

Import Performance And Import Demand Functions For South Africa

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July 2000

Executive Summary

It is generally acknowledged that there is no sufficient, exhaustive and elaborate empirical examination of the quantitative impact of policies pertaining to import demand and economic growth in South Africa. In order to arrive at conclusive, sagacious and applicable policies on the economic growth potential of an economy, it is imperative to evaluate, empirically, whether envisaged economic growth rates and employment creation are feasible, given the socio-economic circumstances.

The fundamental question of the constraint or rather effective constraints to high economic growth rates, measured by gross domestic product, has always deserved urgent attention but has been neglected. There appears to be strong reasons to believe that the South African economy, like other middle-income developing economies, is subject to a “powerful balance of payments constraint that effectively aborts the growth process before it is able to deliver rising per capita incomes” (Industrial Strategy Project, 1995 :49).

Furthermore, although this issue is widely recognized, there has been little systematic analysis of this important question. Many writings which, implicitly or explicitly, note the foreign exchange shortage as adversely affecting the economy’s growth capacity have tended to focus and give enormous emphasis on exports and export expansion as a means to eradicate this economic dilemma. However, together with exports the demand for imports clearly determines the behavior of the trade account of the balance of payments as a whole. Consequently, this paper intends to consider one important aspect of the balance of payments constraint, namely, the import performance and import demand elasticities.

The study derives the import demand function and applies the recent time-series techniques to modeling economic time-series. Prior to the empirical model, the paper describes the behavior of imports. This section examines the cyclical and trend behavior of import performance since the beginning of the 1970s. The study also briefly looks at the relationship between import of capital goods and investments in South Africa. The geographic origin of imports by regional trading blocks is also discussed. That is followed by an extensive literature survey conducted on import demand elasticities in South Africa and trade elasticities in general. The import performance and import demand functions were studied in an economic policy context and the analyses were in some cases restricted by data constraints. Import behavior patterns and empirical results of the import demand models are discussed and international comparisons are drawn.

There are a few basic points that emanate from the overall discussion. In the import performance section, it can be concluded that labour intensive commodities have the

largest share in total imports; there is a very steady, insignificant decline in import penetration ratios and these have increased lately and that import of capital goods is positively correlated to investment.

The description of studies shows that the demand for imports is largely influenced by economic activity as compared to relative prices. Some of the results are shown in the appendices and discussed in text, where comparisons are made between the results of different studies and the main findings of this study. Precisely, the major finding is that, as other studies concluded, the propensity to import with respect to income is more significant than the price elasticity of demand for imports.

The import performance findings combined with time-series estimation results raise doubts to envisioned employment creation levels and economic growth rates in South Africa. This is questionable because South Africa's imports have been on an increase whilst exports have not performed well. From the time-series point of view and based on estimation results, the current economic strategies should also address the import demand question or foreign exchange and domestic economy development if the projected growth rates and employment levels are to be achieved.

1 INTRODUCTION

It is widely acknowledged that the South African economy is, arguably, constrained by the lack of foreign exchange. As an example, Joffe et al in the Industrial Strategy Project (1995: 49) reflect on the manner in which the balance of payments constraint "effectively aborts the growth process before it is able to deliver rising per capita incomes". Also, the South Africa macroeconomic framework (Gear, 1996:3) notes that "the balance of payments remains a structural barrier to accelerated growth" for South Africa. A possible existence of a foreign exchange shortage in the South African economy was long noted by the Central Economic Advisory Service (NEM, 1993) and equally discussed by the Macroeconomic Research Group (MERG, 1993). Bliss (1989), Eaton (1989) and Bacha (1990) have examined the main binding constraints of faster growth of economies and conclude that the shortage of savings or foreign exchange will inevitably negatively affect the economic growth of a nation. Bacha (1990: 282), in particular, demonstrates that most developing countries are hooked by a foreign exchange constraint rather than a savings constraint. There appears to be good reasons to believe that the economic growth of the South African economy is effectively constrained by the lack of foreign exchange.

In South Africa, many studies have vigorously pursued the problem of slow economic growth and generally conclude that policy makers should aim at increasing exports. This conclusion implies that export promotion and/or import liberalization can remedy low growth. However, these studies do not, *per se*, look at the possibility whereby exports are unable to increase sufficiently enough in order to overcome the foreign exchange constraint. This study recognizes that possibility and it reiterates that together with the behavior of exports, the demand for imports determines the behavior of the trade account as a whole. Consequently, this study intends to contribute to the understanding of South

Africa's foreign trade profile by examining the other side of the balance of payments, namely import performance and import demand elasticities. The study assesses import demand elasticities for South Africa with respect to real income and relative prices using recent econometric techniques. The study begins with a brief description of the South African import performance. Section three concentrates on a review of studies of import demand elasticities. Section four discusses results of the import demand models estimated for South Africa. Lastly, the paper concludes by drawing some policy suggestions.

2. IMPORT PERFORMANCE IN SOUTH AFRICA

The demand for imports is determined by both economic and non-economic factors. These will, generally, include exchange rates and/or relative prices, economic activity, domestic and external economic conditions, production and/or labour costs, and political circumstances (World Bank, 1987). However, as argued by Erasmus (1978) and elsewhere, relative prices and real income are the major factors significantly affecting the demand for imports and supply of exports. This issue is discussed more extensively in subsequent sections.

Rivera-Batiz (1985) argues that a rise in economic activity would induce an increase in imports, the reason being that high real income promotes consumption. In the case of South Africa, as income rises there is high probability that imports will increase perhaps because of the need for those commodities or because of other factors. In that regard, there is direct connection between economic growth and the trade balance. Micro-economic theory postulates the demand for any good to be a function of income and prices, *ceteris paribus*. In this context, relative price changes have, presumably, an impact on the current account balance through changes in import demand. In theory, an increase in relative prices should reduce the demand where as a rise in income will increase the demand for a commodity.

According to Rangasamy (1990), effective exchange rates play a pivotal role in determining imports and exports of the nation. This leads us to the 'Marshall-Lerner' condition which contends that for devaluation policies to be effective, import demand and export supply elasticities must exceed one. This shows the major role played by exchange rates in determining the magnitudes of both imports and exports. Holden (1990,1991) discusses this issue in larger detail in that the efficacy of any foreign trade regime relies on effective exchange rates as they fundamentally affect the trade balance. Political factors have also been identified to have an impact on foreign trade regimes as argued by Rangasamy (1990). For instance, Moll (1990) argued that South African economic policies were influenced by the political beliefs based on the former government's ideological apparatus. However, these issues are beyond the scope of this study. This paper confines itself into the description of trade behavior and the statistical estimation of the magnitudes of import demand elasticities, thereby suggesting policies for the economy that emanate from subsequent analysis.

