to three weeks after the survey quarter for which responses are sought. The early availability of Konjunkturtest data is acknowledged to be one of the benefits derived from this survey method (refer Section 5.4 of this study). In practice, the qualitative building data used in this investigation are available some months before official data sources that relate to the building industry. Examples are building plans passed, and buildings completed, published by the Central Statistical Service, Pretoria. Quarterly data of investment in buildings are available from the SA Reserve Bank with a lag of three months or more, when compared to the BER business survey data.

It is often the case that the official data published on a monthly or quarterly basis (with a lag of three months or more) are preliminary. In contrast, the qualitative building data for a particular survey quarter, derived by means of the Konjunkturtest, are final. This represents another advantage for analytical purposes.

In view of the above considerations and the fact that all survey indicators used in this investigation for any particular quarter become available simultaneously, one can conclude that all variables would score equally highly under the currency of data selection criteria. It is unnecessary, therefore, to score variables individually.

8.5.4 Consistency of timing

The nature of the qualitative data used in this study is such that all variables would score equally highly under the first three selection criteria discussed above. However, all survey indicators do not score equally highly under the remaining three selection criteria and they have, therefore, to be scored individually. As asserted by Zarnowitz and Boschan (1975a:171), and confirmed by Diebold and Rudebusch (1989:371), the consistency of timing of upper and lower turning points is of prime importance for the use of the cyclical indicators. This aspect of the methodology therefore requires a detailed discussion.

Establishing the consistency of timing of the indicators involves four phases, according to Zarnowitz and Boschan (1975a:172). These are: cycle identification of specific time series; determining peaks and troughs of the reference cycle; matching the specific cycle turning points with the corresponding reference dates ; and performance scores for timing.

8.5.4.1 **Cycle identification of specific time series**

This section deals with the identification of the specific cycles in the time series used in this investigation. The programmed selection of cyclical turning points has been based on the method employed by Janse van Rensburg (1990:15-22) who, in turn, based his study on the methods of Bry and Boschan (1971a;1971b). The technical details provided in the remainder of this sub-section follow closely those of Bry and Boschan. The Bry-Boschan computer programme is used by the National Bureau of Economic Research, U.S.A.

In their analysis of business cycles, the National Bureau of Economic Research, U.S.A, follows a number of rules, which are aimed at minimising the role of individual judgement in the determination of turning points in business cycles; yet in the formulation of these rules and still more in their implementation, individual judgement continues to play an important role. Examples of such rules and procedures are given below.

8.5.4.1.1 Specific cycles should have a duration of at least 15 months; that is, from trough to trough or peak to peak the duration must be at least 15 months.

8.5.4.1.2 Specific cycles should have a duration of less than 12 years.

8.5.4.1.3 The amplitudes of the specific cycles will be larger on average than those of the irregular fluctuations encountered in the series.

8.5.4.1.4 The amplitude of a doubtful expansion or contraction should not be materially smaller than that of the smallest clearest recognisable cycle in the series.

8.5.4.1.5 Peaks and troughs alternate; that is, a peak cannot succeed another peak without an intervening trough. Hence peaks should not be identified at the ends of series unless it is clearly possible for the next succeeding turn to be a trough; analogous considerations apply to troughs.

8.5.4.1.6 Sometimes a difficulty arises in cases of "double turns", that is, when a series returns to its previous peak or its previous trough level after some intermediate fluctuation. The decision in case of double peaks or double troughs is, of course, a very important one for timing analysis, since a minor difference in level and a marginal decision in the selection of turns can cause relatively large differences in timing and duration measures. The basic rule is that the peak should be the last high month just preceding the month in which the downward movement starts. However, if the period between the two peaks contains downward movements and only one or two steep rises, the first high should be chosen.

8.5.4.1.7 There are cases in which, instead of showing clearly defined turns, the series maintains a peak or a trough for several months in a row. The basic rule is to regard the last of the equal values as the turn, since the decisive change of cyclical direction manifests itself only after that month. However, if a series forms a definite step pattern in which plateaus and changes between plateau levels are common, the search for "turning points" may be inappropriate. In such instances it may be desirable to identify the beginnings and ends of ridges and valleys.

Determination of turning points can have far-reaching consequences for analysis; specifically as it affects all basic measures of cyclical durations and amplitudes. Thus it is desirable to free the process as far as possible from the uncertainties of varying interpretation and bias by codifying the relevant rules and considerations to reduce the selection to a programmed sequence of steps, and to relegate the process to execution by computer.

8.5.4.1.8 **Approach employed.** The approach employed in the computer program is very similar to the traditional process of turning point determination practised by the National Bureau of Economic Research, U.S.A. It roughly parallels the traditional sequence of first identifying major cyclical swings, then delineating the neighbourhoods of their maxima and minima, and, finally, narrowing the search for turning points to specific calendar dates.

The programmed strategy will be discussed in the following paragraphs.

First of all, some moving averages representing trend and cycle elements only are derived. These relatively smooth curves serve as the basis for determining the existence of expansions and contractions and for selecting the general neighbourhoods of potential peaks and troughs. Local maxima and minima are excluded by postulating a minimum cycle duration; shorter fluctuations are eliminated in such a way that only major peaks and troughs remain.

Next, the neighbourhoods of potential turns are redefined by identifying peaks and troughs corresponding to those of the trend-cycle curves on a time series that is only slightly smoothed by a short-term moving average. The objective here is to come closer to the eventual location by excluding the influence of values that may be several months removed from the final turns.

Once the immediate neighbourhood of a potential turn is established on this curve, the analysis shifts to the unsmoothed data. The highest (or lowest) original values within a short span of the turns on the smoothed curve are chosen as preliminary turning points. These turns are tested for a minimum cycle duration rule and for compliance with some other minor constraints; elimination of disqualified fluctuations leads to the selection of final turns.

The approach followed in the computer program neglects amplitude considerations, except for those implicit in the various smoothing processes. The reason for this is the complications that arise from the difficulty of setting adequate standards. Although it may be theoretically and technically feasible to incorporate explicit amplitude considerations in programmed turning point selection, such incorporation would complicate the procedures considerably and perhaps render them impractical.

When random movements complicate the determination of specific turns, some guidance can be obtained through smoothing by moving averages. The intermediate output tables and corresponding charts of some seasonal analysis programs can be of great help in deciding doubtful cases, both with regard to recognition of cycles and determination of turns. But the cycles and their turning points are eventually identified in the seasonally adjusted data, not in the smoothed series.

8.5.4.1.9 **Procedure for programmed determination of turning points.** The essential steps of the procedure are:

* determination of extremes and substitution of values;
* determination of cycles in 12-months moving averages;
* determination of corresponding turns in the Spencer curve; and
* determination of corresponding turns in short-term moving averages.

8.5.4.1.10 **Determination of extremes and substitution of values.** Extreme values are defined as values whose ratios to a 15-month preliminary unadjusted Spencer curve (a discussion of Spencer curves follows shortly) are outside a specified range. The exclusion criterion is 3.5 standard deviations of the ratios. At those dates where the series deviate from the Spencer curve by more than 3.5 standard deviations the unadjusted Spencer curve values are substituted for the extreme values in the original series in order to derive a revised trend-cycle representation.

Spencer's technique (Kendall & Stuart, 1968:372) for determining moving averages involves the application of four consecutive moving averages, each with its own particular set of weights, to a series. This formula covers a set of 15 consecutive points in a series. The weights applied to these 15 points in a series are:

1/320x{-3, -6, -5, 3, 21, 46, 67, 74, 67, 46, 21, 3, -5, -6, -3}

8.5.4.1.11 **Determination of cycles in 12-month moving averages.** This is the first series from which turning points are determined, after adjustment for extreme values. The reason for starting with the twelve-month moving average rather than with the Spencer curve is that the Spencer curve is too flexible for our purpose (that is, it contains too many minor fluctuations).

The selection of turning points is done in two steps. First, tentative turns are established, and second, these turns are tested for compliance with a set of constraint rules. Any months whose value is higher that those of the five preceding months and the five following months is regarded as the date of a tentative peak; analogously, the month whose value is lower than the five values on each side is regarded as the date of a tentative trough.

The turns selected on the twelve-month moving average are subjected to only one test - a check on the proper alternation of peaks and troughs. This is accomplished by the elimination of multiple turns. Thus of two or more contiguous peaks, the highest one (and if they have the same value, the latest) survives; and an analogous rule holds for troughs.

8.5.4.1.12 **Determination of corresponding turns in the Spencer curve.** The following step in the process is the determination of tentative and final cyclical turns in the Spencer curve. The Spencer curve is chosen as the first intermediate curve because its turns tend to be closer to those of the original data, a desirable step toward the final goal.

The program searches - in the neighbourhood (delineated as ± five months) of the turns established for the twelve-month moving average - for corresponding turns on the Spencer curve. The Spencer curve turns, thus located, are subjected to two tests:

* like turns must be at least fifteen months apart; and
* the alternation of peaks and troughs must be maintained.

The stipulation that turns must not be closer than six months from the end of the series is introduced to avoid spurious highs or lows that have no cyclical significance.

The adopted rule that peaks as well as troughs must be at least fifteen months apart from like turns enforce a minimum-duration for recognised cycles. When the program identifies like turns that are too close, it excludes the lower of two peaks and the higher of two troughs. When any turn is excluded an opposite turn is eliminated to maintain the proper alternation of peaks and troughs.

If the duration of a contraction in the twelve-month moving average is less than 10 months long, the searches for peaks and for troughs on the Spencer curve overlap. It thus follows that the searches could conceivably lead to a Spencer curve contraction in which the low precedes rather than follows the peak. Because conditions leading to such a 'crossover' throw doubt on the existence of a genuine contraction, both turns involved are therefore omitted.

8.5.4.1.13 **Determination of corresponding turns in the short-term moving average.** One may argue that the Spencer curve cycles should form the basis of cyclical analysis, since conceptually they are closest to the trend-cycle component of the observed values. Spencer curves, as in all long-term moving averages, tend to shift turns, affect slopes, and convert irregular fluctuations into smooth wavelike patterns. It thus follows that the analysis cannot be based on smoothed series alone, but must consider the behaviour of unsmoothed observations. Cycles, as analysed by the National Bureau of Economic Research, U.S.A., are based on unsmoothed values. The exclusive use of smoothed series would therefore not only make cyclical analysis dependent upon the particular smoothing term and weighting scheme but would also be a radical departure from cycle measures previously used by the National Bureau of Economic Research, U.S.A., and other investigators, and would impair comparability of research results. The search thus must continue for values close to the Spencer curve turns that are peaks or troughs in the original seasonally adjusted data.

The original seasonally adjusted data smoothed by a short-term average is represented by the MCD (months for cyclical dominance) curve. The MCD of any series is the number of months required for the systematic trend-cycle forces to assert themselves against the irregular time series component. In other words, the MCD is the shortest span *i*, in months, for which the irregular movement (I_i) in the series is on the average smaller than the cyclical movement (C_i), that is, $I_i/C_i < 1$. The smoother a series, the smaller is its MCD. If a series has strong cycles and little irregularity, it will not take long (perhaps not longer than one or two months) until the average change in the trend-cycle component exceeds the average change in the irregular component. If a series has shallow cycles but is very choppy, it may take many months before the cyclical movement asserts itself. In the first case no smoothing, or smoothing by only a very short-term average, is required to bring out the cyclically relevant movements; in the second case a correspondingly longer term is needed. The MCD curve represents the data smoothed by the MCD term obtained from the relationship of trend-cycle and irregular movements in the analysed activity. The effect of irregular changes and the influence of remote values is reduced by confining the span of the smoothing term used to a narrow range of three to six months. For measured MCD's of one and two months, a three-month term is applied; for MCD's of seven or more months, a six-month term is used.

Turns are determined by selecting the highest peak on the MCD curve within a span of five months from the dates of the peaks identified on the Spencer curve; MCD troughs are similarly selected. Before this determination of the turns is made final, turns at the very beginning and end of the MCD series are omitted, the minimum duration rule is enforced, and the turns are tested for crossovers.

8.5.4.1.14 **Determination of turning points in unsmoothed series.** The final step of the procedure is to find the peak and trough values in the unsmoothed data that correspond to the MCD turns previously established. This simple search is similar to the previous transitions (from turns in the twelve-month moving average to Spencer curve turns and from Spencer curve turns to MCD curve turns). The program establishes the highest values in the unsmoothed data within a span of ± MCD or ± 4 months (whichever is longer) from the peak in the MCD curve; correspondingly, the lower value of the unsmoothed data in the neighbourhood of MCD troughs is established. Turns closer than six months from the ends are not accepted. Additionally, the first and last peak (or trough) must be at least as high (or as low) as any value between it and the end of the series.

Full cycles (peak-to-peak and trough-to-trough) are checked for a minimum duration of fifteen months. The fact that this criterion was applied earlier to the trend-cycle curve does not necessarily imply that the related cycle in the unsmoothed data satisfied this condition, as the actual initial and terminal turns can be closer than the related turns on the Spencer curve.

The last constraints for which the turning points are tested is a five-month minimum rule for phase durations. There is no equivalent rule in the standard analysis of the National Bureau of Economic Research, U.S.A. However, early experience showed that some sharp, short episodic movements can be redistributed by the various moving averages into fluctuations of cyclical contours and durations. This minimum-phase-duration rule, which is set at five months, is an attempt to rectify this possible complication.

8.5.4.1.15 **Implementing the adapted NBER computer program.** The original NBER program was written for a compiler that runs on a main frame computer in the FORTRAN computer language. This program was initially written to run on a punch-card system. It was converted at the University of Stellenbosch to be used as a software file stored on magnetic disk. Due to the large number of time series that were intended to be analysed with this program and the strict format in which the program accepts its input, the program was adapted to run on a personal computer with DOS as operating system and FORTRAN '77 as compiler. It was difficult to cast the time series in the format that the program required in the relatively user-unfriendly environment of the main frame, but this task was successfully undertaken by Janse van Rensburg in his study completed in 1990 and for the current investigation.

8.5.4.2 Peaks and troughs of the reference cycle

Determining the consistency of timing also entails a decision on the reference dates to be used, i.e. on the chronology of building cycle peaks and troughs in South Africa. In this study of the timing characteristics, the historical diffusion index of construction activities, compiled by the South African Reserve Bank is used. This information was presented in Table 8.3.

8.5.4.3 Matching the specific cycle turning points with the corresponding reference dates

Matching the specific-cycle turning points with the corresponding reference dates. This task has been undertaken for both building contractors and sub-contractors. In all, 58 indicators are assessed in this manner, shown in Tables 8.5 (contractors) and 8.6.(sub-contractors).

		Score
Standard deviation:	less than 3 months	100
	more than 3 months, but less than 6 months	75
	more than 6 months, but less than 9 months	50
	more than 9 months.	25

Table 8.5

Qualitative time series: Turning points of SA Reserve Bank sectoral reference cycle and turning points and leads(-)/lags(+) of building contractors and developers in months

SA Reserve Bank sectoral reference cycle

TROUGHS		PEAKS	
Year	**Months**	**Year**	**Month**
		1970	12
1972	12	1974	9
1978	10	1982	8
1983	1	1983	11
1987	4	1989	1

Qualitative time series of building contractors and developers

	TROUGHS	Leads(-) or lags (+)		PEAKS	Leads(-) or lags (+)
BCD1: Value of work done during survey quarter compared to a year ago: Estimated					
1973	6	+6	1974	9	0
1987	3	-7	1980	12	-20
1983	9	+8	1984	3	+4
1986	3	-13	1988	3	-10
Median lead		-0,5	Median lead		-5
			All turns		-3,5
Standard deviation		8,79	Standard deviation		8,35

Table 8.5 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BCD2: Value of work done during survey quarter, compared to a year ago: Expected					
1972	12	0	1973	12	-9
1977	9	-13	1980	12	-20
1982	12	-1	1983	12	+1
1985	3	-25	1988	3	-10
1988	12	-	1989	6	-
Median lead		-7	Median lead		-9,5
			All turns		-9,5
Standard deviation		10,18	Standard deviation		7,43

BCD3: Volume of work done compared to a year ago: Estimated					
1983	9	+8	1984	6	+7
1985	6	-22			
Median lead		-7	Median lag		+7
			All turns		+7
Standard deviation		15,0			

BCD4: Volume of work done compared to a year ago: Expected					
1985	9	-19	1984	6	+7
			1989	9	+8
Median lead		-19	Median lag		+7,5
			All turns		+7,0
			Standard deviation		0,5

Table 8.5 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BCD5: Value of work done compared to previous quarter: Estimated					
			1971	12	+12
1973	3	+3	1973	12	-9
1978	3	-7	1981	6	-14
1986	6	-10	1988	6	-7
Median lead		-7	Median lead		-8
			All turns		-7
Standard deviation		5,56	Standard deviation		9,86

BCD6: Volume of work done compared to previous quarter: Expected					
1982	6	-7	1983	12	+1
1985	3	-25	1987	6	-19
Median lead		-16	Median lead		-9
			All turns		-13
Standard deviation		9,0	Standard deviation		10,0

BCD7: Volume of work done compared to previous quarter: Estimated					
			1971	12	+12
1973	3	+3	1973	12	-9
1978	3	-7	1981	6	-14
1985	6	-22	1988	6	-7
Median lead		-7	Median lead		-8
			All turns		-7
Standard deviation		10,27	Standard deviation		9,86

Table 8.5 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BCD8: Volume of work done compared to previous quarter: Expected					
1982	6	-7	1983	12	+1
1985	3	-25	1987	6	-19
Median lead		-16	Median lead		-9
			All turns		-13
Standard deviation		9,00	Standard deviation		9,00
BCD9: Competition in tendering (inverted)					
1972	12	0			
1977	3	-19	1974	3	-6
1982	9	-4	1981	3	-17
1985	3	-25	1984	3	+4
			1988	6	-7
Median lead		-3	Median lead		-6,5
			All turns		-5
Standard deviation		10,32	Standard deviation		7,43
BCD10: Labour shortages: Artisans					
1972	6	-6	1974	3	-6
1977	3	-19	1981	12	-8
1983	6	+5	1984	3	+4
1986	9	-7	1988	9	-4
Median lead		-6,5	Median lead		-5
			All turns		-6
Standard deviation		8,50	Standard deviation		4,56

Table 8.5 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BCD11: Labour shortages: Foremen					
1972	9	-3	1974	3	-6
1977	3	-19	1978	9	-
1979	3	-	1981	12	-8
1983	3	+2	1984	3	+4
1986	9	-7	1988	9	-4
Median lead		-5	Median lead		-5
			All turns		-5
Standard deviation		7,76	Standard deviation		4,56

BCD12: Labour shortages: Blacks					
			1972	3	+15
1973	6	+6	1974	3	-6
1978	3	-7	1980	12	-20
1983	9	+8	1984	3	+4
1986	12	-4			
Median lag		+2	Median lead		-2
			All turns		0
Standard deviation		6,38	Standard deviation		12,89

BCD13: Labour shortages: "Other"					
			1981	6	-14
1983	9	+8	1984	3	+4
1986	12	-4			
Median lag		+4	Median lead		-5
			All turns		0
Standard deviation		6,0	Standard deviation		9,0

Table 8.5 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BCD14: Materials shortages					
1972	9	-3	1973	12	-9
1978	3	-7	1981	3	-17
1983	3	+2	1983	12	+1
1986	9	-7	1988	9	-4
Median lead		-5	Median lead		-6,5
			All turns		-5,5
Standard deviation		3,7	Standard deviation		6,65

BCD15: Inadequate finance facilities (inverted)					
1972	3	-9			
1975	6	-	1973	6	-15
1976	9	-25	1975	12	-
1982	9	-4	1979	12	-32
1985	3	-25	1983	3	-8
1989	6	-	1987	12	-13
Median lead		-17	Median lead		-14
			All turns		-14
Standard deviation		9,42	Standard deviation		9,03

BCD16: Constraints: Cost of finance					
			1982	9	+1
1986	6	-7	1985	3	+16
Median lead		-7	Median lag		+8,5
			All turns		+1
			Standard deviation		7,50

Table 8.5 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BCD17: Constraints: Insufficient demand for building (inverted)					
1982	12	-1			
1986	6	-7	1983	12	+1
Median lead		-4	Median lag		+1
			All turns		+1
Standard deviation		3,00			

BCD18: Unsatisfactory materials supplies: Stock bricks					
1972	6	-6	1973	12	-9
1977	3	-19	1978	6	-
1979	6	-	1980	12	-20
1983	3	+2	1983	12	+1
1986	6	-7	1988	9	-4
Median lead		-6,5	Median lead		-6,5
			All turns		-6,5
Standard deviation		7,5	Standard deviation		7,78

BCD19: Unsatisfactory materials supplies: Face bricks					
1972	12	0	1973	12	-9
1977	6	-16	1980	12	-20
1983	3	+2	1983	9	-2
1986	6	-7	1988	9	-4
Median lead		-3,5	Median lead		-6,5
			All turns		-5,5
Standard deviation		7,05	Standard deviation		6,98

Table 8.5 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BCD20: Unsatisfactory materials supplies: Cement					
			1971	9	+9
1972	9	-3	1973	12	-9
1978	1	-9	1978	6	-
1979	7	-	1981	9	-11
1982	9	-4	1983	6	-5
1985	3	-25	1986	9	-
1987	12	-	1988	9	-4
1989	3	-			
Median lead		-6,5	Median lead		-5
			All turns		-5
Standard deviation		8,81	Standard deviation		6,99

BCD21: Unsatisfactory materials supplies: Steel reinforcing					
1973	3	+3	1975	3	+6
1979	1	+3	1979	12	-
1980	9	-	1981	6	-14
1982	12	-1	1984	9	+10
1985	6	-22			
Median lead		-1	Median lag		+6
			All turns		+3
Standard deviation		10,57	Standard deviation		10,5

Table 8.5 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BCD22: Unsatisfactory materials supplies: Timber					
			1971	9	+9
1972	12	0	1974	9	0
1977	9	-13	1981	3	-17
1982	9	-4	1983	12	+1
Median lead		-4	Median lag		+0,5
			All turns		0
Standard deviation		5,44	Standard deviation		9,57

BCD23: Unsatisfactory materials suppliers: Glass					
			1971	9	+9
1972	12	0	1974	3	-6
1976	3	-	1977	12	-
1978	12	+2	1980	12	-20
1982	9	-4	1983	12	+1
1984	9	-			
Median lead/lag		0	Median lead		-2,5
			All turns		0
Standard deviation		2,49	Standard deviation		10,7

BCD24: Unsatisfactory materials supplies: Roofing materials					
1972	9	-3	1974	6	-3
1979	3	+5	1979	9	-
1980	6	-	1981	9	-11
1982	9	+4	1984	3	+4
Median lag		+4	Median lead		-3
			All turns		+4
Standard deviation		3,2	Standard deviation		6,1

Table 8.5 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BCD25: Unsatisfactory materials supplies: Plumbing materials					
1972	9	-3	1973	12	-9
1978	6	-4	1981	3	-17
1987	6	+2	1988	6	-7
Median lead		-3	Median lead		-9
			All turns		-5,5
Standard deviation		2,62	Standard deviation		4,32

BCD26: Unsatisfactory materials supplies: Other					
1973	6	+6	1974	9	0
1975	3	-	1976	7	-
1978	2	-8	1980	12	-20
Median lead		-1	Median lead		-10
			All turns		-4
Standard deviation		7,0	Standard deviation		10,0

BCD27: Prevailing business conditions: Satisfactory					
1972	3	-9	1974	6	-3
1977	12	-10	1981	12	-20
1982	12	-1	1983	12	+1
1986	9	-7	1989	12	+11
Median lead		-8	Median lead		-1
			All turns		-5
Standard deviation		3,49	Standard deviation		11,19

Table 8.5 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BCD28: Prevailing business conditions compared to a year ago					
			1971	6	+6
1972	3	-9	1973	12	-9
1977	6	-16	1980	12	-20
1982	12	-1	1983	12	+1
1985	3	-25	1988	3	-10
Median lead		-12,5	Median lead		-9
			All turns		-9
Standard deviation		8,84	Standard deviation		9,09

BCD29: Business conditions expected in coming quarter compared to a year ago					
1982	9	-4	1983	12	+1
1985	3	-25			
Median lead		-14,5	Median lag		+1
			All turns		-4
Standard deviation		10,5			

Table 8.6

Qualitative time series: Turning points of SA Reserve Bank sectoral reference cycle and turning points and leads(-)/lags(+) of sub-contractors in months

SA Reserve Bank sectoral reference cycle

TROUGHS		PEAKS	
Year	Months	Year	Month
		1970	12
1972	12	1974	9
1978	10	1982	8
1983	1	1983	11
1987	4	1989	1

Qualitative time series of sub-contractors

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC1: Value of work done compared to a year ago: Estimated					
1972	6	-6	1974	6	-3
1977	6	-16	1980	12	-20
1982	9	-4	1983	12	+1
1985	12	-16	1988	9	-4
Median lead		-11	Median lead		-3,5
			All turns		-4
Standard deviation		5,55	Standard deviation		8,02

Table 8.6 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC2: Value of work done compared to a year ago: Expected					
			1974	9	0
1977	3	-19	1980	12	-20
1982	12	-1	1984	3	+4
1986	9	-7	1987	6	-19
Median lead		-7	Median lead		-8,5
			All turns		-7
Standard deviation		7,48	Standard deviation		10,85

SBC3: Volume of work done compared to a year ago: Estimated					
1983	6	+5	1983	12	+1
Median lag		+5	Median lag		+1
			All turns		+3

SBC4: Volume of work done compared to a year ago: Expected					
1982	9	-4	1983	12	+1
1984	12	-28			
Median lead		-16	Median lag		+1
			All turns		-4
Standard deviation		12,0			

Table 8.6 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC5: Value of work done compared to previous quarter: Estimated					
			1971	9	+9
1972	12	0	1973	9	-12
1977	3	-19	1979	12	-32
1983	3	+2	1983	12	+1
1985	12	-16			
Median lead		-8	Median lead		-5,5
			All turns		-6
Standard deviation		12,46	Standard deviation		15,5

SBC6: Volume of work done compared to previous quarter: Expected					
1982	12	-1	1984	3	+4
1985	12	-16	1987	6	-19
Median lead		-8,5	Median lead		-7,5
			All turns		-8,5
Standard deviation		7,5	Standard deviation		11,5

