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**International Trade and Economic Growth:
The Case of South Africa**

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Abstract

This paper gives a review of the economic growth literature, by examining both theoretical and empirical literature on the relationship between international trade and economic growth. The paper finds that theoretical growth models still fall short of identifying a direct channel of investigating the relationship between international trade and economic growth. Instead, economic theorists have developed theoretical models to investigate the relationship between international trade and economic growth, through the indirect channel of productivity gains, believed to be associated with higher international trade. Although most studies highlight the positive impact of international trade on economic growth, a review of the literature still shows mixed results on this relationship.

For South Africa, most empirical studies associate the improvement in total factor productivity since the early 1990s to the liberalisation of South Africa's trade and this improvement in TFP is said to have contributed towards much of the improvement in GDP during the same period. This study uses a unified model to investigate the relationship between trade liberalisation and economic growth, by explicitly including the factors of TFP growth in the growth model, for the period 1970-2005. Trade liberalisation (measured both by the change in trade policy and the level of foreign trade) was found to be a significant factor of the growth in output per worker, through increased productivity, during the period under study. Private sector investment was also found to be a highly significant factor of growth in output per worker during the period 1970-2005.

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- Each contribution from another source has been cited and referenced.
- This dissertation is my own work. It has not been previously submitted at any other institution.

Sign: P. Oliphant

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University of Cape Town

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1. Introduction

The idea that international trade leads to higher economic growth has gained popularity in economic growth literature and has been subject to much empirical investigation. Most researchers have argued that more open and outward oriented economies grow much faster than economies that have protectionist trade policies. However, there is still much debate in economic growth literature on the relationship between international trade and economic development. Both theoretical and empirical investigation has resulted in mixed results on this relationship. While some studies have found a positive relationship, others have found no relationship at all, while some have even found this relationship to be negative.

This paper gives a review of the economic growth literature, by examining both theoretical and empirical literature on the relationship between international trade and economic growth. The paper also attempts to extend the empirical investigation on the relationship between international trade and economic growth in South Africa. South Africa presents an interesting case study due to the variation in trade policy before and after South Africa's democratic transition in 1994.

The paper begins with an overview of theoretical literature on economic growth and international trade. A review of international empirical evidence is presented in section three. Section four reviews the case of South Africa, by giving a brief overview of South Africa's trade policy, trade development and economic performance both before and after the transition period. The section also reviews empirical literature on the relationship between international trade and economic growth in South Africa. Section five presents the empirical model employed in this study to examine the relationship between international trade and economic growth, and the results are presented in this section. Section six concludes.

2. Theoretical literature

Theoretical investigation into the relationship between international trade and economic growth can be traced as far back to the classical theory, which began with Adam Smith (1976). In Smith's theory, economic growth was driven by the growth in capital, labour, land and increases in overall productivity. The main idea from Smith's theory is that 'the division of labour (or specialisation) improves growth and more importantly, that the division of labour was limited by the extent of the internal market'¹. Therefore according to Smith's theory, 'international trade made it possible to overcome the limitations of the internal market and by increasing the extent of the market, international trade facilitated the division of labour and encouraged technical innovations, thereby increasing productivity and overall economic growth' (Afonso, 2001: 4).

The classical theories of economic growth were followed by neoclassical growth theories, which began with Solow (1956) and Swan (1956). In these models, economic growth was determined by the growth in capital, labour, and exogenous technological progress. In these tradition neoclassical models, long-run or steady state economic growth is achieved through the increase in the productivity of factors, brought about by technological progress (Romer, 2001). However, because technological progress is exogenous in these models, international trade does not affect the long-run economic growth.

When the neoclassical growth model is extended to open economies, international trade can have a once-off effect on the steady state level of output (which can be positive or negative, depending on the impact of trade policy). In this instance, international trade affects the allocation of resources between sectors, and therefore the steady state level of savings and capital accumulation, which in turn has a transitional effect on the steady state level of output (Jonsson and Subramanian, 2001: 198). Therefore, like in classical models, international trade can have an effect on economic growth in neoclassical models, although this impact is only transitional in neoclassical models. It has been pointed out that the transitional period in neoclassical model could last for many years, in

¹ <http://ccpa.newschool.edu/het/essays/growth/classicalgrowth.htm>.

which case international trade could display growth effects on output (Nowak-Lenmann, 2000: 9).

Dissatisfaction with treatment of technological progress as exogenous in neoclassical models led to the emergence of the endogenous growth theory (which started with Romer (1986) and Lucas (1988)). In endogenous growth models, technological progress is driven by the behavior of profit maximising firms through the allocation of resources to the creation of new technologies, through for example, innovation, imitation and technology transfer (Romer, 1990). Firms undertake innovation to improve existing technologies in order to improve the productivity of factors or decrease the cost of production; to increase the variety of inputs used in production and products produced; and improve the quality of existing inputs and products. Imitation on the other hand is a process whereby firms undertake to learn and adapt new technologies used in other firms. Both innovation and imitation require the expansion of resources into research and development (R&D) (Chou and Wong, 1997, p6-7).

Technology transfer, on the other hand, involves the direct transfer of new technologies from other firms and this can be achieved through various channels, for example through the direct purchase of technologies from other firms, or indirectly through technical spillovers from being in contact with other firms, through international trade, joint ventures and foreign direct investment (FDI) (Chou and Wong, 1997, p6-7). Long-run growth in this regard is therefore driven by the intentional expansion of resources by firms into technological progress, through R&D and technological transfer.

The above analysis of endogenous growth theory therefore suggests that international trade can have a long-run effect on economic growth by enhancing productivity through technological progress. For instance, international trade could result in technology spillovers, whereby local firms acquire new technologies from foreign firms, for example through the importation of capital goods from foreign countries (see for example Grossman and Helpman (1991)). These new technologies enhance the productivity of factors, therefore leading to higher output growth. Secondly, international trade can

enhance efficiency through cheap intermediate goods imports and competition from cheaper imports, resulting in the decrease in margins and the elimination of inefficiencies (see for example, Quah and Rauch (1990) and Chang et al. (2005)). Lastly, international trade can facilitate productivity through economies of scale associated with the increase in market size. Therefore, by facilitating technological progress, international trade can have a long-run impact on economic growth in endogenous growth models. Although this analysis might suggest a positive impact of international trade on economic growth, it should be noted that international trade can have a negative impact on growth if for example, local firms do have a comparative disadvantage in innovation and imitation, or if local firms cannot compete with cheaper imports.

From the above, it can be seen that endogenous growth models provide a theoretical framework for analysing the relationship between international trade and economic growth, by making technological progress endogenous. As a result, endogenous theory has become the foundation of economic growth analysis and many economists continue to use endogenous growth models in an attempt to explain the link between international trade and growth. However, it should be noted that, although endogenous growth theories allow for a theoretical framework for analysing the relationship between international trade and growth, this theory also falls short of explaining the direct channel through which trade affects economic growth, suggesting that the direct effects of international trade on economic growth cannot still be justified on theoretical grounds.

One source of difficulty in postulating the direct link between international trade and economic growth is associated with the measure of trade policy or openness indicators. In general, there is no perfect or uniform indicator of trade policy and in many cases it is often difficult to accurately quantify trade policy. Importantly, the effects of trade policies might differ across countries and therefore it might be misleading to generalise the effect of trade policy in one economy to other economies even of even similar characteristics (Nowak-Lenmann, 2000: 13). Pritchett (1996) gives a critique of the various measures of trade. Secondly, it is also argued that trade liberalisation is often implemented as part of a package with other economic policies, making it difficult to

isolate the impact of trade policy from other macroeconomic policies (Baldwin (2002) in Winters, 2004: 9).

Many empirical studies have been criticised for investigating the relationship between trade and economic growth without any clear theoretical framework that postulate the direct link between the two variables. As such, some researchers have attempted to overcome this shortcoming by using the indirect link between international trade and growth, by using models that capture the impact of international trade on factor productivity, which is assumed to lead to higher economic growth. The next section presents international empirical evidence on the relationship between international trade and economic growth.