2.1 Description of Import Trends

The following discussion focuses on the description of the behavior of South Africa's imports. The discussion also briefly alludes to the geographical origin of South Africa's imports, in terms of regional trading blocks. The main objective of this sub-section is to describe the import performance of the South African economy. This aim is accomplished through examination of the trends and cyclical variations in imports. This is made possible by assessing the composition of imports by main economic sectors and sub-sectors, rates of growth of imports, import penetration ratios and other relevant data. The study also briefly looks into the possible relationships between imports and investment.

2.2 Data and Methods

There are a few important issues to be noted in relation to data and methods of analysis. The data used here are taken from different sources and transformed to fit the current context of discussion. The primary data source of many trade series is the Department of Customs and Exercise.

These data are normally audited by the Statistics South Africa (formerly known as Central Statistical Services). The Policy Analysis section of the Department of Trade and Industry also examines these data while the Industrial Development Corporation (IDC), the South African Reserve Bank (SARB) and WEFA Southern Africa keep track of these data and use them for policy analysis of various kinds. The first set of data used in the current section are taken from the IDC sectoral data produced in 1995. These data offer trends for the years 1972 to 1993 and are available for 36 economic sectors. These data have not been up-dated for the years after 1993. This has been attributed to changes in ISIC codes that were taking place during the production of this study. WEFA has a relatively similar data for the period 1970 to 1995. However, these data are not entirely the same as the classification system is slightly different.

This study mainly uses IDC industry data because these were the only data within reach at the study's inception. Moreover, the IDC has continued producing industry data that are reasonably compatible which is useful for describing trends after 1993. Because of the lack of complete consistency of these data, only the composition of imports is examined after 1995. Other sources, including the author's own calculations, are also used in explaining trends. The data from 1993 to 1997 have been converted into 1995 prices.

As mentioned in section 1, this paper also briefly describes the geographical origin of South Africa's imports. Although this is not the main focus of the current study, it is crucial for policy making with regards to foreign trade and foreign trade relations. The data used for the calculation of the composition of South Africa's imports by country of source are the un-audited Customs and Excise trade data which comprise imports from 270 countries and 99 ISIC sectors. These data were transformed into annual data (constant 1990 prices) for the period 1993-1997 and countries were aggregated into trading blocks such as SACU, SADC, EU, NAFTA, APEC, PTA, ASEAN, MERCOSUR and others. These data have been taken from the Policy Analysis section of the

Department of Trade and Industry. It only serves here as an indication of how trade with regions changed during 1993-97 and can as yet not be used for sophisticated analysis as they are not audited and available for only five years.

2.3 The Nature of South African Imports

Historically, South Africa can be classified as a minerals-based economy¹. This means that for decades the economy has relied on exports of primary sector². However, this has been subject to debates (see, Ariovich, 1979, 1980 and Holden and Holden, 1991).

Table 1 shows the composition of total imports by main sector, for selected years, in current rand millions calculated as the percentage shares of each sector to total imports using IDC (Economic Analysis System, 1972- 1993). This table has been extended using sectoral data from IDC (1998).

Table 1: Composition of South Africa's Imports by Main Economic Sectors 1975-1997 (%)

Sector	1975	1980	1985	1990	1993	1997 ³
Agriculture	1.75	1.29	2.97	1.63	2.54	5.83
Gold mining	0.01	0	0	0	0	0
Other mining	12.27	17.01	11.16	10.57	9.05	18.74
Manufacturing	69.22	65.56	67.87	68.01	65.81	75.43
Services	16.76	16.13	18.78	19.79	21.6	-
Total	100	100	100	100	100	100

Source: IDC, 1995 and 1998

Table 1 shows that more than 60% of total imports are manufacturing imports, although this declined slightly between 1990 and 1993. There are myriad reasons, both economic and political, for this trend (i.e. import behavior) which will be discussed in the sections below. Briefly, this is related to the historical development of industrialization in South Africa.

Table 1 also illustrates that the percentage share of manufacturing imports in total imports has increased from 68.01% in 1990 to 75.43% in 1997. Similarly, the share of other mining imports from total imports has increased from 10.57% in 1990 to 18.74 in 1997. Over all, the share of each sector has increased, particularly since 1990. Data for

¹ Own calculations, using the input-output tables for 1995, show that most sectors are natural- resource based. For example, 16 of 23 manufacturing sectors use more than 20% of inputs from primary sectors.

² Fine and Rustomjee (1996) and Bell and Farrell (1997) present relevant policy issues pertaining to the "Mineral's Energy Complex" and its impact on manufacturing performance.

³ The 1997 figures are computed from the 1998 IDC sector data published in "Trade for Growth" review. Services sector data were not available.

the services sector is not available but it may be safe to assume that the share of services has increased as well.

2.4 Cyclical and Secular Trends

In spite of some cyclical movement in the SA trade balance, imports have shown a considerable increase during the period of analysis. This is clearly noticeable in the case of manufacturing where imports have increased consistently. Table 2 below depicts total imports by main economic sectors in current rand terms for the period 1975 to 1997 using IDC sectoral data series (1995) and IDC (1998) sectoral data.

Table 2: South Africa's Imports 1975-1997 (R million)

Sector	1975	1980	1985	1990	1993	1997
Agriculture	142.09	220.01	847.79	881.32	2697.28	5351.6
Gold mining	0.84	0.24	0	0	0	0
Other mining	996.92	2892.87	3186.43	5712.73	6891.3	17200.6
Manufacturing	5626.15	11151.3	19169.1	36757.6	50115.7	69243.47
Services	1362	2743.5	5342.65	10694.2	16450.6	-
Total Imports	8128	17008	28546.0	54046.0	76155.0	91795.6

Source: IDC, 1995 and 1998

However, table 2 does not illustrate growth rates, it simply gives an indication of the value of imports by different sectors in current terms. In current prices, Table 2 tentatively shows that total imports since 1975 have increased with manufacturing leading the trend, followed by services, other mining, and agriculture. Table 3 shows that growth rates for most manufacturing sub-sectors have been positive, except for some particular periods associated with external factors values of imports have risen continuously. The figures of 1993 to 1997 taken from IDC (1998) show that the level of imports has consistently increased since 1993. The total import figures have risen from R76 155 million in 1993 to R91 796 million in 1997.

2.5 Growth Rates of Imports

The some negative growth rates of imports, as shown in table 3, can be attributed to the collapse of the Breton Woods System which caused exchange rates volatility, external shocks such as oil price shocks, and sanctions. Perhaps political conditions and large debt burden also affected growth of imports particularly during the 1980/85 period. This point can also be elucidated by looking at disaggregated levels of the growth rates of manufacturing imports. Table 3 confirms the view that in 1980/85 the economy was a little unstable due to the factors named above.