SBC7: Volume of work done compared to previous quarter: Estimated					
			1971	9	-9
1973	3	+3	1973	9	-12
1977	3	-19	1979	12	-32
1983	3	+2	1983	12	+1
1985	12	-16	1988	9	-4
Median lead		-7	Median lead		-4
			All turns		-4
Standard deviation		10,06	Standard deviation		11,3

Table 8.6 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC8: Volume of work done compared to previous quarter: Expected					
1982	12	-1	1984	3	+4
1984	12	-28	1987	6	-19
Median lead		-14,5	Median lead		-7,5
			All turns		-10
Standard deviation		13,5	Standard deviation		11,5

SBC9: Competition in tendering (inverted)					
1973	3	+3	1974	3	-6
1977	6	-16	1981	3	-17
1982	9	-4	1984	3	+4
1986	12	-4	1988	12	-1
Median lead		-4	Median lead		-3,5
			All turns		-4
Standard deviation		6,83	Standard deviation		7,78

SBC10: Labour shortages: Artisans					
			1971	9	+9
1972	12	0	1974	6	-3
1977	9	-13	1981	9	-11
1983	3	+2	1983	12	+1
1986	3	-13	1989	12	-1
Median lead		-6,5	Median lead		-1
			All turns		-1
Standard deviation		7,04	Standard deviation		6,45

Table 8.6 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC11: Labour shortages: Foremen					
			1971	9	+9
1973	3	+3	1973	12	-9
1977	9	-13	1981	9	-11
1982	9	-4	1983	12	+1
1986	9	-19	1988	9	-4
Median lead		-8,5	Median lead		-4
			All turns		-4
Standard deviation		8,41	Standard deviation		7,22

SBC12: Labour shortages: Blacks					
1973	3	+3	1974	9	0
1978	6	-4	1979	9	-
1980	3	-	1981	9	-11
1982	9	-4	1984	6	-5
1986	9	-7	1987	3	-20
Median lead		-4	Median lead		-11
			All turns		-4
Standard deviation		3,67	Standard deviation		7,45

SBC13: Labour shortages: "Other"					
			1981	9	-11
1983	3	+2	1984	3	+4
1986	9	-7	1988	6	-7
Median lead		-2,4	Median lead		-7
			All turns		-7
Standard deviation		4,5	Standard deviation		6,34

Table 8.6 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC14: Shortages: Building materials					
			1974	12	+3
1977	9	-13	1978	3	-
1978	12	-	1981	9	-11
1983	3	+2	1984	3	+4
1986	6	-10	1989	3	+2
Median lead		-10	Median lag		+2,5
			All turns		+2
Standard deviation		6,48	Standard deviation		6,1

SBC15: Inadequate finance facilities (inverted)					
1971	9	-15			
1975	3	-	1973	6	-15
1977	9	-13	1976	3	-
1985	6	-22	1979	12	-32
1987	3	-	1986	3	-
1989	3	-	1988	6	-7
Median lead		-15	Median lead		-15
			All turns		-14
Standard deviation		3,86	Standard deviation		10,42

SBC16: Constraints: Cost of finance					
			1982	12	+4
1983	6	+5	1985	6	+19
1986	9	-7	1987	3	-22
Median lead		-1	Median lag		+4
			All turns		+4
Standard deviation		6,0	Standard deviation		16,94

Table 8.6 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC17: Constraints: Insufficient demand for building (inverted)					
1983	6	+5	1984	3	+4
1985	12	-16			
Median lead		-5,5	Median lag		+4
			All turns		+4
Standard deviation		10,5			

SBC18: Unsatisfactory supplies of materials: Stock bricks					
1982	12	-1	1982	6	-2
1985	9	-	1983	12	+1
1987	6	+2	1986	9	-
Median lag		+0,5	Median lead		-0,5
			All turns		0
Standard deviation		1,5	Standard deviation		1,5

SBC19: Unsatisfactory materials supplies: Face bricks					
1982	12	-1	1983	9	-2
1987	6	+2			
Median lag		+0,5	Median lead		-2
			All turns		-1
Standard deviation		1,5			

Table 8.6 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC20: Unsatisfactory materials supplies: Cement					
			1981	12	-8
1983	3	+2	1983	9	-2
Median lag		+2	Median lead		-5
			All turns		-2
			Standard deviation		3,0

SBC21: Unsatisfactory materials supplies: Steel reinforcing					
			1981	9	-11
1983	3	+2	1983	6	-5
Median lag		+2	Median lead		-8
			All turns		-5
			Standard deviation		3,0

SBC22: Unsatisfactory materials supplies: Timber					
			1981	9	-11
1983	4	+3	1984	12	+13
Median lag		+3	Median lead		-1
			All turns		+3
			Standard deviation		12

Table 8.6 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC23: Unsatisfactory materials suppliers: Glass					
			1981	9	-11
1982	7	-6	1983	6	-5
Median lead		-6	Median lead		-8
			All turns		-6
			Standard deviation		3,0

SBC24: Unsatisfactory materials supplies: Roofing materials					
			1981	12	-8
1984	6	+17	1984	12	+13
Median lag		+17	Median lag		+2,5
			All turns		+13
			Standard deviation		10,5

SBC25: Unsatisfactory materials supplies: Plumbing materials					
1981	6	+5	1982	3	-5
1983	3	+2	1984	6	+7
Median lag		+3,5	Median lag		+1
			All turns		+3,5
Standard deviation		1,5	Standard deviation		6,0

Table 8.6 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC26: Unsatisfactory materials supplies: Other					
			1981	9	-11
1982	10	-3	1983	12	+1
Median lead		-3	Median lead		-5
			All turns		-3
			Standard deviation		6

SBC27: Prevailing business conditions: Satisfactory					
1972	6	-6	1973	9	-12
1977	9	-13	1980	9	-23
1986	3	-13	1988	3	-10
1989	3	-	1989	12	-
Median lead		-13	Median lead		-12
			All turns		-12,5
Standard deviation		3,3	Standard deviation		5,72

SBC28: Prevailing business conditions compared to a year ago					
			1973	9	-12
1976	9	-25	1980	12	-20
1983	3	+2	1984	3	+4
1985	6	-22	1988	3	-10
Median lead		-22	Median lead		-11
			All turns		-12
Standard deviation		12,08	Standard deviation		8,65

Table 8.6 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
SBC29: Business conditions expected in coming quarter compared to a year ago					
1982	12	-1	1984	3	+4
1984	12	-27			
Median lead		-14	Median lag		+4
			All turns		-1
Standard deviation		13			

In summarising the major results of Tables 8.5 and 8.6 it is interesting to note that many of the individual time series record median leads of between three and nine months. This applies to both contractors (Table 8.5) and sub-contractors (Table 8.6). However, the median leads of some series are longer than others. For instance, the median lead of the value of work done by contractors during the survey quarter, compared to the previous quarter (BCD 6), is 16 months at troughs and 13 months at all turns. Similarly in the case of BCD 8, i.e. the volume of work expected to be done by contractors during the coming quarter, compared to the previous quarter.

The median leads of inadequate finance facilities (BCD 15) are 17 months at troughs and 14 months at peaks. Comparison with data for sub-contractors yield median leads for inadequate finance facilities (SBC 15) of 15 months at troughs and peaks. Current business conditions prevailing amongst sub-contractors, compared to a year ago (SBC 28), record median leads of 22 months at troughs and 11 months at peaks. By contrast, the median lags of unsatisfactory supplies of roofing materials experienced by contractors (BCD 24), and by sub-contractors (SBC 24), are significant and vary between 4 months and 17 months respectively.

To facilitate comparisons and to identify outliers readily, the medians of leads and lags at troughs, peaks and at all turns are again summarised in the summary scoring tables, i.e. Table 8.12 (contractors) and Table 8.13 (sub-contractors).

8.5.4.4 Performance scoring: Probability and dispersion

In determining the timing score of an indicator Zarnowitz and Boschan consider two aspects. Firstly, they establish the probability that the observed number of timing comparisons of a given type will be equalled or exceeded by chance. This probability measure carries a weight of 80% of the timing component. Secondly, the dispersion of the leads and lags about their mean is accorded a weight of 20% in the timing performance score. The dispersion scores are based on the values of the standard deviations of leads and lags. They find that the standard deviations of leads tend to be much larger at peaks than at troughs. Reference to Tables 8.5 and 8.6 shows that this is also generally the case in the current study.

8.5.4.4.1 Probability scoring

To determine the probabilities that correspond to the observed timing records of the individual indicators Zarnowitz and Boschan (1975a:173) apply cumulative binomial distribution. An additional assumption is that the results in successive cycles are independent. Therefore, the high relative frequency of leads at business downturns, when coupled with the high probability that such leads are due to chance, means that a series must have a highly consistent record of early timing to qualify as a leader at peaks.

In applying these principles to the current investigation a matrix can be drawn up that reflects the estimated probability of turning points occurring by chance. Three non-overlapping categories are used. Refer to Table 8.7.

Table 8.7

Qualitative time series and timing of turning points: Probability distribution of variables into leading, coincident or lagging indicators

	Respondents	Leading	Coincident	Lagging	Total turning points identified
PEAKS	Contractors	60	3	32	
	Sub-contractors	50	2	28	
	Sub-total	110	5	60	175
	Estimated probability	110/175 = 0,63	5/175 = 0,03	60/175 = 0,34	
TROUGHS	Contractors	65	5	23	
	Sub-contractors	46	2	21	
	Sub-total	111	7	44	162
	Estimated probability	111/162 = 0,69	7/162 = 0,04	44/162 = 0,27	

According to Glass and Stanley (1970:208) the binomial distribution has many important uses in theoretical and applied statistics. The expression

$$probability(n_1) = \binom{n}{n_1} p^{n_1} q^{n-n_1}$$

is the formula for the binomial distribution where p is the probability of a turning point occurring due to chance and q is the probability of a turning point not occurring due to chance, which equals 1-p, and $n_1 = 0,1,2\ldots, n$.

It is assumed that these "binomial trials" are independent of one another.

Table 8.8 provides, for contractors and sub-contractors, the probability of turning points of the qualitative time series not occurring due to chance (1-p), together with the scores awarded according to the following scoring system:

Table 8.8

Qualitative time series: Probability scores of turning points not occurring due to chance

Contractors							Sub-contractors						
	Peaks (Estimated) p=0,63			Troughs p=0,69				Peaks (Estimated) p=0,63			Troughs p=0,69		
Time series	Turning points	1-p	Score	Turning points	1-p	Score	Time series	Turning points	1-p	Score	Turning points	1-p	Score
BCD 1	4/5	0,609	25	4/4	0,773	50	SBC 1	4/5	0,609	25	4/4	0,773	50
BCD 2	5/5	0,901	100	4/4	0,773	50	SBC 2	4/5	0,609	25	3/4	0,366	0
BCD 3	1/2	0,137	0	2/2	0,524	0	SBC 3	1/2	0,137	0	1/2	0,096	0
BCD 4	2/2	0,603	25	1/2	0,096	0	SBC 4	1/2	0,137	0	2/2	0,524	0
BCD 5	4/5	0,609	25	3/4	0,366	0	SBC 5	4/5	0,609	25	4/4	0,773	50
BCD 6	2/2	0,603	25	2/2	0,524	0	SBC 6	2/2	0,603	25	2/2	0,524	0
BCD 7	4/5	0,609	25	3/4	0,366	0	SBC 7	5/5	0,901	100	4/4	0,773	50
BCD 8	2/2	0,603	25	2/2	0,524	0	SBC 8	2/2	0,603	25	2/2	0,524	0
BCD 9	4/5	0,609	25	4/4	0,773	50	SBC 9	4/5	0,609	25	4/4	0,773	50
BCD 10	4/5	0,609	25	4/4	0,773	50	SBC 10	5/5	0,901	100	4/4	0,773	50
BCD 11	5/5	0,901	100	4/4	0,773	50	SBC 11	5/5	0,901	100	4/4	0,773	50
BCD 12	Discontinued			Discontinued			SBC 12	Discontinued			Discontinued		
BCD 13	Discontinued			Discontinued			SBC 13	Discontinued			Discontinued		
BCD 14	4/5	0,609	25	4/4	0,773	50	SBC 14	4/4	0,901	100	4/4	0,773	50
BCD 15	5/5	0,901	100	4/4	0,773	50	SBC 15	5/5	0,901	100	4/4	0,773	50

Table 8.8 (continued)

BCD 16	2/2	0,603	25	1/2	0,096	0	SBC 16	2/2	0,603	25	2/2	0,524	0
BCD 17	1/2	0,137	0	2/2	0,524	0	SBC 17	1/2	0,137	0	2/2	0,524	0
BCD 18	5/5	0,901	100	4/4	0,773	50	SBC 18	2/2	0,603	25	2/2	0,524	0
BCD 19	4/5	0,609	25	4/4	0,773	50	SBC 19	1/2	0,137	0	2/2	0,524	0
BCD 20	5/5	0,901	100	4/4	0,773	50	SBC 20	2/2	0,603	25	1/2	0,096	0
BCD 21	Discontinued			Discontinued			SBC 21	Discontinued			Discontinued		
BCD 22	Discontinued			Discontinued			SBC 22	Discontinued			Discontinued		
BCD 23	Discontinued			Discontinued			SBC 23	Discontinued			Discontinued		
BCD 24	Discontinued			Discontinued			SBC 24	Discontinued			Discontinued		
BCD 25	3/5	0,267	0	3/4	0,366	0	SBC 25	2/2	0,603	25	2/2	0,524	0
BCD 26	Discontinued			Discontinued			SBC 26	Discontinued			Discontinued		
BCD 27	4/5	0,609	25	4/4	0,773	50	SBC 27	4/5	0,609	25	4/4	0,773	50
BCD 28	5/5	0,901	100	4/4	0,773	50	SBC 28	4/5	0,609	25	3/4	0,366	0
BCD 29	1/2	0,137	0	2/2	0,524	0	SBC 29	1/2	0,137	0	2/2	0,524	0

(1-p)	**Score**
>0,9	100
>0,8 <0,9	75
>0,7 <0,8	50
>0,6 <0,7	25
>0,5 <0,6	0

8.5.4.4.2 **Dispersion**

Twenty percent of the timing score is allocated to the dispersion of leads and lags about their mean. Tables 8.5 and 8.6 provide the median leads and lags, as well as the standard deviations of these leads and lags in months.

It was considered appropriate to allocate timing scores for dispersion according to four intervals.

		Score
Standard deviation:	less than 3 months	100
	more than 3 months, but less than 6 months	75
	more than 6 months, but less than 9 months	50
	more than 9 months.	25

8.5.5 **Conformity to historical cycles**

Zarnowitz and Boschan (1975a:173) stated that how well a series has conformed can be measured by relating the number of business (or building) cycle phases that are matched by the specific-cycle movements to the total number of phases covered. In the context of this study it implies that an indicator that matches all nine cyclical turning points identified in the SARB sectoral reference cycle during the period 1970 to 1990 (refer Section 8.4), would be accorded a high score. Should an indicator match, say, seven cyclical turning points, a much lower score would arise. However, it should also be kept in mind that not all indicators analysed in this study are available for the full two decades. Therefore, scoring takes into account the period for which each survey indicator is available, as well as the number of turning points identified in the reference cycle during the equivalent time span. This information is given in Table 8.10.

Zarnowitz and Boschan (1975a:173) mention two other aspects of cyclical conformity. One deals with the number of "extra turns" of specific cycles that do not match turning points identified in the reference cycle. The other takes account of the amplitude of cyclical fluctuations in the survey indicators. The number of extra turns of survey indicators are determined and scores are awarded according to those in Table 8.10.

Zarnowitz and Boschan (1975a:173) derive their amplitude measure by computing the percentage change between the peak and trough values of the time series at successive reference dates and dividing the results by the durations of the corresponding phases. It is known that the survey indicators are already cast in a form that is the equivalent of first-order differences. Therefore, it would not be economically meaningful to calculate percentage changes. Consequently, no amplitude scores were allocated in this study.

Zarnowitz and Boschan (1975a:173) allocated scores as follows: probability score, maximum 50 points; extra turns score, maximum 30 points; and amplitude score, maximum 20 points. As a result of the fact that amplitude scores are not allocated to survey data in this study, the conformity scores are reapportioned as follows:

Table 8.9

Maximum scores for conformity criteria reapportioned

	Zarnowitz and Boschan (1975a)	Current study (1994)
Probability score	50	62,5
Extra turns score	30	37,5
Amplitude score	20	-

Given the above re-assessment of the scores for the conformity criteria, Table 8.10 can be composed to reflect the revised scores for the probability measure and those for extra turns (also known as "in-between cycles" or "false signals").

Table 8.10

Revised scores for probability measure and those for extra turns

A. PROBABILITY SCORES	**Maximum 62,5**
Survey indicators available for period 1970:4 to 1990:2	
9 out of 9 turns	62,50
8 out of 9 turns (8/9 x 62,5)	55,56
7 out of 9 turns (7/9 x 62,5)	48,61
6 out of 9 turns (6/9 x 62,5)	41,67
5 out of 9 turns (5/9 x 62,5)	34,72
Survey indicators available for period 1970:4 to 1985:4	
7 out of 7 turns	62,50
6 out of 7 turns (6/7 x 62,5)	53,57
5 out of 7 turns (5/7 x 62,5)	44,64
4 out of 7 turns (4/7 x 62,5)	35,71
Survey indicators available for period 1980:2 to 1990:2	
5 out of 5 turns	62,50
4 out of 5 turns (4/5 x 62,5)	50,00
3 out of 5 turns (3/5 x 62,5)	37,50
2 out of 5 turns (2/5 x 62,5)	25,00
Survey indicators available for period 1980:2 to 1985:4	
3 out of 3 turns	62,50
2 out of 3 turns (2/3 x 62,5)	41,67
1 out of 3 turns (1/3 x 62,5)	20,83
B. EXTRA TURNS SCORE (or "false signals")	**Maximum 37,5**
No extra turns	37,50
1 extra turn	31,50
2 extra turns	25,00
3 extra turns	18,75
4 extra turns	12,50
5 extra turns	6,25

8.5.6 Smoothness

Zarnowitz and Boschan (1975a:173) stated that: "An indicator with a good performance record on cyclical conformity and timing may, nevertheless, be of little value for current business cycle analysis and forecasting if its cyclical movements are obscured by large erratic variations. Indeed, insufficient smoothness is the main defect in many indicators". To determine the random component, one of the options of the Census II computer programme of the U.S. Bureau of the Census, Department of Commerce, was applied. These computations were based on the Census II Decomposition Method as set out in Forecasting Methods and Applications by Makridakis and Wheelwright (1978:106-138). The overall averages of the absolute values of the month-on-previous month changes are given in the Scoring Tables 8.12 and 8.13.

The irregular component was scored as follows:

		Score
Irregularity:	less than 5%	100
	more than 5%, but less than 10%	75
	more than 10%, but less than 15%	50
	more than 15%	25

8.5.7 Revised weighting system

The NBER weighting system is based on the six criteria discussed in Section 8.2. The selection criteria applicable in this investigation are reduced to three by virtue of the special nature of the Konjunkturtest survey data. It is appropriate therefore to revise the weighting system, as all weights must add to 100. Table 8.11 provides the adjusted weights.

Table 8.11

Revised weighting system for qualitative survey indicators

Criteria	NBER weights	NBER methodology applied to qualitative survey indicators
1. Economic significance	16,7	-
2. Statistical adequacy	16,7	-
3. Timing	26,7	47,09
4. Conformity	13,3	29,45
5. Smoothness	10,0	23,46
6. Currency		-
	100,1*	100,0

* The weights do not add up exactly to 100 because of rounding.

The summary scores are given in Table 8.12 (contractors) and Table 8.13 (sub-contractors).

Table 8.12

Summary scoring tables: Qualitative data

Application of three NBER scoring criteria to BER business survey data of building contractors and developers

Building contractors and developers		1. TIMING													
Series codes (date from when available)	Variables	Median leads (-) or lags (+) in months			Probability scores				Standard deviations		Scores for dispersion				Weighted Scores for timing criteria
					at troughs		at peaks								
		at troughs	at peaks	at all turns	Scores	Sub-total	Scores	Sub-total	at troughs	at peaks	Scores at troughs	Weighted scores at troughs	Scores at peaks	Weighted scores at peaks	Sub-Total
	Weights ....→ Sub-weights ....→				18,836		18,836					4,709		4,709	47,09
BCD1 (70:4)	Value of work done during survey quarter, compared to a year ago: Estimated	-0,5	-5	-3,5	50	941,8	25	470,9	8,79	8,35	50	235,450	50	235,45	1883,6
BCD2 (70:4)	Value of work done during survey quarter, compared to a year ago: Expected	-7	-9,5	-9,5	50	941,8	100	1883,6	10,18	7,43	25	117,725	50	235,45	3178,575
BCD3 (80:2)	Volume of work done during survey quarter, compared to a year ago: Estimated	-7	7	7	0	0	0	0	15,0	0	25	117,725	0	0	117,725
BCD4 (80:2)	Volume of work done during survey quarter, compared to a year ago: Expected	-19	7,5	7	0	0	25	470,9	0	0,5	0	0	100	470,9	941,8
BCD5 (70:4)	Value of work done during survey quarter, compared to previous quarter: Estimated	-7	-8	-7	0	0	25	470,9	5,56	9,86	75	353,175	25	117,725	941,8

Table 8.12 Timing (continued)

BCD6 (80:2)	Value of work done during survey quarter, compared to previous quarter: Expected	-16	-9	-13	0	0	25	470,9	9,0	10,0	25	117,725	25	117,725	706,35
BCD7 (70:4)	Volume of work done during survey quarter, compared to previous quarter: Estimated	-7	-8	-7	0	0	25	470,9	8,2	10,27	25	117,725	100	470,9	1059,525
BCD8 (80:2)	Volume of work done during survey quarter, compared to previous quarter: Expected	-16	-9	-13	0	0	25	470,9	9,0	9,0	25	117,725	25	117,725	706,35
BCD9 (70:4)	Competition in tendering	-3	-6,5	-5	50	941,8	25	470,9	10,32	7,43	25	117,725	50	235,45	1765,875
BCD10 (70:4)	Labour shortages: Artisans	-6,5	-5	-6	50	941,8	25	470,9	8,50	4,56	50	235,45	75	353,175	2001,325
BCD11 (70:4)	Labour shortages: Foremen	-5	-5	-5	50	941,8	100	1883,6	7,76	4,56	50	235,45	75	353,175	3414,025
BCD12 (70:4)	Labour shortages: Blacks	2	-2	0	-	0	-	0	6,38	12,89	50	235,45	25	117,725	353,175
BCD13 (80:2)	Labour shortages: Other	4	-5	0	-	0	-	0	6,0	9,0	50	235,45	25	117,725	353,175
BCD14 (70:4)	Materials shortages	-5	-6,5	-5,5	50	941,8	25	470,9	3,7	6,65	75	353,175	50	235,45	2001,325
BCD15 (70:4)	Inadequate finance facilities (inverted)	-17	-14	-14	50	941,8	100	1883,6	9,42	9,03	25	117,725	25	117,725	3060,85
BCD16 (80:2)	Constraints: Cost of finance	-7	8,5	1	0	0	25	470,9	0	7,50	0	0	50	235,45	706,35
BCD17 (80:2)	Constraints: Insufficient demand for building (inverted)	-4	1	-1	0	0	0	0	3,0	0	75	353,175	0	0	353,175
BCD18 (70:4)	Unsatisfactory materials supplies: Stock bricks	-6,5	-6,5	-6,5	50	941,8	100	1883,6	7,5	7,78	50	235,45	50	235,45	3296,3

Table 8.12 Timing (continued)

BCD19 (70:4)	Unsatisfactory materials supplies: Face bricks	-3,5	-6,5	-5,5	50	941,8	25	470,9	7,05	6,98	50	235,45	50	235,45	1883,6
BCD20 (70:4)	Unsatisfactory materials supplies: Cement	-6,5	-5	-5	50	941,8	100	1883,6	8,81	6,99	50	235,45	50	235,45	3296,3
BCD21 (70:4)	Unsatisfactory materials supplies: Steel reinforcing	-1	6	3	-	0	-	0	10,57	10,5	25	117,725	25	117,725	235,45
BCD22 (70:4)	Unsatisfactory materials supplies: Timber	-4	0,5	0	-	0	-	0	5,44	9,47	75	353,175	25	117,725	2943,125
BCD23 (70:4)	Unsatisfactory materials supplies: Glass	0	-2,5	0	-	0	-	0	2,49	10,7	100	470,9	25	117,725	4120,375
BCD24 (70:4)	Unsatisfactory materials supplies: Roofing materials	4	4	4	-	0	-	0	3,2	6,1	75	353,175	50	235,45	
BCD25 (70:4)	Unsatisfactory materials supplies: Plumbing materials	-3	-9	-5,5	0	0	0	0	2,62	4,32	100	470,9	75	353,175	824,075
BCD26 (70:4)	Unsatisfactory materials supplies: Other	-1	-10	-4	-	0	-	0	7,0	10,0	50	235,45	25	117,725	353,175
BCD27 (70:4)	Prevailing business conditions: Satisfactory	-8	-1	-5	50	941,8	25	470,9	3,49	11,19	75	353,175	25	117,725	1883,6
BCD28 (70:4)	Prevailing business conditions, compared to a year ago	-12,5	-9	-9	50	941,8	100	1883,6	8,84	0,09	50	235,45	25	117,725	3178,575
BCD29 (70:4)	Business conditions, expected in coming quarter, compared to a year ago	-14,5	1	-4	0	0	0	0	10,5	0	25	117,725	0	0	117,725

Table 8.12 Conformity, smoothness (continued)

	2. CONFORMITY				3. SMOOTHNESS			TOTAL	COMMENTS
	Probability score	Extra turns score	Total scores for conformity	Weighted score sub-total	Random component (irregularity) %	Score	Weighted score sub-total	Total weighted scores	
Weights ....→ Sub-weights .....→	62,5	37,5	100,0	29,45			23,46	100,0	
BCD1 (70:4)	55,6	37,5	93,1	2741,795	5,85	75	1759,5	63,85	Selected
BCD2 (70:4)	55,6	25,0	80,6	2373,670	6,76	75	1759,5	73,12	Selected
BCD3 (80:2)	37,5	37,5	75,0	2208,750	5,32	75	1759,5	40,86	Lagging indicator: Discarded
BCD4 (80:2)	37,5	37,5	75,0	2208,750	10,04	50	1173,0	43,24	Lagging indicator: Discarded
BCD5 (70:4)	48,6	37,5	86,1	2535,645	4,11	100	2346,0	58,24	Selected

