PRODUCTIVITY AND MICRO ECONOMIC GROWTH: AN ACCOUNTING MEASURE APPROACH

Presented to:
The Department of Accounting
University of Cape Town

In Partial Fulfillment
of the Requirements for the
Master of Commerce
Degree in
Financial Management

By

Bradley Gerdis

August 1997

Declaration

I, Bradley Gerdis, declare that this thesis entitled "Productivity and Micro Economic Growth: An Accounting Measure Approach" is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of a complete reference.

Signed by candidate

BRADLEY GERDIS

25 August 1997

Acknowledgments

I would like to express my sincere thanks to the following people for their assistance and support in the completion of this thesis:

To Professor Enrico Uliana for his valuable insight, constructive contribution and continued assistance as supervisor of this thesis.

To Dr Dudley Jackson for his kind permission to use the data sample which I obtained from his DBL. thesis.

I would also like to thank my friends Nolan Wolff, for allowing me to continually draw on his statistical knowledge, and Brandon Hucq for the kind use of his computer.

Finally, and most importantly, I wish to thank my parents, Alan and Ellen, for their continued support and above all for giving me the opportunity of an education.

Abstract

As productivity is accepted as a prime determinant of macro economic growth and as the macro economy constitutes an aggregation of micro economic components, the link between productivity and growth at the micro economic (or firm) level warrants further investigation.

The objective of this paper is to investigate this relationship between productivity and micro economic growth and to simultaneously address the specific concerns of both management and labour with regard to productivity initiatives.

After presenting a conceptual framework for productivity accounting and introducing the strategic implications of productivity related information, the paper progresses onto an empirical study into the relationship between productivity and firm specific growth. This empirical study uses various correlation models applied to a sample of companies to statistically test the relationship between productivity and various measures of firm specific growth.

Of particular relevance to this study is the use of appropriate growth measures based on the firms' strategic objectives and on factors directly related to the specific issues being addressed, as opposed to a single growth measure applied indiscriminately across the entire sample of companies.

After investigating the relationship between productivity and micro economic growth (as appropriately defined), the empirical study concludes that the concerns cited by both management and labour as reasons for their respective aversions to productivity initiatives are unfounded. The empirical study also offers preliminary evidence to support the use of the price recovery term as an indication of strategic objective.

This paper concludes by proposing that the links introduced here between productivity and micro economic growth serve as a basis for the inclusion of micro economic factors into future research into the relationship between productivity and growth.

CHAPTER ONE - INTRODUCTION

1.1 Introduction

An area of standing debate in the study of productivity is the link between productivity and growth. At the centre of this debate is the question of whether productivity gains are used to fund future growth in an enterprise or whether such savings are seen as a basis for reducing costs as the firm is effectively able to maintain its current production level while simultaneously consuming fewer resources.

While it is generally accepted that at the macro level increases in productivity bring economic growth through simultaneous decreases in unemployment and inflation [Prokopenko, 1995: p28; Uliana & Miller, 1996: p5], productivity initiatives at a firm level are often viewed with suspicion [Uliana & Miller, 1996: p8].

At the managerial level resistance to productivity schemes is often attributed to a fear of inward focus leading to potential cut backs and eventual down sizing. As productivity increases can be pursued through reductions in expenses or resource consumption, it is feared that attempts to do "more with less" could perpetuate into a negative cycle of doing "less with less" [Henkoff, 1990: p26; Uliana & Miller, 1996: p10].

In addition to the concerns of management, productivity improvement initiatives are often met with resistance from labour [Uliana & Miller, 1996: p8]. This is particularly true when partial productivity measures are used to relate output to labour time as a variable input. In the absence of a link between productivity gains and firm specific growth, productivity gains based on partial labour productivity measures would imply

a decreasing need for labour. It follows then that if the labour force is more productive, less labour will be needed to produce the equivalent level of output. Once faced with this dilemma, a natural aversion by the labour force to increases in productivity could be expected.

1.2 Objectives And Scope Of The Study

In light of the above, the establishment of a link between productivity gains and growth at the firm level is imperative to secure the commitment of all parties to productivity initiatives. The presence or absence of such a link between productivity and micro economic (or firm specific) growth will therefore form the central thesis of this study.

While previous work has been done into the relationships between productivity, price recovery and growth [Miller, 1984; Miller, Jackson & Parsons, 1992; Parsons, 1984; Uliana, 1996; Van Loggerenberg & Cucchiaro, 1981/82], the emphasis of the majority of these studies has been on the relationship between productivity and price recovery, with growth invariably being touched on as a side issue, if at all. Furthermore, prior work on the specific relationship between productivity and growth [Jackson, 1990] used a single measure of growth in the analyses. However, as different firms are likely to have different strategic objectives resulting in management focusing on growth in different areas, it is submitted that the use of a single growth measure applied indiscriminately across a multitude of firms could impose restrictions on the interpretation of the results achieved.

In addition to differing strategic objectives affecting the choice of growth measure to be used in the analysis, it is proposed that the appropriate definition of growth is dependent on the objective of the analysis itself. If the objective of the analysis is to examine the relationship between productivity and growth with regard to a variable resource, then a short term, resource specific measure of growth would be more appropriate than a long term measure of general growth across the entire enterprise. For example, when examining the effect of productivity changes on the level of employment, direct labour compensation should be used to measure growth in the labour force as a variable resource, while changes in the level of either the asset base or market share of a firm would be more appropriate measures of general, long term growth across the entire enterprise. For these reasons particular attention is paid to selecting appropriate growth measures to be used in this study.

The objective of this thesis is therefore to investigate the relationship between productivity and various measures of growth at a firm level in order to address the following issues:

- does increased productivity lead to growth?

  i.e. are productivity gains used to finance an expansion in the firm?

or

- is productivity pursued at the expense of growth?

  i.e. are productivity gains pursued through cost reductions and "downsizing" ?

and

- the implications of the above results on management and labour.

i.e. to address the specific concerns cited by management and labour contributing to their potential aversions to productivity initiatives.

1.3 Nature Of The Study

The paper begins with an analysis of productivity accounting and a review of the relevant literature, including a detailed analysis of the output of a productivity accounting exercise. The concept of growth is then examined and various measures are suggested and investigated. The strategic implications of productivity related information will also be introduced, where the emphasis will be placed on the possible use of the price recovery term as an indication of strategic objective.

The study addresses the above issues by empirically testing the relationship between productivity and growth through the use of various correlation models. Separate correlations each using an appropriate definition of growth against productivity are run to address each of the issues. For example, to empirically test the concerns of the labour force that productivity gains result in cut backs, change in the level of the labour force is used as the growth measure. Management's concern of productivity initiatives leading to downsizing, cost cutting and potential inward focus are tested empirically using changes in variable resource consumption as the growth measure.

A more holistic relationship between productivity and growth is then empirically tested through the use of growth measures based on the firm's broader strategic objectives. In these instances broader measures of growth such as growth in market share and growth in the asset base of the firm are used.

1.4 Motivation For Study

As South Africa emerges from its isolated past into the international realm, local enterprises are faced with increasing competition from the global market. Due to a history of economic isolation, high protection of local industries and labour intensive manufacturing processes, many local firms exhibit low levels of productivity and hence they now find themselves unable to compete for global resources [Uliana & Miller, 1996: p5; Van Staden, 1995: p14]. In the light of the above, and the fact that productivity is accepted as being *"...the prime determinant of a nation's long run standard of living..."* and *"... the only meaningful concept of competitiveness at the national level..."* [Porter, 1990: p84], the need for increased productivity is clear.

Furthermore, as *"... productivity lies at the base of the standard of living of a nation and of every individual in that nation."* [Committee for Economic Affairs, 1989: p249], and as *"Sustainable competitive advantage arises only by having higher productivity..."* [Banker, Datar and Kaplan, 1989: p530], productivity is accepted to be one of the most important determinants of macro economic growth, bringing simultaneous increases in living standards and competitiveness coupled with decreases in inflation [Foyster, 1996: p12; Prokopenko, 1995: p28; Miller, Jackson & Parsons, 1992: p192-193; O'Mahoney, 1994: p85; Uliana & Miller, 1996: p5].

As macro economic theory deals with economic aggregates at a national level, and as *"... it is not nations per se which are the source of productivity and wealth, but companies, and individuals within companies, and in particular managers of these companies whose responsibility it is to ensure the optimum use of resources."* [Peddie, 1992: p205], for national wealth creation to result, productivity initiatives need to be

focused at a micro (or firm) level [Foyster, 1996: p12; Miller, Jackson & Parsons, 1992: p192].

The motivation of this study is therefore to promote awareness of the importance of productivity at a firm level and to secure the commitment of the parties (both management and labour) to productivity initiatives through addressing their concerns which have resulted in resistance to such initiatives.

In summary, if a positive link between productivity and firm specific growth can be established, then macro economic growth can be pursued through increases in productivity at a micro economic level.

CHAPTER TWO - PRODUCTIVITY, PRICE RECOVERY AND RELATED TOPICS

2.1 Productivity Defined

Productivity measures the ratio of actual inputs used to actual output achieved. Productivity improvements are in essence achieved through greater efficiency in the production process, or in its simplest form, increasing this ratio of outputs to inputs. Miller aptly explains it as *"... the mileage companies get from their resources."* [Miller, 1984: p145]. Table 1 illustrates combinations of inputs and outputs which lead to increased productivity:

Table 1: Sources of Increased Productivity

	INPUTS	OUTPUTS
1	Increase	Greater increase
2	Constant	Increase
3	Decrease	Increase
4	Decrease	Constant
5	Decrease	Lesser decrease

Although all the combinations listed above achieve productivity gains, each differs in approach. Moving down the table the emphasis is shifted from achieving productivity gains through expansion and growth (combinations 1 and 2) to achieving productivity gains through cost cutting and shrinkage (combinations 4 and 5). Productivity initiatives can therefore have either positive or negative affects on both the business entity itself and on the parties involved in the business. For example, combination 1 could stimulate employment *and* growth in the business while combination 5 might cause both the level of employment and the long term prospects of the firm to decline.

Similarly, combination 2 could benefit the firm through expansion without affecting the level of employment, while combination 4 may imply the pursuit of productivity gains through loss of jobs.

The link between productivity and growth could thus be positive *or* negative.

2.2 Productivity Measurement Techniques

There are two broad approaches to productivity measurement:

1. partial productivity measures
2. total factor productivity measures

2.2.1 Partial Productivity Measures

Partial productivity measures compare the quantity of output achieved to the quantity of a *single* input used and are usually expressed in terms of physical quantities. Partial productivity can be expressed mathematically as the following ratio:

$$\textbf{Partial Productivity} = \frac{\textbf{(Quantity of output produced)}}{\textbf{(Quantity of single input used)}}$$

Viewed in isolation partial productivity measures have little meaning. They are used for comparison purposes to gauge productivity changes; for example over time, across facilities or relative to a benchmark.

Although partial productivity measures are useful in measuring the changes in the productivity of individual inputs, they ignore the affect of changes in the mix of inputs

on the productivity of the entire manufacturing process. As inputs in a manufacturing process can have complimentary or substitutionary relationships with other inputs in the same process, changes in the quantity of one input can affect the quantity of the other input used and hence the partial productivity of both of these inputs. For example, capital and labour might be substitutes in the production process, hence increases in labour productivity arising out of decreases in the quantity of labour used might result in the increased use of capital in the production process, causing a drop in the partial productivity of capital. Conversely if there was a complementary relationship between two inputs, such as labour and another variable overhead (which uses labour as a cost driver), increases in labour productivity arising out of decreases in the quantity of labour used would result in a corresponding increase in the productivity of the other variable overhead (as its consumption falls).

As most manufacturing processes combine a variety of inputs, the information value of partial productivity measures is limited. As they do not allow for the effect of changes in the mix of inputs they are unable to focus on the productivity of the total resource base.

2.2.2 Total Factor Productivity Measures

Total factor productivity overcomes the limitations of partial productivity measures in that total factor productivity allows for the effects of changes in the mix of inputs in the production process. Total factor productivity therefore differs from partial productivity measures in that it takes a multi-factor perspective, focusing

simultaneously on *all* inputs used, and in so doing allows for the trade off across inputs.

The difference between the calculation of partial factor productivity and total factor productivity lies in the measurement of inputs. As partial factor productivity relates output to a *single* input, the denominator is simply a measure of the number of units of that input. For total factor productivity however, as a variety of different inputs are used, the need for a common unit of measure arises. For this reason, monetary values are used as the common denominator by which inputs are aggregated.

Total factor productivity can be mathematically expressed as follows:

$$\textbf{Total Factor Productivity} = \frac{\textbf{(Quantity of output produced)}}{\textbf{(Costs of all inputs used)}}$$

The calculation of total factor productivity differs from partial productivity in that total factor productivity takes into account the relative prices of *all* inputs. Where partial productivity is the ratio of output to the quantity of a *single* input, total factor productivity is calculated as the ratio of the quantity of output produced to the quantity of *all* inputs used, where inputs are combined on the basis of current period prices.

The major benefit of using total factor productivity is that it incorporates productivity gains achieved from altering the mix of inputs as well as those achieved from using fewer inputs in producing a given level of output. This technique is therefore preferential as it shows how effectively a firm has used its entire resource base.

2.3 Productivity Accounting

The empirical analysis used to test the relationship between productivity and growth further on in the text relies on productivity related information. This information is generated from a productivity accounting exercise, thus the following section will present a conceptual framework for productivity reporting.

2.3.1 The Productivity Report

A productivity report is the result of a productivity accounting exercise based on a total factor productivity measurement model whereby monetary values are attached to changes in productivity related information. The purpose of a productivity reporting exercise is to isolate the factors contributing to the change in profit of a firm from one period to the next. In so doing, changes in profitability due to changes in productivity can be separated from other factors that impact on total performance, such as changes due to price recovery and growth.

As the inclusion of a productivity report in a firm's published financial statements is not a statutory requirement, there is no prescribed format for such a report. This is perhaps due in part to the fact that the accounting profession has until recently shown little interest in the area of productivity accounting [Banker, Datar & Kaplan, 1989: p528; Foyster, 1996: p12-13]. This lack of interest has been attributed to the mistaken belief that standard costing systems provide the same information [Banker, Datar & Kaplan, 1989: p528].

Although there is as yet no prescribed format for productivity reporting, recent increases in interest in the area of productivity accounting, particularly evident in

South Africa [Foyster, 1996; Miller, Jackson & Parsons, 1992; Peddie, 1992; Uliana, 1994; Uliana, 1996; Uliana & Miller, 1996], however point towards a conceptual framework for the preparation of a such a report. An example of a movement towards the recognition of the potential of productivity accounting can be found in the published annual financial statements of Eskom, a major South African parastatal electricity utility company.