Table 3: Growth Rates for each Sub-sector Imports 1972-1997 (constant 1993 prices)

Sector	1972/75	1975/80	1980/85	1985/90	1990/93	1996/97
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Food	1.83	0.98	6.78	0.47	-0.92	11.35
Beverages	22.94	1.75	8.98	6.21	-2.84	3.22
Tobacco	-8.33	-12.51	4.32	-16.67	23.8	-
Textiles	-4.97	2.13	-0.69	-3.18	4.26	0.04
Clothing	-7.01	-0.15	-3.74	-4.49	29.55	-2.47
Leather	-6.22	-17.96	-1.84	26.98	-1.46	8.42
Footwear	4.37	2.67	6	-8.01	17.45	0.04
Wood	-14.96	-5.46	5.8	0.03	6.99	2.81
Furniture	0.92	-100	-100	38.27	12.41	6.69
Paper	12.51	0.11	-6.69	-3.55	-1.51	-0.86
Printing	-1.85	14.72	2.1	8.75	-10.08	-5.45
Chemicals	1.99	-0.4	-0.82	5.88	-1.28	-0.73
Rubber	7.47	5.23	7.47	8.72	-1.97	0.20
Plastic	-0.95	4.65	10.2	8.45	4.06	0.40
Pottery	13.07	-7.28	10.82	-8.05	9.27	-
Glass	-5.54	1.14	-0.11	-4.89	2.59	1.39
Non-metallic	29.25	-9.54	-2.9	2.26	5.2	0.21
Iron and steel	5.28	-20.14	-2.9	3.53	-13.59	2.00
Non-ferrous	-4.20	9.44	1.85	5.19	2.66	-1.07
Metals	7.31	0.99	-3.04	-0.28	-1.47	-1.12
Machinery	14.97	0.37	-4.69	0.84	-3.69	1.43
Elect. Machinery	12.03	0.96	0.54	1.28	-0.1	2.09
Transport equipment	3.60	4.37	-8.61	-1.19	2.45	-
Other Transport	19.18	-3.3	-7.18	2.59	3.78	-1.75
Other manufacturing	23.06	10.41	-6.44	10.08	2.16	2.79
Total manufacturing	7.53	0.65	-3.12	1.99	-0.68	0.22

Source: IDC, 1995 and 1998

A large number of sub-sectors show a drastic decline in their growth rates in 1980/85 and that is the period where both economic and political instability prevailed. However, this trend changes over time. For instance, certain sectors have been importing more whilst others have been reducing their imports. The growth of total manufacturing imports has increased during 1996/97 when many sectors recorded positive growth rates. In terms of factor intensity, only labour-intensive sectors recorded positive growth rates whilst capital-intensive and intermediate capital-intensive sectors have continuously recorded negative growth rates.

2.6 Import Penetration and Import Demand

Looking at the period of 1946 to 1997 using the SARB data (various issues), the import-GDP ratios has slightly declined in the 1980s and increased there after. Table 4 shows that the merchandise import-GDP ratio has increased from 19.77% in 1986 to 31.27% in 1996 whilst the total export-GDP ratio decreased from 36.92% in 1986 to 31.86% in 1996. Import-GDP ratios have also continued to increase. For example, the import-penetration ratio of 1997 stands at 32.26% which is close to double the figure of 1986.

Table 4: Ratios (%) of Trade to Total Economy (1946 - 1997)

	1946	1956	1966	1976	1986	1996	1997
Imports – GDP	27.41	25.48	21.22	26.44	19.77	31.27	32.26
Exports – GDP	27.60	34.99	29.06	31.22	36.92	31.86	33.09
Total Trade - GDP	55.01	60.47	50.28	57.67	56.7	63.13	65.35

Source: SARB (various issues)

The above trend would suggest that there has been some degree of import replacement in the economy in the 1980s. This means that certain commodities originally imported have been produced in South Africa in the past two decades. However, there are problems with this conclusion because the decrease in the import-GDP ratio may be the result of lower growth rates. Nevertheless, the import-GDP ratio of 1996 was 31.27% and that of 1997 was 32.26%. There are reasons to believe that imports have grown more rapidly in 1997 and 1998.

The import penetration ratios for the manufacturing industry, in Table 5, calculated as the ratio of imports to domestic demand (gross output plus imports less exports, multiplied by a 100), show that the import penetration to the economy has been relatively constant, although slightly decreasing and increasing in some years.

Table 5: Import Penetration for Manufacturing Sectors (1975 - 1995)

	1975	1980	1985	1990	1993	1995
Capital-intensive Sectors	17.36	12.8	10.52	12.42	11.98	13.18
Intermediate Sectors	19.19	17.33	14.25	12.87	14.37	21.47
Labour-intensive Sectors	28.98	25.42	25.72	25.93	25.7	31.58
Ultra labour-intensive Sectors	17.97	18.7	15.07	17.82	20.19	31.60
Total Manufacturing	21.67	18.76	16.44	16.83	17.27	24.46

Source: IDC, 1995, Bell and Cattaneo (1997: 16), and IDC, WEFA, 1998

In terms of capital-labour intensity for manufacturing alone, imports have concentrated in labour-intensive commodities. As shown, labour-intensive and ultra-labour-intensive sectors have more than 30% import penetration ratios in 1995, significantly high relative to other sectors' import penetration ratios. This also raises some policy questions since the manufacturing sector is the largest provider of employment and has a larger share of imports.

2.7 Import of Capital Goods

Although this paper mainly focuses on import performance and import demand elasticities, brief attention is given to the analysis of the investment angle to imports. This section briefly describes a relationship between imports and fixed investment.

In practice, particularly for small open economies like South Africa, the share of capital goods imports to total imports is generally higher than the shares of other commodities. If, as commonly postulated, capital goods imports represent investment into the small open economy it is therefore imperative to assess the nature of the relationship between imports of capital goods and investment in South Africa. As explained in the introduction, this paper focuses on import demand elasticities using recent time-series methods that is based on microeconomic demand theory that attributes changes in the demand for any commodity to income and prices. As a result, the discussion of investment is additional because South Africa, as a small open economy, imports relatively large amounts of capital goods. There are other complex issues that come out of this relationship which are not part of this research. For instance, the multiplier effects of changes in import of investment goods to the economy through changes in the balance of payments are not part of this study. This study assumes that imports of any good, capital or otherwise, affect the current account of the balance of payments, particularly if the growth of exports is poor.