Table 8.12 Conformity, smoothness (continued)

BCD6 (80:2)	50,0	37,5	87,5	2576,875	6,40	75	1759,5	50,43	Selected
BCD7 (70:4)	48,6	37,5	86,1	2535,645	5,33	75	1759,5	53,55	Selected
BCD8 (80:2)	50,0	37,5	87,5	2576,875	6,15	75	1759,5	50,43	Selected
BCD9 (70:4)	55,6	37,5	93,1	2741,795	4,44	100	2346,0	65,54	Selected
BCD10 (70:4)	55,6	25,0	80,6	2373,670	22,71	25	586,5	46,92	Selected
BCD11 (70:4)	55,6	37,5	93,1	2741,795	24,60	25	586,5	67,42	Selected
BCD12 (70:4)	62,5	37,5	100,0	2945,000	66,88	25	586,5	38,85	Discontinued 88:4
BCD13 (80:2)	62,5	37,5	100,0	2945,000	51,97	25	586,5	38,85	Discontinued 88:4
BCD14 (70:4)	55,6	37,5	93,1	2741,795	11,31	75	1759,5	65,03	Selected
BCD15 (70:4)	55,6	18,75	74,4	2191,080	9,11	100	2346,0	75,98	Selected
BCD16 (80:2)	37,5	37,5	75,0	2208,750	6,59	100	2346,0	52,61	Lagging indicator: Discarded
BCD17 (80:2)	37,5	37,5	75,0	2208,750	6,99	100	2346,0	49,08	Selected
BCD18 (70:4)	55,6	25,0	80,6	2373,670	17,39	50	1173,0	68,43	Selected

Table 8.12 Conformity, smoothness (continued)

BCD19 (70:4)	55,6	37,5	93,1	2741,795	19,08	50	1173,0	57,98	Selected
BCD20 (70:4)	62,5	6,25	68,8	2026,160	48,06	25	586,5	59,09	Selected
BCD21 (70:4)	62,5	25,0	87,5	2576,875	-	-	-	-	Discontinued 85:4
BCD22 (70:4)	62,5	37,5	100,00	2945,000	-	-	-	-	Discontinued 85:4
BCD23 (70:4)	62,5	18,75	81,25	2392,820	-	-	-	-	Discontinued 85:4
BCD24 (70:4)	53,6	25,0	78,6	2314,770	-	-	-	-	Discontinued 85:4
BCD25 (70:4)	41,7	37,5	79,2	2332,470	27,92	25	586,5	37,43	Selected
BCD26 (70:4)	35,7	25,0	60,7	1787,620	-	-	-	-	Discontinued 85:4
BCD27 (70:4)	55,6	37,5	93,1	2741,795	18,29	50	1173,0	57,98	Selected
BCD28 (70:4)	62,5	37,5	100,0	2945,000	21,80	25	586,5	67,10	Selected
BCD29 (70:4)	37,5	37,5	75,0	2208,750	22,64	25	586,5	29,13	Selected

Table 8.13

Summary scoring tables: Qualitative data

Application of three NBER selection criteria to BER survey data of sub-contractors

Sub-contractors		1. TIMING														
Series codes (date from when available)	Variables	Median leads (-) or lags (+) in months			Probability scores				Standard deviations		Scores for dispersion				Weighted scores for timing criteria
					at troughs		at peaks								
		at troughs	at peaks	at all turns	Scores	Sub-total	Scores	Sub-total	at troughs	at peaks	Scores at troughs	Weighted scores at troughs	Scores at peaks	Weighted scores at peaks	Sub-total
	Weights ....→ Sub-weights ....→				18,836		18,836					4,709		4,709	47,09
SBC1 (70:4)	Value of work done during survey quarter, compared to a year ago: Estimated	-11	-3,5	-4	50	941,8	25	470,9	5,55	80,2	75	353,175	50	235,45	2001,325
SBC2 (70:4)	Value of work done during survey quarter, compared to a year ago: Expected	-7	-8,5	-7	0	0	25	470,9	7,48	10,85	25	235,45	25	117,725	824,075
SBC3 (80:2)	Volume of work done during survey quarter, compared to a year ago: Estimated	5	1	3	0	0	0	0	0	0	0	0	0	0	0
SBC4 (80:2)	Volume of work done during survey quarter, compared to a year ago: Expected	-16	1	-4	0	0	0	0	12	0	25	117,725	0	0	117,725
SBC5 (70:4)	Value of work done during survey quarter, compared to previous quarter: Estimated	-8	-5,5	-6	50	941,8	25	470,9	12,46	15,5	25	117,725	25	117,725	1648,15

Table 8.13 Timing (continued)

SBC6 (80:2)	Value of work done during survey quarter, compared to previous quarter: Expected	-8,5	-7,5	-8,5	0	0	25	470,9	7,5	11,5	50	235,45	25	117,725	824,075
SBC7 (70:4)	Volume of work done during survey quarter, compared to previous quarter: Estimated	-7	-4	-4	50	941,8	100	1883,6	10,06	11,3	25	117,725	25	117,725	3060,85
SBC8 (80:2)	Volume of work done during survey quarter, compared to previous quarter: Expected	-14,5	-7,5	-10	0	0	25	470,9	13,50	11,50	25	117,725	25	117,725	706,35
SBC9 (70:4)	Competition in tendering	-4	-3,5	-4	50	941,8	25	470,9	6,83	7,78	50	235,45	50	235,45	1883,6
SBC10 (70:4)	Labour shortages: Artisans	-6,5	-1	-1	50	941,8	100	1883,6	7,04	6,45	50	235,45	50	235,45	3296,3
SBC11 (70:4)	Labour shortages: Foremen	-8,5	-4	-4	50	941,8	100	1883,6	8,41	7,22	50	235,45	50	235,45	3296,3
SBC12 (70:4)	Labour shortages: Blacks	-4	-11	-4	-	0	-	0	3,67	7,45	75	353,175	50	235,45	588,625
SBC13 (80:2)	Labour shortages: Other	-2,5	-7	-7	-	0	-	0	4,5	6,34	75	353,175	50	235,45	588,625
SBC14 (70:4)	Materials shortages	-10	2,5	2	50	941,8	100	1883,6	6,48	6,1	50	235,45	50	235,45	3296,3
SBC15 (70:4)	Inadequate finance facilities (inverted)	-15	-15	-14	50	941,8	100	1883,6	3,86	10,42	75	353,175	25	117,725	3296,3
SBC16 (80:2)	Constraints: Cost of finance	-1	4	4	0	0	25	470,9	6,0	16,94	50	235,45	25	117,725	824,075
SBC17 (80:2)	Constraints: Insufficient demand for building (inverted)	-5,5	4	4	0	0	0	0	10,5	0	25	117,725	0	0	117,725
SBC18 (70:4)	Unsatisfactory materials supplies: Stock bricks	0,5	-0,5	0	0	0	25	470,9	1,5	1,5	100	470,9	100	470,9	1412,7

Table 8.13 Timing (continued)

SBC19 (70:4)	Unsatisfactory materials supplies: Face bricks	0,5	-2	-1	0	0	0	0	1,5	0	100	470,9	0	0	470,9
SBC20 (70:4)	Unsatisfactory materials supplies: Cement	2	-5	-2	0	0	25	470,9	0	3,0	0	0	75	353,175	824,075
SBC21 (70:4)	Unsatisfactory materials supplies: Steel reinforcing	2	-8	-5	-	0	-	0	0	3,0	0	0	75	353,175	353,175
SBC22 (70:4)	Unsatisfactory materials supplies: Timber	3	-1	3	-	0	-	0	0	12,0	0	0	25	117,725	117,725
SBC23 (70:4)	Unsatisfactory materials supplies: Glass	-6	-8	-6	-	0	-	0	0	3,0	0	0	75	353,175	353,175
SBC24 (70:4)	Unsatisfactory materials supplies: Roofing materials	17	2,5	13	-	0	-	0	0	10,5	0	0	25	117,725	117,725
SBC25 (70:4)	Unsatisfactory materials supplies: Plumbing materials	3,5	1	3,5	0	0	25	470,9	1,5	6,0	100	470,9	50	235,45	1177,25
SBC26 (70:4)	Unsatisfactory materials supplies: Other	-3	-5	-3	-	0	-	0	0	6,0	0	0	50	235,45	235,45
SBC27 (70:4)	Prevailing business conditions: Satisfactory	-13	-12	-12,5	50	941,8	25	470,9	3,3	5,72	75	353,175	75	353,175	2119,05
SBC28 (70:4)	Prevailing business conditions, compared to a year ago	-22	-11	-12	0	0	25	470,9	12,08	8,65	25	117,725	50	235,45	824,075
SBC29 (70:4)	Business conditions, expected in coming quarter, compared to a year ago	-14	4	-1	0	0	0	0	13,0	0	25	117,725	0	0	117,725

Table 8.13 Conformity, smoothness (continued)

	2. CONFORMITY				3. SMOOTHNESS			TOTAL	COMMENTS
	Probability score	Extra turns score	Total scores for conformity	Weighted score sub-total	Random component (irregularity) %	Score	Weighted score sub-total	Total weighted scores	
Weights ....→ Sub-weights ......→	62,5	37,5	100,0	29,45			23,46	100,0	
SBC1 (70:4)	55,6	37,5	93,1	2741,795	11,30	75	1759,5	62,03	Selected
SBC2 (70:4)	48,6	37,5	86,1	2535,645	10,52	75	1759,5	51,19	Selected
SBC3 (80:2)	25,0	37,5	62,5	1840,625	9,90	100	2346,0	41,87	Lagging indicator
SBC4 (80:2)	37,5	37,5	75,0	2208,75	11,62	75	1759,5	40,86	Selected
SBC5 (70:4)	55,6	37,5	93,1	2741,795	15,34	50	1173,0	55,63	Selected

Table 8.13 Conformity, smoothness (continued)

SBC6 (80:2)	50,0	37,5	87,5	2576,875	11,49	75	1712,58	51,14	Selected
SBC7 (70:4)	62,5	37,5	100	2945,0	14,61	75	1759,5	77,65	Selected
SBC8 (80:2)	50,0	37,5	87,5	2576,875	9,58	100	2346,0	56,29	Selected
SBC9 (70:4)	55,6	37,5	93,1	2741,795	3,96	100	2346,0	69,71	Selected
SBC10 (70:4)	62,5	37,5	100	2945,0	12,99	75	1759,5	80,00	Selected
SBC11 (70:4)	62,5	37,5	100,1	2945,0	19,16	50	1173,0	74,14	Selected
SBC12 (70:4)	62,5	25,0	187,5	257,875	-	-	-	-	Discontinued 88:4
SBC13 (80:2)	62,5	37,5	100,0	2945,0	-	-	-	-	Discontinued 88:4
SBC14 (70:4)	48,6	25	73,6	2167,52	16,36	50	1173,0	66,37	Lagging indicator
SBC15 (70:4)	41,1	6,25	47,95	1412,128	16,98	50	1173,0	58,81	Selected
SBC16 (80:2)	62,5	37,5	100	2945,0	8,50	75	1759,5	55,29	Lagging indicator
SBC17 (80:2)	37,5	37,5	75,0	2208,75	6,11	75	1759,5	40,86	Lagging indicator
SBC18 (70:4)	50,0	25,0	75,0	2208,75	-	-	-	-	Preponderance of zero's in variable

Table 8.13 Conformity, smoothness (continued)

SBC19 (70:4)	37,5	37,5	75,0	2208,755	-	-	-	-	Preponderance of zero's in variable
SBC20 (70:4)	37,5	37,5	75,0	2208,75	-	-	-	-	Preponderance of zero's in variable
SBC21 (70:4)	62,5	37,5	100,0	2945,0	-	-	-	-	Discontinued 85:4
SBC22 (70:4)	62,5	37,5	100,0	2945,0	-	-	-	-	Discontinued 85:4
SBC23 (70:4)	62,5	37,55	100,0	2945,0	-	-	-	-	Discontinued 85:4
SBC24 (70:4)	62,5	37,5	100,0	2945,0	-	-	-	-	Discontinued 85:4
SBC25 (70:4)	50,0	37,5	87,5	2576,875	18,23	50	1173,0	49,27	Lagging indicator
SBC26 (70:4)	62,5	37,5	100,0	2945,0	-	-	-	-	Discontinued 85:4
SBC27 (70:4)	41,7	25,0	66,7	1964,32	14,1	75	1759,5	58,43	Selected
SBC28 (70:4)	48,6	37,5	86,1	2535,645	12,94	75	1759,5	51,19	Selected
SBC29 (70:4)	37,5	37,5	75,0	2208,75	16,0	50	1173,0	35,0	Selected

8.6 Assessment of composite leading index for the South African building industry based on survey variables

The values of the composite index compiled from 33 survey indicators in this chapter are provided in Table 8.14.

Table 8.14

Index values of composite leading index for the South African building industry devised by applying NBER methodology to BER business survey data (1970:4 to 1990:2)

Quarter	Index	Quarter	Index	Quarter	Index	Quarter	Index
1970:4	49						
1971:1	45	1977:1	20	1983:1	34 (T)	1989:1	47
1971:2	41	1977:2	22	1983:2	40	1989:2	43
1971:3	47	1977:3	19	1983:3	41	1989:3	42
1971:4	40	1977:4	22	1983:4	48 (P)	1989:4	44
1972:1	35	1978:1	19 (T)	1984:1	47	1990:1	39
1972:2	35	1978:2	23	1984:2	43	1990:2	37
1972:3	33	1978:3	25	1984:3	37		
1972:4	31 (T)	1978:4	27	1984:4	28		
1973:1	33	1979:1	23	1985:1	29		
1973:2	37	1979:2	36	1985:2	26		
1973:3	46	1979:3	37	1985:3	27		
1973:4	49 (P)	1979:4	42	1985:4	23 (T)		
1974:1	41	1980:1	36	1986:1	25		
1974:2	50	1980:2	55	1986:2	26		
1974:3	45	1980:3	63	1986:3	25		
1974:4	43	1980:4	68 (P)	1986:4	31		
1975:1	33	1981:1	65	1987:1	41		
1975:2	39	1981:2	66	1987:2	44		
1975:3	36	1981:3	65	1987:3	45		
1975:4	33	1981:4	62	1987:4	54		
1976:1	23	1982:1	51	1988:1	57 (P)		
1976:2	28	1982:2	51	1988:2	55		
1976:3	28	1982:3	38	1988:3	52		
1976:4	25	1982:4	37	1988:4	47		

(T) represents the trough of the cycle (P) represents the peak of the cycle

This cyclical indicator displays the following turning points, when compared with the SARB sectoral reference cycle. Turning points in the sectoral reference cycle are defined as those points at which the diffusion index cuts the neutrality level of 50.

Table 8.15

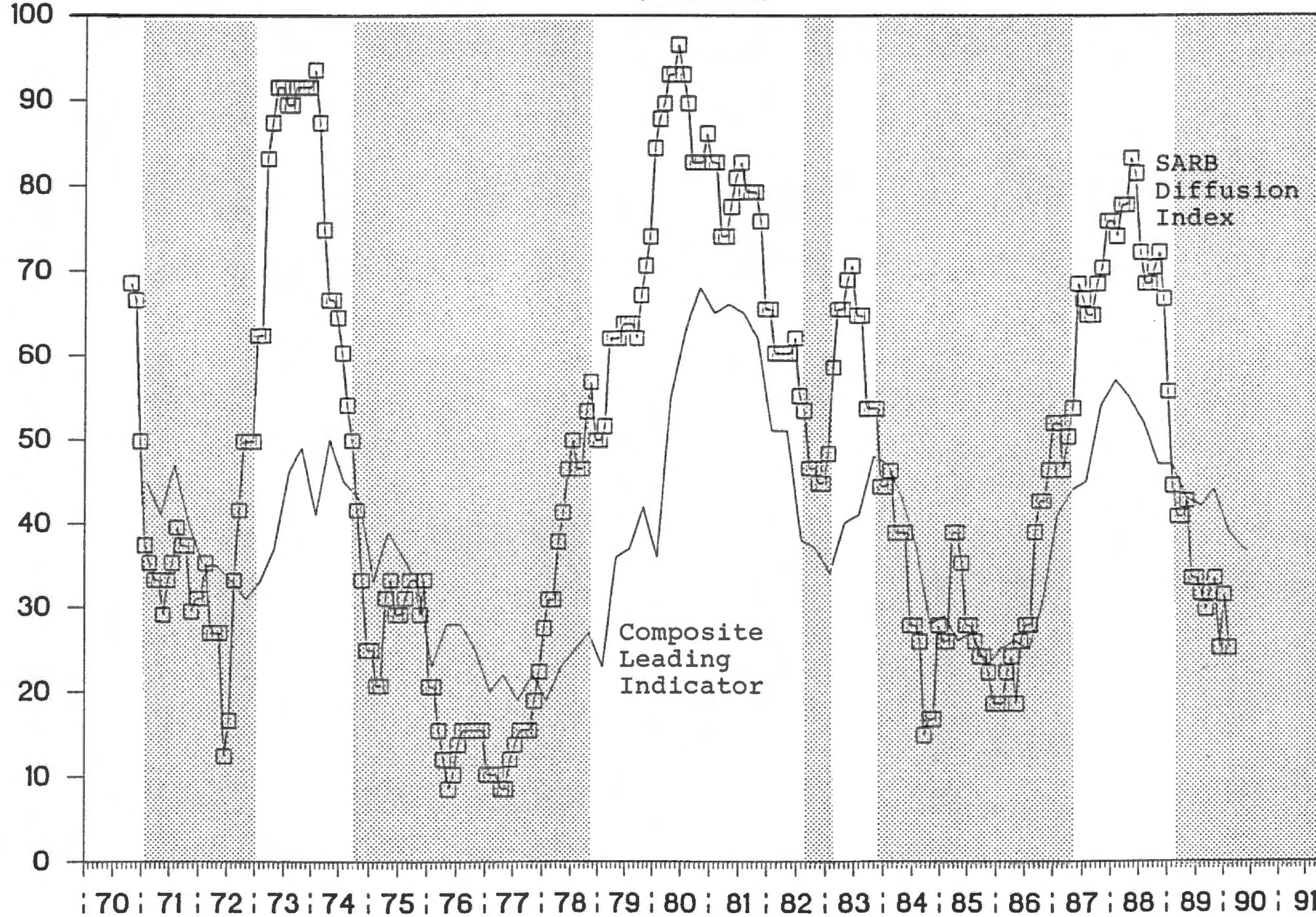
Turning points of qualitative composite leading index and leads or lags when compared to SARB sectoral reference cycle

TROUGHS			PEAKS		
Year	Months	Leads(-) or lags(+) in months	Year	Months	Leads(-) or lags(+) in months
1972	12	0	1973	12	-9
1978	3	-7	1980	12	-20
1983	3	2	1983	12	1
1985	12	-16	1988	3	-10
Median lead		-3,5	Median lead		-9,5
			All turns		-8,0
Standard deviation		7,05	Standard deviation		7,43

Graph 31 depicts the course of the composite leading index for the South African building industry and the sectoral reference cycle that is represented by the SARB historical diffusion index for construction activities. One can observe a number of features. These two indicators generally correspond closely. In the year 1972 the turning points in these two indicators are coincident. In the year 1983 the peak in the composite leading index actually lags the peak in the sectoral reference cycle by one month. If it is kept in mind that the peak in the composite leading index occurred in the fourth quarter of 1983 and that this is taken to mean December, then the middle-month of the fourth quarter is November, i.e. the same month as the peak in the sectoral reference cycle. Therefore, for all practical purposes, one could regard both indicators as being coincident in 1972 and 1983 as well.

Graph 31

SARB HISTORICAL DIFFUSION INDEX OF CONSTRUCTION ACTIVITIES COMPARED TO COMPOSITE LEADING INDICATOR BUILDING INDUSTRY (1970-1990)



At the remaining turning points, the leads and lags of the composite leading index vary from a lead of 20 months to a lag of 2 months. The median lead time at "all turns" is eight months. When assessing upper and lower turning points separately, it is evident that the median lead time is longer in the case of peaks (being nine and a half months) than in the case of troughs (being three and a half months). The maxima of the composite leading index is greater in the case of the 1980 upswing phase than in the upswing phases of 1973/74 and 1988/89. This finding is in keeping with the maxima of the SARB sectoral reference cycle. The minima of the composite leading indicator in the recession of 1977 and 1985 are on a par and greater than the minima recorded in the 1982 recession. This finding is, likewise, in keeping with the minima of the SARB sectoral reference cycle.

The peak in 1973/74 has the shape of the letter "m". This double peak could be attributable to exogenous economic events such as the oil price shock of October 1973 and the gold price rise in 1974. The composite leading index exhibits three inverted "v" shaped peaks, in 1980, 1983 and 1988. The troughs of the composite leading index in 1977 and 1985 resemble the letter "w". This finding suggests that because of uncertainties then prevailing, contractors and sub-contractors were unable to record a clear turnaround the way they did at three out of four peaks. The SARB reference cycle records nine turning points during the period 1970 to 1990, yet the composite leading index only eight. Presumably, had the data been available, the composite leading index would have led the peak in the sectoral reference cycle in the year 1970.

Finally, the composite leading index records the longest leads when the amplitude of the cyclical swings are significant. Observe that in the 1983/84 upswing - that was of limited duration and moderate amplitude - the composite leading index actually lagged, rather than led, the SARB sectoral reference cycle by one month.

8.7 **Summary**

In this chapter two research methods are combined. The quantitative NBER methodology was applied to qualitative Konjunkturtest data emanating from the Bureau for Economic Research, University of Stellenbosch. The objective was to devise a leading indicator for the South African building sector. This was achieved by scoring the survey indicators according to procedures explained in the 1975 revision of the NBER scoring system. The NBER method was briefly explained; the six selection criteria for scoring indicators were discussed; revisions to the system of U.S. leading indicators were analysed; the arguments surrounding "measurement without theory" were considered; the SARB sectoral reference cycle was discussed and, finally, the scoring system was applied to South African business survey indicators. By virtue of the special characteristics and attributes of the Konjunkturtest data, three of the NBER criteria are applied and a leading index for the South African building industry was devised. This indicator was then appraised. It is found that the median lead at troughs is three and a half months and nine and a half months in the case of peaks.

* * * * * * *

Chapter 9

Devising a composite leading indicator for the South African building industry by applying NBER methodology to quantitative time series

9.1 Introduction

The main focus of this study is to devise a composite leading indicator for the South African building industry by means of qualitative business survey data. There are three reasons why the survey data are well suited for this purpose. Firstly, survey data are available approximately two weeks after the end of the survey quarter, i.e. the data are current. Secondly, the data are homogenous in the sense that responses vary between 0 and 100. Consequently, it is a relatively straightforward process to combine individual indicators into a composite index once the NBER scoring system has been applied. Thirdly, included in the set of data are indicators that reflect respondents' expectations during the coming quarter. Although these anticipations need not be fulfilled, the expectations data do provide an early guideline of the trend in certain variables.

It has been argued by Strigel (1981:27) that qualitative data can be gathered and processed sooner than most official quantitative statistics. Yet, it is possible that certain quantitative indicators may have long-leading characteristics so that, even allowing for delays in publication, they may be suitable candidates for inclusion in a composite leading index. The remainder of this section deals with this hypothesis.

Essentially, the aim of this section is to establish whether the lead times of the qualitative leading index can be improved by the inclusion of certain quantitative indicators.

In Section 9.2 a number of quantitative time series are considered that were not selected for further analysis. Reasons are proffered why these data sources are found to be unsuitable. Section 9.3 then identifies and describes eleven quantitative indicators that were selected for further analysis. Section 9.4 provides information on the results yielded by the initial selection. These eleven time series are then scored according to the criteria of the National Bureau of Economic Research, U.S.A. Eight indicators are selected in the final scoring procedure. A composite index that leads turning points of the building cycle is then devised in Section 9.5. This leading indicator is evaluated and results are summarised.

9.2 Quantitative time series not selected for further analysis

A preliminary investigation identified twenty-three economic indicators that are related to the building industry. Twelve of these indicators were not selected for further analysis. Reasons are given in this section why these indicators were discarded. Section 9.3 provides an overview of the remaining eleven indicators included in further analysis.

This section is based on pioneering work undertaken by Martin (1981) and Van der Walt (1982). Each indicator is briefly discussed and reasons given why a particular time series was not included in further analysis.

9.2.1 Building plans passed: Value of non-residential, additions & alterations and total

These time series are published by the Central Statistical Service, Pretoria, on a monthly basis. According to Martin (1981:40) the additions and alterations series coincides rather than leads the business cycle. In the case of the non-residential indicator, Van der Walt (1982:347) classified this time series in the group of series found to have no consistent or corresponding turning points at peaks and troughs of the business cycle. In the case of total building plans passed, Van der Walt (1982:347) included the total of the series in the coinciding indicator he developed.

9.2.2 Buildings completed: Value of residential, non-residential, additions & alterations and total

These series are published by the Central Statistical Service on a monthly basis. In his study Van der Walt (1982:347) included the value of completed dwelling houses and the value of total buildings completed in the lagging indicator he developed. Martin (1981:45-50) found the other components of the buildings completed time series also to be lagging indicators.

9.2.3 Volume of manufacturing production: Bricks and tiles

These time series are published by the Central Statistical Service on a monthly basis. In his analysis Van der Walt (1982:347) included them in the group of indicators found not to have a consistent or corresponding relationship with peaks and troughs of the business cycle.

9.2.4 Value of wholesale sales: Building and construction materials

This time series is published by the Central Statistical Service on a monthly basis. Martin (1981:67) pointed out that the time series has, since 1976, included construction materials in addition to materials used in the building industry. This makes the series less applicable to the building industry. Van der Walt (1982:347) included this time series amongst those found not to have a consistent or corresponding relationship with peaks and troughs of the business cycle.

9.2.5 Building societies: Mortgage bonds granted but not yet paid out

This series is published by the South African Reserve Bank on a monthly basis. In his analysis Van der Walt (1982:348) categorised this time series with those found not to have consistent or corresponding turning points at peaks and troughs of the business cycle.