Eskom include a productivity statement in their annual financial statements (Figure 1) which reconciles the change in net income (as taken from the income statement) from one period to the next by breaking it up into its component parts of productivity (further sub-divided into changes due to capacity utilization and efficiency), price recovery and growth.

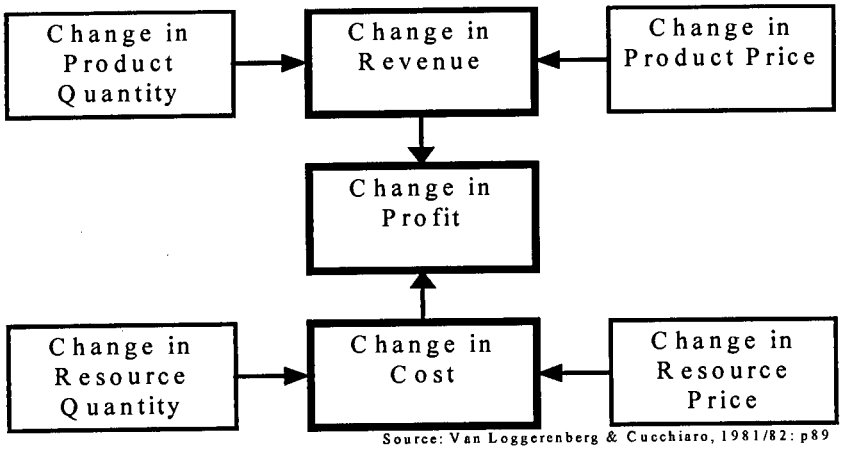
Figure 1: Eskom's Productivity Statement

	1996		*1995*	
	Rm		***Rm***	
Net income for the year	3072		2716	
Net income for previous year	2716		2268	
Change in net income	356		448	
Attributable to:				
Wealth reinvested in the business	106		200	
Productivity improvement		488		224
Price over/(under) recovery		(382)		(24)
Growth	250		248	
	356		448	

Source: Eskom Annual Report, 1996: p32

Figure 2 represents the traditional accounting approach to profit calculation. The centre column illustrates that profit is a function of Revenue and Costs. Viewing the diagram horizontally it can be seen that Revenue is affected by changes in product quantity and product price, while Costs are affected by changes in resource quantity and resource price.

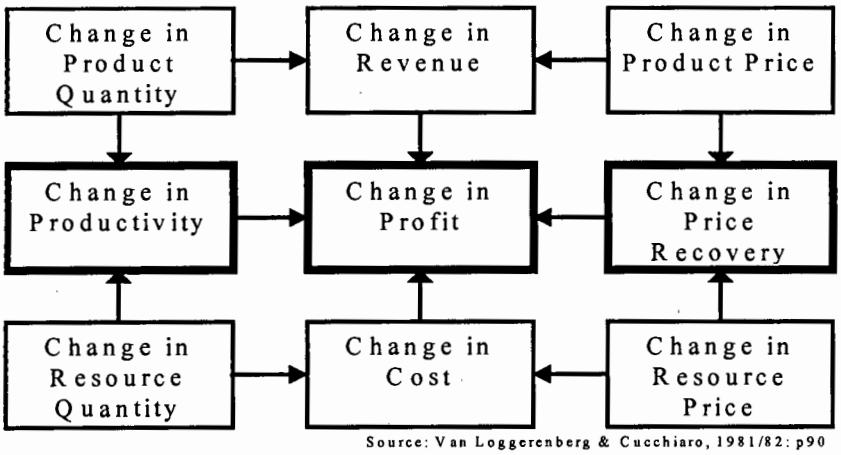
Figure 2: Traditional Accounting Approach to Profit



Source: Van Loggerenberg & Cucchiaro, 1981/82: p89

In Figure 3 below, the same basic accounting information used to calculate revenues and costs in the determination of profit in Figure 2 is used to expand the traditional approach to accounting for profit to illustrate the fundamentals of productivity accounting.

Figure 3: Fundamentals of Productivity Accounting



Source: Van Loggerenberg & Cucchiaro, 1981/82: p90

Viewing the diagram vertically, the first column in Figure 3 represents the change in product quantity (output) and the corresponding change in resource quantity (input). As described above, the ratio of these two figures gives the change in productivity. Similarly, the third column in Figure 3 reflects how the ratio of the changes in the prices of inputs and outputs are a measure of price recovery.

It is therefore clear that by shifting the emphasis from the centre column in Figure 2 to the centre row in Figure 3, an alternative insight into the factors affecting profit is gained. Using the same accounting information, we are able to move from a traditional accounting approach to profit (Revenue less Costs) to an alternative approach where the component parts of Revenue and Costs are used to highlight the effect of productivity and price recovery on profit. The informational properties of this additional data will be investigated below.

2.3.2 Productivity

The productivity figure represents the change in net income due to management activity. Isolating this figure gives insight into the efficiency of resource management as the effects of pricing decisions have been removed. Referring to Figure 3, the impact of changes in productivity on profit is clear. Increases in productivity occur either through a relative increase in output (product quantity) and/or a relative decrease in input (resource quantity). As increases in product quantity increase Revenue and decreases in resource quantity decrease Costs, it is clear that an increase in the productivity ratio translates directly into an increase in profit.

Now that the relationship between productivity and profit has been established, the productivity figure warrants closer examination. Although productivity has been defined as simply the ratio of outputs to inputs, it can be decomposed into two more distinct and measurable components:

- Change in capacity utilization
- Change in efficiency

2.3.2.1 Change In Capacity Utilisation

Increased capacity utilization occurs where a firm is able to increase its output while using a constant level of fixed resources. For example if a firm is able to increase product output using its existing plant, then it has increased its capacity utilization.

Viewed in isolation, capacity utilization is considered to be largely uncontrollable due to its implied reliance on an increase in sales (of the additional output) [Van

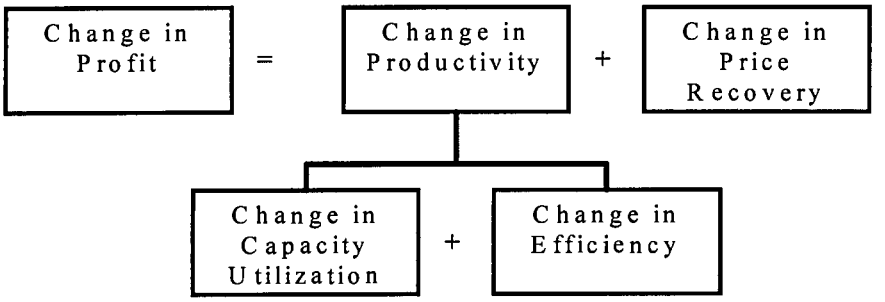
Loggerenberg & Cucchiaro, 1981/82: p90]. This is due to the fact that sales volume is dependent on variables which are exogenous to the production process e.g. industry/market growth, economic environment and market share. However, it should be noted that management may be able to use pricing strategies to affect the market for its output, in which event, depending on the price elasticity of demand for its products, increases in capacity utilization become more controllable. This concept will be addressed in greater detail in the following section on the strategic implications of productivity related information.

2.3.2.2 Change In Efficiency

Changes in efficiency, representing the other component of a firm's productivity, are achieved through reducing the quantity of fixed resources and/or the consumption of variable resources in the production of a given level of output. Changes in efficiency therefore represent a more direct indication of management's performance as it is reliant on resource management, which is more controllable by management than is output (which dictates changes in capacity utilization as described above).

As changes in both capacity utilization and efficiency impact on the output/input ratio (productivity), they impact directly on profit. Figure 4 below presents a diagrammatic productivity accounting model incorporating the factors contributing to the change in profit.

Figure 4: Productivity Accounting Model



Source: Van Loggerenberg & Cucchiaro, 1981/82: p90

2.3.3 Price Recovery

The second factor contributing to the change in profits (Figures 3 and 4) is price recovery. Price recovery reflects the change in profit resulting from management's control of prices and in its simplest form is a measure of the changes in output prices relative to the changes in input prices.

Referring again to Figure 3, a similar analysis used to illustrate the impact of changes in productivity on profit can be applied to the price recovery term. As the price recovery term is a ratio of output to input prices, an increase necessarily occurs where output prices increase *(decrease)* at a relatively greater *(lesser)* rate than input prices. This in turn implies a relative increase in Revenue to Costs, which translates directly into increased profit.

Price over *(under)* recovery therefore occurs when output prices increase greater *(less)* than input prices in the same period. Price recovery can therefore be viewed as a distribution variable as price over recovery causes profit to increase, which accrues to

the owners of the firm, while price under recovery often occurs through passing savings on to customers through deflationary output pricing.

This possibility of management being able to utilise pricing strategies to boost profit or to absorb output price inflation has certain strategic implications which will be examined further below.

2.3.4 Growth

Referring again to Eskom's productivity statement in Figure 1, the final source of the change in net income is attributed to a "growth" component. This growth figure is the change in net income from one period to the next as a result of the firm simply being bigger than it was in the previous period. Growth occurs where resource prices and quantities increase at the same rate as output prices and quantities and as such accounts for the growth in net income unrelated to productivity or price recovery. It can simply be calculated as the residual component contributing to the change in net income after productivity and price recovery have been accounted for. The growth component can be explained as the increase in profit achieved from applying a constant rate of return to a larger asset base.

It should be noted that this growth term is not a true measure of firm growth, but rather a measure of the *effect* of growth on the change in net income. It appears here for reasons of completeness, but will not form part of the ensuing analysis.

2.4 The Strategic Implications Of Productivity Related Information

From the above analyses it is clear that profits can be generated through increases in productivity or price recovery (or both). The important distinction to be made is that profits achieved through productivity gains are a result of wealth creation, while profits driven through price recovery relate to redistribution of existing wealth [Miller, Jackson & Parsons, 1992: p192].

As the benefits attached to productivity growth are clear, its inclusion in the firm's strategic objectives is intuitive and therefore warrants little further examination. Of greater interest is the strategic impact of policy decisions relating to price recovery. This section will therefore examine the strategic implications of policy decisions made using productivity related information with particular emphasis being placed on the implications of driving profit through price recovery.

2.4.1 Profit Through Price Recovery

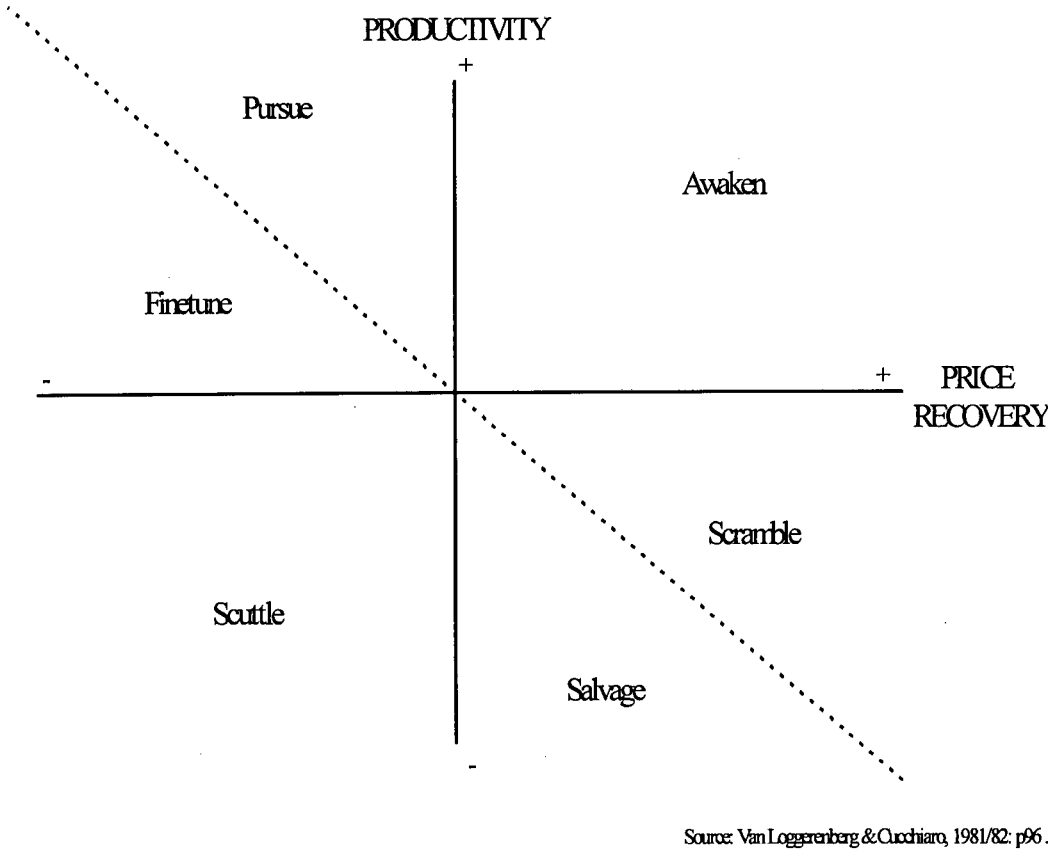
The ability to drive profits through continual price over recovery is dependent on the market in which the firm operates. In a competitive environment continual price over recovery is likely to indicate large margins and excess returns. As competitive markets are characterised by low barriers to entry and exit, the existence of excess returns would attract competitors as outside firms enter the industry to exploit such returns. This would drive output prices down which would eliminate the firms price recovery gains.

Conversely it is unlikely that any firm can continually absorb resource price inflation necessary to achieve long run price under recovery as this would likely lead to eventual failure. Therefore, in a competitive environment, long run price recovery should tend toward zero.

Should a firm however operate in a monopoly environment characterised by high barriers to entry, the extraction of monopoly profits would be achievable, thus long run price over recovery could be maintainable. Indeed, in such a situation the ability to maintain price over recoveries would provide an indication of management's ability to exploit their strategic advantage [Uliana, 1996: p6].

Van Loggerenberg and Cucchiaro (1981/82: p91) describe the use of price over recovery as an "unsafe", short term means of profit growth. They submit that a "safer", long term approach is to use productivity gains to offset price under recovery. In this situation the firm would be able to maintain profits through productivity growth, while the negative price recovery would avoid the threat of increased competition, with the possible added benefit of increasing market share. This strategic relationship between productivity and price recovery can be graphically represented in the form of a Strategic Segments Grid.

Figure 5: Strategic Segments Grid



Source: Van Loggerenberg & Cucchiaro, 1981/82: p96.

The Strategic Segments Grid shows the possible combinations of productivity and price recovery representing sources of a firm's profit change over time. The horizontal axis shows the change in price recovery while the vertical axis shows the change in productivity. The dotted diagonal line represents the points where the combination of productivity and price recovery changes exactly offset one another, i.e. points of constant profitability. Points above the dotted diagonal line represent increases in profitability while points below the dotted line represent points of decreased profitability.