3. International empirical literature

There are two strands of empirical studies on the link between international trade and economic growth, namely cross-country and intra-country or case studies. Examples of earlier (and widely cited) cross-country studies that examine the impact of trade on economic growth include Dollar (1992), Sachs and Warner (1995), Edwards (1998) and Coe, Helpman, and Hoffmaister (1997). More recent cross-country studies include Wacziarg (2001), Loots (2002), Dollar and Kraay (2004) and Chen and Gupta (2006). These studies have focused either on the direct channel of international trade on output growth or in the impact of trade on total factor productivity (TFP). The broad conclusion from these studies is that higher international trade has a positive impact on economic growth. Furthermore, some of these studies have focused on developing countries, and have highlighted the importance of trade liberalisation as a key to the development of poor nations.

Despite the broad finding by many cross country studies that international trade has a positive impact on economic growth, the validity and/or reliability of these studies have has been called into question (see for example Edwards (1993) and Rodriguez and Rodrik (1999)). First, these studies have been criticised on the ground that they use regression

models without a clear, if any, theoretical framework which explains the link between international trade and economic growth. This is particularly a problem in studies that examine the direct impact of international trade on output growth.

Secondly, these studies are criticised based on the choice of the trade measure employed in these studies, which often result in endogeneity or measurement problems. The problem of endogeneity is particularly prevalent in studies that use the level of foreign trade (such as exports and imports) as a measure of trade. In this regard, the endogeneity problem arises because foreign trade variables (imports and exports) are outcome measures, which makes it difficult to determine the direction of causality between international trade and output growth. That is, it becomes difficult to determine whether trade liberalisation as measure by the level of foreign trade result in or from output growth.

Some studies have tried to overcome the endogeneity problem by using, or even constructing, other variables to measure trade. However, even so, the use of these other trade variables has been criticised because they either mismeasure trade policy (Dollar, 1992) or the trade policy variable is picking up other effect such as macroeconomic stability or regional dummies (Sachs and Warner, 1995), or because their results are not robust to alternative specifications (Edwards, 1998) (Rodriguez and Rodrik (1999)). Additionally, because there is not uniform measure of trade policy, cross-country studies can be misleading by generalising the impact of trade policies across countries, without taking into account the specific characteristics of each country (Nowak-Lenmann, 2000: 13).

The second strand of empirical literature on the relationship between international trade and growth consists of intra-country or case studies based either cross-sectoral, plant-level, or aggregate time series analysis. Case studies have found a variety of channels through which international trade can impact on economic growth. The common channel used in most of these studies is the productivity gains channel. For instance, most sectoral and aggregate time series studies find that trade liberalisation, was usually followed by

substantial increases in productivity, arising from increased competition (Ferreira and Rossi, 2001 in Winters, 2004), the decline in margins and economies of scale (Kim, 2000), the elimination of inefficient firms, cheaper intermediate inputs and increased competition from cheaper imports (Tybout and Westbrook, 1995).

Sectoral and plant level case studies also allow for the examination of the assumption that exporting is the key to productivity gains and hence higher growth. These studies are based on the premise that exporting firms are found to be generally more productive than non-exporting firms, and the hypothesis to be examined in this regard is whether increased exports lead to higher productivity. Although some studies have found that exporting leads to higher productivity, some studies have shown that exporting either doesn't play a role in efficiency gains (for example, Arnold and Hussinger (2005)), or that the causations actually runs from higher efficiency to exporting, with more productive firms self-selecting into export markets (see for instance Bernard and Jensen, 1999). However, some studies have shown that while self-selection may determine entry into the export market, exporting further enhances the productivity of these firms; see for instance Melitz (2003), Girma et al. (2004) and Biesbroeck (2005).

The assumption that exporting is the key to productivity gains has gained much popularity, as shown by the increase in the stock of empirical studies on the export-led growth (ELG) hypothesis. The popularity of the ELG hypothesis was inspired by the experience of East Asian economies, whose rapid growth has largely been attributed to their outward-oriented trade policies, reflected by their increased involvement in the export market. However, empirical investigation into the ELG hypothesis has resulted in mixed results. While some aggregate time series studies have found that exporting leads to higher economic growth, therefore providing support for the ELG hypothesis (for example, Ghatak et al. (1997) for the case of Malaysia; Abdulai and Jaquet (2002) for Cote d'Ivoire; and Medina-Smith (2001) for the case of Costa Rica), some studies have found that the causal link runs in the opposite direction, where higher growth leads to an increase in aggregate exports. For instance, while Awokuse (2003) finds support for the ELG hypothesis for Canada, an earlier study by Henriques and Sadorsky (1996) found

that the causation actually ran from higher GDP to higher exports, implying that the ELG hypothesis does not hold for the case of Canada.

From the above analysis, it can be seen that case studies have resulted in mixed results regarding the relationship between international trade and economic growth. While some studies have highlighted the efficiency gains associated with international trade, and hence the positive impact of trade on economic growth, some studies have either found no role for international trade in productivity growth, while some have found that the causation actually runs from higher efficiency to increased trade. Furthermore, these studies have also highlighted that international trade can in fact have a negative impact on economic growth, for instance if local firms cannot compete in international markets.

Although case studies have resulted in mixed results, it is argued that case studies provide a more appropriate approach of investigating the relationship between international trade and economic growth, by providing a theoretical framework to investigate this relationship (albeit through the indirect link of trade to growth through efficiency gains). Therefore, based on this, case studies have become more preferable than cross-country studies. However, analysis of some case studies has shown that some case studies also suffer from some empirical shortcomings highlighted in cross-country studies, such as measurement and endogeneity problems. The problem of endogeneity is particularly common in ELG hypothesis case studies.

However, despite the shortcomings highlighted above, it is clear that, in the absence of conclusive theoretical models that capture the direct relationship between international trade and growth, case studies provide a more convincing basis of investigating this relationship. Therefore, while cognizance is given to some of the limitations of case studies, this study proposes to examine the relationship between trade and economic growth for the case of South Africa, given the absence of alternative and more conclusive frameworks of analysis.

The next section gives an overview of South Africa's trade policy, trade development and economic growth. The aim of the section is to examine how South Africa's trade policy has evolved since the political transition in the early 1990s. More specifically, this section examines whether South Africa has become more open to international trade, by reviewing some empirical studies that have examined this and by looking at simple measures of trade openness to give an indication of this. The analysis shows that South Africa has become more open to international trade, even though the extent of liberalisation is still subject to empirical research. Given this, there has been a lot of empirical investigation on whether trade liberalisation has resulted in higher economic growth in South Africa. This empirical evidence is also presented in the next section.

4. South African literature

4.1 South African trade policy

Both international and domestic political and economic factors have played an important role in South Africa's trade policy and trade development. As was mentioned earlier, economic self-sufficiency pervaded the developing world during the 1950s, 1960 and early 1970s. As such, a large number of developing countries implemented import substitution industrialisation (ISI) policies, based on a very limited degree of international openness. The rationale behind the adoption of ISI policies by developing countries was based on the "infant industry argument".

The infant industry argument for developing countries was based on two fundamental premises. Firstly, that 'a secular deterioration in the international price of raw materials and commodities would result, in the absence of industrialisation in the less developed countries, in an ever-growing widening of the gap between rich and poor countries, and secondly, that in order to industrialise, the smaller countries require (temporary) assistance in the form of protection to the newly emerging manufacturing sectors' (Edwards, 1993: 1358).

Like many developing countries, after the Second World War, South Africa adopted the import substitution strategy, characterised by high tariffs and extensive import controls, including import quotas, in order to stimulate industrialisation. More specifically, in 1944, a Board of Trade and Industries Act was passed, whereby high initial tariffs were introduced to establish new industries, with the intention to lower or abolish these tariffs as industries became strong enough to compete internationally (Muradzikwa et al., 2004: 295).

From the mid-1960s, there was a growing perception across the world that import substitution was no longer the driving force behind promoting industrial growth and as many countries started opening their markets to international trade in the 1970s, South Africa followed suite, by gradually shifting its trade policy towards export promotion. This led to the introduction of export subsidies to counter the anti-export bias of the import substitution industrialisation policy and to the relaxation of quantitative restrictions. An attempt at trade liberalisation continued into the 1980, and in 1985, trade liberalisation was further enhanced by the scrapping of the publication of a positive list, which specified the items that could be imported without permission, and the replacement of this with a negative list that included all the items that needed approval to be imported (Muradzikwa et al., 2004: 304).