9.2.6 Employment and hours worked: Construction

These monthly time series are published by the Central Statistical Service. A visual inspection of employment data relating to building workers, provided by Martin (1981:93-96), indicates that these time series lag the business cycle. Similarly, Van der Walt (1982:339) included hours worked by construction workers in the lagging indicator he developed. He also found that the indicator reflecting the number of hours worked is published three to five months after the month of survey which reduces the currency of the time series.

9.2.7 **Index of physical volume of manufacturing production: Cement**

This time series is published by the Central Statistical Service on a monthly basis. Martin (1981:74) pointed out that a large portion of total cement production is used in the civil engineering industry for the construction of bridges, tunnelling and concrete structures, such as dams. It is less applicable to the building industry for this reason. Van der Walt (1982:345) included this time series in the coinciding indicator he developed.

9.2.8 **Cement sales**

This time series (representing 50 kilogram pockets of cement sold) is obtainable from the South African Cement Producers Association, Johannesburg, on a confidential basis. Martin (1981:72-74) pointed out that it is strongly seasonal due to the annual builders' holiday (mid-December to mid-January) and that it does not exhibit a consistent pattern of corresponding turning points with peaks and troughs of the business cycle. It also suffers from the same shortcoming as the index of cement production, viz. that sales of cement are not limited just to the building industry.

9.2.9 **Index of physical volume of mining production: Building materials**

This index is published by the Central Statistical Service on a monthly basis and incorporates building materials, such as flint clay, gypsum, granite, lime and limestone, sandstone, silica and vermiculite. Martin (1981:84) states that the building industry is not the sole user of these materials. This limits the usefulness of the time series for building industry purposes. Van der Walt (1982:346) included this series in the lagging indicator he developed.

9.2.10 **Township developers: Work on hand and work done**

These time series are compiled on a quarterly basis by the Central Statistical Service and are published with a lag of between six and nine months after the date of survey. Consequently, they were not selected for further analysis.

9.2.11 Value of actual and anticipated capital expenditure of the public sector

These time series are published by the Central Statistical Service. Martin (1981:72) pointed out that the data reflect the opinions of heads of government departments and are often subject to overstatement. A breakdown is provided for residential, non-residential buildings and other construction works. However, the data are available on an annual basis only and they were therefore not selected for further analysis.

9.2.12 Gross domestic investment by type of asset: Residential and non-residential buildings

These time series are published on both a quarterly and an annual basis by the South African Reserve Bank. Publication of the quarterly data is usually between three to five months in arrears. Martin (1981:60) expressed certain reservations about these time series because of frequent revisions of the data. Van der Walt (1982:347) included these time series in the lagging indicator he developed.

9.3 An overview of the eleven quantitative time series selected for further analysis

Van der Walt (1982:255-256) pointed out that an investigation of business cycles and leading indicators should be related to various economic processes. The following schedule gives a summary of various economic aspects covered in this study and the eleven time series chosen.

Economic aspects covered	**Indicator**
Representing domestic liquidity	Value of reserves
Building activity-related	Number of dwelling house plans passed
Building activity-related	Value of residential building plans passed
Availability of finance	Value of building loans granted
Cost of finance (credit)	Bankers' acceptance rate

Output prices and keenness of competition in tendering	Annual percentage change of BER building cost index
Tendering environment (i.e. keenness of competition and market conditions)	Average number of tenders received per project
Ratio of output prices to input costs.	Profitability/Productivity measure.

9.3.1 Value of gross gold and foreign reserves held by the SA Reserve Bank

This time series is published by the South African Reserve Bank on a monthly basis. It has a number of attributes, e.g. the early availability of data and the major economic significance thereof. In his analysis of 109 different time series, Van der Walt (1982:345) allocated the highest score to this indicator. He subsequently included this series in the composite leading indicator he developed for the overall South African economy. Van Coller (1980:55) also included this key economic indicator in the composite leading index he developed for the South African economy. Barr (1983:40) included this time series in the leading indicator he developed for the overall economy by means of stepwise regression methods.

It will be recalled that this indicator was used in Chapter 3 of this study as a proxy for domestic liquidity levels. It was emphasised that rising domestic liquidity usually leads to a decrease in interest rates and that investment in buildings (especially housing) is extremely sensitive to interest rate movements. Based upon these theoretical considerations it is appropriate to select gold and foreign reserves for further economic analysis.

The time series was analysed at current prices, as well as in deflated form. In the latter case an index published by the SA Reserve Bank reflecting the real effective exchange rate of the rand was used as a deflator. Although it is customary to analyse the data at current prices only, it was felt that some benefit might result if this indicator were to be deflated. The reason is that South Africa experienced a sharp decline in the trade-weighted exchange rate of the local currency during, especially, 1985/86. It was felt that turning points in the indicator might therefore be affected. Consequently, both these time series were included in the initial selection procedures.

9.3.2 **Building plans passed: Number of dwelling houses**

This time series is published by the Central Statistical Service on a monthly basis. It is usually available two to three months after the month of survey. As it is expressed in terms of number of dwelling units, the series does not need to be deflated. Martin (1981:31) mentions that this time series is widely used as a proxy for building demand in the residential sector. Van Coller (1980:55) included this time series in the composite leading indicator he developed for the South African economy.

9.3.3 **Building plans passed: Total value of residential buildings**

This time series is published by the Central Statistical Service on a monthly basis. It comprises the categories of dwelling houses (mentioned above), townhouses and flats. Van der Walt (1982:344) included this time series in the composite leading indicator he developed for the South African economy. This series was analysed at current prices and at constant prices. A building cost deflator compiled by the Bureau for Economic Research, University of Stellenbosch, was used to eliminate the effects of building cost fluctuations. This was done because very sharp building cost increases during, especially, 1980/81 could affect turning points evident in the undeflated series.

9.3.4 **Building societies: Value of mortgage loans granted for the erection of buildings**

This time series is published by the South African Reserve Bank on a monthly basis and is usually available three months after the survey date. Van der Walt (1982:345) included this time series in the composite leading indicator he developed for the South African economy. It will be recalled that this time series was used in Chapter 3 as a proxy for the availability of capital, a key determinant of demand in the building industry. It was found to have a close relationship with the movements of gold and foreign exchange reserves. The indicator was analysed at current prices and in deflated form. A building cost index was used as deflator. This was done because very sharp building cost increases during, especially, 1980/81 could affect turning points evident in the undeflated time series.

9.3.5 **Interest rates: Three months bankers' acceptance rate (BA rate)**

This time series is published by the South African Reserve Bank and reflects the interest rate at which trade bills are discounted. It is available on a daily basis. As the BA rate is often adjusted at daily intervals, the month-end rate was used for purposes of economic analysis. It will be recalled that the mortgage rate, representing the cost of capital, featured prominently in the empirical analysis undertaken in Chapter 3 of this study. The BA rate is used in this section of the study as a substitute for mortgage rates because it is more sensitive to the business cycle and has a longer lead time. The BA rate has been inverted for purposes of analysis to be compatible with the other economic indicators.

9.3.6 **Prices: BER building cost index**

This indicator is published on a quarterly basis by the Bureau for Economic Research, University of Stellenbosch. This building cost indicator was included in the empirical analysis undertaken in Chapter 3 of this study. In index form this indicator does not exhibit strong cyclical tendencies. Yet the fluctuations are pronounced when expressed in annual percentage change terms. In this analysis the quarterly data were interpolated linearly to yield monthly values. A six month moving average of the interpolated data was then calculated to smooth the data. This resulted in some loss of currency. Finally, the annual percentage change was derived.

9.3.7 **Average number of tenders received per building project**

This time series is published by the Bureau for Economic Research, University of Stellenbosch. It forms part of the data output of the BER building cost index discussed above. In European countries the average number of tenders is used to help establish turning points in the building cycle (Kilian and Snyman, 1990:1). A visual inspection of the course of this indicator shows that the average number of tenders received rises during recessions and declines during upswing phases of the building cycle. The course of this indicator is consistent with theoretical considerations in that it is logical for a contractor (and, by implication for all contractors) to tender on more projects at a time of severe shortage of work. By doing so, contractors improve their chances of winning a contract in a highly competitive tendering environment. To make it compatible with the other time series this indicator was inverted for purposes of analysis.

9.3.8 **Profitability/Productivity measure**

In his investigation of business cycles Van der Walt (1982:255-256) mentioned that an evaluation of time series should take account of various economic processes. One such group is represented by "prices, costs and profits." In the current study the ratio of building prices and building costs was included in the initial selection procedure. This ratio was determined by dividing the BER building cost index (analysis of tender prices) by Work Group 24.1 of the Contract Price Adjustment Provisions (Haylett Formula). The Haylett Formula represents a price revision system and is based on producers' prices of building materials, labour costs of building workers, together with plant and equipment costs. This ratio represents the relationship of output prices to input costs. Because contractors widen their profit margins, one would expect output prices to rise more rapidly than input costs during upswing phases of the business cycle, i.e. the ratio should rise.

By contrast, during recessions the ratio should drop because competition in tendering forces contractors to trim their profit margins, with the result that output prices rise less rapidly than input costs. Empirically, the ratio behaves according to these theoretical considerations. Therefore, one could term the ratio of output prices to input costs a "profitability measure," assuming labour productivity to be constant.

However, in Chapter 3 of this study it was mentioned that labour productivity decreases during an upswing phase of the business cycle and rises during a recessionary phase. The rise in labour productivity occurs on account of decreased job security that accompanies a recession. As yet there is no reliable index or other measure of labour productivity in the South African building industry. Yet a proxy for fluctuations in labour productivity can be derived by dividing output prices by input costs, assuming that contractors' output prices are intended to compensate for variations in labour productivity. It can be seen that such a "productivity measure" is the same as that derived for "profitability," i.e. output prices divided by input costs. Yet the ratio of output prices and input costs does not decrease in upswing phases and rise in recessions. One could therefore conclude that the economic effects of fluctuations in profitability overshadow the effects of productivity changes. The derived ratio is therefore appropriately termed a "profitability/productivity" measure. Visually, this indicator is strongly cyclical and it seems to make sense to include it in an analysis of time series aimed at compiling a leading indicator.

In the remainder of this section these eleven time series are analysed according to the methods developed by the NBER, U.S.A.

9.4 NBER scoring system applied to quantitative time series

The six criteria used to determine the performances of individual indicators are (Zarnowitz and Boschan 1975a: 170-174):

* economic significance;
* statistical adequacy;
* timing;
* conformity to historical cycles;
* smoothness; and
* currency.

These criteria were discussed in Section 8.2.1. In the remainder of this section these eleven indicators are scored according to these criteria for the period January 1971 to December 1991.

9.4.1 Economic significance

Under this criteria higher scores are awarded to indicators that reflect more significant aspects of the economic process and have broader coverage of economic activities (e.g. gross domestic product). Indicators that have a narrower coverage are allocated lower scores (e.g. industrial production). In the context of this study, the importance of indicators for the South African building industry are considered. The theoretical considerations discussed in Chapter 3 show that total reserves and interest rates are important variables in the context of the building industry. Indicators such as dwelling house plans passed and building loans granted refer to components of the building industry. This is also the case with the indicator that refers to costs and prices, viz. the building cost index of the Bureau for Economic Research, University of Stellenbosch.

It seems appropriate to score the eleven indicators according to the accompanying criteria:

Broad economic coverage	100
Component	75

The scores of the eleven indicators included in the initial selection are given in Table 9.1.

Table 9.1

Scores for economic significance

Indicator	**Score**
Broad economic coverage	
Reserves (current prices)	100
Reserves (constant prices)	100
Interest rates (BA rate)	100
Components related to building activity	
Number of dwelling house plans passed	75
Total value of residential plans passed (current prices)	75
Total value of residential plans passed (constant prices)	75
Building loans granted (current prices)	75
Building loans granted (constant prices)	75
Component of costs and prices	
BER building cost index: Annual percentage change of six month moving average	75
Profitability/Productivity measure	75
Component reflecting market conditions	
Average number of tenders received per project	75

As in the 1975 Zarnowitz-Boschan scoring system, the economic significance criteria carries a weight of 16,7 per cent.

9.4.2 **Statistical adequacy**

The second scoring criteria considers the reliability of the statistical data and the frequency of revisions of such data. The data selected for analysis emanate from reputable organisations, viz. the South African Reserve Bank (SARB), the Central Statistical Service (CSS) and the Bureau for Economic Research (BER). Consequently, all eleven indicators would score equally under the "statistical reliability" criteria. No individual scores were therefore allocated.

Regarding the "frequencing of revisions" criteria, it seemed appropriate to score the individual indicators as follows:

No revisions of basic data	100
Occasional revisions of basic data	75
Regular revisions of basic data	50

The scores of eleven indicators are given in Table 9.2.

Table 9.2

Scores for statistical adequacy

Indicator	Source	Score
No revisions		
Reserves (current prices)	SARB	100
Reserves (constant prices)	SARB	100
BA rate	SARB	100
Building loans (current prices)	SARB	100
Building loans (constant prices)	SARB	100
Occasional revisions		
Number of dwelling house plans passed	CSS	75
Total value of residential plans passed (current prices)	CSS	75
Total value of residential plans passed (constant prices)	CSS	75
Average number of tenders received per project	BER	75
Regular revisions		
Building cost index: Annual percentage change of six month moving average	BER	50
Profitability/productivity measure	BER	50

In accordance with the 1975 Zarnowitz-Boschan scoring system the criteria for statistical adequacy is given a weight of 16,7%.

9.4.3 **Timing**

To establish the consistency of timing of the individual indicators four phases are considered (Zarnowitz & Boschan, 1975:172).

9.4.3.1 **Identification of specific cycles**

The first step involves the identification of the specific cycles in the eleven indicators selected for further analysis. Use was made of the NBER turning point determination programme for the selection of cyclical turning points. This computer programme was adapted to operate on a personal computer. Details were provided in Section 8.4.4.1.

9.4.3.2 **Reference dates of peaks and troughs**

The reference dates to be used in the comparisons are the same as the reference chronology applied to qualitative time series in earlier sections of this study. These reference dates of peaks and troughs in the building cycle are based on turning points in the historical diffusion index of construction activities compiled by the SA Reserve Bank. Details were provided in Section 8.4.

9.4.3.3 **Matching of specific turns with reference dates**

The reference dates of the SARB and the specific turns of the eleven economic indicators are given in Table 9.3.

Table 9.3

Quantitative indicators: Turning points of SA Reserve Bank sectoral reference cycle and turning points and leads(-)/lags(+) of specific time series in months

SA Reserve Bank sectoral reference cycle

TROUGHS		PEAKS	
Year	Month	Year	Month
		1970	12
1972	12	1974	9
1978	10	1982	8
1983	1	1983	11
1987	4	1989	1

Qualitative time series

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
Gold and foreign exchange reserves, current values					
1971	8	-16	1975	10	+13
1977	9	-13	1980	9	-23
1982	6	-7	1984	11	+12
1986	4	-12	1987	7	-18
1988	10	-			
Median lead		-12,5	Median lead		-3
			All turns		-12,5
Standard deviation		3,24	Standard deviation		16,6

Table 9.3 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
Gold and foreign exchange reserves, deflated with real effective exchange rate of the rand					
1971	8	-16	1975	10	+13
1977	9	-13	1980	9	-23
1982	1	-12	1984	8	+21
1986	4	-12	1987	7	-18
1988	10	-			
Median lead		-12,5	Median lead		-2,5
			All turns		-12,5
Standard deviation		1,64	Standard deviation		19,04

Building plans passed number of dwelling houses					
1971	12	-12	1973	8	-13
1974	12	-	1976	2	-
1982	12	-10	1980	10	-22
1981	12	-13	1983	6	-5
1984	12	-28	1988	6	-7
Median lead		-12,5	Median lead		-10
			All turns		-12,5
Standard deviation		7,15	Standard deviation		6,61

Building plans passed total residential, current prices					
1972	1	-11	1973	8	-13
1974	12	-	1975	9	-
1977	12	-10	1981	5	-15
1981	12	-13	1983	8	-3
1985	12	-16	1988	6	-7
1989	12	-			
Median lead		-12	Median lead		-10
			All turns		-12
Standard deviation		2,29	Standard deviation		4,77

Table 9.3 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
Building plans passed total residential, deflated with building cost deflator					
1972	1	-11	1973	7	-14
1974	12	-	1975	9	-
1977	12	-10	1980	10	-22
1981	12	-13	1983	8	-3
1985	12	-16	1988	6	-7
Median lead		-12	Median lead		-10,5
			All turns		-12
Standard deviation		2,29	Standard deviation		7,23
Building society mortgage loans granted, current prices					
1974	12	-	1975	7	-
1977	11	-11	1980	11	-21
1981	12	-13	1983	3	-8
1984	12	-28	1988	8	-5
1990	1	-			
Median lead		-13	Median lead		-8
			All turns		-12
Standard deviation		7,59	Standard deviation		6,94
Building society mortgage loans granted, deflated with building cost deflator					
1971	12	-12	1973	8	-13
1974	12	-	1975	7	-
1977	11	-11	1980	8	-24
1981	12	-13	1983	3	-8
1985	1	-27	1987	11	-14
1990	1	-			
Median lead		-12,5	Median lead		-13,5
			All turns		-13
Standard deviation		6,53	Standard deviation		5,8

Table 9.3 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
BA rate (3 months), inverted					
1971	11	-13	1973	6	-15
1976	3	-31	1979	11	-33
1984	8	-32	1987	8	-17
Median lead		-31	Median lead		-17
			All turns		-24
Standard deviation		8,73	Standard deviation		8,06

BER building cost index, annual percentage change of six month moving average					
1972	6	-6	1973	12	-9
1978	1	-9	1981	3	-17
1983	3	+2	1984	4	+5
1985	7	-21	1989	2	+1
Median lead		-7,5	Median lead		-4
			All turns		-7,5
Standard deviation		8,26	Standard deviation		8,60

Average number of tenders received per project, inverted					
1973	6	+6	1974	9	0
1978	3	-7	1982	3	-5
1983	9	+8	1984	6	+7
1986	9	-7	1989	6	+5
Median lead		-0,5	Median lag		+2,5
			All turns		+2,5
Standard deviation		7,04	Standard deviation		4,66

Table 9.3 (continued)

	TROUGHS	Leads(-) or lags(+)		PEAKS	Leads(-) or lags(+)
Profitability/Productivity measure					
1972	6	-6	1973	10	-11
1978	1	-9	1981	3	-17
1983	3	+2	1984	4	+5
1985	7	-21	1988	11	-2
Median lead		-7,5	Median lead		-6,5
			All turns		-7,5
Standard deviation		8,26	Standard deviation		8,41

In summary, it is evident that a number of the individual time series record median leads of between 10 and 13 months at troughs and at peaks. The median value of the average number of tenders per project is an outlier, the median lead at troughs being merely half a month. At peaks the median lag is two and a half months.

Comparisons between the median leads at troughs, peaks and at all turns are facilitated by reference to the summary scoring table, i.e. Table 9.11. In that table the median values are again summarised.

9.4.3.4 **Probability and dispersion scores**

The timing of turning points carries a weight of 26,7% in the NBER scoring system. Two aspects are considered, viz. the probability that peaks and troughs occur due to chance, as well as the dispersion of the leads and lags about their mean.

9.4.3.4.1 **Probability scores**

The probabilities corresponding to the observed timing records are established by application of cumulative binomial distribution. A series must have a consistent record of early timing in order to qualify as a leader at peaks and troughs if a high probability exists that turning points are due to chance. An assumption is made that the results in successive cycles are independent. A matrix can be drawn up to determine the estimated probability that turning points are due to chance.

Table 9.4

Quantitative time series and timing of turning points: Probability distribution of variables into leading, coincident or lagging indicators

	Leading	Coincident	Lagging	Total turning points identified
PEAKS	29	1	8	38
Estimated probability	29/38=0,76	1/38=0,03	8/38=0,21	
TROUGHS	33	0	4	37
Estimated probability	33/37=0,89	0	4/37=0,11	

The principles of cumulative binomial distribution, as given by Glass and Stanley (1970:208), were explained in Section 8.4.4.4 and applied to the qualitative indicators. When these principles are applied to the eleven quantitative indicators the following results are obtained.

Table 9.5 provides the probability of turning points not occurring due to chance (1-p). Scores were awarded according to the following scoring system:

(1-p)	**Score**
>0,5	100
>0,3 <0,5	75
>0,1 <0,3	50
<0,1	25

9.4.3.4.2 **Dispersion scores**

The scores for dispersion are based on the standard deviations of the leads about their mean. The values of the standard deviations are provided in Table 9.6. Scores were allocated according to the following system:

Standard deviation in months	**Score**
less than 3 months	100
more than 3 months, but less than 6 months	75
more than 6 months, but less than 9 months	50
more than 9 months	25

9.4.4 **Conformity to historical cycles**

The fourth criterion to be considered has a weight of 16,7 per cent in the NBER scoring system. Three features are analysed, viz. the probability of turning points being matched, the score for "extra turns" and an amplitude score.

9.4.4.1 **Probability scores**

How well a series has conformed can be measured by relating the number of building cycle phases that are matched by the specific-cycle movements to the total number of phases

Table 9.5

Quantitative time series: Probability scores of turning points not occurring due to chance

SERIES	TROUGHS (Estimated p = 0,89)			PEAKS (Estimated p = 0,76)		
	Turning points	(1-p)	Score	Turning points	(1-p)	Score
Reserves (current prices)	4/5	0,097	25	2/4	0,045	25
Reserves (constant prices)	4/5	0,097	25	2/4	0,045	25
Number of dwelling house plans passed	4/6	0,021	25	4/5	0,346	75
Total value of residential plans passed (current prices)	4/6	0,021	25	4/5	0,346	75
Total value of residential plans passed (constant prices)	4/5	0,097	25	4/5	0,346	75
Building loans granted (current prices)	3/5	0,011	25	3/4	0,245	50
Building loans granted (constant prices)	4/6	0,021	25	4/5	0,346	75
Bankers' 3 months acceptance rate	3/3	0,583	100	3/3	0,561	100
BER building cost index: Annual percentage change of six month moving average	3/4	0,062	25	2/4	0,045	25
Average number of tenders received per project	2/4	0,005	25	1/4	0,003	25
Profitability/Productivity measure	3/4	0,062	25	3/4	0,245	50

Table 9.6

Dispersion scores: Standard deviations of eleven quantitative indicators and scores awarded

Series	Standard deviation in months		Scores	
	at troughs	at peaks	at troughs	at peaks
Reserves (current prices)	3,24	16,6	75	25
Reserves (constant prices)	1,64	19,04	100	25
Number of dwelling house plans passed	7,15	6,61	50	50
Total value of residential plans passed (current prices)	2,29	4,77	100	75
Total value of residential plans passed (constant prices)	2,29	7,23	100	50
Building loans (current prices)	7,59	6,94	50	50
Building loans (constant prices)	6,53	5,80	50	75
Bankers' 3 months acceptance rate	8,06	4,78	50	75
BER building cost index: Annual percentage change of six month moving average	8,26	8,60	50	50
Average number of tenders received per project	7,04	4,66	50	75
Profitability/Productivity measure	8,26	8,41	50	50

covered. In the context of this study an indicator that matched all nine turning points in the reference cycle would be awarded a high score. The eleven indicators are analysed for the period January 1971 until December 1991, i.e. a data base spanning 21 years. The scores are given in Table 9.8 which follows the revision of weights in Table 9.7

The scores were allocated according to the accompanying scale:

Probability of turning points	**Score**
9 out of 9 turns	100
8 out of 9 turns	75
7 out of 9 turns	50
6 out of 9 turns	25
4 out of 9 turns	0

9.4.4.2 **"Extra turns" score**

An indicator that gives a number of "extra turns", or false signals, is awarded a lower score than an indicator that yields a true signal or turning point. Scoring was based on the accompanying scale:

Number of extra turns	**Score**
No extra turns	100
One extra turn	75
Two extra turns	50
Three extra turns	25
More than three extra turns	0

9.4.4.3 **Amplitude scores**

Zarnowitz and Boschan (1975a:173) calculated the amplitude of cyclical fluctuations in a series and mentioned that it is a positive feature of an indicator when larger movements are more distinct. No score was awarded for differences in amplitude between various indicators in the current study. However, the amplitude selection of eleven indicators were done on the basis of adequate cycle amplitudes and good visual conformity with the reference cycle (Van Coller, 1980:45). It can be argued that Zarnowitz and Boschan give the amplitude score a low weight of 3,34 per cent in overall scoring and that the lack of an amplitude score for each indicator in this study would not affect the overall scores of indicators to any significant extent.

As amplitude scores are not awarded in this study it is necessary to recalculate the component weights accordingly, given that conformity has an overall weight of 16,7 per cent. These are provided in Table 9.7.

Table 9.7

Revised scores for conformity criteria

	Zarnowitz and Boschan (1975)	**Current study 1994 (rounded off)**
Probability score	50% x 16,7 = 8,35	10,4
Extra turns score	30% x 16,7 = 5,01	6,3
Amplitude score	20% x 16,7 = 3,34	-
	-------	------
	16,7	16,7

Table 9.8 provides the scores for the eleven quantitative indicators according to the probability and "extra turns" criteria.

9.4.5 **Smoothness**

Zarnowitz and Boschan (1975a:173) mentioned that insufficient smoothness is the main defect in many indicators. Their measure of smoothness was based on the relationship between the irregular component and the cyclical component of a time series. For monthly data the MCD estimate is used. This measure represents the "months for cyclical dominance" and identifies the shortest span in months for which the average percentage change (without regard to sign)

Table 9.8

Conformity scores: Probability measure and "extra turns" scores

Indicator	Probability		"Extra turns"	
	Turning points matched	Score	Number of extra turns	Score
Reserves (current prices)	8/9	75	1	75
Reserves (constant prices)	8/9	75	1	75
Number of dwelling house plans passed	8/9	75	3	25
Total value of residential building plans passed (current prices)	8/9	75	3	25
Total value of residential building plans passed (constant prices)	8/9	75	2	50
Building loans (current prices)	6/9	25	3	25
Building loans (constant prices)	8/9	75	3	25
Bankers' 3 months acceptance rate	6/9	25	0	100
BER building cost index: Annual percentage change of six month moving average	8/9	75	0	100
Average number of tenders received per project	8/9	75	0	100
Profitability/Productivity measure	8/9	75	0	100

in the trend-cycle component of the time series is greater than that of the irregular component. Using airline data as an example, Makridakis and Wheelwright (1978:133) mentioned that as the time span of a time series increases, the changes in the trend-cycle component tend to become greater, while those of the irregular component become less because of the averaging of the random terms. If the MCD of a time series has a value of 2 it means that over two months the trend-cycle dominates the fluctuations of the irregular component. Indicators with small MCD's are awarded higher scores than those with larger MCD's.