Van Loggerenberg and Cucchiaro [1981/82: p96-98] prescribe typical strategic responses for each of the six segments of the Strategic Segments Grid:

- **SCUTTLE**

  As firms in this segment are characterised by negative productivity and negative price recovery, a complete turn-around strategy would be necessary to avoid closure. This situation typically occurs where the firm is subject to escalating costs which it can not offset through product price increases.

- **SALVAGE**

  Firms in this segment need to be "salvaged" as profitability is being driven down through productivity losses which exceed the gains from positive price recovery.

- **SCRAMBLE**

  Firms in this segment are achieving profits through price recovery gains which more than offset their productivity losses. As explained above, this is an "unsafe", short term method of driving profits as the excess price recovery is likely to attract competition. The firm should strive to achieve productivity gains.

- **AWAKEN**

  Profits are being driven by both positive productivity and price recovery. The threat of possible increased competition still exists, however it would only lower, not eliminate, profitability as productivity gains would remain.

- **PURSUE**

  This is the most desirable of the strategic segments and should therefore be "pursued". As productivity gains are used to finance price under recovery the firm is able to maintain profit growth with no threat of additional competition.

- **FINE-TUNE**

  As the price under recovery exceeds the productivity gains for firms in this segment, the balance between these two factors needs to be "fine-tuned" so that the firm is able to move to a position of profitability (above the dotted diagonal line).

2.4.2 Price Recovery As An Indicator Of Strategic Objective

In chapter one the importance of using appropriate firm specific growth measures in studying the relationship between productivity and growth at the firm level was introduced. As firms pursuing different strategic objectives are likely to experience growth in different areas of their businesses, the ability to differentiate firms on the basis of their strategic objectives is relevant to this study. As the price recovery term has been shown above to be a distribution variable it is submitted that it can be viewed as an indication of a firm's strategic objective.

As negative price recovery occurs through deflationary output pricing, all other things remaining equal, the output of a firm exhibiting negative price recovery should be priced relatively lower in real terms than in the previous period. This would result in its products becoming more competitively priced in consumer product markets.

Assuming a normal demand curve (downward sloping) for the products produced by the firm, the relative decrease in price would cause an increase in quantity demanded and hence a corresponding increase in market share. Therefore, in so far as prices are an endogenous variable within the framework of the firm (i.e. management has control over output pricing), it is submitted that the price recovery term can be used as an indication of management's decision to pursue expansion in market share as a strategic objective.

Conversely, firms exhibiting positive price recovery tendencies can be assumed to be retaining gains within the firm which would facilitate growth in the asset base (assuming no additional distributions). A positive price recovery term can therefore be used as an indication of management's decision to pursue the strategic objective of growth through expansion in the asset base.

The relevance of this link between a firm's price recovery characteristics and its strategic objective will be expanded upon in the following chapter, where the firm's strategic objective, as indicated by its price recovery term, will be used to select an appropriate measure of growth to be used for that firm.

It should be further noted that this ability of management, to use price recovery to influence the market for its output, also impacts on the productivity of the firm. When change in capacity utilization was introduced above as a component of productivity, it was stated that it was *"largely uncontrollable due to its implied reliance on an increase in sales"* [p18]. However, if management is able to use pricing strategies to induce the market to absorb its additional output through negative price recovery (as

illustrated above), then the change in capacity utilization becomes more controllable, thereby increasing management's scope to achieve productivity gains.

Furthermore, the use of the price recovery term as an indicator of strategic objective provides additional insight into the classification of firms in terms of their placement on the Strategic Segments Grid. For example it would appear that firms in the "AWAKEN" segment are pursuing a strategic objective of expansion in the asset base, while firms in the "PURSUE" segment would be pursuing a strategic objective of increase in market share.

2.5 Summary And Conclusion

This chapter can be conceptually divided into two broad sections. The first deals with conventional aspects of productivity theory such as productivity accounting and measurement techniques, while the second section introduces strategic aspects of productivity related information. In both of these sections frequent reference was made to the work of Van Loggerenberg and Cucchiaro, initially with respect to their contribution towards a conceptual framework for productivity accounting and subsequently in placing productivity related information within a strategic framework. It is this second area, their contribution towards a strategic framework, which has particular relevance in the context of this study as it offers a practical framework to support the concept introduced here of the strategic relevance of the price recovery term.

CHAPTER THREE - RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

Chapter one introduced the need to establish empirical links between productivity and growth at a firm level. Chapter two then explored productivity and price recovery as determinants of profitability in addition to introducing aspects of the effects of corporate strategy on firm growth. This chapter addresses the issues raised in chapter one by applying the theoretical constructs established in chapter two in formulating the methodology to be used to explore the existence of a statistical relationship between productivity and various measures of growth at the firm level.

As the purpose of this empirical study is to explore the existence of a statistical relationship between productivity and various growth constructs, a number of correlation models, each relating productivity to different measures of growth, are used. Although a high degree of correlation between a set of variables does not necessarily imply causation, the results of the correlation techniques are none-the-less relevant as it is the strength of the relationships between the sets of variables as evidenced by the correlation coefficient (r) that is of relevance to this study.

3.2 Hypotheses

The objective of this study as presented in chapter one is to investigate the relationship between productivity and growth, i.e. is productivity used to achieve growth (a positive relationship) or is productivity pursued at the expense of growth (a negative relationship) ?

The hypotheses used to test these relationships can be stated as follows:

Null hypothesis:

H_0: No relationship exists between changes in productivity and changes in the relevant growth measure.

Alternative hypothesis:

H_1: There is a relationship between changes in productivity and changes in the relevant growth measure.

As the analyses are based on the output of correlation models which use the correlation coefficient (r) as a indication of the existence of a statistical relationship, the hypothesis can be restated as follows:

Null hypothesis:

H_0: $r = 0$

Alternative hypothesis:

H_1: $r <> 0$

As the objective of this study is to explore the existence of a relationship between productivity and growth, and not to build a predictive model, a high degree of correlation is neither required nor expected.

As a correlation coefficient of zero implies no relationship between the variables in a regression model, it follows that when the correlation coefficient can be shown to be significantly different from zero a statistical relationship between the variables can be assumed to exist. The t_{stat} will be used to test whether the observed value for **r** is significantly different from zero. All tests are done at the 5% significance level.

3.3 Sample

Due to the difficulty in obtaining original data at the level of detail necessary to complete such an analysis, the sample of companies used in this analysis was obtained from a previous study done into the application of organizational performance models in the South African footwear industry [Jackson, 1990].

The sample used for this study is a sub-set of the sample of companies selected by the National Productivity Institute (NPI) in conjunction with the Footwear Manufacturers Federation (FMF) for inclusion in what has become one of the most detailed data banks of its kind in South Africa. For this reason, it should be noted that the sample used in this analysis is not a random sample of companies, but rather consists of a subset of selected companies from within the footwear industry. The primary reasons cited for the manner of selection of companies into the sample (which are equally applicable to the limited size of the sample) are as follows:

- The analysis relies on detailed, and hence often confidential information, such as a company's management accounts. Many companies are not prepared to divulge this information.

- The information systems in some companies, particularly the smaller companies, are inadequate to produce the necessary level of detail required for an analysis of this nature.
- The available data has been limited to the NPI's annual footwear databank, which consists of approximately twenty companies per year selected by the NPI in conjunction with the FMF.
- In order to maintain continuity of the data, companies that have been intermittently included in the NPI's database have been excluded from this sample, resulting in a final sample of thirteen companies.

[Source: Jackson, 1990: p 308-309, as amended]

Despite the non-random nature of the sample used in this analysis, it is however submitted that as these are all valid examples of typical manufacturing companies whose data exhibits a high degree of integrity, the conclusions of the analyses provide significant insight into the general characteristics of productivity relationships at a micro economic level.

The resulting sample which is used in this study comprises thirteen companies within the South African footwear industry. These companies exclude small factories and comprise mainly large companies producing in excess of five hundred thousand pairs of shoes annually.

For these thirteen companies between five and seven years of continuous data has resulted in a total sample of 75 different intervals (years) giving 62 contrast periods.

3.4 Data Specifications And Definitions

All the data was taken from the companies' management accounts. Unless otherwise stated, all calculations are based on percentage changes in the relevant variable over one year periods as calculated according to the following formula:

% Change in variable = $(RV_n - RV_{n-1}) / RV_{n-1} * 100$

Where:

RV_n = Rand Value of variable in year n

The data sets for each variable can be found in Appendix A.

3.4.1 Productivity

The productivity figures used in the analysis are the percentage change in productivity over a year and are calculated as the ratio of: the ratio of the change in sales quantity (output) produced over the year to the ratio of the change in resource quantity (input) consumed over the year. Algebraically this can be stated as follows:

% Change in Productivity = $[(QS_t / QS_{t-1}) / (QR_t / QR_{t-1}) - 1] * 100$

Where:

QS_t = Quantity of Sales in period (t)

QS_{t-1} = Quantity of Sales in period (t - 1)

QR_t = Quantity of Resource consumed in period (t)

QR_{t-1} = Quantity of Resource consumed in period (t - 1)

3.4.2 Price Recovery

In chapter two the price recovery term was proposed as an indication of a firm's strategic objective. It was further submitted that companies pursuing different strategic objectives are likely to experience growth in different areas of their businesses. In order to be able to run an exploratory analysis whereby the growth measure to be used in analysing the relationship between productivity and growth differs for each company on the basis of its strategic objective, the companies in this sample have been differentiated on the basis of their price recovery characteristics.

These price recovery terms are calculated as absolute monetary values according to the following formula:

PRICE RECOVERY = VR_{t-1} * (PS_{REL} - PR_{REL}) * QS_{REL}

Where:

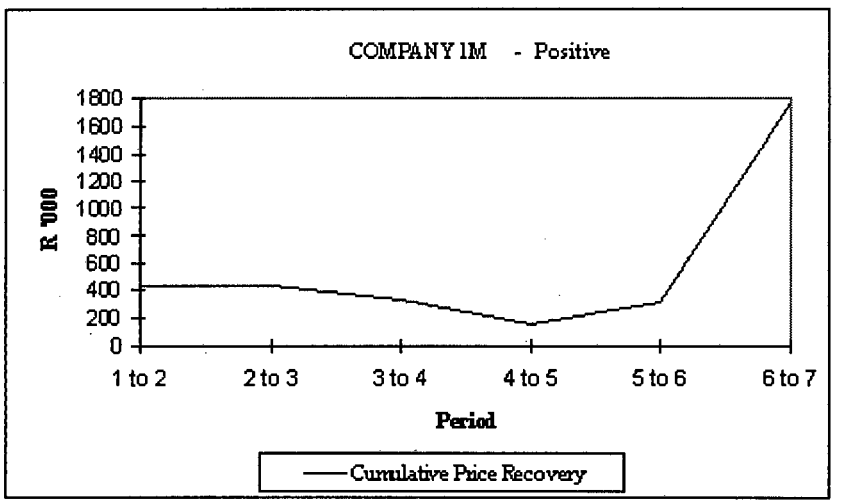
- VR_{t-1} = The monetary value of the resources used in period (t - 1)
- PS_{REL} = The ratio of price of outputs in period (t) to price of outputs in period (t - 1).
- PR_{REL} = The ratio of price of inputs in period (t) to price of inputs in period (t - 1).
- QS_{REL} = The ratio of sales quantity in period (t) to sales quantity in period (t - 1).

Cumulative price recovery figures are calculated through incremental summation and plotted for each company [Appendix B]. These plots are then analysed by inspection

in order to categorise the companies into groups exhibiting positive, negative and fluctuating price recovery.

The companies are analysed using cumulative price recovery figures, as opposed to absolute monetary movements in price recovery, as cumulative figures provide a more accurate indication of a firm's price recovery characteristics over a period of time. Where for example a firm's price recovery may fluctuate from positive to negative from one period to the next, the cumulative net position provides a more accurate indication of the level of retentions available for growth. The plot for Company 1M [Figure 6 (from Appendix B)] is used as an illustrative example:

Figure 6: Cumulative Price Recovery Plot for Company 1M



As the gradient of the graph fluctuates from positive to negative the company experiences periods of both price over and under recovery. However, as the cumulative figure remains above the horizontal axis (where cumulative price recovery equals zero) for the full duration of the period under review, the extent of the price under recoveries never completely offset the price over recoveries. As the net position

is thus always positive, Company 1M is grouped as a positive price recovery firm. Conversely should the cumulative price recovery plot have remained below the horizontal axis, the company would have been classified as a negative price recovery firm regardless of the changes in the gradient of the line over time. Fluctuating price recovery firms are those where the period changes in price recovery were so large that they managed to more than offset the previous cumulative movements (i.e. the graph cuts the horizontal axis).

The resulting groups consist of six companies with a tendency towards positive price recovery, three companies with a tendency towards negative price recovery and four companies whose price recovery tends to fluctuate over time.

The group exhibiting fluctuating price recovery terms are excluded from further price recovery related analysis due to the obvious limitation of assigning a strategic objective to these companies on the basis of their price recovery characteristics. The remaining two groups are analysed as follows:

Those companies exhibiting positive price recovery characteristics are assumed to be retaining excess gains within the business and hence pursuing strategies of growth through increases in the asset base. The relationship between productivity and growth for this set of companies is therefore explored through a correlation model relating change in productivity to change in total assets.

Those companies exhibiting negative price recovery characteristics are assumed to be pursuing growth strategies of increases in market share through deflationary output

pricing (refer to chapter two). The relationship between productivity and growth for this set of companies is therefore explored through a correlation model relating change in productivity to change in market share.

3.4.3 Direct Labour

The figures used for direct labour include normal and over time where applicable. Two tests are done to examine the relationship between productivity growth and changes in direct labour to gauge the implications of productivity initiatives with regard to the labour force.

The first test looks to the cause of productivity gains in order to examine the possibility that such gains are pursued through decreases in the use of direct labour as a variable input. This test therefore looks for the existence of a negative relationship between the two variables.

The second test deals with the possible effects of productivity initiatives on the labour force into the future. The objective is to test the validity of labour's concerns, introduced in chapter one, that increases in productivity may lead to decreases in the labour force (as output can be maintained at its current level while consuming less labour). For this test a lagged correlation model is used where change in direct labour is lagged by one period against change in productivity. The purpose of this test is to explore the relationship between changes in productivity in the current period and changes in direct labour in the following period. That is, in order to gain an insight into whether increases in productivity are used as a platform to reduce the level of

direct labour, or whether productivity gains are used to finance future growth in the business as evidenced through a positive growth in the labour force.