An important factor to consider when evaluating South African trade policy is South African politics, which had an important influence on the country's trade development particularly since the 1970s. Opposition against the apartheid policies of the ruling National Party gained momentum in the 1970s and this had a major impact on the country's economic development. The 1973 Durban strikes, marked the intensification of opposition against the apartheid government since the Sharpsville massacre of March 1960. The 1976 Soweto revolt, opposition against of the three-chamber parliamentary system in 1983, as well as the rejection of President P. W. Botha's Rubicon speech in 1985, led to widespread unrest and marked the pinnacle of both internal and international opposition against the apartheid system.

International opposition against South Africa led to the introduction of trade and financial sanctions against the South African government, and this led to a serious liquidity crunch as capital fled South Africa, leading to the balance of payment crisis. In order to maintain the balance of payment equilibrium (or to earn sufficient foreign exchange to repay foreign debt), South African trade policy was aimed at ensuring current account surpluses during the sanction period. This was primarily achieved through expenditure reduction policies in the form of high interest rates, and through the imposition of import permits. According to Belli et al. (1993), by the end of the 1980s, South Africa had the most tariff lines, most tariff rates, the widest range of tariffs, and the second highest level of dispersion among developing countries, therefore interrupting the progress that was made on trade liberalisation.

The depressed state of the economy during this period left manufacturers with rising unused capacity and saw manufacturers turning to export markets. In order to compensate manufacturers for the price disadvantage they faced in international markets, a number of export schemes were introduced in the 1980s. In 1990, these export schemes were consolidated into one scheme—the Generalized Export Incentive Scheme (GEIS)—‘that provided a tax-free subsidy to exporters related to the value of exports, the degree of processing of the exported product, the extent of local content embodied in exports, and the degree of overvaluation of the exchange rate’ (Jonsson and Subramania, 2001: 200).

Trade liberalisation in the 1990s

In response to the serious impact of trade and financial sanctions on the South African economy and mounting internal and external opposition towards the apartheid government, President F.W. de Klerk, who replaced President P. W. Botha in 1989, saw the need to address these issues by implementing some changes in the politics of the country. More specifically, in 1990 the African National Congress was unbanned, Nelson Mandela was released from prison, and negotiations for a democratic South Africa began and in 1994, South Africa held its first democratic election, and a new government led the African National Congress was voted into power.

Following the political transition in 1994, a consultative process, involving government, labour and organised business, was undertaken to look at ways of transforming South Africa's economic policies. In particular, recognition of the limitation of the protectionist regime of the 1980s as well as the poor performance of primary commodities in international market, amongst other reasons, led to a formal process of trade policy reform. Therefore the reform of the South African trade policy gained momentum in the early 1990s when South Africa committed to both multilateral and unilateral trade liberalization policies.

Multilateral trade liberalisation

Between 1990 and 1994, trade liberalization largely took the form of eliminating the remaining import licensing procedures that were in place and reducing import tariffs. According to Jonsson and Subramanian (2001: 201), the average tariff was reduced from 28 percent to 16 percent while the import surcharge was eliminated and hence the sum of all charges was reduced from 34 percent to 16 percent. However, the commitment of South Africa to liberalise its trade policy was formalised in the 1995 Uruguay Round and South Africa's offer to the World Trade Organization (WTO) consisting of a five-year tariff reduction and rationalisation program. The offer aimed to:

- 'Reduce the number of tariff lines (from over 13,000) at the six-digit harmonized code level by 15 percent in the first year and by 30 percent or higher by 1999;
- Convert all quantitative restrictions (QRs) on agricultural imports to bound advalorem rates; lower all bound agricultural tariffs by 21 percent on average; and reduce export subsidies by 36 percent;
- Increase the number of bindings on industrial products from 55 percent to 98 percent by 1999; replace formula duties with tariffs; and reduce the number of tariff rates to six (0 percent, 5 percent, 10 percent, 15 percent, 20 percent, and 30 percent) with the exception of the "sensitive" industries (textiles, clothing, and motor vehicles);

- Liberalise the sensitive industries over an 8-year period; and
- Phase out the GEIS by 1997' (Jonsson and Subramanian, 2001: 203).

Jonsson and Subramanian (2001: 203) reported that 'during 1990-1998, liberalisation of the trade regime for manufacturing products resulted in: the elimination of the few qualitative restrictions that remained; reduction in the average tariff (including all charges) from 34 percent in 1990 to 10 percent in 1998; considerable variation in tariff cuts across sectors; and simplification of the tariff regime'. In addition, the GEIS was fully abolished in 1997.

Unilateral trade liberalisation

In 1994, the government also announced a schedule of unilateral trade liberalisation expiring in 1999 that went beyond the Uruguay Round commitments. According to Jonsson and Subramanian (2001: 201), 'South Africa's average (import-weighted) tariffs in manufacturing declined from 16 percent in 1994 to 10 percent in 1998. Furthermore, the tariff regime has been rationalised, with the number of lines reduced from over 13,000 in 1990 to about 7,900 in 1998, and the number of tariff bands reduced from over 200 to about 72'.

Jonsson and Subramanian (2001: 201) also reported that the tariff regime was simplified, with the number of lines carrying formula duties declining from 1,900 in 1993 to 28 in 1997, and the number of lines facing specific tariffs falling from 500 to 227. Furthermore, Jonsson and Subramanian (2001: 201) reported that by 2001, 'the average (import-weighted) tariff was below the level committed by South Africa in the WTO by more than 5 percentage points, although there were considerable variations in tariffs across sectors'. Furthermore, in 2001, almost all the quantitative restrictions were eliminated, including those operating through the agricultural marketing boards.

Trade agreements

In addition to unilateral and multilateral liberalisation, South Africa has also made significant progress towards strengthening bilateral ties with some of its main trading partners. For example, in 1996 South Africa entered into a trade agreement with countries in the Southern African Development Community (SADC) region, in the form of the SADC Free Trade Protocol. In 2000 South Africa entered into another free trade agreement with the European Union, referred to as the South Africa-European Union Trade, Development and Corporation Agreement (TDCA). Also in 2000, South Africa gained preferential access to the United States for some products under the African Growth and Opportunity Act (AGOA), and in 2004 South Africa signed a Preferential Trade Agreement with SACU and MERCOUR (Edwards, 2006, p3).

The above analysis suggests that South Africa has made considerable progress in terms of liberalising its trade, as shown by the elimination of almost all quantitative restrictions and the significant rationalisation and the simplification of tariffs. However, despite this, there is still much debate as to whether the South African trade policy has been liberalised. While researchers agree that progress has been made in lowering the level of nominal protection, there is still debate around whether the level of effective protection has actually declined.

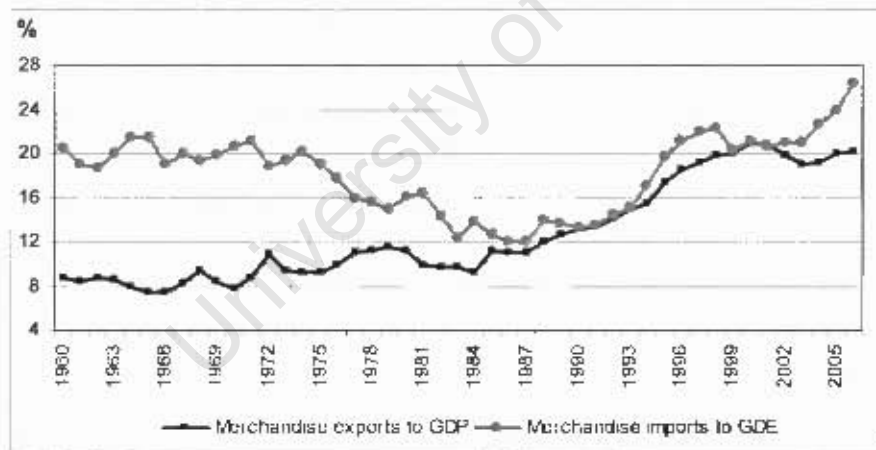
For example, while Fedderke and Vase (2001) argue that 'more of South Africa's output was protected in 1998 than in 1988', Rangasamy and Harmse (2003) disputed this argument, stating that '...to argue that more of South Africa's output has been subject to increased levels of protection during the 1990s is not only incorrect but also a misrepresentation of facts'. A recent study by Edwards (2006) which examines whether South Africa has liberalised its trade reported that South Africa has made significant progress in simplifying the tariff schedule and reducing tariff protection. However Edwards (2006) argues that further progress can be made in removing tariff peaks, reducing tariff dispersion, and lowering the anti-export bias arising from protection.