Calculating the MCD's of the eleven time series with the aid of the X-9 version of the Census II Decomposition Method, as set out in Forecasting Methods and Applications by Makridakis and Wheelwright (1978:106-138), yielded the following results. Refer to Table 9.9.

Table 9.9

MCD's of quantitative series and scores awarded for the smoothness criteria

Series	MCD	Score
Reserves (current prices)	5	25
Reserves (constant prices)	5	25
Number of dwelling house plans passed	5	25
Total value of residential plans passed (current prices)	5	25
Total value of residential plans passed (constant prices)	5	25
Building loans (current prices)	5	25
Building loans (constant prices)	5	25
Bankers' 3 months acceptance rate	3	75
BER building cost index: Annual percentage change of six month moving average	>5	0
Average number of tenders received per project	3	75
Profitability/Productivity measure	>5	0

The scores were awarded according to the following system:

MCD 2 months	= 100
MCD 3 months	= 75
MCD 4 months	= 50
MCD 5 months	= 25
MCD>5 months	= 0

9.4.6 **Currency**

The final criterion deals with the currency or timeliness of the indicators. Two aspects are considered (Zarnowitz & Boschan, 1975a:173), viz. periodicity and lag of release. The periodicity deals with how frequently the figures are compiled e.g. daily, monthly, annually. Lag of release refers to how promptly the data become available after the period to which they refer, i.e. the delay in reporting.

The scores were allocated according to the accompanying scoring system.

Periodicity	**Score**
Monthly	100
Quarterly	75
Annually	50

Lag of Release	**Score**
One month	100
Two months	75
Three months	50
Four months	25

The scores for currency are given in Table 9.10.

9.5 **The final selection of quantitative indicators**

In the previous sections of this chapter a number of building-related indicators were considered. The initial selection identified eleven potentially useful time series. These quantitative time series were analysed to determine their potential in a composite leading indicator for the South African building industry. The six criteria scores were allocated according to the NBER methodology. These scores are then used as weights in the

Table 9.10

Currency: Periodicity and lag of release scores

Indicator	Periodicity		Lag of release	
	Compiled	Score	in months	Score
Reserves (current prices)	monthly	100	1	100
Reserves (constant prices)	monthly	100	1	100
Number of dwelling house plans passed	monthly	100	3	50
Total value of residential building plans passed (current prices)	monthly	100	3	50
Total value of residential building plans passed (constant prices)	monthly	100	3	50
Building loans (current prices)	monthly	100	3	50
Building loans (constant prices)	monthly	100	3	50
Bankers' 3 months acceptance rate	monthly*	100	1	100
BER building cost index: Annual percentage change of six month moving average	quarterly	75	1	100
Average number of tenders received per project	quarterly	75	1	100
Profitability/Productivity measure	quarterly	75	1	100

* Even though interest rates are available on a daily basis it has been treated as a monthly series for analytical purposes.

composite leading indicator.

The results of the **initial analysis** involving eleven indicators are summarised in Table 9.11.

The method for deriving composite indices has been set out in Zarnowitz and Boschan (1975a:173-174), Van Coller (1980:63-67) and Van der Walt (1982:369-372). To undertake this task a computer programme was specially developed to handle the eleven indicators. The methodology, as set out by Van Coller (1992), has been applied. It will be recalled that a composite index is a single time series which reflects the aggregate performance of a group of time series. Each time series may differ in unit of measurement, amplitude of variation and level.

There are five basic steps in computing such an index:

9.5.1 For each component series, symmetrical percentage changes are computed using the formula 200 $(X_{t+1}-X_t)/(X_{t+1}+X_t)$. (For some series month-to-month differences are taken. This must be done for series with zero or negative observations. Symmetrical changes are used to ensure that increases and decreases are treated identically, so that no distortion results when changes and differences are averaged).

9.5.2 Each series of changes in Step 1 is standardised i.e. divided by a long-run trailing moving average of these changes, without regard to sign. In computing the composite index of leading indicators, a sixty month trailing moving average is used. For the first five years of any series then, the component standardisation factor is the average without regard to sign for the first sixty months, but changes monthly thereafter. Standardisation puts all the components on an equal basis (i.e., their average month-to-month change is 1,0) and prevents the more volatile series from dominating the indices.

9.5.3 For each month a weighted average of the standardised changes in Step 2 is computed. The sum of the weights equals the number of series in the index so that the divisor is the number of components, unless a data value is unavailable for a given month, in which case the sum of these weights corresponding to available data values becomes the divisor. Step 2, in effect, gives each series the same weight. It is sometimes desirable to

Table 9.11

Summary scoring tables: Quantitative time series. Application of NBER scoring criteria to 11 time series

Time series	1. ECONOMIC SIGNIFICANCE		2. STATISTICAL ADEQUACY	
	Scores	Weighted scores sub-total	Scores	Weighted scores sub-total
Criteria weights ....→ Sub-weights ....→		16,7		16,7
Gold and foreign exchange reserves: Current prices	100	1670,0	100	1670,0
Gold and foreign exchange reserves: Deflated values	100	1670,0	100	1670,0
BPP dwelling houses: Number	75	1252,5	75	1252,5
BPP total res: Current values	75	1252,5	75	1252,5
BPP total res: Deflated values	75	1252,5	75	1252,5
Building loans: Current values	75	1252,5	100	1670,0
Building loans: Deflated	75	1252,5	100	1670,0
Bankers' acceptance rate (inverted)	100	1670,0	100	1670,0
BER BCI Index: Percentage change	75	1252,5	50	835,0
Average number of tenders per project	75	1252,5	75	1252,5
Profitability/Productivity measure	75	1252,5	50	835,0

Table 9.11 (continued)

3. TIMING													
Probability scoring				Median leads or lags in months			Standard deviation						
Troughs 10,68		Peaks 10,68					Troughs	Peaks	Scores at troughs	Weighted scores at troughs 2,67	Scores at peaks	Weighted scores at peaks 2,67	Weighted scores sub-total 26,7
Scores	Weighted scores sub-total	Scores	Weighted scores sub-total	Troughs	Peaks	All turns							
25	267	25	267	-12,5	-3	-12,5	3,24	16,6	75	200,25	25	66,75	801,00
25	267	25	267	-12,5	-2,5	-12,5	1,64	19,04	100	267,00	25	66,75	867,75
25	267	75	801	-12,5	-10	-12,5	7,15	6,61	50	133,50	50	133,50	1335,00
25	267	75	801	-12	-10	-12	2,29	4,77	100	267,00	75	200,25	1535,25
25	267	75	801	-12	-10,5	-12	2,29	7,23	100	267,00	50	133,50	1468,50
25	267	50	534	-13	-8	-12	7,59	6,94	50	133,5	50	133,50	1068,00
25	267	75	801	-12,5	-13,5	-13	6,53	5,80	50	133,5	75	200,25	1401,75
100	1068	100	1068	-1	-11	-10	8,06	4,78	50	133,5	75	200,25	2469,75
25	267	25	267	-7,5	-4	-7,5	8,26	8,60	50	133,5	50	133,50	801,00
25	267	25	267	-0,5	2,5	2,5	7,04	4,66	50	133,5	75	200,25	867,75
25	267	50	534	-7,5	-6,5	-7,5	8,26	8,41	50	133,5	50	133,50	1068,00

Table 9.11 (continued)

4. CONFORMITY					5. SMOOTHNESS			6. CURRENCY					TOTAL
Probability scores	Weighted scores 10,4	Extra turns scores	Weighted scores 6,3	Weighted scores sub-total 16,7	MCD (months for cyclical dominance)	Scores	Weighted scores sub-total 13,3	Monthly/Quarterly		Delays in reporting		Weighted scores sub-total 9,9	Grand total of weighted scores 100,00
								Scores	Weighted Scores 4,95	Scores	Weighted scores 4,95		
75	780	75	472,5	1252,5	5	25	332,5	100	495,00	100	495,00	990,00	6716,00
75	780	75	472,5	1252,5	5	25	332,5	100	495,00	100	495,00	990,00	6782,75
75	780	25	157,5	937,5	5	25	332,5	100	495,00	50	247,50	742,50	5852,50
75	780	25	157,5	937,5	5	25	332,5	100	495,00	50	247,50	742,50	6052,75
75	780	50	315,0	1095,0	5	25	332,5	100	495,00	50	247,50	742,50	6143,50
25	260	25	157,5	417,5	5	25	332,5	100	495,00	50	247,50	742,50	5483,00
75	780	25	157,5	937,5	5	25	332,5	100	495,00	50	247,50	742,50	6336,75
25	260	100	630,0	890,0	3	75	997,5	100	495,00	100	495,00	990,00	8687,25
75	780	100	630,0	1410,0	>5	0	0	75	371,25	100	495,00	866,25	5164,75
75	780	100	630,0	1410,0	3	75	997,5	75	371,25	100	495,00	866,25	6646,50
75	780	100	630,0	1410,0	>5	0	0	75	371,25	50	247,50	618,75	5184,25

give more or less weight to different components. In computing the composites of leading, coincident and lagging indicators, for example, the components are given weights proportional to the scores they achieved as cyclical indicators. The scores are determined by a series' economic significance, statistical adequacy, cyclical timing, conformity to business cycles, smoothness, and currency (Zarnowitz & Boschan, 1975a:170-174). The weight for a particular series is its score divided by the average score for all components of the given composite index.

9.5.4 The average changes from Step 3 are also standardised (i.e., divided by their average without regard to sign). This standardisation procedure makes the average month-to-month percentage change (without regard to sign) in the composite index equal to one and provides a useful standard with which to compare changes for any particular period. This index standardisation factor is computed from January 1971 through December 1991 for the composite index of leading indicators.

9.5.5 The results of Step 4 whose terms are say, r1,r2,r3...rt, are accumulated on 100 with the formula

$$\frac{200+r}{200-r}$$

e.g. January 1971 has the value of 100, February will have the value

$$100x\frac{200+r_1}{200-r_1}$$

March will be

$$100x\frac{200+r_1}{200-r_1}x\frac{200+r_2}{200-r_2}$$

The index is then obtained by rebasing this series on 1990 i.e. dividing the series by the average of the value in 1990. Occasionally, it is desirable to match the trend of an index with the trend of another series. This is accomplished in the indices program by using the method of cyclical averages. The trend of each of the two series is computed by finding, for each, the average value of the earliest specific business cycle (peak-to-peak) and the average value of the most recent specific cycle, centering each average in the centre of the cycle and applying the compound interest formula to the ratio of the latest to the earliest cycle averages. The differences between the two trends thus obtained is then added to the standardised average changes of Step 4 and these modified changes are accumulated and rebased as in Step 5. In this procedure, known as reverse trend adjustment (Shiskin, 1967:45-49; Van Coller, 1980:65-66), the trend of the South African Reserve Bank series total investment in buildings (1946 to 1991) was substituted for the trend of the composite leading index. Though the difference in the trends of these two series was negligible (0,04438% per month) the procedure was nevertheless followed as described above.

In the current study a great many empirical tests were carried out, using various combinations of these eleven indicators to develop a composite leading indicator. A partial composite index was compiled of reserves, dwelling houses, residential plans passed and building loans. These had strong cyclical characteristics. However, difficulties were experienced in combining certain indicators. For example, the bankers' acceptance rate, the building cost index, average number of tenders received per project, and the profitability/productivity measure oscillate between certain upper and lower levels. They contain no clear long-term trend, though they are strongly cyclical. It was therefore decided to convert these four series to indices and to incorporate them with the partial composite index consisting of reserves, dwelling houses, residential plans passed and building loans. The weights used in developing this final composite indicator are equal to the scores yielded by applying the NBER scoring system in the manner described in previous sections of this chapter.

Visual inspection of the graphs of three time series that were treated in deflated form yielded unacceptable results insofar as the general shape and trend were concerned. These three deflated series, viz. reserves, residential plans passed and building loans granted, were consequently discarded, despite the fact that they had returned acceptable scores when applying the NBER criteria. Their usefulness would also have been diminished as the deflators only become available with a lag of four months or more.

Eight series remained from the eleven originally selected and these were combined to yield a composite leading indicator based on quantitative data inputs. This composite indicator in its final form consists of: The value of reserves; the number of dwelling houses; the values of residential plans passed and building loans; the bankers' three months acceptance rate; the annual percentage change of the BER building cost index; the average number of tenders received per project; the profitability/productivity measure.

In summary, eleven indicators were initially selected and analysed according to the NBER scoring system. For reasons enumerated above three of these indicators were later discarded. The **final selection** yielded the following eight indicators, given in Table 9.12.

Table 9.12

Summary of criteria scores and final weights

Final series selected	Criteria scores	Final weights
Reserves (current prices)	6716,00	13,49
Number of dwelling house plans passed	5852,50	11,76
Total value of residential building plans passed (current prices)	6052,75	12,16
Building loans (current prices)	5483,00	11,01
Bankers' 3 months acceptance rate	8687,25	17,45
BER building cost index: Annual percentage change of six month moving average	5164,75	10,37
Average number of tenders received per project	6646,50	13,35
Profitability/Productivity measure	5184,25	10,41
Total	**49787,00**	**100,00**

9.6 Evaluation of composite leading indicator for the South African building industry based on quantitative time series

The index values of the composite leading index are given in Table 9.13. This index has been compiled by applying the above weights to the relevent eight quantitative time series.

Table 9.13

Index values of composite leading index for the South African building industry devised by applying NBER methodology to eight quantitative time series (1971 to 1991)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
January	43,7	33,9	42,6	45,8	38,1	38,5	31,9	28,4	36,2	64,4	68,6
February	44,0	31,9	42,1	45,6	39,6	35,2	31,2	27,4	39,6	65,0	65,1
March	45,0	28,9	41,7	46,5	38,1	33,7	30,5	28,3	43,3	64,8	62,9
April	46,2	28,1(T)	47,9	46,1	39,8	34,6	30,3	30,6	45,7	64,6	61,8
May	45,7	28,2	51,8	42,9	42,3	33,3	29,4	32,1	47,4	65,5	60,0
June	45,6	28,7	54,8	40,8	45,2	34,0	28,7	33,3	48,2	67,5	57,4
July	42,0	29,6	56,4(P)	40,2	44,4	33,8	28,0	32,3	51,3	73,1	54,0
August	42,8	33,8	51,1	39,3	40,0	32,9	27,8	32,9	53,7	73,9	52,4
September	40,4	34,1	47,8	36,9	39,6	35,0	27,2(T)	31,8	55,2	74,9	51,5
October	37,5	36,5	48,7	35,7	40,4	34,9	27,4	33,4	60,6	76,4(P)	50,6
November	36,0	38,9	47,2	36,9	40,8	34,6	27,5	34,9	61,5	75,2	47,9
December	34,9	40,6	45,5	36,9	39,6	34,1	28,1	35,2	61,7	72,0	46,0
	1982	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	
January	45,6	45,2	46,9	45,7	58,2	74,2	107,9	96,3	89,9	106,2	
February	44,0	49,8	48,7	43,6	57,8	80,4	106,8	97,6	89,5	108,2	
March	44,7	49,3	47,9	44,3	57,6	83,2	108,3	95,9	90,2	109,7	
April	42,4	51,6(P)	46,7	43,6(T)	60,9	86,2	105,3	93,0	94,2	109,9	
May	41,0	51,1	47,5	43,7	61,1	86,0	109,8	94,4	98,2	107,3	
June	41,9	50,6	46,7	47,1	60,1	86,6	108,0	95,0	105,4	101,8	
July	39,9	50,1	46,2	46,8	61,4	93,1	109,0	87,2	109,1	104,1	
August	39,9(T)	51,0	45,1	48,5	63,8	92,2	109,8(P)	88,1	109,1	103,4	
September	41,5	49,8	45,2	51,1	69,1	93,4	104,6	92,2	107,6	104,5	
October	41,2	48,8	44,8	52,1	72,2	96,5	100,4	90,0	102,9	105,0	
November	43,3	48,1	45,9	54,5	69,3	98,8	100,0	90,0	100,6	106,8	
December	44,7	49,0	45,2	53,1	74,4	101,7	101,9	93,9	102,6	110,7	

(T) represents the trough of the cycle

(P) represents the peak of the cycle

Graph 32 shows the cyclical fluctuations of the composite leading index derived from the quantitative time series, against the background of the various phases of the reference cycle. In this presentation the downward phases of the building cycle (i.e. the SARB sectoral reference cycle) have been shaded.

The dates of the upper and lower turning points of the composite leading indicator are given in Table 9.14. The SARB sectoral reference turning points were provided in Table 9.3.

Table 9.14

Turning points of quantitative composite leading indicator and leads or lags when compared to SARB sectoral reference cycle

TROUGHS			PEAKS		
Year	**Months**	**Leads(-) or lags(+) in months**	**Year**	**Months**	**Leads(-) or lags(+) in months**
1972	4	-8	1973	7	-14
1977	9	-13	1980	10	-22
1982	8	-5	1983	4	-7
1985	4	-24	1988	8	-5
Median lead		-10,5	Median lead		-10,5
			All turns		-10,5
Standard deviation		7,23	Standard deviation		6,67

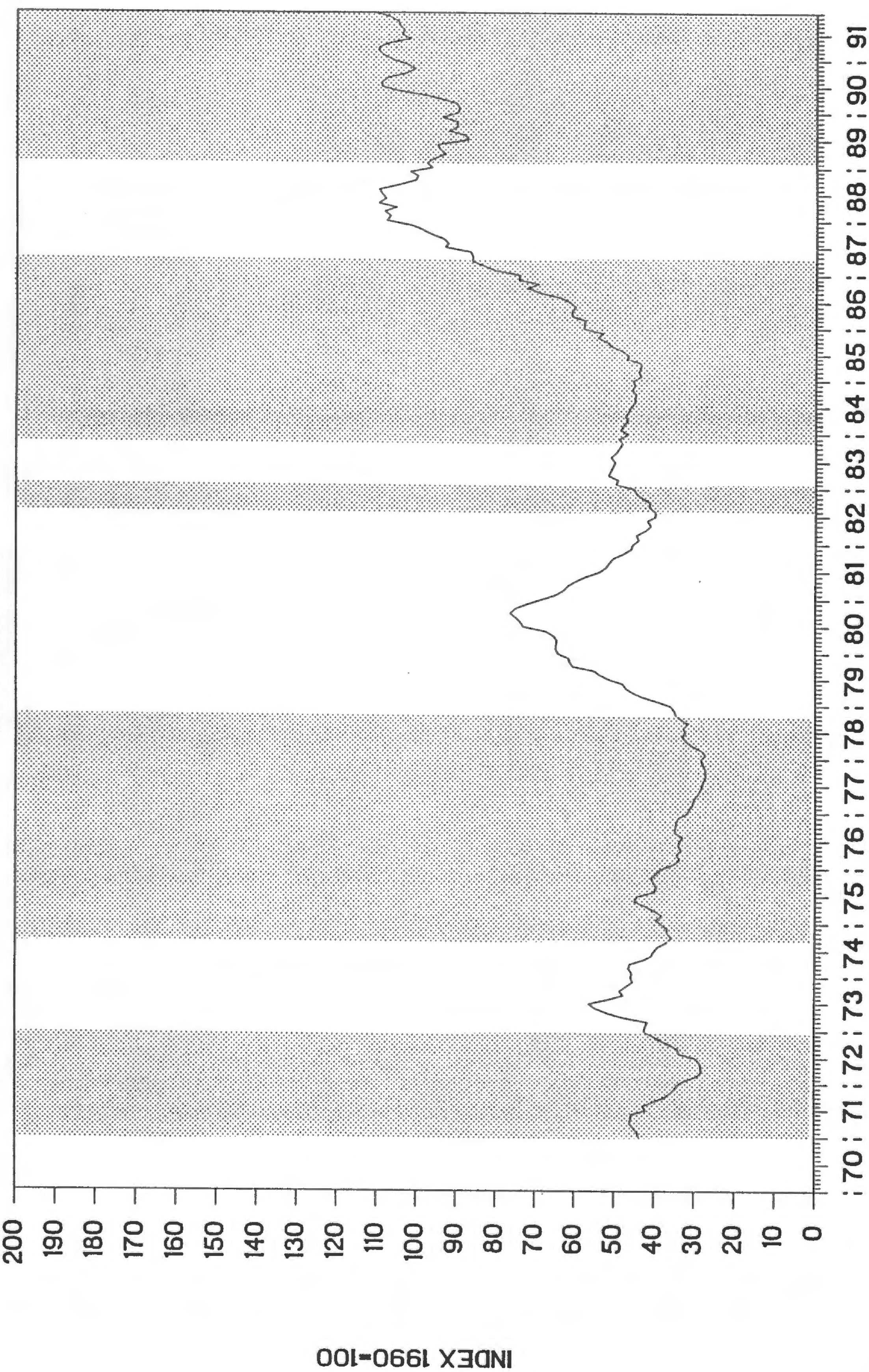
It is evident that the median lead time is the same at troughs and at peaks (10,5 months). The standard deviation is just over 7 months in the case of troughs and almost 7 months at peaks.

Eight turning points are clearly identifiable in the composite time series. The median lead times and standard deviations have been based on these turning points. However, two periods of uncertain nature deserve special attention. It is evident that the indicator exhibits

Graph 32

QUANTITATIVE LEADING INDICATOR

INDEX 1990=100



tentative signs of a peak early in 1971, yet the evidence is not clear-cut. Consequently, this quasi-turning point was ignored in the above calculations.

Secondly, there is evidence of a wave-like movement in the composite indicator during the period 1989/91. This sideways movement cannot easily be explained, yet it is also evident in the leading indicator that Van Coller (1980) developed. This indicator is published on a regular basis in BER Building and Construction (refer, for instance, BER Building and Construction, 6(3), 1991:1). As there is no definitive evidence of a lower or upper turning point during this period, it has also been ignored in the computations above.

A comparison is made of the timing characteristics of the composite indicators derived from qualitative data (Chapter 8) and from quantitative data (Chapter 9) in the final chapter of this study.

9.7 Summary

In this chapter various quantitative indicators were analysed and combined to yield a composite index for the South African building industry. The selection process was based on the scoring system developed by the NBER, U.S.A. Initially, twenty-three individual indicators were considered. Of these, twelve were discarded as they were not leading indicators or had other deficiencies (Martin, 1981; Van der Walt, 1982). The remaining eleven indicators were analysed with the turning point determination program and were evaluated according to the six criteria described by Zarnowitz and Boschan (1975a:170-174). In the final selection, eight indicators were included to yield a composite leading index for the South African building industry. These eight indicators reflect various aspects of the construction process. The timing of turning points of the composite leading indicator were discussed and summarised. It was found that the median lead times at troughs and peaks are the same, being 10,5 months. The standard deviations are just over seven months at troughs and almost seven months at peaks.

* * * * * *

Chapter 10

Comparisons, conclusions and summary

10.1 Introduction

In this chapter various comparisons of indices are made. Firstly, the upper and lower turning points of the qualitative composite index (Chapter 8) are compared to those of the quantitative composite index (Chapter 9). Next, a combined composite index is derived from these two composite indices, with equal weighting. This combined index is then compared to the SARB sectoral reference cycle. These results are interpreted and conclusions are drawn. Some directions for further research are provided. This study is summarised.

10.2 Comparison between turning points of qualitative and quantitative composite indices

Table 10.1 provides the summarised findings contained in Chapters 8 and 9.

Table 10.1

Comparison of turning points of qualitative and quantitative composite indices

Turning points of qualitative composite index			
Troughs		Peaks	
Year	Month	Year	Month
1972	12	1973	12
1978	3	1980	12
1983	3	1983	12
1985	12	1988	3
Turning points of quantitative composite index			
Troughs		Peaks	
Year	Month	Year	Month
1972	4	1973	7
1977	9	1980	10
1982	8	1983	4
1985	4	1988	8
Leads in months between these two composite indices at various turning points			
Troughs		Peaks	
Months	Leader	Months	Leader
8	Quantitative	5	Quantitative
6	Quantitative	2	Quantitative
5	Qualitative	8	Quantitative
8	Quantitative	5	Qualitative

It is evident that the quantitative composite index leads the qualitative composite index at six turning points. In three out of these six cases the quantitative composite index leads by eight months. The qualitative composite index is the leader (by 5 months in both cases) in only two of the eight turning points considered.

10.3 **Construction and evaluation of combined leading indicator**

Judged superficially, it could be concluded from Table 10.1 that the quantitative composite index is to be preferred above the qualitative composite index by virtue of more frequent and longer lead times. However, the quantitative indicators on which the quantitative composite index is based are not as current as are the qualitative indicators that form the basis of the qualitative composite index. Indeed, it was pointed out in previous sections of this study that currency is one of the major advantages of qualitative data. To incorporate the attributes of both these composite indices it would seem to make sense to construct a combined indicator from these two composite indices. Barring any objective measure to the contrary, it seems reasonable to allocate equal weights to each composite index in this combined indicator. The results of this computation are given in Table 10.2.

Graph 33 presents this information in graphical form against the background of the various phases of the SARB sectoral reference cycle. The analysis covers the period from January 1971 to December 1991. It should be noted that the SARB sectoral reference cycle recorded a peak in January 1989. At the time of writing (March 1994) no subsequent lower turning point had been determined by the Economic Department of the South African Reserve Bank. Consequently, the period from January 1989 to December 1991 is appropriately shaded to indicate the downward phase of the building cycle.