3.4.4 Total Variable Costs

Total variable costs include the following:

- Direct Labour (as above)
- Raw Materials

Change in total variable costs are used as a short term growth measure with the objective of addressing management's concern of productivity increases being pursued through cut backs and cost reductions, potentially resulting in inward focus.

As with direct labour, two tests are done to investigate this relationship. The first test uses a simple correlation model to test the relationship between change in productivity and change in total variable costs. The objective is to investigate the possible existence of a negative relationship which would support the concerns of management.

Additionally, a lagged correlation where change in total variable costs is lagged by one period against change in productivity is performed in the same manner as with direct labour. The purpose is to more accurately gauge whether productivity gains are used as a means to reduce future consumption of variable resources, or whether such gains are used to finance short term growth as measured by a positive change in the level of total variable resources consumed.

3.4.5 Total Assets

The asset figures represent the amounts of assets remaining in the company at the end of the year as taken from the management accounts and comprise the following:

Total Assets = Fixed Assets + Net Current Assets

Note that where the traditional formula for total assets uses *gross* current assets, the figure used here (*net* current assets) is net of creditors. The reason for this approach is that creditors reflect raw materials not yet paid for and thus represent a negative resource when compared to other assets. Adjusting for creditors therefore facilitates a more accurate assessment of the level of resources remaining in the business at year end.

The change in total assets is used as a growth measure to test the relationship between productivity and growth for those companies that appear to be pursuing the strategic objective of growth through expansion in their asset bases (as evidenced through their positive price recovery terms - see "Price Recovery" section above). To test this relationship, a correlation model relating the change in total assets to the change in productivity is used across only those companies exhibiting a tendency towards positive price recovery.

3.4.6 Plant And Machinery

Once the above relationship has been investigated, (i.e. whether positive price recovery companies have retained productivity gains within the firm), a test is done to

explore whether productivity gains have been used to finance an expansion in the productive capacity of the firm.

The change in the level of investment in plant and machinery is used as an indication of the growth in productive capacity. As the figures for plant and equipment which appear in the management accounts are at book value (net of depreciation), amounts for accumulated depreciation (as calculated as the incremental summation of depreciation from the date of the first data period for each company) are added back before performing the analysis. i.e.:

Plant & Machinery = Plant & Machinery (@ book value) + Accumulated Depreciation (over the period)

As there is likely to be a delay in the time taken for additional available resources (e.g. resulting from productivity gains) to filter down into the funding of new assets, the change in the level of plant and machinery is lagged by one period against the change in productivity (as the possible source of additional investment expenditure). The lag is restricted to one period due to the already limited size of the sample and the fact that each increase in the lag period translates into a significant reduction in the size of the data set.

3.4.7 Market Share

The market share figures relate to percentage growth in market share and have been derived by using sales turnover as a ratio of the total value of the industry's turnover [Jackson, 1990: p 41].

In a similar manner as with total assets, the change in market share is used to test whether companies that appear to be pursuing the strategic objective of growth in market share (as evidenced through their negative price recovery terms - see "Price Recovery" section above), do in fact show a positive relationship between the level of productivity gains and growth in market share. To test this relationship, a correlation model relating the change in market share to the change in productivity is used across only those companies exhibiting a tendency towards negative price recovery.

3.5 Distribution Of The Data

Parametric statistics such as Pearson's correlation coefficient rely on the assumption that the underlying data conform to a normal distribution. This assumption may however be violated, particularly when dealing with small samples of *"real world"* data. In such circumstances where a normal distribution of the underlying data can not be assumed, non-parametric (or *"distribution free"*) models should be used to ensure integrity of the results. For this reason, Spearman's ranked correlation coefficient is used as a complementary non-parametric technique for each of the analyses described above in order to pre-empt possible problems associated with non-normally distributed data sets and to ensure the integrity of the final results.

Although correlation is a measure of the relationship between a set of variables, a hi level of correlation does not necessarily imply causation. The first reason for this is that two completely unrelated variables may move in tandem due to coincidence, causing a high degree of correlation. The second reason is that there may be no direct relationship between the two variables, but they may be indirectly linked through a third, external variable with which each is independently linked. This would result in a high degree of correlation between the variables within the model without the existence of a causative relationship.

As the variables used in each of the correlation models in the ensuing analyses were selected on the basis of a pre-existing intuitive relationship, the first reason cited above is not relevant in the instance of this study.

The second possibility of a high degree of correlation being the result of the influence of an external variable on the model is addressed through the use of the Durbin - Watson test statistic. The Durbin - Watson test statistic tests for the influence of an external variable on the variables within a regression model by checking for autocorrelation of the residuals (or error terms). Autocorrelation refers to the situation where the residuals are not independent (i.e. they are not randomly distributed, but rather follow a pattern), a situation caused by the influence of an exogenous variable.

While the Durbin - Watson test statistic relies on the output of a regression model, it is appropriately used here as it gives an indication of the extent to which the correlation coefficient is influenced by the affects of an exogenous variable.

Note that this section does not serve as a foundation for implying causation from correlation. It serves rather to add substance to the perceived extent of the relationships investigated on the basis of their correlation results.

CHAPTER FOUR - RESEARCH RESULTS

4.1 Introduction

This chapter contains an analysis of the results of the tests described in chapter three. The correlation output relating productivity to each growth measure (Table 2) will be analysed in the same manner in which they were introduced in chapter three. All analyses were done using Statistica for Windows (release 5.0).

Table 2: Correlation Output

		PEARSON			SPEARMAN				
Variable	**Sample**	**r**	**t**	**p**	**r**	**t**	**p**	**D-W**	**Lag**
Direct Labour	All	-0.01	-0.11	0.916	-0.01	-0.05	0.957	1.9	
Direct Labour (lagged)	All	-0.13	-0.91	0.368	-0.16	-1.1	0.279	1.9	1
Total Variable Costs	All	0.16	1.23	0.223	0.11	0.86	0.394	1.9	
Total Variable Costs (lagged)	All	0.1	0.68	0.501	-0.02	-0.16	0.873	1.9	1
Total Assets	Positive P/R	-0.55	-3.52	0.001	-0.51	-3.14	0.004	1.8	
Plant and Machinery	Positive P/R	-0.37	-1.87	0.075	-0.3	-1.46	0.159	1.6	1
Market Share	Negative P/R	0.6	2.69	0.019	0.64	3	0.01	1.8	

Significant correlations at $p < 0.050$ are shaded

4.2 Distribution Of The Data

Analysing the data using Pearson's parametric correlation method yielded the same results as Spearman's non-parametric method. As there is therefore no reason for concern as to the distribution of the underlying data only one set of results is used in the analysis (Pearson), although both sets are presented (Table 2) for reasons of completeness.

As the results of the Durbin - Watson tests (D-W figures in Table 2) all fall very close to 2, it can be assumed that there is no evidence of autocorrelation between any of the variables within the models (Gujarati, 1995: p423).

4.3 Direct Labour

The concern of labour cited in chapter one of productivity improvements being pursued through reductions in the labour force would imply a high negative correlation between these two variables. Although the resulting correlation coefficient is negative ($r = -0.01$), it is extremely close to zero and hence statistically insignificant ($p = 0.916$). The null hypothesis (H_0: $r = 0$) can therefore not be rejected. Hence, contrary to the concerns of labour, productivity does not appear to be pursued through reductions in the labour force as there does not appear to be a relationship between reductions in the labour force and increases in productivity within the same period.

Furthermore, the concern of increased productivity *leading* to a reduction in the labour force (as output is maintainable at its previous level while simultaneously consuming fewer resources) has been addressed through lagging direct labour as the dependent variable against productivity as the independent variable. The resulting correlation coefficient of -0.13 is not significantly different from zero ($p = 0.368$) which fails to reject the null hypothesis. As no significant relationship exists between the level of productivity in the current period and the level of direct labour in the following period, productivity gains do not appear to be used as a basis for reducing the labour force in the following period. This absence of a relationship however also implies that

productivity gains are not used as a basis for the future expansion of the labour force either.

Therefore, although the aversion by labour to productivity initiatives on the basis of a potential reduction in employment would appear unsubstantiated, the absence of a positive link between *increases* in productivity and the level of employment in subsequent periods could account for a certain level of indifference on the part of labour to such schemes. As productivity gains do not appear to be used to finance an expansion in the labour force, the benefits of these schemes seem to accrue elsewhere which presents little, if any, incentive for labour to strive for such productivity increases.

4.4 Total Variable Costs

Similar to the analysis of the relationship between changes in direct labour and changes in productivity above, the concerns of management that productivity initiatives may be pursued through cost reductions and cutbacks, and may result in inward focus and a shrinking enterprise, appear to be unfounded.

The low level of correlation between productivity and variable resource consumption ($r = 0.16$) is not significant ($p = 0.223$) which fails to reject the null hypothesis. Changes in productivity are thus not related to changes in the level of variable resource consumption, i.e. productivity is not pursued through cost reductions and cutbacks .

Lagging total variable resources as the dependent variable against productivity as the independent variable produces a positive, yet statistically insignificant, correlation coefficient ($r = 0.1$; $p = 0.501$). Hence increases in productivity are not followed by a decrease in the level of variable resource consumption, i.e. productivity gains do not appear to lead to inward focus or a shrinking enterprise.

It should noted that while no *significant* relationship could be found between changes in productivity and the level of variable resource consumption, as both of the above results are positive, these tests not only dispel the possibility of any negative relationship, they also hint at a positive link between productivity and growth as both variables move in the same direction.

4.5 Total Assets

The correlation output in table 2 shows a negative relationship between the change in productivity and the change in total assets. The implication is that the asset base declines with increases in productivity. As this test is done across those firms exhibiting positive price recovery characteristics, this result is contrary to the intuitive proposition submitted in chapter two that such firms pursue a strategic objective of growth in the asset base. This result should however be viewed with caution as it is more likely due to limitations within the data sample than due to the true underlying relationship between the two variables. Specifically, as complete financial accounts were not available for the companies comprising this sample, amounts reflecting withdrawals from the businesses (e.g. distributions to the owners) were not available. This in turn impacts directly on the ability to account correctly for changes in the asset

bases of the firms. Further investigation is therefore needed incorporating more detailed information and across a larger sample before a conclusion can be reached in this regard.

4.6 Plant And Machinery

The relationship between the change in productivity and the change in the level of plant and machinery in the following period is examined in order to gauge whether productivity gains are used to finance expansions in productive capacity.

The results of the correlation test (Table 2) present no evidence of a significant relationship at the 5% level. As in the case of total assets above, the inability to account correctly for withdrawals from the businesses has implications on the interpretation of this result as such amounts would reduce the level of resources available for re-investment in productive capacity. For this reason this result may not provide an accurate picture of the true underlying relationship of these variables.

4.7 Market Share

The correlation coefficient of 0.6 achieved when correlating the change in market share against the change in productivity for negative price recovery firms indicates a highly significant positive relationship ($p = 0.019$). Increases in productivity are therefore matched by growth in market share for negative price recovery firms. In addition to establishing a clear link between productivity and growth, this result lends

support to the proposition that price recovery can be used as a proxy for strategic objective (increase in market share in this instance).

4.8 Summary And Conclusion

The results presented here show no evidence of a negative relationship between productivity and a change in the level of either direct labour or variable resource consumption. The concerns of both management and labour cited as reasons for non-compliance with productivity initiatives have therefore been shown to be unsubstantiated.

The positive link observed between productivity and the change in market share for firms exhibiting negative price recovery not only offers additional evidence of a link between productivity and growth, it also supports the concept of using the price recovery term as an indication of strategic objective. While the same positive results could not be concluded for positive price recovery firms, it is submitted that this is more likely due to restrictions in the underlying data than due to a true relationship between the variables.

CHAPTER FIVE - CONCLUSION

5.1 Introduction

In chapter one the study of the relationship between productivity and growth was introduced as an *"area of standing debate"*. As it was shown to be generally accepted that productivity is a key element of macro economic growth, and as the macro economy constitutes an aggregation of micro economic components, the need to establish a link between productivity and growth at the firm level was emphasised. The objective of this study was to investigate the presence or absence of such a link between productivity and firm specific growth.

How this study differs from similar studies is in the selective definition of measures of firm growth. Instead of using a single growth measure applied indiscriminately across the entire spectrum of companies within the sample, different growth measures were examined in order to allow for the different objectives of the analyses themselves, as well as for the effects of the impact of differing strategic objectives on firm growth. This also enabled the analysis to address the specific concerns of both management and labour which had been cited as grounds for resistance by the respective parties to productivity initiatives.

In the course of the investigation, the link between productivity and growth at the firm level was shown to be dependent on the definition of the growth measure used in the analysis. It was shown that a positive relationship exists between productivity and growth in market share for firms pursuing growth in market share as their assumed strategic objective. While the same positive relationship could not be established for firms assumed to be pursuing growth in the asset base as their strategic objective, it

was concluded that this intuitive relationship should not be dispelled as limitations of the data set are likely to have obscured the true nature of the relationship.

Furthermore, as the achievement of productivity gains were shown to be neither the result of, nor the basis for reductions in either the consumption of direct labour or total variable resources, the concerns cited by both parties, management and labour, as legitimate foundations for non-compliance with productivity initiatives have been shown to be unsubstantiated.

5.2 Comparisons To Previous Studies

In their paper on the affects of productivity changes within industries producing non-tangible outputs, Ferleger and Mandle [1994: p60,p61] found statistically significant evidence to suggest a positive relationship between productivity and labour compensation. This sentiment is echoed by Krugman [1994: p116] who cites numerous examples from economic history where long term productivity growth has been met with a corresponding increase in wages. The most recent confirmation of this relationship can be found in the 1997 South African budget review which states *"... the rise in real wages has been accompanied by a further increase in labour productivity..."* [Department of Finance, 1997: p2.4].

Although the above results differ from those achieved in this study to the extent that no relationship was found here between a change in productivity and a change in labour compensation, it should be noted that the above studies have had the benefit of looking at this relationship over significantly longer periods than was possible here

due to the limited sample size. Therefore, although a corresponding positive link between productivity and labour compensation could not be illustrated in this study, of greater significance is the result that the above studies support the conclusion reached here that there is definitely no *negative* relationship between productivity growth and labour compensation.

Previous studies into the relationship between cost cutting strategies and productivity growth have concluded that for the majority of cases there is no evidence to support a link of this nature [American Management Association, 1994: p61; Cameron, 1990: p27]. The results of these studies that productivity gains are not achieved through cost cutting strategies are therefore consistent with those achieved here.

5.3 Areas Of Future Study

As productivity accounting gains wider acceptance, the pool of productivity related information can be expected to increase. When such information becomes available, there will be scope for further study into the relationships investigated here. A possible objective of such a study would be to confirm the results achieved here by investigating these relationships across a sample encompassing a larger number of companies over varied industries and over a longer period.