In conclusion, while there is debate about whether South Africa has indeed reduced its effective protection (and hence liberalised its trade regime), there is no doubt that the South African economy has become increasingly more open to international trade when compared to the period before South Africa's transition. In what follows, the paper gives an overview of South Africa's trade and economic development.

4.2 Trade development and economic growth

A simple review of measures of trade openness reveals that South Africa has indeed become more open to international trade. Figure 1 depicts real merchandise export and imports as a ratio of Gross Domestic Product (GDP) and Gross Domestic Expenditure (GDE) respectively, measures which give an indication of a country's openness to international trade.

Figure 1: Merchandise imports as a percentage of GDE and merchandise exports as a percentage of GDP



Source: SARB

Figure 1 shows that merchandise imports as a percentage of GDE fluctuated around 20 percent in the 1960s, before starting to decline in the early 1970s. This decline in imports relative to GDE continued throughout much of the 1980s. In 1987, merchandise imports as a percentage of GDE were about 12 percent, and they have since increased to about 26

percent in 2006. Merchandise exports as a percentage of GDP were below 12 percent during the 1960s through to the early 1980s. From 1984, there was an upward trend in merchandise exports as a percentage of GDP, from 11 percent in 1980 to about 20 percent in 2006. The increase in import penetration and export orientation indicate that South Africa's has become increasingly open to international trade.

Trade volumes have also increased following the reintegration of South Africa into the global economy. As shown in Figure 2, import volumes increased steadily during the 1960s and the early 1970s, supported by the government's import substitution industrialisation strategy. Import levels showed no significant trend in from the early 1970s to the early 1990s. This poor import growth was mainly as a result of the depreciation of the rand and the imposition of import surcharges in the mid-1980s. The recession in the domestic economy in 1989 also contributed towards this poor import growth.

Figure 2: Volume of imports and exports of goods and non-factor services



Source: SARB

Growth in import volumes recovered from the early 1990s, following South Africa's reintegration into the international market. Specific factors that drove the level of imports in the early 1990s include large imports of capital equipment (for example in the mining industry), the periodic substitution of locally produced goods by imported goods in

reaction to a decline in the relative prices of imported goods, and the execution of previously postponed aircraft purchases by South African Airways. The increased importance of non-traditional manufactured exports which required more intermediate imports than traditional imports also contributed to the rise in the level of imports in the 1990s (Mohr, 2003: 382).

Export volumes on the other hand stagnated in the 1960s due to the export-bias that prevailed during that period. However, exports grew steadily during the 1970s, as South Africa shifted towards export promotion during that period. However, from the late 1970s to the mid-1980s, exports stagnated as a result of the imposition of sanctions on South African exports as well as a decline in primary sector exports, particularly gold. From the late 1980s and early 1990s, export growth was achieved, spurred by the depreciation in the currency and the introduction of export subsidies provided under the General Export Incentive Scheme (GEIS).

From 1994, export levels grew even faster, following the undertaking by government to liberalise the South African trade regime. Some specific factors that influenced the strong performance of exports in the 1990s include: the generally strong world economy and the concomitant growth in world trade, fostered by the international trend towards trade liberalisation; a change in attitude of South African manufacturers towards exports, also responding to trade policy initiatives; the opening up of new, non-traditional markets as trade sanctions were lifted (for example in Africa) and the rapid expansion of these markets compared to the economies of South Africa's traditional trading partners; as well as the various trade agreement entered into by South Africa. The decline in the nominal (sometimes real) effective exchange rate of the rand during the period as well as the introduction of the Motor Industry Development Scheme (MIDP) during the second half of the 1990 also contributed to the growth in exports (Mohr, 2003: 380-381).

The above analysis shows that the democratic transition of South Africa in 1994 led to an increase in the integration of the South African economy into the global arena. More specifically, South Africa has made significant progress in liberalising its trade, which

has led to South Africa becoming more open to international trade. A review of South Africa's growth performance reveals a similar pattern to that displayed by South Africa's trade performance.

Table 1: GDP and GDP per capita growth rates

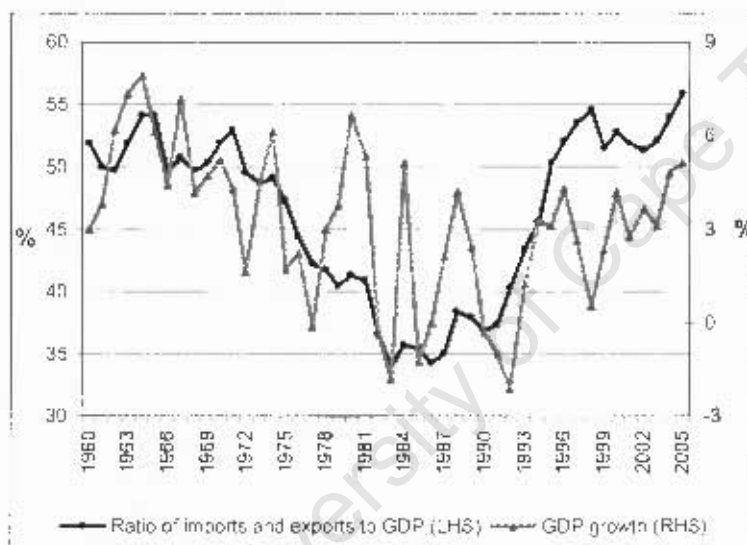
	GDP	GDP per capita
1960	3.0	0.5
1965	6.1	3.2
1970	5.3	2.5
1975	1.7	-0.6
1980	6.6	4.2
1985	-1.2	-3.4
1990	-0.3	-2.4
1995	3.1	1.0
2000	4.2	2.1
2006	5.0	3.6
1960-1974	5.1	2.4
1975-1984	2.6	0.2
1985-1994	0.8	-1.3
1995-2006	3.5	1.6
2000-2006	4.1	2.4

Source: SARB

Table 1 above shows the growth in South Africa's GDP and GDP per capita since 1960. Table 1 shows that GDP growth fell from an average of 5.1 percent during the period 1960-1974 to an average of only 0.8 percent during the period 1985-1994. During the same period, GDP per capita growth fell from an average of 2.4 percent to a negative growth rate of 1.3 percent. The period after the end of apartheid saw an improvement in both GDP and GDP growth per capita, which averaged 3.5 percent and 1.6 percent respectively between 1995 and 2006. More specifically, between 2000 and 2006, GDP and GDP growth per capita averaged an improved 4.1 percent and 2.4 percent respectively, and from 2004 to 2006, annual GDP has been growing at 5 percent while per capita GDP has been growing at 3 percent.

From the above, it can be seen that South Africa's growth performance has improved since the end of apartheid. Notably, the improvement in South Africa's growth performance during this period corresponds to the improvement in South Africa's trade performance. This trend is also confirmed in Figure 3, which shows that the ratio of imports and exports to GDP (commonly used as a measure of trade openness) and GDP growth have been moving in the same direction since 1960. Figure 3 therefore seems to suggest that there is a relationship between the level of trade openness and the average growth.

Figure 3: Ratio of imports and exports to GDP and GDP growth



Source: SARB

A question that arises is whether the above analysis suggests that there is a relationship between international trade and economic growth in South Africa, and more specifically whether the improvement in growth can be attributed to the increased openness to international trade or to the liberalisation of the South Africa's trade regime. The paper will attempt to answer these questions, by undertaking an empirical investigation into the relationship between international trade and economic growth for the case of South Africa in section five. Before embarking on this, a review of the existing empirical

literature on the impact of international trade on economic growth in South Africa is given below.

4.3 South African empirical literature

This section gives a review of three prominent studies that investigate the relationship between trade and growth in South Africa. First, a study by Jonsson and Subramanian (2001) uses both cross-section and aggregate time series analysis to examine the relationship between trade and total factor productivity in South Africa. The cross section analysis in this study is based on pooled data for the years 1990-1994 and 1994-1998 for 24 manufacturing industries. TFP was calculated as the difference between growth in real value added and real factor accumulation in each sector, while the trade policy variable was calculated as the sum of all import charges (tariff and import surcharges) for each sector. Therefore the cross section analysis of this study investigates the impact of the change in tariffs on total factor productivity, where the change in tariffs reflects the change in domestic prices resulting from the reduction in tariffs. The results of this analysis show that the improvement in productivity in the various sectors was explained by the reduction in nominal tariffs in those sectors.