However, there is evidence of erratic short-term movements in this indicator. Given the long lead times of the composite leading indicator it should be possible to smooth the data without much loss of currency. A three-month moving average was applied to the data given in Table 10.2. These findings are presented graphically in Graph 34. The arrows indicate the lead times when compared to the SARB sectoral reference cycle. In the period 1982/83 the composite index and the SARB sectoral reference cycle are virtually coincident. A comparison of Graphs 33 and 34 reveals that smoothing the data in this manner does facilitate

Table 10.2

Values of final composite leading indicator derived from 50% of qualitative composite index and 50% of quantitative composite index (1971 to 1991)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
January	84,4	65,6	67,1	79,9	64,9	51,2	43,7	40,6	50,0	82,2	124,6
February	84,5	64,6	66,9	79,7	65,6	49,5	43,4	40,1	51,8	82,5	122,8
March	85,0	63,1	66,7	80,2	64,9	48,8	43,0	40,5	53,6	82,4	121,7
April	80,1	62,6	75,4	92,5(P)	74,1	56,2	45,7	47,2	72,8	108,7	122,6
May	79,8	62,7	77,3	90,9	75,3	55,6	45,3	48,0	73,7	109,1	121,7
June	79,7	62,9	78,8	89,8	76,8	55,9	44,9	48,6	74,1	110,1	120,4
July	86,3	60,6(T)	92,1	82,6	72,2	55,8	40,4	50,9	77,0	124,1	117,3
August	86,7	62,8	89,5	82,1	70,0	55,3	40,3	51,2	78,3	124,5	116,5
September	85,5	62,9	87,8	81,0	69,8	56,4	40,0(T)	50,6	79,0	124,9	116,0
October	74,3	61,3	92,4	77,6	66,0	52,2	44,2	54,2	88,7	132,6(P)	111,4
November	73,6	62,5	91,7	78,2	66,2	52,0	44,3	54,9	89,1	132,0	110,1
December	73,0	63,4	90,8	78,2	65,6	51,7	44,6	55,1	89,2	130,5	109,1
	1982	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	
January	93,6	69,8(T)	88,7	63,1	63,8	94,0	133,1	113,4	99,1	99,0	
February	92,8	72,1	89,6	62,1	63,6	97,1	132,6	114,1	98,9	99,9	
March	93,2	71,9	89,2	62,4	63,5	98,6	133,3(P)	113,2	99,3	100,7	
April	92,0	81,4	83,1	57,9	66,5	104,2	129,0	106,2	98,5	98,0	
May	91,3	81,1	83,5	57,9(T)	66,7	104,1	131,3	106,9	100,5	96,7	
June	91,8	80,9	83,1	59,6	66,2	104,4	130,4	107,2	104,1	93,9	
July	72,7	82,0	74,5	60,9	65,4	109,1	126,7	102,0	104,5	99,3	
August	72,7	82,4	73,9	61,7	66,6	108,6	127,1	102,4	104,6	98,9	
September	73,5	81,8	74,0	63,0	69,3	109,2	124,5	104,4	103,8	99,5	
October	72,0	91,1	61,3	58,0	79,2	123,3	115,5	106,1	95,9	96,9	
November	73,0	90,7	61,8	59,2	77,7	124,4	115,3	106,1	94,8	97,9	
December	73,7	91,2(P)	61,5	58,5	80,2	125,8	116,2	108,0	95,8	99,8	

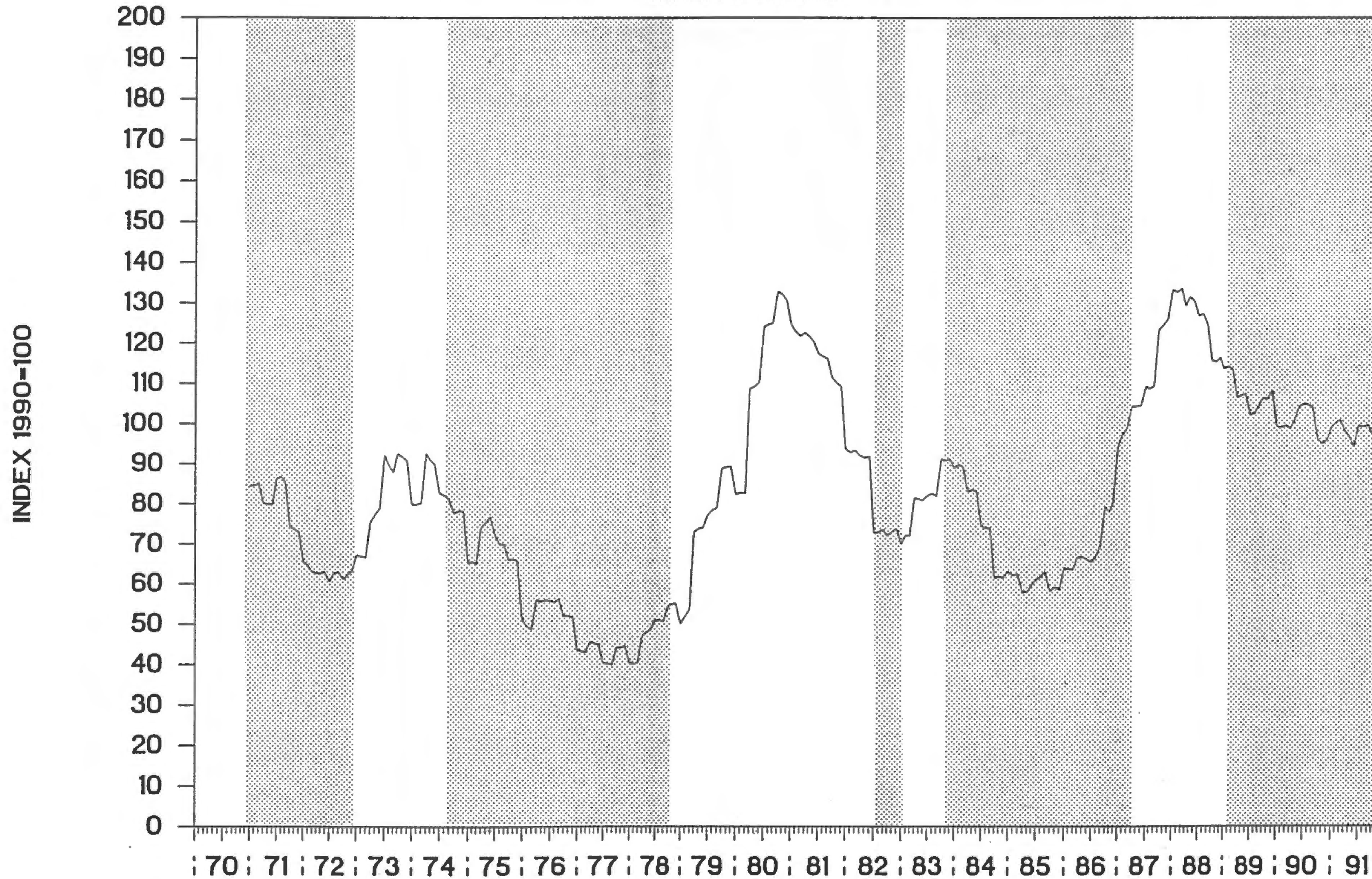
(T) represents the trough of the cycle

(P) represents the peak of the cycle

Graph 33

QUALITATIVE, QUANTITATIVE DATA COMBINED

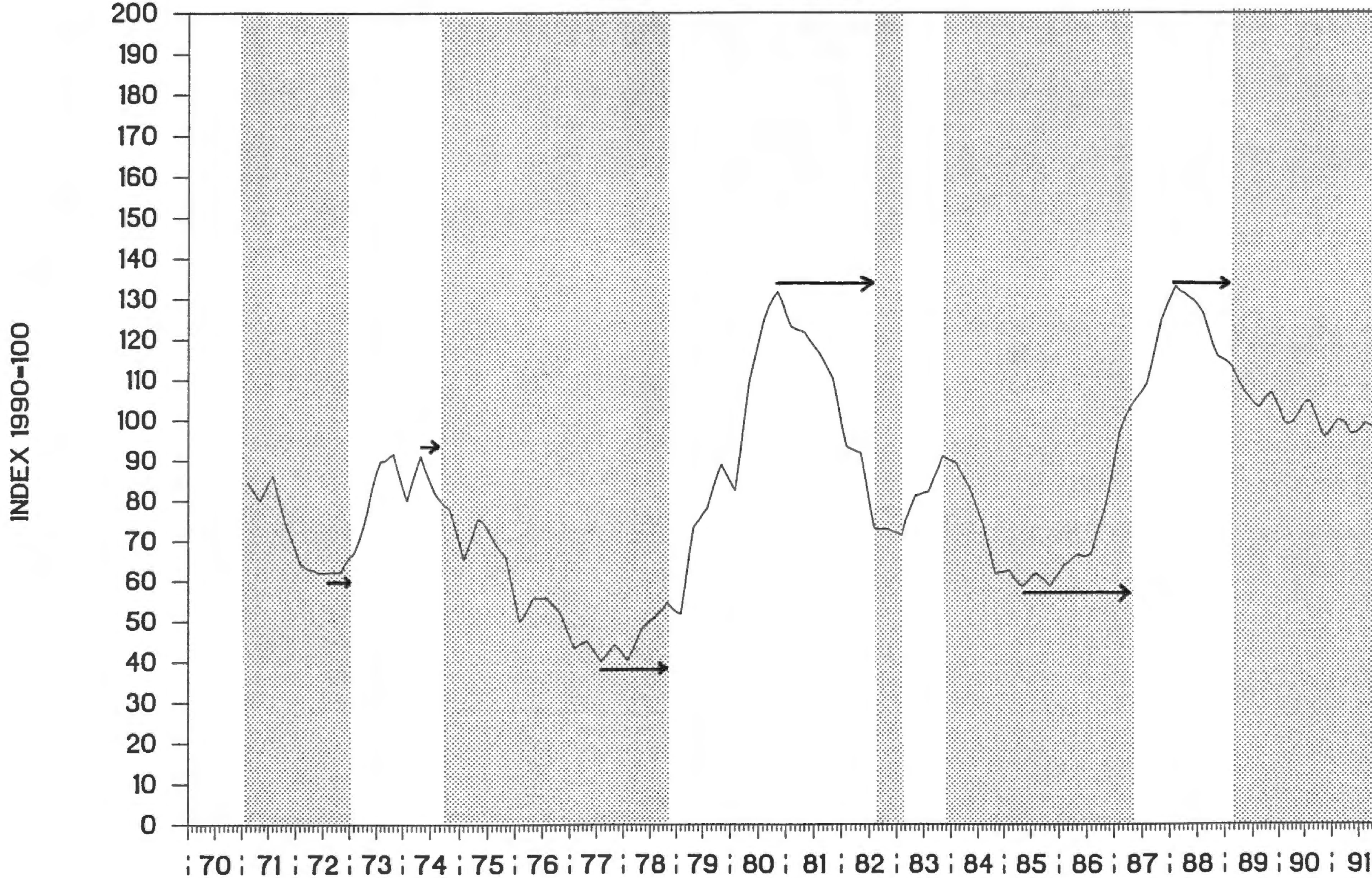
INDEX 1990=100



Graph 34

QUALITATIVE, QUANTITATIVE DATA COMBINED

3 MONTH MOVING AVERAGE



Note: The arrows denote the lead time

the interpretation of the cyclical movements of the leading indicator.

Next, the turning points in this final composite leading indicator are compared to the SARB sectoral reference cycle. The findings are presented in Table 10.3.

Table 10.3

Turning points and leads/lags in the final composite leading indicator and the SARB sectoral reference cycle

SARB sectoral reference cycle

Troughs		Peaks	
Year	**Month**	**Year**	**Month**
		1970	12
1972	12	1974	9
1978	10	1982	8
1983	1	1983	11
1987	4	1989	1

Final composite leading indicator

Troughs			Peaks		
Year	**Month**	**Leads(-) or lags(+)**	**Year**	**Month**	**Leads(-) or lags(+)**
1972	7	-5	1974	4	-5
1977	9	-13	1980	10	-22
1983	1	0	1983	12	+1
1985	5	-23	1988	3	-10
Median lead		-9	Median lead		-7,5
			All turns		-10,0
Standard deviation		8,70	Standard deviation		8,46

It can be argued that this final composite leading indicator of the South African building industry incorporates the attributes of both composite indices on which it is based. These are clear cyclical movement, long lead times and currency of data. In most cases the quantitative data become available about three to four months after the current month. In the case of the qualitative data, the business survey results become available within two to three weeks after the survey quarter. For instance, business survey results for the first quarter of any year should be available by mid-April. At that point the monthly quantitative data for January of that year should be published. Consequently, by the end of April it should be possible to compute the combined leading indicator for the month of January. In general terms, the publication lag is overshadowed by the long lead times of the composite indicator.

In pursuing this line of reasoning, allowance can be made for the publication lag of individual quantitative indicators. It is reasonable to assume that the individual quantitative time series with the longest publication lag becomes available after four months. By subtracting four months from the lead times of the quantitative composite index at various turning points a "net lead time" can be calculated. This information is provided in Table 10.4 and makes use of information extracted from Table 10.1.

Table 10.4

Calculation of net leads or lags between quantitative and qualitative composite indices after allowing for publication lag of four months

TROUGHS				PEAKS			
Leader	Months	Publication lag	Net lead(-) or lag(+)	Leader	Months	Publication lag	Net lead(-) or lag(+)
Quantitative	8	4	-4	Quantitative	5	4	-1
Quantitative	6	4	-2	Quantitative	2	4	+2
Qualitative	5	4	+9	Quantitative	8	4	-4
Quantitative	8	4	-4	Qualitative	5	4	+9

It is evident that the lead times are much reduced and in the two cases where the quantitative composite index lags the turning point in the qualitative composite index, such lags are increased to nine months.

Allowance has been made in Table 10.4 for the publication lag pertaining to the quantitative composite index. Such publication lags usually represent one of the shortcomings of using quantitative time series when constructing leading indices. There is, however, a second important shortcoming of quantitative time series worth considering. This relates to revisions of quantitative data.

Certain of the quantitative time series selected in this study are revised after initial publication. This represents a serious shortcoming as revisions of preliminary data could potentially affect the timing of an upper or lower turning point. By contrast, the qualitative data used in this study are final. This represents one of the advantages of using qualitative data sources.

Given these considerations it can be argued that the generally longer lead times of the quantitative composite index are counterbalanced by the attributes of the qualitative composite index, viz. early availability and no revisions of data. This finding suggests that, for practical reasons, a forecaster could benefit by using the qualitative and quantitative composite indices independently. There seems to be little to be gained by constructing a combined index. The evidence suggests that by waiting for all component indices of the final composite indicator to become available, currency (and potential lead time) is lost. It therefore seems appropriate to use these two composite indices independently, yet in conjunction with other economic indicators. This topic is pursued in the next section.

10.4 Conclusions

The objective of this study has been to devise and develop leading indicators for the South African building industry. To achieve this goal two different leading indices have been developed, one based on qualitative business survey data, the other on quantitative data sources. A combined leading indicator has also been constructed from these two composite indices. Various aspects of the statistical performance of these three economic indicators are compared in Table 10.5.

Table 10.5

Comparison of various aspects of the statistical performance of leading indicators for the South African building industry developed in this study			
Aspects of statistical performance	Qualitative composite index	Quantitative composite index	Final composite leading indicator
Median lead time(-) in months			
at troughs	-3,5	-10,5	-9,0
at peaks	-9,5	-10,5	-7,5
at all turns	-8,0	-10,5	-10,0
Standard deviation			
at troughs	7,05	7,23	8,70
at peaks	7,43	6,67	8,46
Effective median lead times of turning points in the composite leading indicators after allowing for publication lags of one month in the case of the qualitative indicator and four months in the case of the quantitative indicator			
Median lead time(-) in months			
at troughs	-2,5	-6,5	-5,0
at peaks	-8,5	-6,5	-3,5
at all turns	-7,0	-6,5	-6,0

It is evident from the information given in Table 10.5 that the median lead time at troughs is longest in the case of the quantitative composite index, being 10,5 months. It is shortest at troughs in the case of the qualitative composite index, being three and a half months. The median lead time at peaks is nine and a half months in the case of the qualitative composite index. This provides a full six months advantage when determining turning points at peaks, relative to troughs. This important finding supports Strigel's (1991:20) assertion that "... the lead times of leading indicators usually are substantially longer at the upper turning points than at the lower turning points". However, this finding is not substantiated by the performance of the lead time of the quantitative composite index, being 10,5 months at both peaks and troughs. This finding is also not borne out in the case of the final composite leading indicator where the median lead time at troughs is nine months. At peaks it is seven and a half months. These findings support the suggestion that the composite indices be handled independently to achieve best results.

For practical purposes, cognizance has to be taken of the publication delays in both qualitative and quantitative data. By doing so, the effective (i.e. useful) leads of the various indices can be established for the benefit of policy makers, researchers and others. It was argued above that the publication lag is roughly one month in the case of qualitative data. For quantitative data sources the publication delay is roughly four months.

The lower section of Table 10.5 provides the effective leads of the various indices, calculated in the following manner. One month is deducted from the median lead of the qualitative indicator and four months in the case of the quantitative index. Four months is deducted from the median lead of the combined index.

This exercise yields the following interesting results. Firstly, the seven month advantage of the quantitative index at troughs is reduced to four months. Secondly, the one month advantage of the quantitative index at peaks is reversed. Instead, the qualitative index leads the quantitative index, by two months on average. Thirdly, at all turns the two and a half month lead of the quantitative index is reversed in favour of the qualitative index. In this case the qualitative index leads by half a month.

It can be concluded that, even when allowing for lags in the publication of basic data sources, the judicious use of these leading indicators can provide advance warning of turning points in the South African building cycle. However, this does not imply that these particular indicators should be used in isolation when forecasting building trends. The evidence shows that these leading indicators are subject to erratic short-term movements. Smoothing of the data (without much loss of currency) facilitates the determination of clear signals (turning points), yet does not solve the problem entirely.

This finding suggests that these composite leading indicators should be used in conjunction with other economic indicators, whether qualitative or quantitative. This approach has universal appeal. Fiedler (1990:137) argues in this regard that he has never known any able economic practitioner who does not use the cyclical indicators as part of his/her forecasting methodology. Fiedler (1990:139) also argues that, from a forecaster's perspective, a composite indicator is limited by a certain degree of timing irregularity. Whereas it is reasonable to expect the composite index to lead at business cycle turning points, it is not reasonable to expect it to precede the turns by a fixed interval.

This perspective is supported by Van Coller (1980:56-58) who argues that leading indicators "... are merely required to lead at peaks and troughs, but there is no stipulation regarding the number of months by which they must lead, as long as the lead times are reasonably consistent". Zarnowitz and Boschan (1975a:173) argue that the problem of irregularity of timing can be partially overcome by smoothing of data, especially those erratic series that have long leads and are available relatively promptly. Fiedler (1990:139) asserts that, the difficulties notwithstanding, the indicator approach is still the best analytical system available for determining the current position of the economy and for predicting its future course over the coming half year.

10.5 Directions for further research

In this study composite leading indicators are devised for the South African building industry. These indices are based on qualitative data sources relating to building contractors and sub-contractors, as well as other building-related quantitative time series. Further research could take various forms. Some suggestions follow.

10.5.1 Manufacturers of building materials

Qualitative data covering the business activities of manufacturers of building materials are available from the fourth quarter of 1970. These quarterly data are compiled by the Bureau for Economic Research, University of Stellenbosch, according to the same methods as those employed to gather information on the business behaviour of building contractors and sub-contractors. It should be possible to combine such quarterly data with relevant quantitative manufacturing-related data to compile a comprehensive leading indicator for the manufacturing sector supplying building materials in South Africa. Such an industry-specific leading indicator could assist planning and the forecasting of demand levels. Improved production planning could ease the recurring shortages of building materials evident in an upswing phase of the building cycle. Similarly, an involuntary rise in the inventory level could be avoided in a downward phase of the cycle by means of a timeous cutback in production. In the construction of such a composite indicator cognizance should be taken of the fact that materials manufacturers feel the effects of economic change at a later stage than either building contractors or merchants of building materials.

10.5.2 Merchants of building materials

Qualitative data covering the business activities of merchants of building materials are available from the fourth quarter of 1970. These quarterly data are also compiled by the BER according to the Konjunkturtest. It is known that merchants resort to restocking and destocking as a means of smoothing the disruptive effects of fluctuations in the building cycle. A comprehensive leading indicator for building merchants could be devised from business survey data and relevant trade-related quantitative time series. Such an indicator could assist planning and forecasting in this sub-sector of the overall building industry.

10.5.3 Residential and non-residential building contractors

BER survey variables are available from the first quarter of 1985 in respect of building contractors and sub-contractors who specialise in the residential sector of the overall building market. Similarly, data are available for those who specialise in the non-residential sector. At this point the data base for these two groups is inadequate to identify a number of cycles for meaningful statistical analysis. Nevertheless, as the data base grows longer it should be possible to develop separate leading indicators for the residential and non-residential sectors of the overall building market. In so doing, cognizance should be taken of the fact that the non-residential sector lags the overall building cycle due to the long planning periods involved in the erection of non-residential buildings.

10.5.4 Professions

BER survey indicators are available from the third quarter of 1986 for two professional groups, architects and quantity surveyors. Once these survey variables are available for a longer time span and once a number of building cycles can be covered, it should be possible to devise a comprehensive leading indicator for these professions involved in the South African building industry. It is possible that several of the indices selected in this study might also be appropriate in the compilation of composite leading indices for the professions.

10.5.5 **Civil engineering contractors**

It was shown in Chapters 3 and 4 that the building industry differs from the civil engineering industry. In the latter industry the type of work undertaken is more heterogenous than in the building industry. Nevertheless, it should be possible to gather useful information on the business activities of civil engineering contractors according to the Konjunkturtest method employed by the BER. Inter-industry and intra-industry comparisons of economic behaviour should then become possible. A start in gathering such information has been made by the South African Federation of Civil Engineering Contractors. As the data base grows longer cyclical analysis of turning points should become possible. In the construction of such a composite index for the civil engineering industry it should be kept in mind that activity levels are greatly influenced by public policy decisions. This implies that information not directly related to civil engineering works (e.g. government finances) will also have to be evaluated to compile a useful leading indicator.

10.5.6 **Regional data**

Regional building data have been gathered by the BER from 1970 to the present. Regional results were published during the period 1970 to 1987. From that date national totals were published. It should again become possible to publish the regional results, given the closer cooperation of participants in the building industry. Such information could guide public policy of the nine regional governments.

10.5.7 **Other applications**

This study is the first attempt undertaken to develop an industry-specific leading indicator for the South African building industry. However, the NBER methodology can readily be applied to other industries as well. For instance, the BER gathers quarterly information on the business activities of local textile manufacturers. Should it be possible to devise a comprehensive leading indicator for this sub-sector of the industry, it could guide public policy, planning and forecasting in this field.

The NBER methodology chosen in this study is widely accepted because of its rigorous nature. Yet some researchers have adapted the NBER methodology or have used alternative forecasting methods in their building research (Van Miltenburg & Romijn, 1993; Hutcheson, 1990; Merkies & Poot, 1990). Further research is required to gather information on structural changes within the macroeconomy and the building industry.

10.5.8 Remaining questions

It has been shown that the composite leading indicators developed in this study have strong cyclical characteristics, yet suffer from erratic behaviour. Smoothing of data (without much loss of currency) solves this problem only partially. A related problem remains, viz. that not all turning points record a clearly defined "v" or an inverted "v". Some turning points resemble a "w". Further research is required to determine the shape of upper and lower turning points with greater precision. Exponential smoothing, the use of Kalman filters or Bayesian probability analysis could possibly assist in this endeavour (Diebold & Rudebusch, 1989; Merkies & Poot, 1990).

Finally, this study has highlighted the disruptive effects of economic fluctuations on the building industry. It is necessary that policy makers take full cognizance of such effects. In particular, building workers are severely affected in an economic downturn. Rapidly rising building prices accompany an upturn in the building cycle. By taking cognizance of forecast trends in building activity, public policy can be adjusted timeously to smooth out the worst effects of economic fluctuations. The composite leading indicators developed in this study can assist the authorities in meeting certain macroeconomic stabilisation policy objectives. Such economic stabilisation is useful as well for attracting investment to South Africa in the mid-1990's and beyond.

10.6 Summary

Leading indicators for the South African building industry are developed in this study. The methodology of the National Bureau of Economic Research, U.S.A., is followed. The data sources are of a qualitative and quantitative nature. The qualitative data emanate from the Bureau for Economic Research (BER), University of Stellenbosch, and these are compiled according to the Konjunkturtest of the Ifo Institute for Economic Research, Munich, Germany. The quantitative data are published by the South African Reserve Bank (SARB), the Central Statistical Service (CSS) and certain other respected organisations.

In Chapter 1 the purpose of the study, as well as the importance thereof for various bodies is explained. These are policy makers, participants in the building industry, members of the economics profession and society at large. In this introductory chapter the method and scope of the study are discussed.

Chapter 2 deals with the theory of investment behaviour and the leading indicator approach. It is shown that the indices which constitute the basis of the relevant leading indicators are chosen on sound theoretical grounds. This chapter lays the foundation for subsequent empirical analysis.

Chapter 3 focuses on various aspects of construction theory. Arguments are put forward to show that the construction industry exhibits certain special characteristics. These relate to the physical nature of the product, the structure and organisation of the construction process, the determinants of demand, and the method of price determination. The interrelationship between the construction industry and the overall economy, as well as the costs of instability are discussed.

Chapter 4 deals in greater detail with the issues surrounding instability in the building industry in South Africa. A macroeconomic perspective of the industry is then followed by a discussion of the role played by mortgage rates, availability of finance, and migration patterns. Special attention is paid to the durability of buildings and how this affects the operation of the acceleration principle of investment in capital goods. The role of the public sector is discussed, as well as the implications of the Reconstruction and Development

Programme of the South African government. Instability and its economic effects on price determination in the building industry is considered. The final section deals with the relevance of the business survey variables and those of the quantitative time series in the light of the theoretical aspects covered in Chapters 2, 3 and 4.

Chapter 5 is devoted to a discussion of the nature of qualitative data, the origins and historical development of qualitative data sources in an international context. The benefits of business surveys are spelt out. The Konjunkturtest features prominently in this discussion.

Chapter 6 deals with business surveys in a South African setting. The focus is on the quarterly business surveys undertaken by the Bureau for Economic Research, University of Stellenbosch. The various development phases of business survey data are discussed and it is shown that this study falls within the "leading indicator stage." Information on the BER surveys is provided and the basic survey questionnaire is described. A method is chosen to evaluate the information content of these surveys as a source of qualitative building information.

Chapter 7 is devoted to a description of the methods of analysis used to evaluate the qualitative data. The results of principal component analyses of the responses to the BER surveys of building contractors and sub-contractors are summarised. It is found that business people who participated in these surveys behave purposefully. In particular, it is shown that their work load and financial considerations play a crucial role in shaping their business behaviour. Finally, it is concluded that the qualitative data exhibit a certain internal reliability and are suitable for use in a composite leading indicator.