2.8 Composition of Imports by Type of Commodity

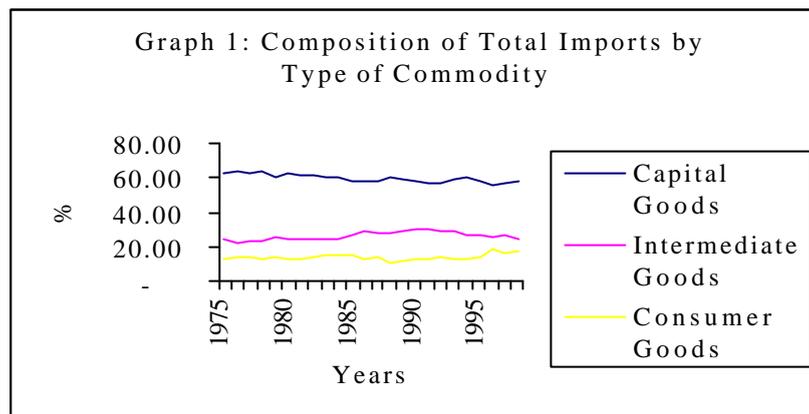
This section highlights the trends in import behavior of certain commodities. The standard categorization is used (i.e. capital goods, intermediate goods, and consumer goods). The discussion will focus on the descriptive trends that associate imports and investment in South Africa. Using WEFA Southern Africa databank, sectors have been classified into capital goods sector, intermediate goods sector, and consumer goods sector. Percentage shares of each category from total imports were calculated using the same data set. Table 6 shows the composition of imports by commodity types. As argued in Hawkins (1997), the share of import of capital goods has been relatively higher than the share of other goods. It has in some way remained constant starting at 57.84% in 1985 to 57.63% in 1998 (selected years).

Table 6: The Percentage Share of Imports to Total Imports – Selected Years (1975 - 1998)

	1975	1980	1985	1990	1995	1998
Capital Goods	62.14	62.22	57.84	57.52	58.24	57.63
Intermediate Goods	24.95	24.56	27.06	29.57	27.03	24.84
Consumer Goods	12.91	13.23	15.10	12.90	14.73	17.52
Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: Calculations from WEFA Southern Africa databank (various issues)

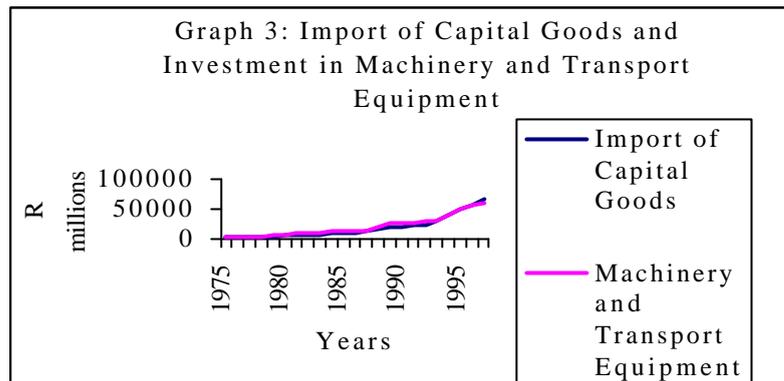
It is also important to note that the share of imports of other sectors, particularly consumer goods have been slightly increasing. For example, consumer goods share starts from 12.91% in 1975 to 17.52% in 1998. Graph 1 indicates that the gap between the share of intermediate goods imports and consumer goods imports is narrowing. Assuming that imports of capital goods reflect investment into South Africa, it implies that investment has remained unchanged. This is debatable because data provided in Mhango (1999) study shows that fixed investment alone has been on an increase.



2.9 The Import - Investment Relationship

Graph 2 shows that investment in the form of gross domestic fixed investment (GDFI) is related to imports. Using SARB data at an aggregate level, GDFI schedule moves closely and in a similar direction with imports schedule. From 1993 onwards, total imports exceed GDFI. One hypothesis is that the South African economy has been in a recovery phase beginning around 1993. The results of an empirical model in section four show that an increase in economic activity stimulates imports.

In graph 2 imports are above investment from 1993 onwards which shows that South Africa does not import only capital goods. Taking one particular sector's investment and comparing that with imports of capital goods, the link between capital goods and investment is further confirmed. Graph 3 shows the schedules of capital goods and investment in machinery and transport equipment. Investment in machinery and transport equipment is correlated to imports of capital goods.



The discussion here needs to be treated with care. It should be noted that explaining relationships by mere trends might give misleading information. Unrelated variables may appear to be related but not in a true economic sense. The analysis here acknowledges shortcomings of the approach used but it seemed the only possible means to describing import-investment relationships. In terms of the focus of this study, the discussion of imports-investment nexus further proves the significance of imports and import demand for the balance of payments. As noted earlier, this simply sketches a possible relationship but has no specific addition to the findings of the study. Tentatively, the link between imports and investments is highlighted.

2.10 The Origin of South African Imports

There are a few basic points that need attention with regards to the origin of South Africa's imports. In terms of trading blocks shown below in table 7, large volumes of South Africa's imports come from the European Union (EU), followed by Asia, North America and North Africa and Middle-east.

Table 7: Composition of South Africa's Imports by Regions and Countries 1993 – 1997 (1990 prices)

	1993	1994	1995	1996	1997
SADC	4.08	2.16	1.78	1.92	1.83
Other African Countries	1.19	0.96	0.90	0.95	1.31
North Africa and Middle East	1.36	4.53	7.64	7.89	11.20
North America	14.76	14.16	13.38	13.52	13.63
EU	43.36	47.26	45.34	44.33	43.37
Other European Countries	0.71	0.71	0.99	0.50	1.90
Latin America and the Caribbean	2.47	2.98	2.92	2.64	3.09

Asia	27.05	25.30	24.01	24.73	20.94
Australia	1.18	1.53	1.76	2.46	2.52
Other Countries	0.31	0.15	0.14	0.17	0.20
Unallocated	3.53	0.25	1.14	0.90	-
Total	100.00	100.00	100.00	100.00	100.00

Source: DTI, Pretoria

SA imports from the EU have remained above 40% of the total imports since 1993, although the share of the EU imports have slightly decreased from 45.34% in 1995 to 43.37% in 1997. Asia's share is above 20% and it has also decreased from 24.01% in 1995 to 20.94 in 1997. The share of North America, the North Africa and the Middle-east has increased. For example, in 1995 the share of North America was 13.38% of the total and this figure slightly increased to 13.63% in 1997 whilst the share of North Africa and the Middle-east rose from 7.64% in 1995 to 11.20% in 1997. From the previous discussion of imports, it is clear that imports in real terms have increased. Examining the direction of SA imports from a different angle the trend remains the same. Looking at table 8 below, the share of the EU is still leading followed by the Asia Pacific Economic Cooperation (APEC) and the North America Free Trade Agreement (NAFTA).

Table 8: Composition of South Africa's Imports by Regional Trading Blocks 1993 – 1997 (1990 prices)

	1993	1994	1995	1996	1997
NAFTA	13.52	13.11	13.10	13.18	13.98
EU	39.62	43.56	43.95	42.96	47.57
APEC	36.32	34.78	34.68	35.67	32.99
SADC	3.72	1.99	1.73	1.86	0.08
PTA	1.40	0.71	0.73	0.89	0.87
PTA less SADC	0.19	0.13	0.19	0.17	0.80
ASEAN	3.54	3.61	3.52	3.39	3.28
MERCOSUR	1.69	2.10	2.10	1.89	2.16
TOTAL	100.00	100.00	100.00	100.00	100.00

Source : DTI, Pretoria

The shares of the EU, NAFTA, and MERCOSUR have marginally increased whilst the shares of other regional blocks such as APEC have remained around the same levels. The Southern Africa Development Community (SADC) and the Preferential Trade Arrangement (PTA or COMESA) supply virtually no imports into South Africa. The EU export shares into total South African imports is important, especially given the recently signed SA-EU Trade, Development and Co-operation Agreement.