A feature of productivity related information which was introduced in the course of this analysis is the informational content of the price recovery term. Initially introduced in chapter two, it was proposed that when viewed in the context of conventional economic wisdom the price recovery term can be viewed as an indicator

of a firm's broader strategic objective. While restrictions in the data set prevented the attainment of conclusive confirmation of this proposition, the positive result achieved with regard to negative price recovery and market share as a strategic objective supports this initial proposition. Although a certain amount of circular logic may be argued in the attainment of this result (as this informational characteristic of the price recovery term had already been assumed at an intuitive level before running the analyses upon which this observation is based), it none-the-less goes some way in confirming the initial intuitive relationship. Although it is beyond the scope and objective of this study, this result points to an area of possible future investigation.

5.4 Conclusion

As the link between productivity and growth at the firm level has been investigated and as the concerns of the various parties to productivity initiatives have been addressed, the objectives of this study have been successfully completed.

Although studies into the relationship between productivity and growth are generally focused at a *macro* economic level [Dougherty & Jorgenson, 1996; Scott, 1993; Solow, 1994, 1988; Witzman, 1996] this thesis has concentrated on the relationship between productivity and *micro* economic growth. As the macro economy essentially constitutes an aggregation of micro economic components, the significance of this study lies in its contribution towards the recognition of the potential contribution of including micro economic factors into future research into the relationship between productivity and growth.

REFERENCES

American Management Association, 1994, In: "When slimming is not enough", *The Economist*, September 3, p61-62.

Banker RD, Datar SM and Kaplan RS, 1989, "Productivity Measurement and Management Accounting", *Journal of Accounting, Auditing and Finance*, Fall, p528-554.

Cameron KS, 1990, In: Pasternak C, "Successful Cutbacks", *HR Magazine*, August, v35, p27.

Committee for Economic Affairs, 1989, "A Strategy and Action Plan to Improve Productivity in the Republic of South Africa", *The President's Council Report of the Committee for Economic Affairs*, Government Printer, Cape Town, PC 1/1989.

Department of Finance, 1997, "Budget Review", Republic of South Africa.

Dougherty C and Jorgenson DW, 1996, "International Comparisons of the Sources of Economic Growth, *AEA Papers and Proceedings*, v86, No.2, p25-28.

Eskom, 1996, Annual Report.

Ferleger LA and Mandle JR, 1994, "The Non-tangible Economy", *Challenge*, September-October, p59-62.

Foyster JW, 1996, "Accounting for Productivity Performance in the Annual Financial Report", *Accountancy and Finance Update*, April, v1, No. 1, p12-13.

Gujarati DN, 1995, *"Basic Econometrics"*, Third Edition, McGraw Hill, p423.

Henkoff R, 1990, "Cost Cutting: How To Do It Right", *Fortune*, April 9, p26-33.

Jackson DJC, 1990, *"An Organisational Performance Measurement Model and Its Application in The Footwear Industry"*, DBL Thesis, The University of South Africa.

Krugman P, 1994, "Does Third World Growth Hurt First World Prosperity?", *Harvard Business Review*, July-August, p113-121.

Miller DM, 1984, "Profitability = Productivity + Price recovery", *Harvard Business Review*, May-June, p145-153.

Miller J, Jackson D and Parsons J, 1992, "Reporting on Productivity in The Financial Statements", *Accountancy SA*, July, p192-199.

O'Mahony M, 1994, "Can Britain Bridge the Productivity Gap?", *Long Range Planning*, v27, April, p85-94.

Parsons J, 1984, "Realst Milkshake", *Productivity SA*, v20, July, p9-13.

Peddie M, 1992, "Productivity and Price recovery Count - If They Can Be Measured", *Accountancy SA*, July, p205-208.

Porter ME, 1990, "The Competitive Advantage of Nations", *Harvard Business Review*, March-April, p84-85.

Prokopenko J, 1995, "Productivity", *Productivity SA*, July-August, p28-29.

Scott MFG, 1993, "Explaining Economic Growth", *AEA Papers and Proceedings*, May, v83, No.2, p421-425.

Solow RM, 1988, "Growth Theory and After", *The American Economic Review*, v78, No.3, p307-317.

Solow RM, 1994, "Perspectives on Growth Theory", *Journal of Economic Perspectives*, v8, No. 1, p45-54.

Uliana E, 1994, "Management Accounting in South Africa in 2004", In: "A View of Tomorrow: Management Accounting in the Year 2004", *International Federation of Accountants*, New York, September, p81-84.

Uliana E, 1996, "Productivity Statements", *Productivity SA*, November-December, p15-18.

Uliana E and Miller J, 1996, "Productivity Accounting: From The Factory To The Boardroom", *Accountancy SA*, June, p5-27.

Van Loggerenberg BJ and Cucchiaro SJ, 1981-82, "Productivity Measurement and The Bottom Line", *National Productivity Review*, Winter, p87-99.

Van Staden G, 1995, "The JSE Not Wild About Productivity", *Productivity SA*, July-August, p14-17.

Wietzman ML, 1996, "Hybridizing Growth Theory", *AEA Papers and Proceedings*, v86, No.2, p207-212.

APPENDICES

Appendix A - Data Tables

[i] Productivity

COMPANY	YEAR	PRODUCTIVITY VARIANCE (% CHANGE IN PRODUCTIVITY)	OUTPUT RATIO	INPUT RATIO
COMPANY 1M	0 to 1			
	1 to 2	-2.87%	-0.0479	-0.0198
	2 to 3	0.18%	-0.1322	-0.1338
	3 to 4	-0.68%	0.0659	0.0732
	4 to 5	-4.17%	-0.2073	-0.1728
	5 to 6	-0.95%	0.1045	0.1151
	6 to 7	-0.23%	0.1057	0.1082
COMPANY 2M	1 to 2			
	2 to 3	-20.54%	-0.2793	-0.0930
	3 to 4	-0.81%	0.0746	0.0834
	4 to 5	12.42%	-0.0631	-0.1666
	5 to 6	-8.81%	-0.0902	-0.0023
	6 to 7	-3.94%	-0.0269	0.0130
COMPANY 3L	0 to 1			
	1 to 2	-3.33%	-0.0748	-0.0429
	2 to 3	-7.26%	-0.0404	0.0347
	3 to 4	3.16%	-0.0731	-0.1015
	4 to 5	-2.33%	-0.2953	-0.2785
	5 to 6	-1.95%	0.0193	0.0396
	6 to 7	-3.46%	-0.0767	-0.0436
COMPANY 4L	2 to 3			
	3 to 4	3.15%	0.3826	0.3404
	4 to 5	-7.82%	0.0962	0.1892
	5 to 6	-3.16%	0.1234	0.1600
	6 to 7	3.04%	0.1902	0.1551
COMPANY 5L	2 to 3			
	3 to 4	-6.54%	-0.1802	-0.1228
	4 to 5	-0.19%	-0.0342	-0.0324
	5 to 6	-2.05%	-0.0413	-0.0212
	6 to 7	-0.26%	0.1474	0.1504
COMPANY 6L	1 to 2			
	2 to 3	14.51%	0.0980	-0.0411
	3 to 4	10.70%	0.0498	-0.0517
	4 to 5	1.73%	-0.0553	-0.0714
	5 to 6	10.51%	0.4059	0.2722
	6 to 7	-0.10%	0.0997	0.1008
COMPANY 7L	1 to 2			
	2 to 3	6.08%	0.1332	0.0683
	3 to 4	-2.24%	-0.1260	-0.1060
	4 to 5	5.51%	-0.1249	-0.1706

COMPANY	YEAR	PRODUCTIVITY VARIANCE (% CHANGE IN PRODUCTIVITY)	OUTPUT RATIO	INPUT RATIO
	5 to 6	1.14%	0.3242	0.3093
	6 to 7	-0.12%	0.0460	0.0473
COMPANY 8M	1 to 2			
	2 to 3	-1.32%	0.0438	0.0578
	3 to 4	2.46%	0.0467	0.0216
	4 to 5	-7.81%	0.0386	0.1266
	5 to 6	4.85%	0.1585	0.1049
	6 to 7	-0.27%	0.0403	0.0431
COMPANY 9M	2 to 3			
	3 to 4	3.28%	0.1060	0.0709
	4 to 5	5.09%	0.0257	-0.0240
	5 to 6	-7.64%	-0.0540	0.0243
	6 to 7	-0.58%	-0.0186	-0.0129
COMPANY 10M	2 to 3			
	3 to 4	3.38%	0.0257	-0.0078
	4 to 5	-2.13%	-0.1425	-0.1238
	5 to 6	4.56%	0.2738	0.2183
	6 to 7	2.63%	0.0834	0.0556
COMPANY 11M	2 to 3			
	3 to 4	7.35%	0.1224	0.0456
	4 to 5	-1.13%	-0.1218	-0.1118
	5 to 6	6.60%	0.1707	0.0982
	6 to 7	-0.59%	0.0346	0.0407
COMPANY 12L	2 to 3			
	3 to 4	7.50%	0.0908	0.0147
	4 to 5	-6.81%	-0.0408	0.0293
	5 to 6	-2.93%	0.0559	0.0878
	6 to 7	-1.32%	0.1020	0.1167
COMPANY 13L	0 to 1			
	1 to 2	2.75%	0.0304	0.0028
	2 to 3	4.33%	0.3277	0.2726
	3 to 4	3.77%	0.1057	0.0655
	4 to 5	4.15%	-0.0341	-0.0726
	5 to 6	-10.10%	-0.1786	-0.0863
	6 to 7	-9.26%	-0.0827	0.0109

Source: Jackson, 1990

Output Ratio = [Quantity of Sales in the Review period (t=n)] / [Quantity of Sales in the Reference period (t=n-1)] -1

Input Ratio = [Quantity of Resources in the Review period (t=n)] / [Quantity of Resources in the Reference period (t=n-1)] -1

Productivity Variance = [(1 + Output Ratio) / (1 + Input Ratio) - 1]

[ii] Price Recovery

COMPANY	YEAR	PRICE RECOVERY VARIANCE	EXPENSES VALUE (t-1)	TOT ASST COMP (t-1)	AGG TOT RSRCE (t-1)	SALES QUANTITY RATIO	SALES PRICE RATIO	RESOURCE PRICE RATIO
COMPANY 1M	1 to 2	445.32	13172.90	665.00	13837.90	-0.0479	0.1871	0.1533
	2 to 3	-12.22	14982.10	661.40	15643.50	-0.1322	0.0617	0.0626
	3 to 4	-93.62	13540.00	858.60	14398.60	0.0659	0.1244	0.1305
	4 to 5	-181.40	16222.50	1246.50	17469.00	-0.2073	0.1598	0.1729
	5 to 6	146.00	15754.30	1193.10	16947.40	0.1045	0.1748	0.1670
	6 to 7	1477.69	20504.40	1548.90	22053.30	0.1057	0.2085	0.1479
COMPANY 2M	2 to 3	1071.86	11401.00	337.40	11738.40	-0.2793	0.2026	0.0759
	3 to 4	169.87	10904.60	550.60	11455.20	0.0746	0.0613	0.0475
	4 to 5	1148.59	12229.70	770.80	13000.50	-0.0631	0.2794	0.1851
	5 to 6	734.82	12213.10	627.50	12840.60	-0.0902	0.2958	0.2329
	6 to 7	657.83	15001.70	793.10	15794.80	-0.0269	0.2607	0.2179
COMPANY 3L	1 to 2	157.84	6479.00	513.00	6992.00	-0.0748	0.1528	0.1284
	2 to 3	226.81	6948.80	602.50	7551.30	-0.0404	0.1559	0.1246
	3 to 4	43.98	8007.40	779.50	8786.90	-0.0731	0.1258	0.1204
	4 to 5	-138.39	8339.50	506.20	8845.70	-0.2953	0.1181	0.1403
	5 to 6	45.25	6778.70	498.70	7277.40	0.0193	0.1526	0.1465
	6 to 7	205.03	8129.40	544.70	8674.10	-0.0767	0.1758	0.1502
COMPANY 4L	3 to 4	-115.74	1829.10	82.20	1911.30	0.3826	0.0638	0.1076
	4 to 5	474.07	2736.20	101.50	2837.70	0.0962	0.3843	0.2319
	5 to 6	402.58	3959.90	197.40	4157.30	0.1234	0.2781	0.1919
	6 to 7	-290.27	5607.60	140.30	5747.90	0.1902	0.1229	0.1653
COMPANY 5L	3 to 4	-51.13	18629.00	862.70	19491.70	-0.1802	0.1342	0.1374
	4 to 5	1115.66	18226.80	1220.40	19447.20	-0.0342	0.2785	0.2191
	5 to 6	175.96	21763.00	1178.90	22941.90	-0.0413	0.2393	0.2313
	6 to 7	935.87	26348.10	1300.80	27648.90	0.1474	0.1576	0.1281
COMPANY 6L	2 to 3	-430.42	5527.70	228.60	5756.30	0.0980	0.0390	0.1071
	3 to 4	-260.45	5809.30	301.50	6110.80	0.0498	0.0473	0.0879
	4 to 5	-491.34	6040.00	264.30	6304.30	-0.0553	0.0524	0.1349
	5 to 6	15.88	6399.00	244.70	6643.70	0.4059	0.1622	0.1605
	6 to 7	60.41	9522.00	286.80	9808.80	0.0997	0.0955	0.0899
COMPANY 7L	2 to 3	-176.31	7290.80	225.60	7516.40	0.1332	0.0537	0.0744
	3 to 4	85.21	8251.70	375.90	8627.60	-0.1260	0.1668	0.1555
	4 to 5	-378.27	8566.00	346.50	8912.50	-0.1249	0.0147	0.0632
	5 to 6	1008.56	7543.50	316.50	7860.00	0.3242	0.2082	0.1113
	6 to 7	90.92	11062.60	374.50	11437.10	0.0460	0.1348	0.1272
COMPANY 8M	2 to 3	631.79	14114.00	721.20	14835.20	0.0438	0.1324	0.0916
	3 to 4	-358.59	15998.00	1131.50	17129.50	0.0467	0.0934	0.1134
	4 to 5	2428.23	18267.00	1216.20	19483.20	0.0386	0.3540	0.2340
	5 to 6	1901.49	25514.00	1570.80	27084.80	0.1585	0.1894	0.1288
	6 to 7	210.85	32054.00	1725.80	33779.80	0.0403	0.1212	0.1152
COMPANY 9M	3 to 4	-802.23	15412.00	887.80	16299.80	0.1060	0.0802	0.1247
	4 to 5	-267.82	18724.00	908.50	19632.50	0.0257	0.1685	0.1818
	5 to 6	2761.45	21513.00	1133.10	22646.10	-0.0540	0.3674	0.2385
	6 to 7	1953.98	27352.00	1378.30	28730.30	-0.0186	0.2140	0.1447
COMPANY 10M	3 to 4	-673.72	11150.00	727.70	11877.70	0.0257	0.0451	0.1004
	4 to 5	-1176.52	12133.00	835.20	12968.20	-0.1425	0.1652	0.2710