The time series analysis on the relationship between TFP and trade on a macro level was done for the period 1971 to 1997. TFP was derived as a residual of the aggregate production function, while the trade variable used in this analysis is the ratio of the sum of real imports and real exports to real GDP. Also included in the time series analysis is the share of machinery and equipment investment in total investment as a proxy for technology, arising from R&D. The assumption here is that 'since South Africa does not undertake significant amount of R&D activity, the bulk of the R&D is expected to be embodied in capital and equipment, especially imported from abroad and looking at total investment in machinery and equipment implicitly aggregates R&D undertaken in South Africa and abroad and assumes that the two have similar effects on TFP' (Jonsson and Subramanian, 2001: 207).

The results of their time series analysis also shows increased productivity associated with an increase in trade. Specifically, they find a positive long-run relationship among TFP, degree of openness, and the proxy for technology. Their results suggest that a 10 percentage point increase in openness is associated with an increase in TFP by 5 percent in the long run. More importantly, their results seem to suggest that the causal relationship runs from trade openness to TFP.

The second study, by Arora and Bhundia (2003), examines potential output and sources of growth in post-apartheid South Africa, using time series techniques and a conventional production function approach. Like Jonsson and Subramania (2001), Arora and Bhundia (2003) derive TFP as a residual from the production function. Their growth accounting results, suggest that the significant increase in real GDP growth after 1994 reflected a significant increase in TFP growth rather than factor accumulation. This finding is in line with the findings of other studies (IMF (1998) and du Plessis and Smit (2006)), which also found that the improvement in TFP growth in the early 1990s contributed to the improvement in growth performance. Arora and Bhundia (2003) go a step further by investigating factors that have contributed towards the improvement in TFP growth. Increased trade (as measure by the trade as a share of GDP) and private investment in machinery and equipment as a share of total investment were found to be statistically significant and positive factors of TFP growth, and the results also suggested that the direction of causality ran from these factors to TFP growth.

The third study, by Harding and Rattso (2005) suggests a different approach, a barrier growth model, in examining the factors of productivity growth in South African manufacturing industries between 1970 and 2003. The barrier growth model is based on the premise that 'all countries can benefit from growth of the world technology frontier, but in different degrees due to barriers to international spillovers' (Harding and Rattso, 2005: 19). According to Harding and Rattso (2005: 16), the model 'implies a long-run relationship between country productivity and the world technology frontier and that changing barriers can add transitional growth'. Their world technology frontier is measured as the US labour productivity and they examine two models using trade

openness and trade policy as measures of barriers to world technology. Harding and Rattso (2005) follow the conventional procedure of estimating TFP as a residual from the production function.

Using the share of foreign trade to GDP as measure of openness, Harding and Rattso (2005), find a positive relationship between trade openness and TFP growth in South Africa during the period under study. However, unlike Jonsson and Subramanian (2001) who find that foreign trade explains 90 percent of TFP growth between 1970 and 1997, Harding and Rattso (2005) find that, although foreign trade is significantly important over the entire period under study, it does not explain much of the TFP growth over the whole period. On the other hand, Harding and Rattso (2005) found that the reduction in trade barriers, calculated on the basis of import tax revenues, explains about a third of the growth of TFP between 1970 and 2003, and separating this into different sub-periods, they find that reduction in tariffs explains most of the rise in productivity in the pre-sanction period and about 70 percent in the post-sanction period.

There are two broad conclusions that can be made from the above review of South African empirical literature. First, TFP growth was found to have improved in the early 1990s, and that this improvement in TFP growth explains much of the improvement in economic growth after the transition period. Secondly, the studies find a positive relationship between increased trade and TFP growth. In the next section, this study attempts to extend and contribute to the existing empirical literature on trade and economic growth in South Africa.

5. Empirical investigation

This study attempts to make a contribution to the existing literature on relationship between international trade and economic growth in South Africa in two ways. First the study extends the analysis period to 2005 and secondly the study replicates an approach used in a study by Chou and Wong (1997), which is based on a unified model introduced

in Long and Wong (1997). Specifically, this study attempts to investigate the relationship between trade and economic growth in South Africa, for the period 1970 to 2005.

5.1 Theoretical framework

This section presents the theoretical framework that will be used to estimate the relationship between trade and economic growth in South Africa. The theoretical framework is based on the endogenous growth theory, where technological progress is determined endogenously in the model. First, it is assumed that the South African economy can be represented by a one-sector model in which a homogenous product is produced. This assumption implies that issues related to resource allocation between sectors, and horizontal and/or vertical innovations are not considered (Lin and Wong, 1997: 4). There is large number of competitive firms, employing capital and labour, to produce the good. International trade and physical movement exists between South Africa and other countries and the economy is completely specialised, exporting the good it produces and importing other goods. Therefore even though only one good is produced in the economy, the residents may consume more than one commodity (Lin and Wong, 1997: 4).

The sectoral production function of the economy is given by:

$$Y = AF(K, L) \quad (1)$$

where Y is aggregate output, A is technological progress (or TFP), K is capital input, and L is labour input. Time sub-indices are dropped for simplicity. Output per worker is defined as $y \equiv Y/L$, therefore (1) can be written as:

$$y = AF(K, L) / L \quad (2)$$

Following Lin and Wong (1997), growth in output per capita can be expressed as²:

$$\hat{y} = \hat{A} + \varepsilon_K \hat{K} - (1 - \varepsilon_L) \hat{L} \quad (3)$$

where “hat” denotes the growth rate of a variable, for example $\hat{y} \equiv d \log y / y$ and ε_K is the elasticity of function $F(.,.)$ with respect to K and ε_L is the elasticity with respect to L . If the ratio of capital to worker is defined as $k \equiv K/L$, then (3) can be written as:

$$\hat{y} = \hat{A} + \varepsilon_K \hat{k} - (1 - \varepsilon_K - \varepsilon_L) \hat{L} \quad (4)$$

which states that output growth is determined by growth in technology (in a Hicks neutral sense), \hat{A} , the growth in capital per worker \hat{k} , and the growth of the working population \hat{L} . Determining the factors of output growth requires estimation of the coefficients in (4). However, the problem with direct estimation of equation (4) is that TFP (A) is not observable. In this study, instead of using the residual based method of TFP, this study includes the determinants of TFP in the production function, based on endogenous theory and evidence.

As was highlighted in endogenous growth literature reviewed above, endogenous growth theory and evidence suggest that several factors can contribute to TFP growth. Factors that have been identified in these models include, technology arising from R&D (Romer, 2001), FDI (Coe, Helpman, and Hoffmaister, 1997) and international trade, through the absorption of technology embodied in imported capital goods (Grossman and Helpman, 1991), and through increased competition (Romer, 1991, Chang et al., 2005).

The TFP input (A) is therefore given by the following function:

$$\hat{A} = g(R, D, T) \quad (5)$$

² See appendix for full derivation

Substituting (5) into (1) and using the same procedure as above, equation (4) above can be extended into the following function³:

$$\hat{y} = \alpha_R \hat{R} + \alpha_D \hat{D} + \alpha_T \hat{T} + \varepsilon_K \hat{k} - (1 - \varepsilon_K - \varepsilon_L) \hat{L} \quad (6)$$

where α_j is the elasticity of function $g(\cdot, \cdot)$ with respect to variable j , $j = R, D, T$ and ε_i is the elasticity of function $F(\cdot, \cdot)$ with respect to i , $i = K, L$. The formulation in (6) highlights the factors of growth in per capita output, which are the growth in the capital-worker ratio (\hat{k}), growth of the working population (\hat{L}) and the growth in TFP, determined directly by the growth in R&D (\hat{R}), the growth in FDI (\hat{D}) and the growth in trade (\hat{T}). Determining the factors of growth requires estimation of the coefficients in (6), which is undertaken in the next section.

5.2 Estimation of the model

This section determines the factors of output growth, by estimating equation (6). Equation (6) is estimated using annual data for the period 1970-2005. Time series data on R&D in South Africa are not easily available therefore, following Jonsson and Subramania (2001), this study uses the share of investment in equipment and machinery in total investment as a proxy for technology arising from R&D. The model uses two measures of international trade, trade openness (calculated as the ratio of the sum of real imports and exports to real GDP) and trade policy (using data from Edwards (2006) and estimated as the ratio of the sum of custom duties and surcharges to merchandise imports).