3. LITERATURE SURVEY

Over the past sixty years or so, and especially since the second World War, economists have long been concerned with statistical estimates of the numerical values to be assigned

to “structural parameters governing international trade relationships”(Cheng, 1959: 107). According to Magee (1975: 175), attention given to international trade relationships or econometric trade models is characterized by both normative and positive reasons. International trade models are said to be useful in measuring the welfare costs of fluctuations in international trade, the welfare effects of macroeconomic restrictions on trade, effects of international trade on domestic growth, policies to obtain internal or external balance, and policy effects of exchange rate changes and trade restrictions on external balance, amongst others (Magee, 1975: 176).

Noting the vast interest that economists have shown in international trade modeling, Goldstein and Khan (1985: 1042) cite the availability of data, understanding or ability to understand the underlying theoretical framework for the determination of trade volumes and prices, and wide applications of estimated income and price elasticities to a host of crucial macro-economic issues, as the main reasons for the unusual degree of attention devoted to trade elasticities.

This refers to a rich data base on the value of imports and exports for many countries and commodities, the familiarity of consumer demand and production theory, and the application of trade elasticities to international transmission of changes in economic activity and relative prices, the impact of expenditure-switching and expenditure-reducing policies, welfare and employment effects of changes in trade restrictions, and other policy implications. Miller and Fratianni (1973: 191) also cite “theoretical apparatus as well as the nature of data variables” to be the main factors shaping the choice of both variables and modeling approach. Some of these reasons have been questioned by other authors (see, Magee, 1975: 187).

For Goldstein and Khan (1985: 1098), empirical research on trade elasticities does not take into account the links between financial and real economic sectors. This implies that many empirical trade models do not consider both financial and real economic variables when estimating regressions. For example, many trade regressions include real imports, real exports, relative prices, and real income but exclude capital flows.

In addition to that, the efficacy of international trade policy largely depends upon the size and significance of both import and export price and income elasticities. This implies that, for instance, when a relative price elasticity to import is bigger and significant, policy makers could modify exchange rates so as to affect imports. Consequently, economists have devoted an enormous amount of attention to the estimation of trade elasticities. However, assignment of statistical and numerical values to international trade relationships has been characterized by both econometric and specification controversies. Mutti (1977: 73) argues that there is no homogenous approach to estimating an import demand equation, and that more general functional forms, which may require more data, should be adopted because many import demand equation specifications are not “applicable in all situations”. There are many disagreements on the common approach to estimation of trade elasticities. As a result, this chapter intends to discuss both theoretical and econometric issues that prevail in many studies and have not been settled.

This section discusses all relevant issues as they relate to the scope of this paper. Considerable attention is given to studies that have not been extensively reviewed, in the past. Other surveys of this nature exist. For example, Cheng (1959), Magee (1975), Goldstein and Khan (1985) and others have reviewed most earlier literature on this subject. I adopt an approach used by Magee (1975) and hence frequent reference to Magee (1975). Issues examined include the theoretical background for import demand estimation, choice and expected signs of the variables entering the import demand equation, import demand equation specification, time lags and dynamics, use of dummies, indices and proxy variables, cyclical and secular factors, levels of disaggregation, simultaneity, stability of trade relationships, methods of measurement, policy conclusions, and suggested future research⁴.

However, this study does not dwell on a critique of broad theoretical and practical shortfalls of international trade models. The main focus for this study is import demand, and as a result emphasis is given to import demand elasticities and not broad international trade models.⁵

3.1 Methods of Measurement

As indicated above, methods of measurement of trade elasticities in general and import demand elasticities in particular differ significantly. There has been a frequent use of Ordinary Least Squares (OLS) in estimation of import demand elasticities with respect to income and relative prices.

This method has been criticized in many respects. The criticisms for this approach include its failure to deal adequately with time-series data and dependency on a large number of questionable assumptions. It is assumed, for instance that exporters and importers are always in the long-run equilibrium, supply price elasticities of imports are infinite, and that consumer money illusion does not exist. These assumptions and other shortfalls of OLS methods may result to 'spurious' and unreliable estimated outcomes.

Fairly recently, Maquez (1994) shows that Full Information Maximum Likelihood performs better than OLS, and Senhadji (1997) proves that Fully Modified (FM) estimators using the Monte Carlo methods out-perform OLS. However, many authors

⁴ The debate on appropriate methods or techniques of estimation remains unsettled. Some of the main studies that extensively discuss modeling techniques and disagreements are Orcutt (1950), Magee (1975), Murray and Ginman (1976), Thursby and Thursby (1984), Golstein and Khan (1985), and more recently Stock and Watson (1987), Pagan and Wiggins (1989), McCallum (1993), Maquez (1994) and Senhadji (1997).

⁵ These issues, including qualities of perfect versus imperfect substitutes approach, various world trade models, competing balance-of-payments theories, and others are not the subject of the current study, although reference to these issues is frequently made as studies engage with them [see, Magee (1975) and Goldstein and Khan (1985) for an exhaustive debate around these controversies].

have continued using the OLS approach arguing that it is relatively easier and convenient. Houthakker and Magee (1969: 111) acknowledge the bias that may be associated with results obtained through the use of ordinary least-squares method in estimating income and price elasticities in world trade.

Magee (1975: 183) opts for the simultaneous-equation approach combined with the use of instrumental variables as it improved demand elasticities. For Khan (1974), a two-stage least squares method proved superior to OLS as it offered significant price elasticities of the demand for imports and a higher coefficient of determination. However, it is unclear whether a method *per se* or other factors influence the significance of results. For instance historical data mis-observation or mis-capturing may affect model results, not the method used (see, Orcut, 1950). There may, thus, still be a case for ordinary least squares methods of estimation. Criticisms based on its dependency on assumptions such as those noted above, and failure to capture data problems in a time-series context, can be dismissed by the fact that a combination of OLS with various diagnostic checks of the series should yield a good result or at least give a broad picture of the nature of economic relationships.

The choice of the method of estimation depends on the purpose of estimation and data availability. As noted above, Mutti (1977: 73) contends that there is no universally accepted, homogenous manner of estimating import demand elasticities. Other studies have used the Gross National Product Framework and the Aggregator Function where imports and exports are modeled simultaneously with the demand and supply functions of domestic factors [see, Kohli (1978) and Lawrence (1989)].

3.2 Import Demand Function(s)

Specification and estimation of the import demand function largely rely on micro-economic consumer demand and production theory. Miller and Fratianni (1973: 191) conclude that the import demand function derived from the utility function has both theoretical and empirical standing.