COMPANY	YEAR	PRICE RECOVERY VARIANCE	EXPENSES VALUE (t-1)	TOT ASST COMP (t-1)	AGG TOT RSRCE (t-1)	SALES QUANTITY RATIO	SALES PRICE RATIO	RESOURCE PRICE RATIO
	5 to 6	1821.10	13571.60	869.40	14441.00	0.2738	0.2267	0.1277
	6 to 7	634.11	18543.00	1297.40	19840.40	0.0834	0.1406	0.1111
COMPANY 11M	3 to 4	-994.81	17128.00	1146.70	18274.70	0.1224	0.0641	0.1126
	4 to 5	-1361.12	19919.30	1341.30	21260.60	-0.1218	0.0995	0.1724
	5 to 6	1705.27	20803.00	1334.20	22137.20	0.1707	0.1833	0.1175
	6 to 7	368.20	25660.80	1506.00	27166.80	0.0346	0.1347	0.1216
COMPANY 12L	3 to 4	-1445.10	9258.30	238.50	9496.80	0.0908	-0.0449	0.0946
	4 to 5	604.00	10265.20	282.40	10547.60	-0.0408	0.1922	0.1325
	5 to 6	1067.20	11925.00	370.60	12295.60	0.0559	0.3644	0.2822
	6 to 7	413.90	16451.90	698.40	17150.30	0.1020	0.1305	0.1086
COMPANY 13L	1 to 2	-1046.73	15955.30	947.40	16902.70	0.0304	0.0250	0.0851
	2 to 3	-832.72	17430.50	962.10	18392.60	0.3277	0.0392	0.0733
	3 to 4	-1077.84	23882.90	1240.80	25123.70	0.1057	0.0452	0.0840
	4 to 5	-2032.09	27465.30	1553.00	29018.30	-0.0341	0.1270	0.1995
	5 to 6	3346.13	30759.00	1520.60	32279.60	-0.1786	0.3120	0.1858
	6 to 7	-1145.27	33456.40	1516.10	34972.50	-0.0827	0.1048	0.1405

Source: Jackson, 1990

Price Recovery = (Aggregate Total Resources) * (Sales Price Ratio - Resource Price Ratio) * (1 + Sales Quantity Ratio)

Aggregate Total Resources = Expenses + Total Asset Compensation

[iii] Total Assets

COMPANY	PRICE RECOVERY CLASSIFICATION	YEAR	CHANGE IN %	TOT ASSETS R'000	TOTAL ASSETS R'000
COMPANY 1M	POSITIVE	0 to 1			4433.3
		1 to 2	2.89%	128.1	4561.4
		2 to 3	21.44%	977.9	5539.3
		3 to 4	32.37%	1793.2	7332.5
		4 to 5	-1.39%	-101.7	7230.8
		5 to 6	38.20%	2762.4	9993.2
		6 to 7	24.69%	2467.1	12460.3
COMPANY 2M	POSITIVE	1 to 2			2327
		2 to 3	52.66%	1225.5	3552.5
		3 to 4	27.63%	981.6	4534.1
		4 to 5	-16.12%	-731	3803.1
		5 to 6	34.55%	1313.9	5117
		6 to 7	24.17%	1237	6354
COMPANY 3L	POSITIVE	0 to 1			3420.1
		1 to 2	21.50%	735.4	4155.5
		2 to 3	21.02%	873.6	5029.1
		3 to 4	-40.79%	-2051.5	2977.6
		4 to 5	1.51%	45.1	3022.7
		5 to 6	16.25%	491.2	3513.9
		6 to 7	11.85%	416.3	3930.2
COMPANY 4L	POSITIVE	2 to 3			530.6
		3 to 4	12.53%	66.5	597.1
		4 to 5	100.40%	599.5	1196.6
		5 to 6	-24.36%	-291.5	905.1
		6 to 7	-12.06%	-109.2	795.9
COMPANY 5L	POSITIVE	2 to 3			5566
		3 to 4	28.98%	1613	7179
		4 to 5	-0.48%	-34.3	7144.7
		5 to 6	17.46%	1247.3	8392
		6 to 7	19.64%	1648.2	10040.2
COMPANY 6L	NEGATIVE	1 to 2			1576.6
		2 to 3	23.37%	368.5	1945.1
		3 to 4	-20.07%	-390.3	1554.8
		4 to 5	-4.62%	-71.9	1482.9
		5 to 6	24.76%	367.1	1850
		6 to 7	35.63%	659.2	2509.2
COMPANY 7L	FLUCTUATING	1 to 2			1555.8
		2 to 3	55.86%	869.1	2424.9
		3 to 4	-15.95%	-386.8	2038.1
		4 to 5	-5.88%	-119.8	1918.3

COMPANY	PRICE RECOVERY CLASSIFICATION	YEAR	CHANGE IN %	TOT ASSETS R'000	TOTAL ASSETS R'000
		5 to 6	25.94%	497.7	2416
		6 to 7	24.67%	596	3012
COMPANY 8M	POSITIVE	1 to 2			4974
		2 to 3	46.76%	2326	7300
		3 to 4	-2.00%	-146	7154
		4 to 5	33.07%	2366	9520
		5 to 6	16.95%	1614	11134
		6 to 7	16.38%	1824	12958
COMPANY 9M	FLUCTUATING	2 to 3			5728
		3 to 4	-6.70%	-384	5344
		4 to 5	28.50%	1523	6867
		5 to 6	29.49%	2025	8892
		6 to 7	21.77%	1936	10828
COMPANY 10M	FLUCTUATING	2 to 3			4695
		3 to 4	4.64%	218	4913
		4 to 5	7.25%	356	5269
		5 to 6	58.85%	3101	8370
		6 to 7	-7.26%	-607.5	7762.5
COMPANY 11M	NEGATIVE	2 to 3			7398
		3 to 4	6.65%	492	7890
		4 to 5	2.48%	196	8086
		5 to 6	20.16%	1630	9716
		6 to 7	-0.98%	-95	9621
COMPANY 12L	FLUCTUATING	2 to 3			1539
		3 to 4	7.93%	122	1661
		4 to 5	35.22%	585	2246
		5 to 6	100.62%	2260	4506
		6 to 7	39.70%	1789	6295
COMPANY 13L	NEGATIVE	0 to 1			6316
		1 to 2	5.05%	319	6635
		2 to 3	20.65%	1370	8005
		3 to 4	14.12%	1130	9135
		4 to 5	0.89%	81	9216
		5 to 6	6.13%	565	9781
		6 to 7	47.25%	4622	14403

[iv] Plant And Machinery

COMPANY	YEAR	% CHANGE IN GROSS PLANT & MACHINERY	GROSS PLANT & MACHINERY	PLANT & MACHINERY	ACC. DEP.	DEPRE-CIATION
COMPANY 1M	ref		324.2	285.1	39.1	39.1
	1 to 2	30.72%	423.8	334	89.8	50.7
	2 to 3	18.19%	500.9	358	142.9	53.1
	3 to 4	21.74%	609.8	411.8	198	55.1
	4 to 5	11.40%	679.3	420.5	258.8	60.8
	5 to 6	16.02%	788.1	451	337.1	78.3
	6 to 7	5.68%	832.9	415.3	417.6	80.5
COMPANY 2M	ref		240	201	39	39.0
	2 to 3	13.96%	273.5	200.3	73.2	34.2
	3 to 4	76.71%	483.3	353.4	129.9	56.7
	4 to 5	4.39%	504.5	309.7	194.8	64.9
	5 to 6	39.19%	702.2	440.3	261.9	67.1
	6 to 7	30.56%	916.8	571.4	345.4	83.5
COMPANY 3L	ref		175.6	153.8	21.8	21.8
	1 to 2	16.80%	205.1	156.8	48.3	26.5
	2 to 3	33.25%	273.3	191	82.3	34.0
	3 to 4	48.44%	405.7	265.1	140.6	58.3
	4 to 5	50.41%	610.2	411.8	198.4	57.8
	5 to 6	5.29%	642.5	387.1	255.4	57.0
	6 to 7	22.43%	786.6	455.7	330.9	75.5
COMPANY 4L	ref		255.7	188.6	67.1	67.1
	3 to 4	36.02%	347.8	195	152.8	85.7
	4 to 5	42.90%	497	220.2	276.8	124.0
	5 to 6	46.72%	729.2	271.3	457.9	181.1
	6 to 7	54.62%	1127.5	481.7	645.8	187.9
COMPANY 5L	ref		580.5	496	84.5	84.5
	3 to 4	5.13%	610.3	409	201.3	116.8
	4 to 5	8.36%	661.3	346	315.3	114.0
	5 to 6	6.52%	704.4	278	426.4	111.1
	6 to 7	57.94%	1112.5	550	562.5	136.1
COMPANY 6L	ref		372.6	318.2	54.4	54.4
	2 to 3	11.35%	414.9	290.5	124.4	70.0
	3 to 4	16.73%	484.3	289.9	194.4	70.0
	4 to 5	3.16%	499.6	229.2	270.4	76.0
	5 to 6	51.80%	758.4	392	366.4	96.0
	6 to 7	10.81%	840.4	374	466.4	100.0
COMPANY 7L	ref		450.7	335.7	115.0	115.0
	2 to 3	46.02%	658.1	427.1	231	116.0
	3 to 4	39.05%	915.1	565.1	350	119.0
	4 to 5	3.93%	951.1	474.1	477	127.0
	5 to 6	13.55%	1080	467	613	136.0
	6 to 7	39.26%	1504	734	770	157.0
COMPANY 8M	ref		909	859	50.0	50.0
	2 to 3	59.96%	1454	1325	129	79.0
	3 to 4	23.45%	1795	1481	314	185.0

COMPANY	YEAR	% CHANGE IN GROSS PLANT & MACHINERY	GROSS PLANT & MACHINERY	PLANT & MACHINERY	ACC. DEP.	DEPRE-CIATION
	4 to 5	5.63%	1896	1367	529	215.0
	5 to 6	54.38%	2927	2108	819	290.0
	6 to 7	26.68%	3708	2425	1283	464.0
COMPANY 9M	ref		1604	1513	91.0	91.0
	3 to 4	11.28%	1785	1500	285	194.0
	4 to 5	4.76%	1870	1418	452	167.0
	5 to 6	7.38%	2008	1377	631	179.0
	6 to 7	10.36%	2216	1398	818	187.0
COMPANY 10M	ref		447	362	85.0	85.0
	3 to 4	8.28%	484	332	152	67.0
	4 to 5	30.99%	634	407	227	75.0
	5 to 6	69.24%	1073	721	352	125.0
	6 to 7	24.88%	1340	863	477	125.0
COMPANY 11M	ref		1213.3	950	263.3	263.3
	3 to 4	25.80%	1526.3	979	547.3	284.0
	4 to 5	32.69%	2025.3	1150	875.3	328.0
	5 to 6	13.62%	2301.1	1069	1232.1	356.8
	6 to 7	15.16%	2650	1043	1607	374.9
COMPANY 12L	ref		307	238	69.0	69.0
	3 to 4	27.36%	391	268	123	54.0
	4 to 5	1.02%	395	217	178	55.0
	5 to 6	3.47%	408.7	187	221.7	43.7
	6 to 7	244.58%	1408.3	989	419.3	197.6
COMPANY 13L	ref		905	780	125.0	125.0
	1 to 2	28.73%	1165	900	265	140.0
	2 to 3	25.25%	1459.2	1042	417.2	152.2
	3 to 4	16.32%	1697.4	1081	616.4	199.2
	4 to 5	23.88%	2102.8	1320	782.8	166.4
	5 to 6	5.41%	2216.5	1291	925.5	142.7
	6 to 7	40.45%	3113	1969	1144	218.5

[v] Market Share

COMPANY	PRICE RECOVERY CLASSIFICATION	YEAR	CHANGE IN MARKET SHARE %
COMPANY 1M	POSITIVE	0 to 1	
		1 to 2	12.98%
		2 to 3	-11.25%
		3 to 4	-2.82%
		4 to 5	-16.41%
		5 to 6	14.12%
		6 to 7	9.24%
COMPANY 2M	POSITIVE	1 to 2	
		2 to 3	-16.51%
		3 to 4	-7.53%
		4 to 5	8.99%
		5 to 6	3.69%
		6 to 7	0.29%
COMPANY 3L	POSITIVE	0 to 1	
		1 to 2	6.61%
		2 to 3	6.85%
		3 to 4	-15.39%
		4 to 5	-28.36%
		5 to 6	3.33%
		6 to 7	-11.25%
COMPANY 4L	POSITIVE	2 to 3	
		3 to 4	19.26%
		4 to 5	37.98%
		5 to 6	26.28%
		6 to 7	9.26%
COMPANY 5L	POSITIVE	2 to 3	
		3 to 4	-24.61%
		4 to 5	12.27%
		5 to 6	4.50%
		6 to 7	8.59%
COMPANY 6L	NEGATIVE	1 to 2	
		2 to 3	0.29%
		3 to 4	-5.18%
		4 to 5	-11.18%
		5 to 6	38.14%
		6 to 7	-1.47%
COMPANY 7L	FLUCTUATING	1 to 2	
		2 to 3	4.97%
		3 to 4	-12.05%
		4 to 5	-20.67%

COMPANY	PRICE RECOVERY CLASSIFICATION	YEAR	CHANGE IN MARKET SHARE %
		5 to 6	35.26%
		6 to 7	-2.92%
COMPANY 8M	POSITIVE	1 to 2	
		2 to 3	3.91%
		3 to 4	-1.30%
		4 to 5	25.64%
		5 to 6	16.50%
		6 to 7	-4.61%
COMPANY 9M	FLUCTUATING	2 to 3	
		3 to 4	3.04%
		4 to 5	7.08%
		5 to 6	9.36%
		6 to 7	-2.56%
COMPANY 10M	FLUCTUATING	2 to 3	
		3 to 4	-7.55%
		4 to 5	-10.73%
		5 to 6	32.11%
		6 to 7	1.07%
COMPANY 11M	NEGATIVE	2 to 3	
		3 to 4	3.01%
		4 to 5	-13.73%
		5 to 6	17.12%
		6 to 7	-3.99%
COMPANY 12L	FLUCTUATING	2 to 3	
		3 to 4	-10.15%
		4 to 5	2.17%
		5 to 6	21.80%
		6 to 7	1.89%
COMPANY 13L	NEGATIVE	0 to 1	
		1 to 2	1.74%
		2 to 3	11.87%
		3 to 4	5.08%
		4 to 5	-4.26%
		5 to 6	-11.90%
		6 to 7	-17.09%