Data on FDI liabilities, which shows the investment by foreigners in the South African economy, is available in official publications. However, the FDI data cannot be included in the estimation due to missing values in the FDI data series. Arora and Bhundia (2003)

³ See appendix for full derivation

suggest that more competition can also be associated with a larger share of the private sector in economic activity, which would contribute to increasing productivity. Therefore, following Arora and Bhundia (2005), data on private investment as a share of total investment is used to capture this effect. Description of the variables used in the estimation and the data sources is given in Table 2.

Table 2. Variables and descriptions

Variables	Descriptions
DLY1	Gross domestic product (GDP) per worker
DLK1	Fixed capital stock per worker
DLL	Employment in the non-agricultural sector
DLME1	Share of investment in machinery and equipment in gross fixed capital formation (GFCF)
DLPI1	Share of private sector investment in GFCF
DLOPEN	Ratio of the sum of exports and import to GDP
DLTARIFFS	Ratio of custom duties (incl. surcharges) to merchandise imports

All the data (excl. Tariffs) are obtained from the Quarterly Bulletin (June 2007) of the South African Reserve Bank.

The data are seasonally adjusted and annualised and are in constant 2000 prices.

Tariffs data are obtained from Edwards (2006)

All the variables are expressed in logarithms (denoted by L)

D denotes the growth rate (i.e. first difference) of the variable

Time series estimation by ordinary least squares requires that the time series data be stationary. A time series is said to be stationary if its mean, its variance, and its autocovariance remain constant over time. This implies that a stationary time series will tend to revert to its mean and fluctuations around this mean (measured by its variance) will have a broadly constant amplitude. If a time series is not stationary as just defined, it is said to be nonstationary (Gujarati, 2003: 797-799). An example of a nonstationary time series is a random walk. A random walk process can be expressed by the following condition:

$$Y_t = \rho Y_{t-1} + u_t \quad (7)$$

which states that some dependant variable Y at time t , is influenced by its lag and a random shock. Many economic and financial time series behave in this manner, e.g., asset prices and exchange rates. Furthermore, a random walk process is also an example of what is known as a unit root. A random walk process such as (7) is said to have unit root if $\rho=1$, which which case the Y will be nonstationary. The terms nonstationary, random walk, and unit root are often treated as synonymous (Gujarati, 2003: 802).

Estimation using nonstationary time series may result in spurious regression. Spurious regression refers to a situation in which a relationship is found between the variables, when none exists. The results of such estimation are therefore meaningless and test statistics (t , F , R^2 and DW) are invalid. In particular, spurious regressions produce results that are characterised by high levels of R^2 , which suggest an existence of a statistically significant relationship among the variables, and the Durban Watson (DW) statistics from these regressions tend to be very low.

To avoid the problem of spurious regressions when conducting regressions among nonstationary time series, the time series has to be transformed to make them stationary. A conventional method used to transform time series data is to difference the data. A time series, say X_t , is said to be integrated of order d if, after differencing it d times, it becomes stationary, denoted as $X \sim I(d)$. This study uses the ordinary least square (OLS) technique to estimate equation (6), conditional on the data being stationary in first differences.

Testing for stationarity

The first step in testing whether the variable in the model are stationary is through a graphical inspection of the data. For this purpose, all the variables are examined through a graphical inspection of their plots. An inspection of the plots of the variables in levels shows that all the series are linearly trended and, given that each variable seems to have a non-constant mean, it appears from the graphs that they are not stationary in levels. To overcome this problem, the variables are transformed into their first differences and the

plots of these variables show no evidence of trend in the data. This would suggest that the data are stationary in their first differences, implying that the data is integrated at an order of 1, denoted $I(1)$.

However, although graphical evidence is useful as a first approximation to examine whether the variables are nonstationary, it is important to perform formal testing procedures in order to make more accurate inferences about the stationarity of the data. The first formal test is an examination of the plot of the autocorrelation functions (ACFs) of the variables, presented in a correlogram. The ACFs of all the variables in levels start high (at a value close to one) and decline very slowly as the lag length increases, indicating that the series are stationary in levels. The ACFs of all the first differenced data on the other hand also start a high value, but decline rapidly towards zero, confirming that the first differenced data is stationary.

Another more formal method of testing whether the time series are nonstationary is the Augmented Dickey-Fuller test. The results of the ADF test are presented in Table 3. The lag order of the ADF tests were determined by choosing the highest positive values the Akaike Information Criteria (AIC), the Schwarz Bayesian Criteria (SBC), and the Hannan-Quinn Criteria (HQC). Following common practice in applied econometrics, two lags were included in the ADF test of the annual data. The results of the ADF tests for the series corroborate the findings from the graphical examinations and the correlograms. The results of the ADF tests show that all the time series in levels are nonstationary and are integrated of order 1, i.e. $I(1)$ at the 95 percent confidence level. They have a stochastic trend and they indicate that the null hypothesis of unit root cannot be rejected for all the variables. When taking first differences of the data, the ADF tests reject unit root for all the series, indicating that the first differenced series are integrated of order 0, i.e. $I(0)$ at the 95 percent confidence level, which means they are stationary.

Table 3. ADF test statistics for individual series

Table 3a. Variables in levels ^a		
Variables	lag order	t-stats
LY1	1	-2.5856
LK1	1	-1.5275
LL	1	-2.4544
LME1	1	-1.7229
LPI1	1	-2.5807
LOPEN	1	-1.6048
LTARIFFS	2	-1.5662
95% critical value for the augmented Dickey-Fuller statistic = -3.5514		

Table 3b. Variables in first differences ^b		
Variables	lag order	t-stats
DLY1	1	-3.7473
DLK1	1	-2.9836
DLL	1	-3.0546
DLME1	0	-3.9111
DLP11	1	-4.6108
DLOPEN	0	-3.5904
DLTARIFFS	1	-5.1449
95% critical value for the augmented Dickey-Fuller statistic = -2.9558		

^a The tests include a constant (intercept) and a (linear) trend

^b The test include a constant (intercept) but not a trend

The sample is from 1970Q1 to 2005Q4

5.3 Estimation results

The above tests showed that the time series are stationary in their first differences. This sections applies OLS estimation using the first differenced time series. The following estimation therefore attempts to investigate whether there is a relationship between trade liberalisation and growth of GDP per worker, by estimating equation (6) using annual data for the period 1970-2005. For policy implications, it is preferable to measure trade liberalisation using a variable that reflects policy stance (i.e. tariffs), rather than the commonly used ratio of trade to GDP, which is an outcome measure. However, since the

latter has been widely used, both measures will be included in the estimation (separately), in order to compare the findings to those of previous studies.

In estimating equation (6), two models were run; each including a different measure of trade (TARIFFS and OPEN). Each model was initially estimated with all the variables included (DLK1, DLL, DLP11, DLME1 and DLOPEN or DLTARIFFS). In the first model including LOPEN, the coefficient of DLME1 was not significant and the diagnostic test showed that there was a problem of autocorrelation in the model. The plot of the residuals from this model revealed that there was a structural break in the data in 1992, possibly reflecting the end of the sanction period. A structural dummy variable D1992 was included in the model and was found to be highly significant and the inclusion of this dummy dealt with the problem of autocorrelation. However, DLME1 was still not significant.

The plot of the employment series (L) shows that there could be a big structural break in 2002, and this is also reflected in the GDP per worker and capital per worker series. This break in the employment series reflects the fact that the employment survey was changed during 2002 (in the third quarter). An intercept dummy variable D2002 was created for 2002 to capture this structural break in the employment series. D2002 was not significant, and as a result a slope dummy variable (the dummy variable multiplied by the labour data series, DS2002) was included in the model. The employment slope dummy variable was also not significant. As a result the employment dummy variables as well as DLME1 was excluded from the model and the final results of the model with DLOPEN are presented in Table 4.

The results of the model in Table 4 show that the coefficients of the variables are all significant and have the correct signs. This implies that the growth rate of capital per worker, labour, private sector investment and the growth in trade openness were important in explaining the change in the growth rate of GDP per worker between 1970 and 2005.