Chapter 8 focuses on the leading indicator methodology developed by the National Bureau of Economic Research (NBER), U.S.A. The debate concerning "measurement without theory" is reviewed. The following six criteria are applied to the basic data to determine appropriate weights. These relate to the scores awarded for:

* economic significance;
* statistical adequacy;
* consistency of timing;

* conformity to historical cycles;
* currency of data; and
* smoothness.

This scoring system is applied to 58 survey variables. Of these, 33 variables are chosen according to the above statistical criteria. These variables are then incorporated into a composite leading index, referred to as the "qualitative leading index" in subsequent chapters. This indicator is evaluated and its leading characteristics determined with reference to the historical diffusion index of the SARB. It is shown that this indicator leads lower turning points by roughly three and a half months. Upper turning points are presaged by roughly nine and a half months.

Chapter 9 is devoted to the development of a composite leading index based on quantitative time series. The same NBER scoring system is applied. The initial investigation considers 23 individual indicators. Twelve of these are discarded because of certain shortcomings. The remaining eleven are scored and in the final selection, eight indicators are chosen according to the above statistical criteria. These form the basis for the "quantitative leading index". This indicator is evaluated against the SARB sectoral reference cycle. It is found that the quantitative composite index leads upper and lower turning points of the building cycle by about ten and a half months.

Chapter 10 deals with various comparisons of the composite indices developed in Chapters 8 and 9. Firstly, the qualitative and quantitative leading indices are juxtaposed. It is found that the lead times of the quantitative composite index are generally longer than those of the qualitative composite index. To incorporate the attributes of both these indices, a combined leading indicator is constructed with each component having equal weighting. The final composite leading indicator is then evaluated against the SARB sectoral reference cycle.

Certain aspects of the statistical performance of these composite indices, after allowance has been made for publication lags of data, are given below.

Effective median lead times of turning points in the composite leading indicators developed in this study after allowing for lags in publication of data (in months):

	Qualitative composite index	Quantitative composite index	Combined leading indicator
Median lead(-) at troughs	-2,5	-6,5	-5,0
Median lead(-) at peaks	-8,5	-6,5	-3,5
Median lead(-) at all turns	-7,0	-6,5	-6,0

This comparison shows that at troughs the quantitative composite index leads the qualitative composite index by four months, on average. At peaks the median lead of the qualitative composite index is two months longer than in the case of the quantitative indicator. At all turns both indicators lead turning points by roughly six and a half to seven months.

The conclusion is drawn that judicious use of these composite leading indicators can assist forecasters, policy makers and participants in the South African building industry in determining turning points in the building cycle. It is argued that these leading indicators should be used in conjunction with other economic indicators to achieve the best forecasting results. Some directions for further research are provided. This study is summarised.

Finally, this study has proved to be worthwhile in that reliable qualitative and quantitative leading indicators have been developed that can assist in forecasting turning points of the building cycle in South Africa. A number of the findings correspond with international experience relating to leading indicators. The development of these indicators is of importance to policy makers and participants in the building industry because judicious use of such leading indicators can assist in the formulation of public policy, planning and the forecasting of future demand levels in the building industry. Improved planning and effective implementation of economic stabilisation policies can enhance the welfare of society at large.

* * * * * * *

REFERENCES

Aaron, H.J. & Pechman, J.A. 1981. How taxes affect economic behaviour. Studies in Government Finance: Washington, D.C.: The Brookings Institution.

Ackley, G. 1961. Macroeconomic theory. New York: Macmillan.

Aiginger, K. 1977. The use of survey data for the analysis of business cycles. CIRET Studies No. 24. Munich: CIRET. (CIRET as used here and elsewhere in this study stands for Centre for International Research on Economic Tendency Surveys).

Anderson, O. 1952. The business test of the Ifo Institute for Economic Research, Munich, and its theoretical model. Review of the International Statistical Institute, 20, 1-17.

Argus. 1990. Price gap between building and buying "unlikely to close". 11 August.

Auerbach, A.J. 1982. The index of leading indicators: "Measurement without theory," thirty-five years later. Review of Economics and Statistics, 64, 589-595.

Austin, M. 1980. Fixed investment, factor substitution and the elasticity of demand. Applied Economics, 12, 75-84.

Backeberg, C.A. 1941. Die boubedryf as middel tot stabilisering van die konjunktuur in Suid-Afrika. Unpublished M. Comm. thesis. Pretoria: University of Pretoria.

Ball, M.J. & Kirwan, R.M. 1977. Urban housing demand: Some evidence from cross-sectional data. Applied Economics, 9(4), 343-366.

Balsley, H.L. 1970. Quantitative research methods for business and economics. New York: Random House.

Barnicke, W.F. 1974. The industrial organization dimensions of cycles in the construction industry. Ottowa: Economic Council of Canada.

Barr, G.D.I. 1983. A leading indicator for the South African economy. Journal for Studies in Economics and Econometrics, 15, 37-53.

Beck, M.T., Bush, M.G. & Hayes, R.W. 1973. The indicator approach to the identification of business cycles. Reserve Bank of Australia, Occasional Paper, 2, June.

Bennett, A. 1984. Output expectations of manufacturing industry. Applied Economics, 16(6), 869-879.

Bester, M.C. 1970. Die determinante van boukonstruksie in Suid-Afrika. Unpublished M. Comm. thesis. Stellenbosch: University of Stellenbosch.

Birch, E.M. & Siebert, C.D. 1976. Uncertainty, permanent demand and investment behaviour. American Economic Review, 66(1), 15-27.

Bishop, D. 1975. Productivity in the construction industry. In Turin, D.J. (ed.) Aspects of the economics of construction. London: Godwin.

Boehm, E.A. 1982. Understanding business cycles: A critical review of theory and fact. Paper given at 11th Conference of Economists, Flinders University, Adelaide, Australia.

Boehm, E.A. 1990. Understanding business cycles today: A critical review of theory and fact. In Klein, P.A. (ed.) Analyzing modern business cycles: Essays honoring Geoffrey H. Moore. London: M.E. Sharpe.

Bon, R. 1989. Building as an economic process. An introduction to building economics. Englewood Cliffs, NJ: Prentice-Hall.

Boschan, C. & Banerji, A. 1990. A reassessment of composite indexes. In Klein, P.A. (ed.) Analyzing modern business cycles: Essays honoring Geoffrey H. Moore. London: M.E. Sharpe.

Boshoff, H. 1991. Value systems forecasting as an aid to business cycle forecasting. Paper read at the 20th CIRET Conference. Budapest, October.

Boshoff, H. 1993. Political forecasting using opinion surveys as an aid to business cycle forecasting. Paper read at the 21st CIRET Conference. Somerset West, October.

Bry, G. & Boschan, C. 1971a. Cyclical analysis of time series: selected procedures and computer programs. Technical Paper 20. National Bureau of Economic Research. New York: Columbia University Press.

Bry, G. & Boschan, C. 1971b. Programmed selection of cyclical turning points in individual time series; program description and input instructions. National Bureau of Economic Research, U.S.A.

Buckley, P.J. & Enderwick, P. 1989. Manpower management. In Hillebrandt, P.M. & Cannon, J. (eds.) The management of construction firms: Aspects of theory. London: Macmillan.

Bureau for Economic Research. 1972. Finale verslag aan die Raad vir Geesteswetenskaplike Navorsing oor 'n studie van die metodiek tans deur die Buro vir Ekonomiese Ondersoek gevolg by sy kwartaal-, jaar- en driejaarlikse ekonomiese vooruitskattings met die doel om, waar moontlik, verbeterings aan te bring. Report R/33/75. Stellenbosch: University of Stellenbosch.

Bureau for Economic Research. 1991. Building and Construction, 6(3), September.

Burnham, J.B. 1972. Private financial institutions and the residential mortgage cycle, with particular reference to the savings and loan industry. In Ways to moderate fluctuations in housing construction. Board of Governors, Federal Reserve Board.

Burns, A.F. & Mitchell, W.C. 1946. Measuring business cycles. New York: National Bureau of Economic Research.

Cagan, P. 1990. The leading indicators and monetary aggregates. In Klein, P.A. (ed.) Analyzing modern business cycles: Essays honoring Geoffrey H. Moore. London: M.E. Sharpe.

Campbell, A.D., Bloom, M. & Groome, C. 1974. Demand-management and the construction industries now and in the future. Building Technology and Management, September, 16-21.

Cargill, T.F. 1971. Construction activity and secular change in the United States. Applied Economics, 3, 85-97.

Carlson, J. 1991. Economic surveys and the scientific method. Paper read at the 20th CIRET Conference. Budapest, October.

Census of Construction. 1985. Report No. 50-01-01. Pretoria: Central Statistical Service.

Chapman, J.A.L. & Webb, M.J. 1983. A comparison of open competitive tenders and negotiated contracts. Unpublished technical report. Cape Town: Department of Construction Economics and Management, University of Cape Town, September.

Child, D. 1970. The essentials of factor analysis. London: Rinehart.

Chirinko, R.S. 1993. Business fixed investment spending: modelling strategies, empirical results, and policy implications. Journal of Economic Literature, 31, 1875-1911.

CIRET. 1993. Circular on the Centre for International Research on Economic Tendency Surveys (CIRET). Munich.

Clark, C. & Jones, G.T. 1971. The demand for housing. University Working Paper No. 11. London: Centre for Environmental Studies. September.

Cloete, J. 1990. The business cycle and the long wave with special reference to South Africa. Johannesburg: The Institute of Bankers.

Davidson, P. 1982/83. Rational expectations: A fallacious foundation for studying crucial decision-making processes. Journal of Post Keynesian Economics, 5(2), 182-198.

Defays, D. 1993. First steps in the harmonisation of innovation surveys in EC and EFTA countries. Paper read at the 21st CIRET Conference. Somerset West, October.

De Jager, C.J. 1993. A comparative analysis of the BER's South African consumer confidence index for whites and blacks: 1982-1992. Paper read at the 21st CIRET Conference. Somerset West, October.

De Kock, G. 1975. The business cycle in South Africa: Recent tendencies. South African Journal of Economics, 43(1), 1-14.

Denny, R. 1985. Flat fees, no bill of quantities: the BPF system. Juta's South African Journal of Property, 2(4), 14-19.

Dernburg, T.F. & McDougall D.M. 1968. Macroeconomics. 3rd ed. New York: McGraw-Hill.

De Vries, A.J.M. & Stuart, O.D.J. 1977. An evaluation of the annual forecast of the Bureau for Economic Research, University of Stellenbosch. Paper read at the 13th CIRET Conference. Munich, September.

De Vos, T.J. 1987. State subsidies for first-time homeowners: An objective evaluation and some constructive proposals. Juta's South African Journal of Property, 3(6), 2-5.

Diebold, F.X. & Rudebusch, G.D. 1989. Scoring the leading indicators. Journal of Business, 62(3), 369-391.

Dryden, J. 1983. The OECD system of leading indicators. Paper read at the 16th CIRET Conference. Washington, D.C., September.

Duesenberry, J.S. 1958. Business cycles and economic growth. New York: McGraw-Hill.

Du Plessis, P.G. 1978. Concentration of economic power in the South African manufacturing industry. South African Journal of Economics, 46(3), 257-271.

Du Toit, A.P.T. 1975. 'n Ekonometriese studie van die investeringsfunksie vir Suid-Afrika. Unpublished Ph.D. dissertation. Stellenbosch: University of Stellenbosch, November.

Du Toit, A.P.T. 1977. Is the probability that a turning point of the business cycle will occur an increasing function of the duration of a cyclical phase? Opinion Survey Report No. 90, 22-30.

Eckstein, O. 1967. Public finance. Englewood Cliffs, NJ: Prentice-Hall.

Economic Council of Canada. 1974. Toward more stable construction. Report of the study on cyclical instability in construction. Ottowa.

Eisner, R. 1963. Investment: Fact and fancy. American Economic Review, 53, 237-246.

Eisner, R. & Strotz, R.H. 1963. Determinants of business investment. In Impacts of monetary policy. Commission on money and credit. Englewood Cliffs, NJ: Prentice-Hall.

Evans, M.K. 1969. Macroeconomic activity: theory, forecasting and control, an economic approach. International ed. New York: Harper & Row.

Evans, M.K. 1983. The use of judgement in econometric forecasting. Paper read at the 16th CIRET Conference. Washington, D.C., September.

Fellberg, U-C. 1979. Attempt to apply the image factor analysis to Ifo-test time series. Paper read at the 14th CIRET Conference. Lisbon, September.

Fiedler, E.R. 1990. The future lies ahead. In Klein, P.A. (ed.) Analyzing modern business cycles: Essays honoring Geoffrey H. Moore. London: M.E. Sharpe.

Finance Week. 1990. Property: Climate changeable, forecast cloudy. 26 July - 1 August.

Fine, B. 1975. Tendering strategy. In Turin, D.A. (ed.) Aspects of the economics of construction. London: Godwin.

Fine, B. 1979. Production management. In Burgess, R.A. (ed.) Management in the construction industry. London: Macmillan.

Fisher, I. 1907. The rate of interest. New York: Macmillan.

Fisher, I. 1930. The theory of interest. New York: Macmillan.

Flanagan, R. & Norman, G. 1989. Pricing policy. In Hillebrandt, P.M. & Cannon, J. (eds.) The management of construction firms: Aspects of theory. London: Macmillan.

Flôres, R.G. Jr. 1991. The stability of the construction engineering survey: A multivariate analysis. Paper read at the 20th CIRET Conference. Budapest, October.

Friend, I. 1970. Summary and recommendations. In Study of the savings and loan industry. Friend, I. (ed.) Washington, D.C.: Federal Home Loan Bank Board, GPO, 1.

Fourie, F.C. van N. & Smit, M.R. 1989. Trends in economic concentration in South Africa. South African Journal of Economics, 57(3), 241-253.

Fourie, F.C. van N. & Smith, A. 1993. Concentration, tariff protection and industrial performance in South Africa. South African Journal of Economics, 61(3), 116-133.

Fourie, F.C. van N. 1993. Economic concentration: A survey and evaluation of policy options. South African Journal of Economics, 61(3), 134-152.

Gerstenberger, W., Lindlbauer, J.D., Nerb, G. & Strigel, W.H. 1971. Abschwung und Rezession im Spiegel Quantitativer and Qualitativer Statistik. CIRET Studies No. 15. Munich: CIRET.

Glass, G.V. & Stanley, J.C. 1970. Statistical methods in education and psychology. New Jersey: Prentice-Hall.

Gluch, E. & Hofman, H. 1986. Leading indicators of demand in structural engineering. In Leading indicators of demand in the building industry. CIRET Studies No. 37. Munich: CIRET.

Goldrian, G. 1987. The aggregation of climate indicators into a composite indicator. In Oppenländer, K.H. & Poser, G. (eds.) 1988. Contributions of business cycle surveys to empirical economics. Papers presented at the 18th CIRET Conference. Zurich. Aldershot: Avebury.

Goldrian, G. & Strigel, W.H. 1991. An indicator for German export business: A new approach. Paper read at the 20th CIRET Conference. Budapest, October.

Gordon, R.J. 1987. Postwar developments in business cycle theory: An unabashedly New-Keynesian perspective. In Oppenländer, K.H. & Poser, G. (eds.) 1988. Contributions of business cycle surveys to empirical economics. Papers presented at the 18th CIRET Conference. Zurich. Aldershot: Avebury.

Gough, T.J. 1972. Determinants of fluctuations in private housing investment. Applied Economics, 4, 135-144.

Gough, T.J. 1975. Phases of British private housebuilding and the supply of mortgage credit. Applied Economics, 7, 213-222.

Graham, A.K. & Senge, P.M. 1980. A long-wave hypothesis of innovation. Technological Forecasting and Social Change, 17, 283-311.

Grebler, L. & Maisel, S.J. 1963. Determinants of residential construction: A review of present knowledge. In Impacts of monetary policy. Englewood Cliffs, NJ: Prentice-Hall.

Grebler, L. & Burns, L.S. 1982. Construction cycles in the United States since World War II. American Real Estate and Urban Economics Association Journal, 10(2), 123-151.

Guttentag, J.M. 1961. The short cycle in residential construction, 1946-59. American Economic Review, 51(1), 275-298.

Haavelmo, T. 1960. A study in the theory of investment. Chicago: University of Chicago Press.

Hansen, A.M. 1951. Business cycles and national income. New York: Norton.

Hicks, J.R. Causality in economics. New York: Basic Books.

Hillebrandt, P.M. 1975. The capacity of the industry. In Turin, D.J. (ed.) Aspects of the economics of construction. London: Godwin.

Hillebrandt, P.M. 1985. Economic theory and the construction industry. London: Macmillan.

Hillebrandt, P.M. & Cannon, J. 1989a. Financial strategy. In Hillebrandt, P.M. & Cannon, J. (eds.) The management of construction firms: Aspects of theory. London: Macmillan.

Hillebrandt, P.M. & Cannon, J. 1989b. Diversification. In Hillebrandt, P.M. & Cannon, J. (eds.) The management of construction firms: Aspects of theory. London: Macmillan.

Hillebrandt, P.M. & Cannon, J. 1990. The modern construction firm. London: Macmillan.

Hindle, R.D. 1991. The business cycle, demand for construction and appropriate selling methods for contractors. Unpublished M.Sc. (Building Management) thesis. Cape Town: Department of Construction Economics and Management, University of Cape Town.

Holm, P. 1967. A desegregated housing market model. In Nevitt, A. A. (ed.) The Economic Problems of Housing. Proceedings of a conference of the International Economic Association. London: Macmillan.

Holmans, A.E. 1971. A forecast of effective demand for housing in Great Britain in the 1970's. Social Trends, 1, 33-45. London: HMSO.

Homeownership Handbook No. 22. 1990. Somerset West.

Hupkes, G.J. et al. 1959. Development and status of and plans for business tendency surveys in several countries - 10 short summaries. Paper read at the 4th CIRET Conference. Munich.

Hupkes, G.J. 1961. An evaluation of the opinion survey method of business forecasting as applied by the Bureau for Economic Research. Stellenbosch: Bureau for Economic Research, University of Stellenbosch.

Hupkes, G.J. 1963. The availability of ex ante data for forecasting net national income and gross domestic expenditure. Paper read at the 6th CIRET Conference. Vienna, April.

Hupkes, G.J. 1967. Investment intentions surveys in South Africa. Paper read at the 8th CIRET Conference. Paris.

Hutcheson, J.M. 1990. Forecasting the building market. Building Economics and Construction Management, (1), 135-143.

Ingersoll, J.E. & Ross, S.A. 1988. Waiting to invest: Investment and uncertainty. Unpublished papers. New Haven, Connecticut, U.S.A.: Yale University.

Janse van Rensburg, M.P. 1990. A reference cycle and leading indicator for South African financial markets: Some results. Unpublished technical report. Bellville: University of Stellenbosch Business School.

Jochems, D.B. & De Wit, G.M. 1960. On the predictive value of regression of business test data on conventional statistics. Report 6001, Netherlands School of Economics.

Johnston, T.L., Jackson, L.W., Scot, A. & Welham, P.J. 1972. The demand for private housing in Scotland: A report for the Scottish Housing Advisory Committee. Edinburgh: HMSO.

Jöhr, W.A. 1978. Psychological infection: A cause of business fluctuations. In Strigel, W.H. (ed.) Problems and Instruments of Business Cycle Analysis. Berlin: Springer-Verlag.

Jordaan, J. 1991. Population growth - our time bomb. The solution to South Africa's population problem. Pretoria: Van Schaik.

Jorgenson, D.W. 1963. Capital theory and investment behaviour. American Economic Review, 53(2), 247-259.

Jorgenson, D.W. 1967. The theory of investment behaviour. In Williams, H.R. & Huffnagle, J.D. (eds.) 1969. Macroeconomic theory: Selected readings. New York: Appleton-Century-Crofts.

Jorgenson, D.W. 1971. Econometric studies of investment behaviour: A Survey. Journal of Economic Literature, 9(4), 1111-1147.

Kantor, B. 1990. A perspective on investment spending in South Africa with a particular emphasis on housing. Paper read at the National Association of Home Builders Housing

Conference. Pretoria. May.

Katona, G. 1960. The powerful consumer. New York: McGraw-Hill.

Keating, G. 1983. The effect of answering practices on the relationship between CBI survey data and official data. Applied Economics, 15, 213-224.

Kendall, M.G. & Stuart, A. 1968. The advanced theory of statistics. London: Charles Griffen & Co.

Keynes, J.M. 1970. The general theory of employment interest and money. London: MacMillan.

Kilian, W.F. 1976. On stabilising construction: an investigation into the characteristics and cyclical fluctuations of the construction industry to recommend possible stabilising measures. Stellenbosch: Bureau for Economic Research, University of Stellenbosch.

Kilian, W.F. 1977. Stability as an objective - developments to date and future possibilities. Paper read at the Annual Congress of the Building Industries Federation. Plettenberg Bay, October.

Kilian, W.F. 1978. The effect of risk and uncertainty in contract prices. Paper read at a seminar of the South African Institute of Building. Cape Town, September.

Kilian, W.F. 1980. Escalating building costs - a threat to homeowners. Inaugural Lecture, Anglo American Professor of Building. Cape Town: University of Cape Town, June.

Kilian, W.F. 1982. An evaluation of contract price adjustment. Confidential report commissioned by the Civil Engineering Advisory Council. Stellenbosch: Bureau for Economic Research, University of Stellenbosch, June.

Kilian, W.F. & Snyman, G.J.J. 1976. An evaluation of the influence of the CPAP formulae. Building Survey No. 30. Stellenbosch: Bureau for Economic Research, University of Stellenbosch, June.

Kilian, W.F. & Snyman, G.J.J. 1979. Research to improve stability in the building industry. Paper read at the 4th South African Building Research Congress. Cape Town, May.

Kilian, W.F. & Snyman, G.J.J. 1984. The Kuznets and Kondratieff cycles and their relevance in property. Juta's South African Journal of Property, 1(16), 13-18.

Kilian, W.F. & Snyman, G.J.J. 1985a. The Haylett controversy - an independent view. Juta's South African Journal of Property, 2(2), 41-48.

Kilian, W.F. & Snyman, G.J.J. 1985b. On containing building costs. Juta's South African Journal of Property, 2(4), 26-30.

Kilian, W.F. & Snyman, G.J.J. 1987. Wither house prices? Juta's South African Journal of Property, 4(1), 6-11.

Kilian, W.F. & Snyman, G.J.J. 1990. Fact, not fiction: An evaluation of contract price adjustment as applied in the South African building industry. Confidential report commissioned by the Building Industries Federation of South Africa. Stellenbosch: Medium-Term Forecasting Associates, May.

Kilian, W.F., Snyman, G.J.J. & Sher, A. 1988. Report on contract price adjustment formulae. Confidential report commissioned by the Civil Engineering Advisory Council. Stellenbosch: Medium-Term Forecasting Associates, October.

Kim, J-O. 1975. Factor analysis. In Nie, N.H. (ed.) Statistical package for the social sciences. 2nd ed. New York: McGraw-Hill.

Klein, L.R. 1990. Cyclical indicators in econometric models. In Klein, P.A. (ed.) Analyzing modern business cycles: Essays honoring Geoffrey H. Moore. London: M.E. Sharpe.

Klein, P.A. 1983. The neglected institutionalism of Wesley Clair Mitchell: The theoretical basis for business cycle indicators. Journal of Economics Issues, 17(4), December.

Klein, P.A. 1990. Entrepreneurial confidence and money illusion. In Klein, P.A. (ed.) Analyzing modern business cycles: Essays honoring Geoffrey H. Moore. London: M.E. Sharpe.

Klein, P.A. & Moore, G.H. 1981. The CBI econometric surveys: An aid in analysing U.K. business cycles. Applied Economics, 13, 167-199.

Klein, P.A. & Moore, G.H. 1981. Industrial Surveys in the U.K.: Part II: Stocks, profits and business confidence over the business cycle. Applied Economics, 13, 465-480.

Klein, P.A. & Moore, G.H. 1983. The leading indicator approach to economic forecasting - retrospect and prospect. Journal of Forecasting, 2(2), 119-135.

Klein, P.A. & Moore, G.H. 1985. Monitoring growth cycles in market-oriented countries: Developing and using international economic indicators. National Bureau of Economic Research Studies in Business Cycles No. 26. Cambridge, Mass: Ballinger.

Klein, P.A. & Moore, G.H. 1986. Purchasing management survey data: Their value as leading indicators. Paper presented at the 6th International Symposium on Forecasting, Paris, France. New York: Center for International Business Cycle Research, Columbia Business School, September.

Kloek, T. & Bannink, R. 1961. Principal component analysis applied to business test data. Paper read at the 5th CIRET Conference. Noordwijk, May.

Knox, A.D. 1952. The acceleration principle and the theory of investment: A survey. In Mueller, M.G. (ed.) 1971. Readings in macroeconomics. London: Holt, Rinehart & Winston.

König, H. 1991. Employment and innovation activity: Analysing the causal relations for qualitative panel data under Markov assumption. Paper read at the 20th CIRET Conference. Budapest, October.

Koopmans, T.C. 1947. Measurement without theory. Review of Economics and Statistics, 29. Reprinted in Gordon, R.A. & Klein, L.R. (eds.) 1965. Readings in business cycles. Illinois: Irwin.

Koopmans, T.C. 1949. A reply. Review of Economics and Statistics, 31. Reprinted in Gordon, R.A. & Klein. L.R. (eds.) 1965. Readings in business cycles. Illinois: Irwin.

Koopmans, T.C. 1957. Additional comment. In Gordon, R.A. & Klein, L.R. (eds.) 1965. Readings in business cycles. Illinois: Irwin.

Kuh, E. 1963. Theory and institutions in the study of investment behaviour. American Economic Review, 53, 260-268.

Langelütke, H. 1955. The Munich test method - A new source of economic information. Paper read at the 17th European Meeting of the Econometric Society. Kiel.

Langmantel, E. 1987. Improving the forecasting behaviour of a business cycle model with the help of anticipatory survey data. In Oppenländer, K.H. & Poser, G. (eds.) 1988. Contributions of business cycle surveys to empirical economics. Papers presented at the 18th CIRET Conference. Zurich. Aldershot: Avebury.

Lea, E. 1973. Stop-go and the building industry. Building, 18 May, 115-118.

Leach, D. 1992a. Concentration and profits in South Africa: Monopoly or efficiency? South African Journal of Economics, 60(2), 143-157.

Leach, D. 1992b. Absolute vs. relative concentration in the manufacturing industry: 1972-1985. South African Journal of Economics, 60(4), 386-399.