[vi] Direct Labour

COMPANY	YEAR	CHANGE IN %	DIRECT LABOUR R '000	DIRECT LABOUR R '000
COMPANY 1M	0 to 1			1860
	1 to 2	4.30%	80	1940
	2 to 3	-1.43%	-27.8	1912.2
	3 to 4	22.53%	430.9	2343.1
	4 to 5	-7.99%	-187.2	2155.9
	5 to 6	37.17%	801.4	2957.3
	6 to 7	27.81%	822.5	3779.8
COMPANY 2M	1 to 2			1375
	2 to 3	9.77%	134.4	1509.4
	3 to 4	7.21%	108.9	1618.3
	4 to 5	-12.71%	-205.7	1412.6
	5 to 6	19.69%	278.1	1690.7
	6 to 7	29.83%	504.3	2195
COMPANY 3L	0 to 1			1852.9
	1 to 2	11.80%	218.7	2071.6
	2 to 3	22.71%	470.4	2542
	3 to 4	0.44%	11.2	2553.2
	4 to 5	-25.72%	-656.8	1896.4
	5 to 6	19.60%	371.7	2268.1
	6 to 7	9.56%	216.9	2485
COMPANY 4L	2 to 3			292.4
	3 to 4	54.65%	159.8	452.2
	4 to 5	30.80%	139.3	591.5
	5 to 6	43.80%	259.1	850.6
	6 to 7	42.32%	360	1210.6
COMPANY 5L	2 to 3			3370.2
	3 to 4	0.04%	1.2	3371.4
	4 to 5	-0.87%	-29.4	3342
	5 to 6	51.21%	1711.4	5053.4
	6 to 7	48.89%	2470.6	7524
COMPANY 6L	1 to 2			1087
	2 to 3	11.32%	123	1210
	3 to 4	-14.71%	-178	1032
	4 to 5	12.31%	127	1159
	5 to 6	50.04%	580	1739
	6 to 7	32.83%	571	2310
COMPANY 7L	1 to 2			1566.1
	2 to 3	13.15%	205.9	1772
	3 to 4	-6.32%	-112	1660
	4 to 5	-9.64%	-160	1500

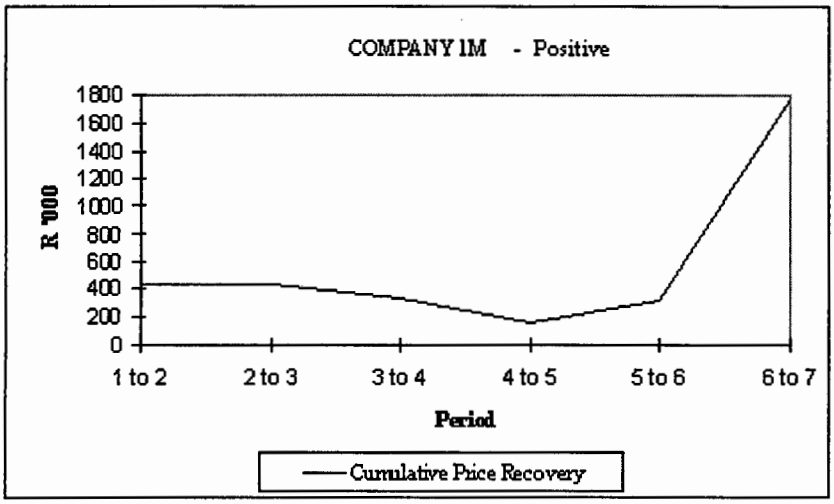
COMPANY	YEAR	CHANGE IN %	DIRECT LABOUR R'000	DIRECT LABOUR R'000
	5 to 6	30.76%	461.4	1961.4
	6 to 7	18.35%	359.9	2321.3
COMPANY 8M	1 to 2			2699
	2 to 3	12.60%	340	3039
	3 to 4	15.30%	465	3504
	4 to 5	26.91%	943	4447
	5 to 6	25.91%	1152	5599
	6 to 7	20.40%	1142	6741
COMPANY 9M	2 to 3			2829
	3 to 4	9.61%	272	3101
	4 to 5	2.73%	84.6	3185.6
	5 to 6	21.76%	693.1	3878.7
	6 to 7	14.78%	573.3	4452
COMPANY 10M	2 to 3			2098
	3 to 4	6.24%	131	2229
	4 to 5	-1.57%	-35	2194
	5 to 6	28.30%	621	2815
	6 to 7	12.97%	365	3180
COMPANY 11M	2 to 3			2760
	3 to 4	9.96%	275	3035
	4 to 5	-1.35%	-41	2994
	5 to 6	36.89%	1104.5	4098.5
	6 to 7	24.63%	1009.5	5108
COMPANY 12L	2 to 3			1949
	3 to 4	12.57%	245	2194
	4 to 5	5.52%	121	2315
	5 to 6	17.60%	407.5	2722.5
	6 to 7	16.50%	449.1	3171.6
COMPANY 13L	0 to 1			2838
	1 to 2	14.94%	424	3262
	2 to 3	36.74%	1198.4	4460.4
	3 to 4	21.11%	941.6	5402
	4 to 5	9.96%	538.3	5940.3
	5 to 6	6.34%	376.4	6316.7
	6 to 7	16.46%	1039.8	7356.5

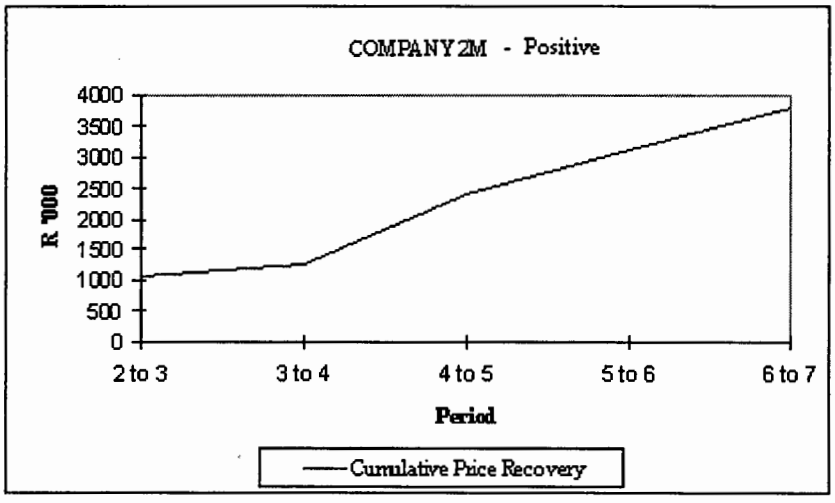
[vii] Total Variable Costs

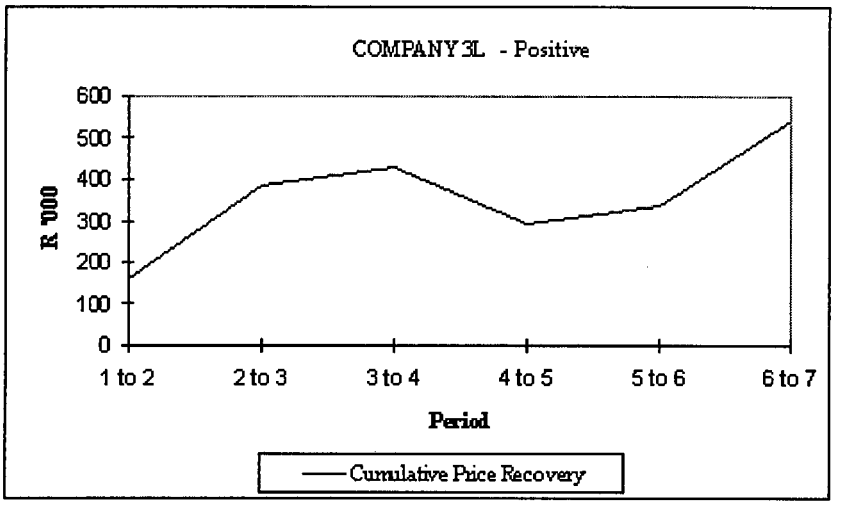
COMPANY	YEAR	CHANGE IN VARIABLE %	TOTAL COSTS R '000	TOTAL VARIABLE COSTS R '000	RAW MATERIAL S R '000	DIRECT LABOUR R' 000
COMPANY 1M	0 to 1			9430.4	7570.4	1860
	1 to 2	8.78%	827.6	10258	8318	1940
	2 to 3	-11.45%	-1174.3	9083.7	7171.5	1912.2
	3 to 4	20.78%	1888	10971.7	8628.6	2343.1
	4 to 5	-5.47%	-600.3	10371.4	8215.5	2155.9
	5 to 6	34.13%	3539.6	13911	10953.7	2957.3
	6 to 7	27.50%	3825.2	17736.2	13956.4	3779.8
COMPANY 2M	1 to 2			8360	6985	1375
	2 to 3	-9.47%	-791.3	7568.7	6059.3	1509.4
	3 to 4	10.31%	780	8348.7	6730.4	1618.3
	4 to 5	3.08%	257.4	8606.1	7193.5	1412.6
	5 to 6	21.67%	1865.3	10471.4	8780.7	1690.7
	6 to 7	-68.45%	-7167.7	3303.7	1108.7	2195
COMPANY 3L	0 to 1			4804	2951.1	1852.9
	1 to 2	6.66%	319.8	5123.8	3052.2	2071.6
	2 to 3	15.02%	769.5	5893.3	3351.3	2542
	3 to 4	0.25%	14.6	5907.9	3354.7	2553.2
	4 to 5	-23.36%	-1379.8	4528.1	2631.7	1896.4
	5 to 6	23.77%	1076.2	5604.3	3336.2	2268.1
	6 to 7	7.27%	407.2	6011.5	3526.5	2485
COMPANY 4L	2 to 3			1407.1	1114.7	292.4
	3 to 4	48.45%	681.8	2088.9	1636.7	452.2
	4 to 5	44.70%	933.8	3022.7	2431.2	591.5
	5 to 6	38.77%	1171.9	4194.6	3344	850.6
	6 to 7	42.61%	1787.4	5982	4771.4	1210.6
COMPANY 5L	2 to 3			15353.4	11983.2	3370.2
	3 to 4	-3.78%	-581	14772.4	11401	3371.4
	4 to 5	18.73%	2766.6	17539	14197	3342
	5 to 6	24.77%	4344.2	21883.2	16829.8	5053.4
	6 to 7	31.42%	6876.4	28759.6	21235.6	7524
COMPANY 6L	1 to 2			3048	1961	1087
	2 to 3	13.29%	405	3453	2243	1210
	3 to 4	1.82%	63	3516	2484	1032
	4 to 5	10.75%	378	3894	2735	1159
	5 to 6	66.69%	2597	6491	4752	1739
	6 to 7	23.23%	1508	7999	5689	2310
COMPANY 7L	1 to 2			4501	2934.9	1566.1
	2 to 3	17.26%	777	5278	3506	1772
	3 to 4	2.41%	127	5405	3745	1660

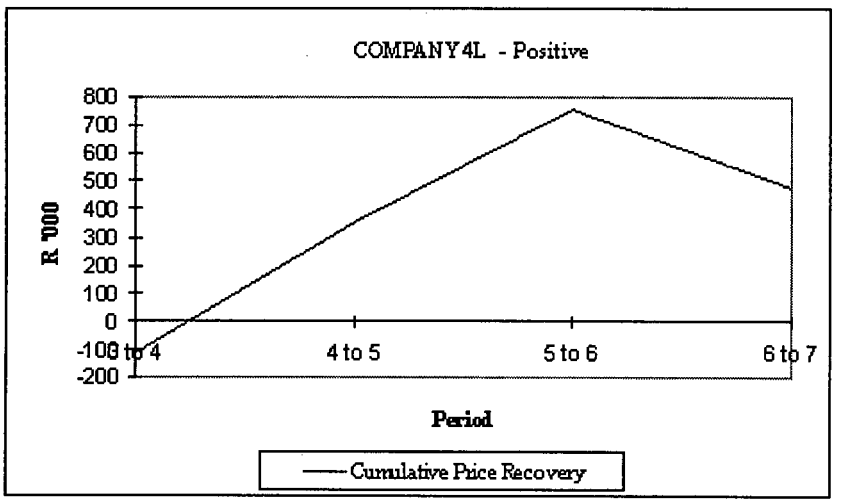
COMPANY	YEAR	CHANGE IN VARIABLE %	TOTAL COSTS R '000	TOTAL VARIABLE COSTS R '000	RAW MATERIALS R '000	DIRECT LABOUR R '000
	4 to 5	-12.45%	-673	4732	3232	1500
	5 to 6	52.23%	2471.5	7203.5	5242.1	1961.4
	6 to 7	17.97%	1294.7	8498.2	6176.9	2321.3
COMPANY 8M	1 to 2			9929	7230	2699
	2 to 3	11.69%	1161	11090	8051	3039
	3 to 4	14.90%	1652	12742	9238	3504
	4 to 5	44.31%	5646	18388	13941	4447
	5 to 6	24.89%	4576	22964	17365	5599
	6 to 7	13.41%	3079	26043	19302	6741
COMPANY 9M	2 to 3			11242	8413	2829
	3 to 4	21.06%	2368	13610	10509	3101
	4 to 5	18.96%	2580.3	16190.3	13004.7	3185.6
	5 to 6	28.54%	4621.4	20811.7	16933	3878.7
	6 to 7	10.42%	2168.9	22980.6	18528.6	4452
COMPANY 10M	2 to 3			7001	4903	2098
	3 to 4	8.91%	624	7625	5396	2229
	4 to 5	17.51%	1335	8960	6766	2194
	5 to 6	33.59%	3010.1	11970.1	9155.1	2815
	6 to 7	15.95%	1908.9	13879	10699	3180
COMPANY 11M	2 to 3			10513.4	7753.4	2760
	3 to 4	18.87%	1983.6	12497	9462	3035
	4 to 5	4.30%	537	13034	10040	2994
	5 to 6	30.79%	4012.9	17046.9	12948.4	4098.5
	6 to 7	17.74%	3024.2	20071.1	14963.1	5108
COMPANY 12L	2 to 3			6158.5	4209.5	1949
	3 to 4	13.57%	835.5	6994	4800	2194
	4 to 5	20.52%	1435	8429	6114	2315
	5 to 6	45.95%	3873.5	12302.5	9580	2722.5
	6 to 7	22.26%	2739.1	15041.6	11870	3171.6
COMPANY 13L	0 to 1			11739	8901	2838
	1 to 2	10.54%	1237	12976	9714	3262
	2 to 3	34.27%	4447.4	17423.4	12963	4460.4
	3 to 4	14.71%	2562.6	19986	14584	5402
	4 to 5	17.64%	3525.3	23511.3	17571	5940.3
	5 to 6	4.37%	1027.1	24538.4	18221.7	6316.7
	6 to 7	9.19%	2255.3	26793.7	19437.2	7356.5