The demand for any commodity depends on relative prices and real income. Consequently, the import demand is viewed, *ceteris paribus*, as a function of relative prices and real income (Erasmus, 1978: 27). In nearly all studies, real income refers to real gross domestic expenditure or real GDP minus exports. This variable, according to Magee (1975) captures domestic economic activity or what Goldstein and Khan (1985: 1056) term the 'scale variable'. Relative prices refer to the ratio of import prices to domestic wholesale prices. Based on the utility maximization function, this specification is standard and frequently used (see, Miller and Fratianni, 1973).

All other studies adhere to this specification, except for the GNP framework approach. However, Khan (1974) questions the use of only two variables in an import demand function. Price and Thornblade (1972) argue that import demand models should consider other factors that influence import demand. As argued in Khan (1974: 692) other factors such as trade restrictions, world economic conditions, the historical dynamics of a

country, and the general features of a nation affect its import demand, especially in the case of developing economies.

3.3 Theoretical Expectations

Magee (1975) and Goldstein and Kahn (1985) have examined the theoretical expectations of relative price and income variables signs. In almost all studies on this subject, relative price variable has been reported to have a negative sign and income variable has a positive sign. This means that import demand or volume of imports responds negatively to prices and positively to economic activity.

There are many reasons to believe that import volumes diminish as price increases. However, it is questionable whether this sign should always be negative. There may be an instance where a particular commodity or sector does not depend on prices *per se*. There are exceptions to demand and supply mechanisms.

Certain commodities are continuously consumed in spite of price changes. For instance, a developing economy undergoing trade policy transformation requires certain commodities, such as capital equipment, in order to construct its industrial base. Consequently, when the world price of these commodities relative to domestic prices increases the developing nation is left with no choice other than to import the commodity as a basic need. However, there is a debate, as presented in Magee (1975), concerning the real sign and level of significance of relative price elasticity of the demand for imports.

In certain instances, both world prices and domestic prices may be rising and the effect of that on the demand for imports may go either way depending on the rate of increase for each price [see Houthakker and Magee's (1969) price elasticity of the South African import demand, Table 2 in appendix I].

Theoretically, economic activity is postulated to increase consumption. In the case of import demand, one expects import demand to increase as real income rises and almost all studies reviewed reported a positive relationship between income and import demand. However, Magee (1975) questions this relationship. According to Magee (1975: 188), the sign of the income coefficient is not necessarily positive as the importable could be superior in consumption such that its consumption rises whilst a consumption for the other commodity diminishes. Magee (1975: 191) cites some possible reasons why there are hardly any negative income elasticities. These include reluctance on the part of researchers to report negative elasticities, systematic tendencies in the growth patterns of demand and supply, mis-specification of import demand functions, and the lack of distinction between short and long term elasticities. Magee's(1975) critique has resulted in better estimates, as various empirical studies have attempted to improve research on trade elasticities by taking cognizance of the theoretical and econometric shortfalls raised.

3.4 Specification Issues

As reflected above, methods of estimation are subject to intense debate. Consequently, various authors have devised better ways to deal with problems associated with mis-specification. Bias and errors inherent in OLS method have resulted in attempts to at least better equation specification. According to Houthakker and Magee (1969: 111), the use of double-logarithmic equations is preferred because “of their general superior fit and easy interpretation”. Murray and Ginman (1976: 75) state that the traditional log-linear model is incorrectly specified. According to Khan (1974: 680), specification of import demand equation in logarithmic form allows imports to react in proportion to a rise and fall in the explanatory variables and also avoids, in a context of constant elasticities of substitution, drastic falls in the elasticity as imports rise. Khan and Ross (1975: 358) present evidence of the appropriate functional form of the import demand equation. Goldstein and Khan (1985: 1044) contend that equation specification depends, amongst other things, on the type of good traded, the end-use to which the traded commodity is put, the institutional framework under which trade takes place, the purpose of the modeling exercise and sometimes on the availability of data. The imperfect and perfect substitute models have dominated empirical literature on trade modeling. Many studies have adopted the imperfect substitutes approach in that they assume no substitutability between imports and exports, except Kohli (1978), Lawrence (1989) and others as they use the GNP and aggregator function which estimates both imports and exports simultaneously.

Specification problems were noticed as early as the 1950s by Orcutt (1950). According to Orcutt (1950: 122), estimates of price elasticity of the demand for imports have been questionably low due to errors and bias emanating from mis-specification, mis-observation, improper historical data and failure to separate cyclical effects from equilibrium relationships of import demand equations. Since then, studies have continuously explored better specification and logarithmic expression of an equation combined with better estimation techniques. This, arguably, has reduced some specification errors.

3.5 Time Lags and Dynamics

In practice, the effect of a policy shift normally takes time to come through. This is the argument that many studies of import demand elasticities present and follow. According to Leamer (1973), Yadav (1975) and Goldstein and Khan (1985) it takes time for import demand to respond to changes in real income and relative prices. Magee (1975: 235) concludes that “price effects can work for up to six years while income effects are probably shorter”.

For Goldstein and Khan (1985: 1066), importers and exporters will not always be on their long run demand and supply schedules. However, the decisions on the number of lags to be included and which variable(s) to lag in an equation, remain to be considered. According to Thursby and Thursby (1984: 120), equations with a lagged dependent variable perform better than other equations that do not include a lagged dependent variable. The studies should somehow take into account economic events and policy

shifts that have happened and predict the time period when an effect filters through. Knowledge about the country being studied is imperative.

3.6 Dummies, Indices and Proxy Variables

Many studies make use of dummies to capture policy changes and structural shifts. This idea is connected to specification issues in that the import demand model is prone to bias and errors if structural shifts are not considered. Consequently, during validation period, researchers should ensure that the series are carefully analyzed such that any anomalies are taken into consideration.

According to Thursby and Thursby (1984: 121), the effects of the breaking of the Bretton Woods system, oil price shocks, and other structural changes must be represented by dummies as they had an enormous impact on international trade. For instance, Price and Thornblade (1972) used seasonal dummies to smooth or capture seasonal patterns of the series. The GNP function framework largely make use of indices, such as an index of technology in order to capture the effect of technological changes (Kohli, 1978). According to Leamer (1973: 443), empirically weighted indices are useful in estimating the import demand function because they trace responses of each commodity or sector, ranging from material extraction to final demand, to changes in real income and relative prices. However, use of indices has been challenged in that they may not reflect true relationships between estimated relationships, especially if incorrectly constructed.

Leamer (1973: 449) acknowledges difficulties in constructing correct indices and presumes that “the difficulties may eventually be resolved”. Relative prices and GDP less exports have been largely used as proxy variables for exchange rate effects and economic activity, respectively (Senhadji, 1997). In instances where appropriate data is not available, certain relevant, closely similar factors are frequently utilized. For example, Kreinin (1973) uses the index of industrial production as a proxy for domestic output and demand.