Lewis, J.P. 1965. Building cycles and Britain's growth. London: Macmillan.

Leyland, J. 1977. Qualitative indicators in international business cycle analysis. Paper read at the 13th CIRET Conference. Munich, September.

Liberatori, L. & Pinca, F. 1975. Factor analysis and results of business surveys. Paper read at the 12th CIRET Conference. Stockholm, June.

Long, J.B. & Plosser, C.I. 1983. Real business cycles. Journal of Political Economy, 91(1), 39-69.

Lucas, R.E. Jr. 1976. Econometric policy evaluation: A critique. Journal of Monetary Economics. Supplementary series, 1, 19-46.

Lucas, R.E. Jr. & Sargent, T.J. (eds.) 1981. Rational expectations and econometric practice, 1. Minneapolis: University of Minnesota Press.

Makridakis, S. & Wheelwright, S.C. 1978. Forecasting methods and applications. New York: Wiley.

Makridakis, S. et al. 1984. The forecasting accuracy of major time series models. New York: Wiley.

Mankiw, N.G. 1990. A quick refresher course in macroeconomics. Journal of Economic Literature, 28, 1645-1660.

Manski, C.F. & Rosen, K.T. 1978. The implications of demand instability for the behaviour of firms: The case of residential construction. American Real Estate and Urban Economics Association Journal, 6(2), 204-226. New Brunswick, N.J.

Markandya, A. 1983. Headship rates and the household formation process in Great Britain. Applied Economics, 15, 821-830.

Marquardt, W. & Strigel, W.H. 1959. Der Konjunkturtest eine neue methode der Wirtschaftsbeobachtung, Schriftenreihe des IFO-Instituts, Nr. 38. Berlin-Munich. Translated by G.J. Hupkes and H. Harlander. 1960. Munich.

Martin, C.H. 1981. A survey and evaluation of available economic time series which are related to building activity with special reference to their prognostic value. Unpublished M. Comm. thesis. Stellenbosch: University of Stellenbosch.

Martin, C.H. 1989. Behuisingsfinansieringsvraagstukke met spesifieke verwysing na Suid-Afrika. Unpublished Ph.D. dissertation. Stellenbosch: University of Stellenbosch.

Martin, C.H. 1992. Chief Economist of the Building Industries Federation of South Africa. Personal communication. Letter dated 28 January.

Martin, R.C. 1978. Credit conditions and the post-war U.S. residential investment cycle. Applied Economics, 10(1), 11-19.

McCallum, B.T. 1987. Postwar developments in business cycle theory: A moderately classical perspective. In Oppenländer, K.H. & Poser, G. (eds.) 1988. Contributions of business cycle surveys to empirical economics. Papers presented at the 18th CIRET Conference. Zurich. Aldershot: Avebury.

Mensch, G. 1979. Stalemate in technology. Cambridge: Ballinger.

Merkies, A.H.Q.M. & Poot, H.J. 1990. A case-study of forecasting building activity in the Netherlands and New Zealand. Building Economics and Construction Management, 1, 201-216.

Meyer, J.R. & Kuh, E. 1957. The investment decision: An empirical study. Cambridge: Harvard University Press.

Mill, J.S. 1909. Principles of political economy. London: Longmans Green & Co.

Mocke, B.A. 1990. 'n Evaluering van Konjunkturtest-data in die boubedryf. Stellenbosch: Bureau for Economic Research, University of Stellenbosch, May.

Mocke, A. & Stuart, O.D.J. 1991. Development of leading indicators in the building and construction industry. Paper read at the 20th CIRET Conference. Budapest, October.

Moolman, J. 1981. Income elasticity of demand for housing. Construct. Cape Town: Department of Construction Economics and Management, University of Cape Town, December.

Moore, G.H. & Cullity, J.P. 1993. The historical record of leading indicators - an answer to "measurement without theory". Paper read at the 21st CIRET Conference. Somerset West, October.

Moore, G.H. & Shiskin, J. 1967. Indicators of business expansions and contractions. New York: National Bureau of Economic Research.

Mouton, I.J. 1976. 'n Markondersoek na die blanke woning-behoefte in die Tygerberg met besondere verwysing na dié van die woonstelbewoners. Unpublished M. Comm. thesis. Stellenbosch: University of Stellenbosch.

Naggl, W. 1983. The anticipations model: A short-term forecasting model based on anticipations data. In Oppenländer, K.H. & Poser, G. (eds.) 1984. Leading indicators and business cycle surveys. Papers presented at the 16th CIRET Conference. Washington, D.C. New York: St. Martin's Press.

Naggl, W. 1985. The forecasting record of the anticipations model since 1983. Paper read at the 17th CIRET Conference. Vienna.

Neftci, S. 1984. Are economic time series asymmetric over the business cycle? Journal of Political Economy, 92, 307-328.

Nerb, G. & Strigel, W.H. 1977. Entrepreneurs' perception of social environment and its influence on growth expectations. Paper read at the 13th CIRET Conference. Munich, September.

O'Dea, D.J. 1975. The cyclical timing of labor market indicators in Great Britain and the United States. Explorations in Economic Research, 1.

Oppenländer, K.H. 1993. Narrowing the induction gap: Measurement without theory? Paper read at the 21st CIRET Conference. Somerset West, October.

Pellisier, G.M. 1992. The information contained in the BER Manufacturing Surveys: A factor analytic approach. Journal for Studies in Economics and Econometrics, 16(2), 19-27.

Pellissier, G.M. & Smit, E. v.d. M. 1993. Constructing sectoral leading indicators using data reduction techniques. Paper read at the 21st CIRET Conference. Somerset West, October.

Pellisier, G.M. & Stuart, O.D.J. 1993. Using business text survey data to test for rationality in business behaviour and to develop economic indicators. Paper read at the 21st CIRET Conference. Somerset West, October.

Persson, B.A. 1975. On the reliability of business tendency survey data as cyclical indicators. Outline of a theory for general evaluation. Paper read at the 12th CIRET Conference. Stockholm, June.

Persson, B.A. 1977. Balance series as true and false indicators of quantitative change: Theory and practice. Paper read at the 13th CIRET Conference. Munich, September.

Piatier, A. 1951/52. Nouvelles méthodes pour l'étude de la conjoncture et la prévision économique. Kyklos, 5. Bern.

Piatier, A. 1953/54. Nouvelles méthodes pour l'étude de la conjoncture et la prévision économique. Kyklos, 7. In Strigel, W.H. 1981. Essays on Trade Cycle Surveys. CIRET Studies No. 30. Munich: CIRET.

Piatier, A. 1979. Business cycle surveys - their utilization for forecasting. Paper read at the 14th CIRET Conference. Lisbon, September.

Pindyck, R.S. 1991. Irreversibility, uncertainty and investment. Journal of Economic Literature, 29, 1110-1148.

Poser, G. 1975. Theoretical implications and empirical results of the use of anticipatory data in a macro-economic model. Paper read at the 12th CIRET Conference. Stockholm, June.

Prescott, E. 1986. Theory ahead of business cycle measurement. Federal Reserve Bank of Minneapolis Quarterly Review (Fall).

Reconstruction and Development Programme. 1994. African National Congress. Johannesburg.

Rode, E. 1988. Rode's report on the South African property market, 3, October.

Rode, E. 1991. Rode's report on the South African property market, 4, November.

Rode, E., Lewis, L.B., Snyman, G.J.J., Touzel, H. & de Vos, T. 1990. Current and future building activity in SA 1990 - 1995. BMI Building Research Strategy Consulting Unit. Rivonia: December.

Roest, W. 1973. Bouw en economische groei. Deventer: Kluwer.

Rosen, K.T. 1979. Cyclical fluctuations in residential construction and financing. In Lange, J.E. & Mills, D.Q. (eds.) The construction industry, balance wheel of the economy. Lexington, Mass.: Heath & Co.

Rosenthal, L. 1989. Income and price elasticities of demand for owner-occupied housing in the UK: Evidence from pooled cross-sectional and time-series data. Applied Economics, 21, 761-775.

Samuelson, P.A. 1967. Economics: An introductory analysis. 7th ed. New York: McGraw Hill.

Schmid, D. 1986. A new qualitative leading indicator for forecasting new savings and loan industry. In Leading indicators of demand in the building industry. CIRET Studies No. 37. Munich: CIRET.

Scholz, L. 1991. Interrelations between intangible and tangible investments, growth and employment: Consequences for innovation-, investment- and business surveys. Paper read at the 20th CIRET Conference. Budapest, October.

Scholz, L. & Kaminski, P. 1993. International comparison of innovation survey data: Methodological problems and empirical results. Paper read at the 21st CIRET Conference. Somerset West, October.

Schumann, C.G.W. 1956. Foreword to article by Van den Berg, M. & Verburgh, C. The accuracy of forecasts in the South African business opinion surveys. The South African Journal of Economics, 24(1), 37.

Schumann, C.G.W. 1957. The opinion survey method within the pattern of business forecasting, with special reference to South Africa. Paper read at the 3rd International Conference of Business Forecasting. Munich, July.

Schumann, C.G.W. 1965. Opinion surveys and national economic budgeting in South Africa. Paper read at the 7th CIRET Conference. Rome, April.

Schumann, C.G.W. 1969. Preface. Building Survey No. 1. Stellenbosch: Bureau for Economic Research, University of Stellenbosch, April.

Schumann, C.G.W. & Van den Bogaerde, F. 1955. Economic diagnosis and business forecasting with special reference to South Africa. Stellenbosch: Bureau for Economic Research, University of Stellenbosch.

Schumpeter, J.A. 1939. Business cycles: A theoretical, historical, and statistical analysis of the capitalist process. Vol. 1 & 2. New York: McGraw-Hill.

Segalla, U. 1991. The BER building cost index - an overview. Studies in Economics and Econometrics, 15(1), 43-57.

Shackle, G.L.S. Uncertainty in economics. Cambridge: Cambridge University Press.

Shapiro, E. 1970. Macroeconomic analysis. 2nd ed. New York: Harcourt Brace.

Shiskin, J. 1967. Reverse trend adjustment of leading indicator. Review of Economics and Statistics, 49, 45-49.

Shiskin, J. & Moore, G.H. 1967. Indicators of business expansions and contractions. New York: National Bureau of Economic Research.

Smit, D.J. & Van der Walt, B.E. 1970. Business cycles in South Africa during the post-war period, 1946 to 1968. South African Reserve Bank Quarterly Bulletin. Pretoria, September.

Smit, D.J. & Van der Walt, B.E. 1973. Business cycles in South Africa during the period 1968 to 1972. South African Reserve Bank Quarterly Bulletin. Pretoria, June.

Smit, D.J. (Part 1) & Van der Walt, B.E. (Part II). 1982. Growth trends and business cycles in the South African economy, 1972 to 1981. South African Reserve Bank Quarterly Bulletin. Pretoria, June.

Smit, E. van der M. 1982. Die waarde van opnamedata in ekonometriese modelle met spesifieke verwysing na die opiniatiewe data van die Buro vir Ekonomiese Ondersoek. Unpublished D. Comm. dissertation. Stellenbosch: University of Stellenbosch.

Smit, E. van der M. 1983a. A systematic comparison of expenditure models of the South African economy excluding and including opinion survey variables. Paper read at the 16th CIRET Conference. Washington, D.C., September.

Smit, E. van der M. 1983b. 'n Ekonometriese bestedingsmodel van die Suid-Afrikaanse ekonomie gebaseer op kwalitatiewe data-insette. Journal for Studies in Economics and Econometrics, 15, 15-37.

Smit, E. van der M. 1983c. The accuracy of the Carlson-Parkin method of quantification - some empirical evidence. Journal for Studies in Economics and Econometrics, Special Edition, November, 89-93.

Smit, E. van der M. 1986. Combining quantitative and qualitative data in business cycle research. South African Journal of Business Management, 17(3), 143-148.

Smit, E. van der M. 1987. The structural stability of econometric relationships containing qualitative survey data. In Oppenländer, K.H. & Poser, G. (eds.) 1988. Contributions of business cycle surveys to empirical economics. Papers presented at the 18th CIRET Conference. Zurich. Aldershot: Avebury.

Smit, E. v.d. M. 1991. Is business survey data of any value for decisions in derivative financial markets: Options and futures? Paper read at the 20th CIRET Conference. Budapest, October.

Smit, E. van der M. & Kotze, D. 1984. A psychological profile of the South African business cycle based on qualitative data. Journal for Studies in Economics and Econometrics, 20, 7-16.

Smith, L.B., Rosen, K.T. & Fallis, G. 1988. Recent developments in economic models of housing markets. Journal of Economic Literature, 26, 29-64.

Snyman, G.J.J. 1980a. Future housing costs and developments. Forty-first Annual Report. Association of Building Societies of South Africa. Johannesburg.

Snyman, G.J.J. 1980b. On building cost indicators. Building Survey No. 44. Stellenbosch: Bureau for Economic Research, University of Stellenbosch, January.

Snyman, G.J.J. 1988. The South African building industry outlook to the year 2000. Paper read at the 11th International South African Building and Construction Exhibition. Johannesburg, August.

Snyman, G.J.J. 1989. How the business cycle influences building costs. Juta's South African Journal of Property, 5(3), 38-44.

Scholz, L. 1991. Interrelations between intangible and tangible investments, growth and employment: Consequences for innovation-, investment- and business surveys. Paper read at the 20th CIRET Conference. Budapest, October.

Scholz, L. & Kaminski, P. 1993. International comparison of innovation survey data: Methodological problems and empirical results. Paper read at the 21st CIRET Conference. Somerset West, October.

Schumann, C.G.W. 1956. Foreword to article by Van den Berg, M. & Verburgh, C. The accuracy of forecasts in the South African business opinion surveys. The South African Journal of Economics, 24(1), 37.

Schumann, C.G.W. 1957. The opinion survey method within the pattern of business forecasting, with special reference to South Africa. Paper read at the 3rd International Conference of Business Forecasting. Munich, July.

Schumann, C.G.W. 1965. Opinion surveys and national economic budgeting in South Africa. Paper read at the 7th CIRET Conference. Rome, April.

Schumann, C.G.W. 1969. Preface. Building Survey No. 1. Stellenbosch: Bureau for Economic Research, University of Stellenbosch, April.

Schumann, C.G.W. & Van den Bogaerde, F. 1955. Economic diagnosis and business forecasting with special reference to South Africa. Stellenbosch: Bureau for Economic Research, University of Stellenbosch.

Schumpeter, J.A. 1939. Business cycles: A theoretical, historical, and statistical analysis of the capitalist process. Vol. 1 & 2. New York: McGraw-Hill.

Segalla, U. 1991. The BER building cost index - an overview. Studies in Economics and Econometrics, 15(1), 43-57.

Shackle, G.L.S. Uncertainty in economics. Cambridge: Cambridge University Press.

Shapiro, E. 1970. Macroeconomic analysis. 2nd ed. New York: Harcourt Brace.

Shiskin, J. 1967. Reverse trend adjustment of leading indicator. Review of Economics and Statistics, 49, 45-49.

Shiskin, J. & Moore, G.H. 1967. Indicators of business expansions and contractions. New York: National Bureau of Economic Research.

Smit, D.J. & Van der Walt, B.E. 1970. Business cycles in South Africa during the post-war period, 1946 to 1968. South African Reserve Bank Quarterly Bulletin. Pretoria, September.

Smit, D.J. & Van der Walt, B.E. 1973. Business cycles in South Africa during the period 1968 to 1972. South African Reserve Bank Quarterly Bulletin. Pretoria, June.

Smit, D.J. (Part 1) & Van der Walt, B.E. (Part II). 1982. Growth trends and business cycles in the South African economy, 1972 to 1981. South African Reserve Bank Quarterly Bulletin. Pretoria, June.

Smit, E. van der M. 1982. Die waarde van opnamedata in ekonometriese modelle met spesifieke verwysing na die opiniatiewe data van die Buro vir Ekonomiese Ondersoek. Unpublished D. Comm. dissertation. Stellenbosch: University of Stellenbosch.

Smit, E. van der M. 1983a. A systematic comparison of expenditure models of the South African economy excluding and including opinion survey variables. Paper read at the 16th CIRET Conference. Washington, D.C., September.

Smit, E. van der M. 1983b. 'n Ekonometriese bestedingsmodel van die Suid-Afrikaanse ekonomie gebaseer op kwalitatiewe data-insette. Journal for Studies in Economics and Econometrics, 15, 15-37.

Smit, E. van der M. 1983c. The accuracy of the Carlson-Parkin method of quantification - some empirical evidence. Journal for Studies in Economics and Econometrics, Special Edition, November, 89-93.

Smit, E. van der M. 1986. Combining quantitative and qualitative data in business cycle research. South African Journal of Business Management, 17(3), 143-148.

Smit, E. van der M. 1987. The structural stability of econometric relationships containing qualitative survey data. In Oppenländer, K.H. & Poser, G. (eds.) 1988. Contributions of business cycle surveys to empirical economics. Papers presented at the 18th CIRET Conference. Zurich. Aldershot: Avebury.

Smit, E. v.d. M. 1991. Is business survey data of any value for decisions in derivative financial markets: Options and futures? Paper read at the 20th CIRET Conference. Budapest, October.

Smit, E. van der M. & Kotze, D. 1984. A psychological profile of the South African business cycle based on qualitative data. Journal for Studies in Economics and Econometrics, 20, 7-16.

Smith, L.B., Rosen, K.T. & Fallis, G. 1988. Recent developments in economic models of housing markets. Journal of Economic Literature, 26, 29-64.

Snyman, G.J.J. 1980a. Future housing costs and developments. Forty-first Annual Report. Association of Building Societies of South Africa. Johannesburg.

Snyman, G.J.J. 1980b. On building cost indicators. Building Survey No. 44. Stellenbosch: Bureau for Economic Research, University of Stellenbosch, January.

Snyman, G.J.J. 1988. The South African building industry outlook to the year 2000. Paper read at the 11th International South African Building and Construction Exhibition. Johannesburg, August.

Snyman, G.J.J. 1989. How the business cycle influences building costs. Juta's South African Journal of Property, 5(3), 38-44.

Snyman, G.J.J. 1991. The building industry retrospect and prospect: Forecast 1991 to 1995. SA Builder, October.

Söffner, F., Lindlbauer, J.D. & Ruderer, I. 1975. Das bauhauptgewerbe im spiegel von Ifo Konjunkturtest und statistik. Ifo Studien zur Bauwirtschaft 3. Munich: Ifo Institute for Economic Research.

South African Reserve Bank, 1990. Quarterly Bulletin. December.

South African Reserve Bank, 1991. South Africa's national accounts, 1946 to 1990. Supplement to Quarterly Bulletin, June.

Spangenberg, J.P. 1985. 'n Teoretiese benadering tot die rol van verwagtings in die ekonomie en 'n oorsigtelike ondersoek na hoe met opnametegnieke gepoog word om subjektiewe veranderlikes te kwantifiseer. Stellenbosch: University of Stellenbosch.

Stacey, R.D. 1968. The accuracy of the Stellenbosch Bureau forecasts (1959 to 1966). South African Journal of Economics, 36, 198-210.

Stalder, P. 1989. Excess demand and capacity utilization - an empirical analysis with Swiss business survey data. Applied Economics, 21, 1383-1395.

Stevens, A.J. 1990. Mortgage interest rates and the effective cost of homeownership: A critical commentary. Juta's South African Journal of Property, 6(3), 57-60.

Stevens, A.J. 1992. An integrated system for evaluating cost-effectiveness and investment performance potential of commercial property investments. Unpublished Ph.D. dissertation. Port Elizabeth: University of Port Elizabeth.

Strigel, W.H. 1972. Trade cycle indicators derived from qualitative data. CIRET Studies No. 19. Munich: CIRET.

Strigel, W.H. (ed.) 1977. In search of economic indicators - essays on business surveys. In Lecture Notes in Economic and Mathematical Systems No. 146. Berlin-Heidelberg-New York.

Strigel, W.H. 1981. Essays on trade cycle surveys. CIRET Studies No. 30. Munich: CIRET.

Strigel, W.H. 1990. Business cycle surveys: A new quality in economic statistics. In Klein, P.A. (ed.) 1990. Analyzing modern business cycles: Essays honoring Geoffrey H. Moore. London: M.E. Sharpe.

Stuart, O.D.J. 1979a. The South African experience with consumer and entrepreneurial surveys. Paper read at the 14th CIRET Conference. Lisbon, September.

Stuart, O.D.J. 1979b. Forecasting consumer durable spending with the aid of consumer attitudes: Notes on a few preliminary results. Journal for Studies in Economics and Econometrics, 6, 39-56.

Van Coller, J.E.M. 1980. A system of composite leading and coinciding indicators for the South African business cycle. Journal for Studies in Economics and Econometrics, 8, 41-73.

Van Coller, J.E.M. 1992. Personal letter. 16 September.

Van der Linden, E.J. 1979. Principal component analysis with data from the EEC-entrepreneurial and consumer surveys. Paper read at the 13th CIRET Conference. Munich, September.

Van der Walt, B.E. 1982. The identification and evaluation of economic indicators for a study of business cycles in South Africa. Unpublished D. Comm. dissertation. Pretoria: Faculty of Economic and Political Sciences, University of Pretoria.

Van der Walt, B.E. 1983. Indicators of business cycle changes in South Africa. South African Reserve Bank Quarterly Bulletin. Pretoria, March.

Van der Walt, B.E. 1989. Business cycles in South Africa during the period 1981 to 1987. South African Reserve Bank Quarterly Bulletin. Pretoria, March.

Van Miltenburg, H. & Romijn, G. 1993. A composite leading indicator for the Dutch construction sector. Paper read at the International Symposium on Economic Evaluation and the Built Environment. Lisbon, September.

Vining, R. 1949. Koopmans on the choice of variables to be studied and of methods of measurement. Review of Economics and Statistics, 31. Reprinted in Gordon, R.A. & Klein, L.R. (eds.) 1965. Readings in business cycles. Illinois: Irwin.

Vining, R. 1949. A rejoinder. Review of Economics and Statistics, 31. Reprinted in Gordon, R.A. & Klein, L.R. (eds.) 1965. Readings in business cycles. Illinois: Irwin.

Vipond, J. & Walker, J.B. 1972. The determinants of housing expenditure and owner occupation. Bulletin of the Oxford University Institute of Economics and Statistics, 34(2), 169-187.

Weintraub, S. 1983. The supply price in the marginal efficiency of capital. Journal of Post Keynesian Economics, 5(4), 618-624.

Whitehead, C.M.E. 1974. The U.K. housing market: An econometric model. Farnborough: Saxon House.

Zarnowitz, V. & Boschan, C. 1975a. Cyclical indicators: An evaluation of new leading indexes. Business Conditions Digest. Bureau of Economic Analysis, U.S. Department of Commerce, Washington, D.C., May.

Zarnowitz, V. & Boschan, C. 1975b. New composite indexes of coincident and lagging indicators. Business Conditions Digest. Bureau of Economic Analysis, U.S. Department of Commerce, Washington, D.C., November.

Zarnowitz, V. 1985. Recent work on business cycles in historical perspective: A review of theories and evidence. Journal of Economic Literature, 23, 523-580.

Stuart, O.D.J. 1980. Analyses of business survey data. Journal for Studies in Economics and Econometrics, 8, 3-19.

Stuart, O.D.J. 1982. The leading characteristics of consumer sentiment data. Journal for Studies in Economics and Econometrics, 13, 79-95.

Stuart, O.D.J. 1983. The role of attitudes in consumer spending. In Opperländer, K.H. & Poser, G. (eds.) 1984. Leading indicators and business cycle surveys. Papers presented at the 16th CIRET Conference. Washington, D.C. New York: St. Martin's Press.

Stuart, O.D.J. 1984. Die ontwikkeling van ekonomiese aanwysers vanuit opiniatiewe data, 'n oorsig van bronne van sagte data en die rekenarisering daarvan, verslag een van RGN Projek A15/4/93. Stellenbosch: Bureau for Economic Research, University of Stellenbosch.

Stuart, O.D.J. 1987. Economic indicators - theory and practice. Stellenbosch: Bureau for Economic Research, University of Stellenbosch.

Stuart, O.D.J. 1993. The use of survey data in a rapidly changing environment. Paper read at the 21st CIRET Conference. Somerset West, October.

Stutz, F.N. 1957. Der Konjunkturtest. In Hupkes, G.J. 1961. An evaluation of the opinion survey method of business forecasting as applied by the Bureau for Economic Research. Stellenbosch: Bureau for Economic Research, University of Stellenbosch.

Tait, A.A. 1972. Value added tax. London: McGraw-Hill.

Tarshis, L. 1961. The elasticity of the marginal efficiency function. American Economic Review, 51(5), 958-985.

Theil, H. 1955. Measuring the accuracy of entrepreneurial anticipations. Paper read at the 17th European Meeting of the Econometric Society. Kiel.

Thom, R. 1984. Housing starts and mortgage availability: Evidence from the U.K. time series. Applied Economics, 16, 881-894.

Tobin, J. 1969. A general equilibrium approach to monetary theory. Journal of Money, Credit, Banking, 1(1), 15-29.

Tompkinson, P. & Common, M. 1983. Evidence on the rationality of expectations in the British manufacturing sector. Applied Economics, 15, 425-436.

Turin, D.A. 1975. Introduction. In Turin, D.A. (ed.) Aspects of the economics of construction. London: Godwin.

United Quarterly Housing Review. 1990. January to March.

Urban Foundation. 1990. Policies for a new urban future, policy overview, the urban challenge. Urban debate 2010, No. 2.

Vaccara, B.N. & Zarnowitz, V. 1977. How good are the leading indicators? Proceedings, Business and Economics Section, American Statistical Association, 2.

Ziegler, M. 1968. Spezialliteratur uber Konjunkturumfragen. CIRET Studies No. 10. Munich: CIRET.

Ziegler, M. 1980. 30 years of international exchange of experience on trade cycle surveys. A synopsis of papers presented at CIRET Conferences. CIRET Studies No. 29. Munich: CIRET.

Ziegler, R. 1985. Early indicators for demand in the building industry. Munich: Ifo Institut für Wirtschaftsforschung. September.

Ziegler, R. 1986. Results of harmonized EC-consumer surveys as leading indicators of the demand for constructional services. In Leading indicators of demand in the building industry. CIRET Studies No. 37. Munich: CIRET.

* * * * * * *