Table 4. Ordinary Least Squares Estimation (DLOPEN)

Dependent variable is DLY1			
34 observations			
Sample 1972 2005			
Regressor	Coefficient	Standard Error	T-Ratio [Prob]
C	0.0064430	0.0048581	1.3262[.195]
DLK1	0.54178	0.15190	3.5667[.001]*
DLL	-0.30181	0.14985	-2.0141[.054]***
DLPI1	0.14318	0.066564	2.1510[.040]**
DLOPEN	0.30387	0.062040	4.8980[.000]*
DI992	-0.054456	0.015386	-3.5394[.001]*
Basic Statistics			
R ²	0.89519	Mean of Dependent Variable	0.0062862
Adjusted R ²	0.87647	S.D. of Dependent Variable	0.041209
S.E. of Regression	0.014483	Equation Log-likelihood	99.0384
F-stat.	7.8299[.000]	Akaike Info. Criterion	93.0384
DW-statistic	1.7735	Schwarz Bayesian Criterion	88.4593
Residual Sum of Squares	0.0058735		
Diagnostic Test			
Test Statistics	LM Version	F Version	
Serial Correlation	0.46029[.497]	0.37054[.548]	
Functional Form	0.96577[.326]	0.78936[.382]	
Normality	0.76924[.681]	Not applicable	
Heteroscedasticity	0.70786[.400]	0.68038[.416]	

* indicates significant at the 1% level

** indicates significant at the 5% level

*** indicates significant at the 10% level

Furthermore, the results in table 4 suggest that if the growth rate of capital per worker increases by 1 percent, on average, the growth rate of output per worker will increase by 0.54178 percent. Similarly, if the growth rate of employment goes up by 1 percent, the growth rate of output per worker will on average decline by -0.30181 percent. This implies that the production function has diminishing returns to labour. Furthermore, a 1 percent increase in the growth rate private sector investment is associated with an

increase of 0.14318 percent in the growth rate of output per worker. Similarly, an increase of 1 percent in the growth rate of trade openness (i.e. trade liberalisation) is associated with a 0.30387 percent increase in the growth rate of output per worker.

In general the model is a good fit, indicated by the highly significant F-statistic and the high value of the R^2 and adjusted R^2 . The R^2 suggest that the regression model is able to explain about 90 percent of the variability in the rate growth rate of output per worker. The high value of the Durban-Watson statistic confirms that there is no autocorrelation in the residuals. This is also confirmed by the diagnostic tests, which indicate that there is no autocorrelation. The diagnostic tests also show that there is no heteroscedasticity in the error terms, and that the model is correctly specified.

The above results confirms that trade liberalisation, as measured by the growth rate in the level of foreign trade, is very significant in explaining the change in the growth rate of capital per worker, through it impact on productivity, during the period 1970-2005. However, as was highlighted earlier, there could be a problem of endogeneity in the model because the foreign trade variables (exports and imports) are endogenous in the growth model, which makes it difficult to determine the direction of causality between trade liberalisation and growth in output per worker. To try to overcome this problem, a second model was run with the lagged value of the trade variable. The results of this model are presented in Table 5 below.

The coefficients of the variables are all significant and have the correct signs in this model. More specifically, the regression model suggests that the lag of the growth rate of foreign trade was a significant factor of the growth rate in output per worker during the period 1970-2005. In particular, a 1 percent increase in the growth rate of the lagged value of foreign trade is associated with an average increase of 0.15778 percent in output per worker in the current period. This implies that trade liberalisation has a lagged impact on the growth rate of output per worker, and from this it can be inferred that direction of causality runs from trade liberalisation to the growth rate of output per worker.

Table 5. Ordinary Least Squares Estimation (DLOPEN (-1))

Dependent variable is DLY1			
34 observations			
Sample 1972 2005			
Regressor	Coefficient	Standard Error	T-Ratio [Prob]
C	0.0093503	0.0063614	1.4699[.153]
DLK1	0.36600	0.18952	1.9312[.064]**
DLI	-0.44252	0.19218	-2.3027[.029]**
DLP11	0.24652	0.089910	2.7419[.011]**
DLOPEN(-1)	0.15778	0.076309	2.0677[.048]**
D1992	-0.038086	0.019131	-1.9908[.056]***
Basic Statistics			
R ²	0.83117	Mean of Dependent Variable	0.0062862
Adjusted R ²	0.80102	S.D. of Dependent Variable	0.041209
S.E. of Regression	0.018382	Equation Log-likelihood	90.9335
F-stat.	27.5689[.000]	Akaike Info. Criterion	84.9335
DW-statistic	1.7785	Schwarz Bayesian Criterion	80.3544
Residual Sum of Squares	0.0094613		
Diagnostic Test			
Test Statistics	LM Version	F Version	
Serial Correlation	0.53089[.466]	.42828[.518]	
Functional Form	1.4898[.222]	1.2373[.276]	
Normality	.75829[.684]	Not applicable	
Heteroscedasticity	1.2979[.255]	1.2700[.268]	

* indicates significant at the 1% level

** indicates significant at the 5% level

*** indicates significant at the 10% level

Table 6 below presents the results of the results of the regression model using DLTARIFFS as the trade variable. The model was initially estimated with all the explanatory variables included, however, DLME1 was not significant. The labour dummy variables, D2002 and DS2002, as well as D1992 were also included in the model but D2002 and DS2002 were not significant while D1992 was highly significant. However, the diagnostic test revealed that the model was not correctly specified and the

coefficient of the capital per worker variable was not significant. The plot of the residuals showed that there were outliers in 1983 and 1991, and an inclusion of dummy variables for these periods (D1983 and D1991), corrected the functional form and DLK1 was also significant.

Table 6. Ordinary Least Squares Estimation (DLTARIFFS)

Dependent variable is DLY1			
33 observations			
Sample 1973 2005			
Regressor	Coefficient	Standard Error	T-Ratio [Prob]
C	0.016752	0.0049768	3.3661[.002]*
DLK1	0.26110	0.15260	1.7110[.099]***
DLL	-0.61825	0.15087	-4.0979[.000]*
DLP11	0.20375	0.072878	2.7958[.010]*
DLTARIFFS	-0.041642	0.013794	-3.0188[.006]*
D1992	-0.045284	0.016085	-2.8154[.009]*
D1983	-0.051748	0.015887	-3.2572[.003]*
D1991	-0.037286	0.016122	-2.3127[.029]**
Basic Statistics			
R ²	0.89446	Mean of Dependent Variable	0.0064159
Adjusted R ²	0.86491	S.D. of Dependent Variable	0.041841
S.E. of Regression	0.015378	Equation Log-likelihood	95.5239
F-stat.	30.2680[.000]	Akaike Info. Criterion	87.5239
DW-statistic	1.7014	Schwarz Bayesian Criterion	81.5378
Residual Sum of Squares	0.0059124		
Diagnostic Test			
Test Statistics	LM Version	F Version	
Serial Correlation	0.28201[.595]	0.20687[.653]	
Functional Form	2.5913[.107]	2.0452[.166]	
Normality	0.10604[.948]	Not applicable	
Heteroscedasticity	0.090136[.764]	0.084905[.773]	

* indicates significant at the 1% level

** indicates significant at the 5% level

*** indicates significant at the 10% level

The results in table 6 show that the regression model with DLTARIFFS is a good fit. The F-statistic is highly significant and the R^2 and adjusted R^2 are very high. The R^2 suggests that the regression model can explain about 89 percent of the variability in the growth rate of output per worker during the period 1970-2005. The diagnostic tests also show that the model is correctly specified, and there is no homoscedasticity or autocorrelation in the error terms.

Furthermore, the coefficients of the variables in the regression model in Table 6 are all significant and have the correct signs. This implies that the growth rate of capital per worker, labour, private sector investment, as well as the growth rate of tariffs were significant in explaining the change in the growth rate of output per worker during the period 1970-2005. More specifically, the results of the model show diminishing returns of output per worker to labour and the DLTARIFFS coefficient is negative, implying that a 1 percent increase in the growth rate of tariffs is associated with a 0.041642 decline in output per worker. This implies that trade liberalisation, through the reduction in tariffs, is associated with an increase in the growth rate of output per worker.

In conclusion, the estimation results show that trade liberalisation, both in terms of the change in the growth rate of foreign trade (ratio of imports and exports to GDP) and trade policy (change in trade barriers), is a significant factor explaining the change in the growth rate of capital per worker, through its impact on productivity, during the period 1970-2005. These results imply that there is a positive relationship between the growth in trade and the growth in output, implying that trade liberalisation can have a long run growth impact on output. It should be noted that, due to the data limitations, this analysis does not examine the impact of trade liberalisation on the level of GDP and therefore this study cannot make a conclusion about the impact of trade liberalisation on the steady state level of GDP.