There may be problems with this approach because the effect is not exact as in the case where an appropriate variable is tested. However, this approach can be seen as second best which gives a picture of the nature of investigated relationships, especially within the context of data constraints discussed above. Houthakker and Magee (1969: 122) acknowledges the “ limitations imposed by short time-series and inadequate data” in the process of estimating price elasticities of the demand for imports. Mutti (1977: 73) warns policy makers that model results should be interpreted with some degree of caution, and that researchers should concentrate on a few manageable critical variables to maintain the usefulness of the model through simplification of reality.

3.7 Statistical Theory

The import demand model specified and estimated must fulfill the requirements of both economic theory and statistical significance. Import demand elasticities could either be statistically significant or insignificant and that gives impetus to clear-sighted trade

policy recommendation. For example, Houthakker and Magee (1969: 121) conclude that the differences in countries' income elasticities of demand will inevitably result to a different trade balance performance for those countries.

In this regard, it is crucial to know exactly by how much a country's volume of imports responds to either relative price or real income changes. Many studies have found that import demand responds more significantly to economic activity than to prices (Magee, 1975). There are questions with this finding as argued in Goldstein and Khan (1985) in the sense that results may not necessarily be meaningful due to the lack of coherent estimation approach that integrates financial and real sectors; link macro-economic theory with economic events, and separation of long and short-run elasticities. Orcutt (1950) debated the correctness and usefulness of price elasticities of demand for imports because of historical data, and aggregation and simultaneity problems in model estimation. In practice, for instance, prices and quantities can move in the same direction, data may be incorrectly observed, and price elasticities can be higher for larger price changes and lower for small price changes. This leads to questionable results, even though model results are 'statistically' significant (see, Magee, 1975: 214-218 and Goldstein and Khan, 1985: 1071- 1075 on simultaneity, multicollinearity, and quantum effects, amongst others). The significance of an equation in this context refers to anything that is statistically different from zero. For example, Khan (1974) found that the import demand equation estimated for developing countries gave elasticities that meant that an increase in economic activity would significantly raise import demand. Studies reviewed above, with the exception of a few, depicted significant elasticities, and therefore authors were able to make policy recommendations. This involves a good coefficient of determination, reasonably high t-values, low auto-correlation and other statistical criteria.

For example, Khan and Ross (1975: 359) praise the import demand elasticities obtained in their model as very good as "judged by generally high values obtained for the R-squared". However, the statistical significance of any model is subject to scrutiny as econometric controversies, including an appropriate modeling strategy, have not been entirely resolved.

3.8 Cyclical and Secular Relationships

Magee (1975: 191) argues that one of the major problems with trade elasticities is that studies do not distinguish between short term and long term relationships. This debate is also discussed in Miller and Fratianni (1973), Khan and Ross (1975), Hughes and Thirlwall (1977), and Goldstein and Khan (1985).

According to these authors, it is of primary importance to separate secular from cyclical factors in the import demand function. This has fundamental policy implications such that policy makers have to know how import demand responds to relative prices and income both in the short and long run. For example, the effects of exchange rate changes have to be understood within that framework. According to Khan and Ross (1975: 357), ignoring the role of secular factors would result in a misleading impression of the import demand elasticity and may also involve the estimation of a mis-specified equation.

Studies that do not distinguish short-term and long-term elasticities have been seriously criticized (see Magee, 1975, and Goldstein and Khan, 1985)

3.9 Levels of Aggregation

Murray and Ginman (1976: 75) question the use of the aggregate import demand model in that “empirical results support rejecting the traditional specification of the import demand model”. The main shortcoming of an aggregate model is that it may not capture the dynamics of the relationships inherent in certain sectors. In a way, it gives a broad picture of the direction of the relationship between variables under investigation although the picture could be mis-leading, as argued in Khan and Ross (1975:357).

Questions relating to aggregate versus disaggregated import demand models are discussed in many articles, including Kwack (1972), Price and Thornblade (1972), Kreinin (1973), Miller and Fratianni (1973), Leamer (1973), Yadav (1975), Murray and Ginman (1976), Weisskoff (1979) and more specifically in Magee (1975) and Goldstein and Khan (1985). Estimation of a disaggregated import demand function by sector, commodity and country has accelerated in the past two decades following Murray and Ginman’s (1976) article which casts doubts on the aggregate import demand function. Decision about the level of disaggregation, consideration of cyclical and secular factors, choice of variables, the type of the model and the method of estimation largely depend on the availability of data and the purpose of estimation (Goldstein and Khan, 1985: 1056).

3.10 Policy Conclusions

The considerable attention given to the estimation of trade elasticities, especially import demand elasticities, is arguably motivated by the importance of trade elasticities on policy issues and foreign trade. It is fundamental to understand the nature of foreign or international trade relationships if foreign trade policy is to be effective. According to Houthakker and Magee (1969: 111), the direction in which the trade balance moves critically depends on “each country’s income elasticity of demand for imports and on the rest of the world’s income elasticity of demand for each country’s exports”.

Magee’s (1975: 176) positive and normative reasons for studying international trade flows also substantiate the policy impact of trade elasticities. Orcut (1950: 117) reveals the fact that relative price changes in an international context have policy implications for trade. For instance, for a devaluation policy to be effective, it is imperative to ascertain the magnitude of the effects that relative price changes instill to the volume of imports and exports. Khan (1974: 692) points out that the Marshall -Lerner condition, which makes a devaluation policy effective, depends on the sizes of both import and export elasticities. In the context of import demand, the level of economic activity or real income is important for foreign exchange accumulation. This can be interpreted in many ways. If import demand responds significantly positive to real income, this means that economic growth will accelerate imports which may erode foreign exchange thereby constraining faster growth of an economy.

On the other hand, this may further improve the domestic economy if imports are of important value to an economy and if exports rise faster than imports, *ceteris paribus*. In addition to that, a reduction of trade restrictions will increase trade, normally the volume of imports in the case of a developing nation, which may exacerbate or worsen the balance of payments constraint.

Khan (1974: 679) maintains the view that for developing economies quantitative restrictions play a pivotal role and that eradication there of increases volume of imports. In this context, trade policy reforms may arguably have a detrimental effect, at least in the short-run, to developing economies' principal objectives such as employment creation, especially through importation of labour-intensive and luxury commodities.

According to Magee (1975: 218), the main policy questions related to empirical estimates of trade behavior include, the trade balance and welfare effects of tariff cuts, the use of the constant-market-share analysis to evaluate the trends in excess demand for tradable commodities, and most importantly alternative approaches to devaluation (also see, Goldstein and Khan, 1985: 1042). In order to understand the effects of tariff policy, exchange rate, and economic performance changes, structural shifts, and other policy shifts, it is critically important to know or examine the trade elasticities in general or import demand elasticities in particular.