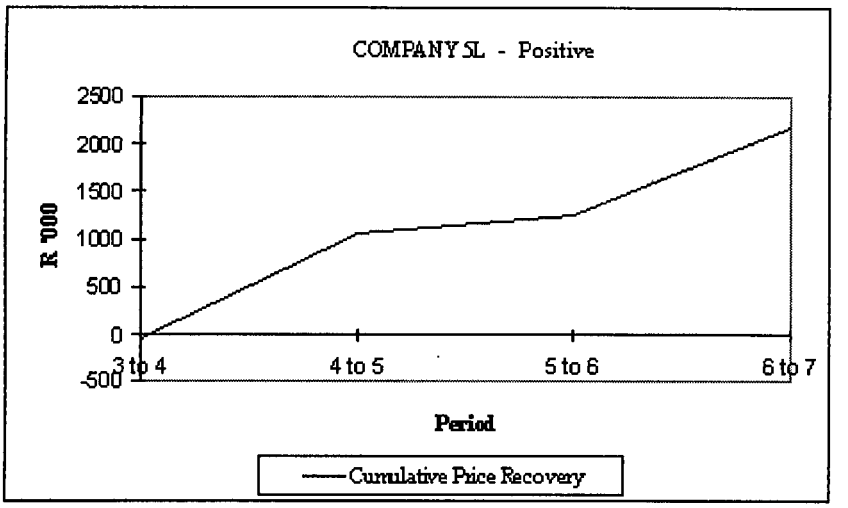
Appendix B - Cumulative Price Recovery Plots

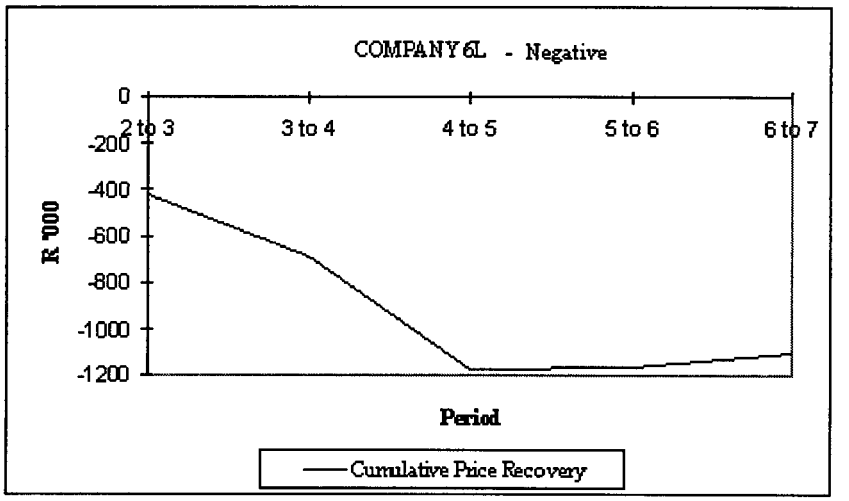


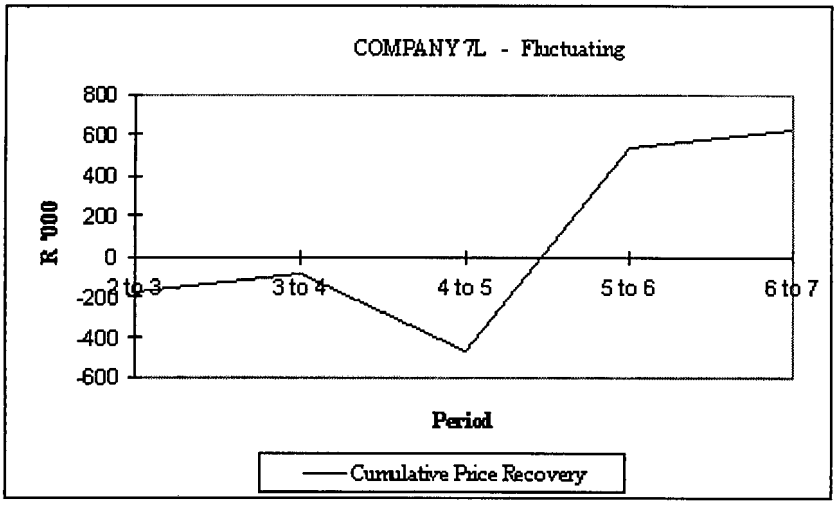


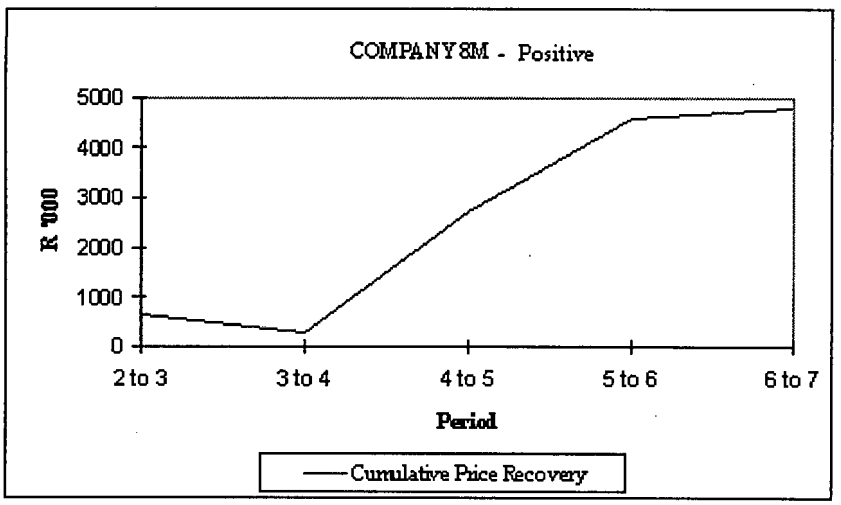

COMPANY3L - Positive
600
500
400
300
200
100
0
R '000
1 to 2
2 to 3
3 to 4
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery

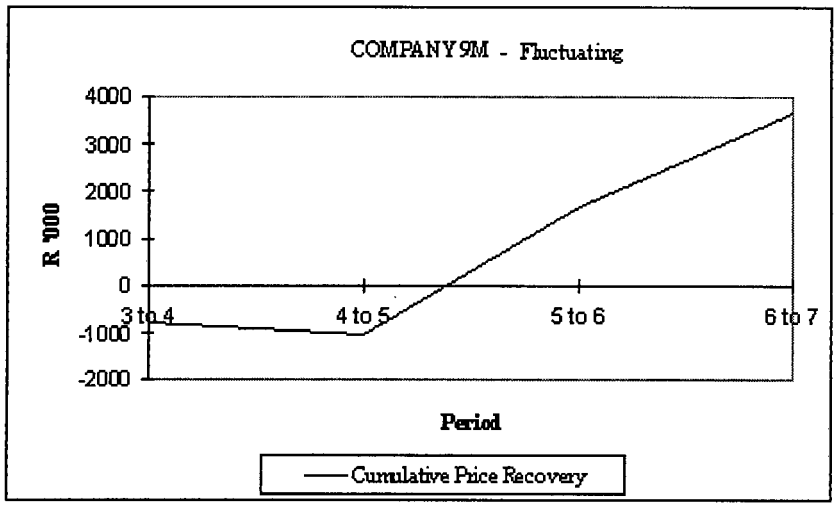

COMPANY4L - Positive
800
700
600
500
400
300
200
100
0
-200
R '000
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery

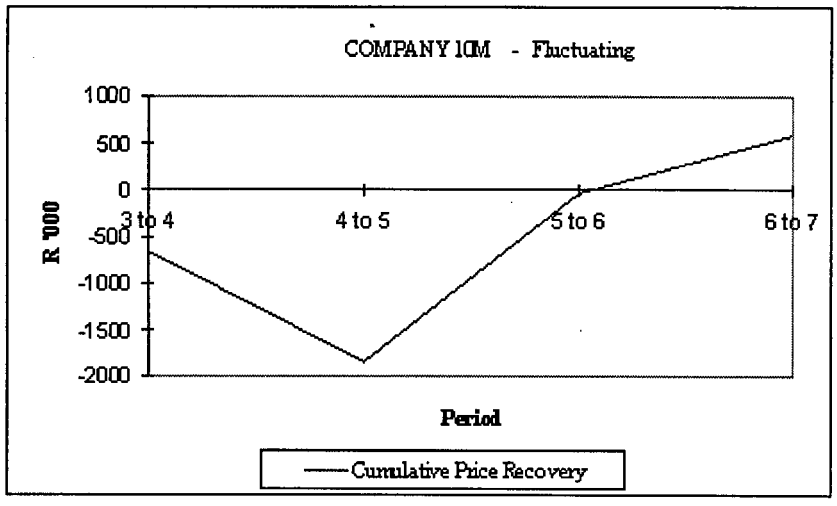

COMPANY 5L - Positive
2500
2000
1500
1000
500
0
-500
R '000
3 to 4
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery

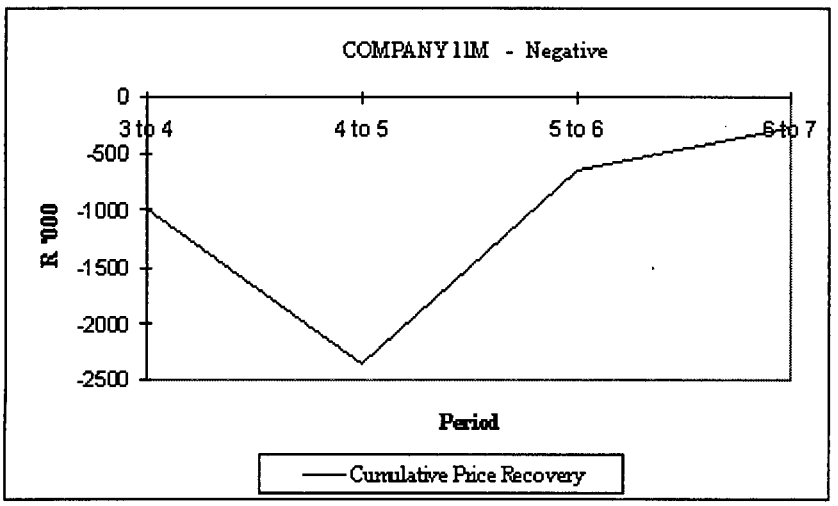

COMPANY 6L - Negative
0
-200
-400
-600
-800
-1000
-1200
R '000
2 to 3
3 to 4
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery

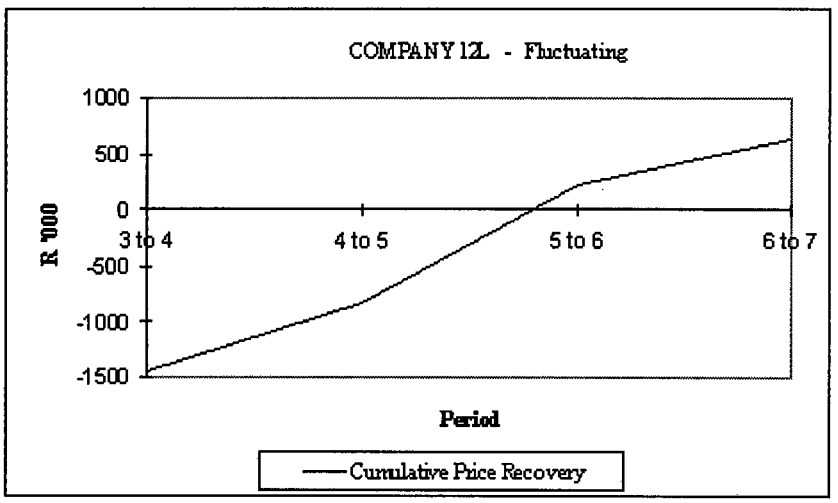

COMPANY 7L - Fluctuating
800
600
400
200
0
-200
-400
-600
R '000
2 to 3
3 to 4
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery

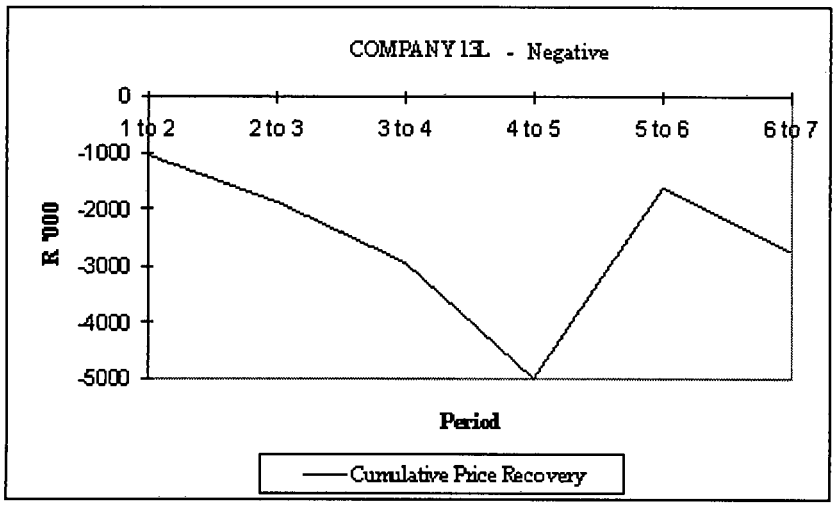

COMPANY 8M - Positive
5000
4000
3000
2000
1000
0
R '000
2 to 3
3 to 4
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery


COMPANY 9M - Fluctuating
4000
3000
2000
1000
0
-1000
-2000
R '000
3 to 4
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery


COMPANY 10M - Fluctuating
1000
500
0
-500
-1000
-1500
-2000
R '000
3 to 4
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery


COMPANY 11M - Negative
0
-500
-1000
-1500
-2000
-2500
R '000
3 to 4
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery


COMPANY 12L - Fluctuating
1000
500
0
-500
-1000
-1500
R '000
3 to 4
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery


COMPANY 13L - Negative
0
-1000
-2000
-3000
-4000
-5000
R '000
1 to 2
2 to 3
3 to 4
4 to 5
5 to 6
6 to 7
Period
Cumulative Price Recovery