Similarly, the results of the analysis show that the growth rate of private sector investment (as a share of total investment) is also significant in explaining the change in the growth rate of output per worker during this period. On the other hand, however, the

growth rate of R&D (proxied by the share of investment in machinery and equipment in total investment) was not found to be a significant factor of the change in the growth rate of output per worker during the period under review. However, it should be noted that this does not necessarily imply that R&D is not a significant factor of growth; instead it could mean that the share of investment in machinery and equipment in total investment is not an appropriate proxy for technology.

6. Conclusion

This paper has given an overview of the literature on economic growth, and paying particular attention on the relationship between international trade and economic growth. What emerged from this overview is that both theoretical and empirical studies have yielded mixed results on this relationship. The study also highlighted some empirical shortcomings involved in the analysis of the relationship between international trade and economic growth. Another important shortcoming that was identified is that theoretical models still fall short of explaining a direct channel through which international trade and economic growth are related. As a result, economic theorists have developed theoretical models to investigate the relationship between international trade and economic growth, through the indirect channel of productivity gains, believed to be associated with higher international trade and most studies have used this indirect channel to undertake empirical investigation on this relationship.

This paper has attempted to extend the investigation into the trade-growth literature for the case of South Africa, using endogenous theory and using the productivity gains channel of international trade on growth. Before embarking in the empirical investigation, this paper gives a review of the South African trade policy and trade development as well as a review of the existing empirical literature on the relationship between international trade and economic growth in South Africa. The main conclusion from this analysis is that South Africa has made significant strides in liberalising its trade and that this increased trade openness has contributed to much of the improvement

in TFP growth since South Africa's democratic transition. This increased productivity it also said to have contributed to the improvement in GDP growth since the 1990s.

The results of the empirical investigation of this study seem to corroborate the findings of the existing studies, in that trade liberalisation is found to have contributed to the growth in GDP during the period 1970-2005. The results of the study suggest that trade liberalisation has a positive effect on the long-run growth rate of output per worker. Although the direction of causality was not explicitly determined in the estimation models, an inclusion of a lagged variable of the foreign trade variable implies that the causality could run from trade liberalisation to economic growth. This results also suggest that the government should continue to adopt policies that are geared towards further increasing South Africa's foreign trade and further liberalising South Africa's trade policies.

Lastly, private investment (as a share of total investment) was also found to be a highly significant factor of TFP and hence output growth between 1970 and 2005. The government's new macroeconomic policy, the Accelerated and Shared Growth Initiative of South African (ASGI-SA), identifies a number of binding constraints to achieving sustainable economic growth in South Africa. These are: 1) the overvaluation and volatility of the South African currency; 2) an inadequate national infrastructure; 3) a shortage of skilled labour; 4) barriers to entry, limits to competition and limited new investment opportunities; 5) a cumbersome regulatory environment and 6) deficiencies in state organisation, capacity and leadership. These constraints are to be tackled through several policy initiatives, including 1) infrastructure investment, 2) key sector investment and promotion strategies; 3) education and skills interventions; 4) bridging the gap between the formal and informal sector; 5) improving public administration.

The binding constraints identified under ASGI-SA and the policy initiatives to tackle these constraints (such as infrastructure spending, skills training, key sector promotion, and second economy interventions) are more in line with promoting and encouraging an environment conducive for private sector investment. This is in line with the findings of

this paper where private sector investment was found to be a significant factor of economic growth, implying that the ASGI-SA is an appropriate strategy in trying to achieve sustainable economic growth.

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APPENDIX

1. Deriving Equation (3)

$$Y = AF(K, L)$$

$$y \equiv Y / L$$

$$y = AF(K, L) / L \text{ or } y = AF / L$$

$$dy = dAF / L + AdF / L - AFdL / L^2 \quad (1)$$

$$dF = (\partial F / \partial K) \cdot dK + (\partial F / \partial L) \cdot dL \quad (2)$$

substitute (2) into (1)

$$dy = dA(F / L) + (A / L)(F_K d_K + F_L d_L) - AF(dL / L^2)$$

$$dy = dA(F / L) + (A / L)(F_K d_K) + (A / L)(F_L d_L) - AF(dL / L^2)$$

$$dy / y = dA(F / L)(L / AF) + (A / L)(F_K d_K)(L / AF) + (A / L)(F_L d_L)(L / AF) - AF(dL / L^2)(L / AF)$$

$$dy / y = dA / A + (F_K / F \cdot d_K) + (F_L / F \cdot d_L) - dL / L \quad (3)$$

$$F_K / F \cdot d_K = \partial F / \partial K \cdot dK \cdot (1 / F) \cdot (K / K)$$

$$F_K / F \cdot d_K = \partial F / \partial K \cdot (K / F) \cdot (dK / K)$$

$$\text{let } \partial F / \partial K \cdot (K / F) = \varepsilon_K$$

$$\therefore F_K / F \cdot d_K = \varepsilon_K (dK / K)$$

$$\text{Similarly } F_L / F \cdot d_L = \varepsilon_L (dL / L)$$

\therefore (3) becomes:

$$dy / y = dA / A + \varepsilon_K (dK / K) + \varepsilon_L (dL / L) - dL / L \quad (4)$$

let "hat" denote the growth rate of a variable (i.e. dX/X) and define the ratio of capital per worker as $k \equiv K / L$.

$$\text{Rearranging the terms (4) becomes: } \hat{y} = \hat{A} + \varepsilon_K \hat{k} - (1 - \varepsilon_K - \varepsilon_L) \hat{L}$$

2. Deriving Equation (6)

$$Y = AF(K, L)$$

$$A = g(R, D, T)$$

$$Y = g(R, D, T)F(K, L)$$

$$y \equiv Y / L$$

$$y = [g(R, D, T)F(K, L)] / L \text{ or } y = gF / L$$

$$dy = dgF / L + g dF / L - gF dL / L^2 \quad (1)$$

$$dg = (\partial g / \partial R) \cdot dR + (\partial g / \partial D) \cdot dD + (\partial g / \partial T) dT \quad (2)$$

$$dF = (\partial F / \partial K) \cdot dK + (\partial F / \partial L) \cdot dL \quad (3)$$

substitute (2) and (3) into (1)

$$dy = (g_R d_R + g_D d_D + g_T d_T)(F / L) + (g / L)(F_K d_K + F_L d_L) - gF(dL / L^2)$$

$$dy = (g_R d_R)(F / L) + (g_D d_D)(F / L) + (g_T d_T)(F / L) + (g / L)(F_K d_K) + (g / L)(F_L d_L) - gF(dL / L^2)$$

$$dy / y = (g_R d_R)(F / L)(L / gF) + (g_D d_D)(F / L)(L / gF) + (g_T d_T)(F / L)(L / gF) + (g / L)(F_K d_K)(L / gF) + (g / L)(F_L d_L)(L / gF) - gF(dL / L^2)(L / gF)$$

$$dy / y = (g_R / g \cdot d_R) + (g_D / g \cdot d_D) + (g_T / g \cdot d_T) + (F_K / F \cdot d_K) + (F_L / F \cdot d_L) - dL / L \quad (4)$$

$$g_R / g \cdot d_R = (\partial g / \partial R) \cdot dR \cdot (1 / g) \cdot (R / R)$$

$$g_R / g \cdot d_R = (\partial g / \partial R) \cdot (R / d) \cdot (dR / R)$$

$$\text{let } (\partial g / \partial R) \cdot (R / d) = \alpha_R$$

$$\therefore g_R / g \cdot d_R = \alpha_R (dR / R)$$

Similarly,

$$g_D / g \cdot d_D = \alpha_D (dD / D)$$

$$g_T / g \cdot d_T = \alpha_T (dT / T)$$

$$F_K / F \cdot d_K = \varepsilon_K (dK / K)$$

$$F_L / F \cdot d_L = \varepsilon_L (dL / L)$$

\therefore (4) becomes:

$$dy / y = \alpha_R (dR / R) + \alpha_D (dD / D) + \alpha_T (dT / T) + \varepsilon_K (dK / K) + \varepsilon_L (dL / L) - dL / L \quad (5)$$

let “hat” denote the growth rate of a variable (i.e. dX/X) and define the ratio of capital per worker as $k \equiv K / L$.

Rearranging the terms (5) becomes:

$$\hat{y} = \alpha_R \hat{R} + \alpha_D \hat{D} + \alpha_T \hat{T} + \varepsilon_K \hat{k} - (1 - \varepsilon_K - \varepsilon_L) \hat{L}$$