Houthakker and Magee (1969:121) concluded that even if all countries grew the same way and had similar inflation, the trade balances of various countries would behave differently, some experiencing secular improvements and others subject to deterioration because of disparities in import demand elasticities with respect to income. Consequently, analysis of each country's income elasticities of the demand for imports remains a fundamental goal in international trade research. Many authors have been able to make sensible policy suggestions through import demand modeling [see, Kwack (1972), Khan (1974), Magee (1975), Goldstein and Kahn (1985) and others].

3.11 Import Demand Studies in South Africa

It should be noted that there are a few published or accessible studies done in South Africa about trade elasticities. These include the pioneering paper by Woods (1958), and later Erasmus (1978), Kahn (1987), and more recently Lawrence and van Westhuizen (1990,1994). The approach is similar to studies reviewed above. For instance, Erasmus (1978) and Kahn (1987) use the OLS approach whilst Lawrence et al adopted the GNP Function Framework used by Kohli (1978). This section provides a brief description of methods used and empirical results of studies.

Woods (1958) estimated a two variable regression of income and trade. He studied the relationships between the money value of visible imports and exports and the money value of South Africa's aggregate income. He concluded that the average propensity to import shows " a fairly high degree of positive correlation with the trade cycle". Imports are found to be very sensitive to income.

As indicated above, Erasmus (1978) used the OLS method looking at South Africa's import demand elasticities with respect to income and relative prices. Like other studies, he found that imports are positively correlated to income whilst the price elasticity result was mixed. He also, like studies reviewed above, used dummies particularly to capture the crude oil shock for the period 1974 to 1976. Kahn (1987) also found a similar result when estimating an import demand function for South Africa for four different manufacturing sectors. Kahn (1987) confirms that relative prices and income are significant explanatory variables of the behavior of import demand and import penetration in South Africa. Lastly, Lawrence et al (1990, 1994) using a different method (GNP function framework) got the result that is in line with economic theory and similar to that of other studies. They found that import demand is generally inelastic to relative price changes.

3.12 Recent Developments in Econometrics and Import Demand Function(s) Estimation

In the past two decades econometric research has accomplished remarkable improvements. That is, improved methods of estimation have been established. For instance, recognizing the shortfalls of traditional methods, time-series methods have gained wide usage. The new methods attempt to deal with unit roots in economic series. Dickey (1976), Dickey and Fuller (1979), Engle and Granger (1987) and Engle and Yoo (1990) have sparked and popularised the new ways of dealing with non-stationary data. In short, the new methods try as much as possible to avoid spurious regression problems. One widely used technique is the Engle-Granger Two step procedure. This method is explained in below.

3.12.1 Engle-Granger Two-step Procedure

There are two well-known approaches to dealing with non-stationary variables, these are the Engle-Granger two-step and Johansen technique. There have been various extensions to these approaches in order to take cognisance of certain limitations of these techniques. For instance, Harris (1995:56) discusses the extensions to the standard Engle-Granger two-step approach phrased as Engle-Granger-Yoo three-step procedure that takes into account the limitations of the Engle-Granger two-step approach. The critical limitation of the Engle-Granger approach is that the use of the Augmented Dicker-Fuller unit root tests effectively restricts short run dynamics, such that the reaction of one variable to another is the same both in the short and long-run. In fact, the model acts as if variables were in equilibrium. The other limitation of the Engle-Granger technique is the prevalence of non-standard distributions to the estimators. The third step of the Engle-Yoo procedure, therefore, is to provide correction of the first stage estimation of the long-run parameters of the model, in order to ensure that distributions return to normal distribution.

There are other issues to be considered in this process. Certain prerequisites should be met for the E-Y procedure to apply. For instance, a particular cointegrating vector should exist. However, for the purposes of the current study the E-G two-step approach is used largely because of its widest use in other studies and because of its relative simplicity. In fact, E-G two-step procedure represents a simple test for the presence or otherwise of cointegration, and is often used as a first indication of whether a particular set of variables represent a combination which is consistent with a long-run equilibrium relationship. It also allows use of the super-consistency property of the Ordinary Least Squares to obtain consistent estimates of the cointegrating vector, provided a unique cointegrating vector exists. Lastly, since the E-G approach is combined with the second stage of estimating short-run dynamics by means of the error-correction mechanism that applies the measure of dis-equilibrium obtained from the equilibrium relationship, it also provides information about the speed of adjustment to equilibrium.

In effect, the EG approach amounts to testing the residuals in terms of whether there is a unit root or not. The null hypothesis is that there is a unit root which means that variables are not co-integrated or there are no cointegrating relationships.

The Engle-Granger approach is illustrated below. The Engle and Granger two-step procedure, roughly discussed above, can be briefly highlighted. After ascertaining the nature of the data, the long-term regression is estimated as:

$$y_t = \beta x_t + \varepsilon_t \quad (1)$$

As said above, residuals are taken from equation 1 and conduct a unit root test on them using the ADF unit root test. If the residuals are stationary then the short-term dynamic model (1) is estimated, otherwise re-check data and re-specify the model.

$$\Upsilon_t = \Upsilon_0 x_t + \Upsilon_1 x_{t-1} + \alpha y_{t-1} + u_t \quad (2)$$

Equation 2 can be expressed in the error-correction form as Harris (1995: 53) suggested:

$$\Delta \varepsilon_t = \bar{\Psi}^* \varepsilon_{t-1} + \sum_{i=1}^{p-1} \Psi_i^* \Delta \varepsilon_{t-i} + \mu + \delta t + \omega_t \quad \text{where } \omega_t \sim \text{IID}(0, \sigma^2) \quad (3)$$

The error term is obtained from the long-term regression ($y_t = \beta x_t + \varepsilon_t$).

In the test one should decide whether to include a deterministic trend. This depends on whether a constant and/or a trend term appear in the static long-term equation. That is, deterministic components can be included in either long-term static or short-term dynamic equation, but not to both.

4. IMPORT DEMAND ELASTICITIES FOR SOUTH AFRICA

The preceding sections have discussed various issues of importance relating to the estimation procedures and the theory governing those procedures. The current section applies the empirical techniques relating to cointegration, error-correction models, and non-stationary data, briefly discussed above.

Like studies reviewed above this section derives and estimates an import demand model that assesses the responsiveness of import demand to relative prices and income, for South Africa. Income, economic activity or scale variable, is expressed as GDP less exports or gross domestic expenditure in real prices. The relative price variable is expressed as the ratio of unit value imports to domestic production prices. Theoretically, income is expected to be positively related to import demand whereas relative prices are expected to be negatively related to import demand. That is, when relative prices or the price of imports relative to domestic prices increase the demand for imports declines and when economic activity or aggregate economic demand rises the demand for imports increases, holding other factors constant.

Time-series techniques are used because some empirical work has shown that the data used for modeling many economic relationships often contain a unit root (for instance, see Granger and Newbold, 1974). Consequently, if this is not taken into account the model may give misleading results. This section begins with stating and mathematically deriving the import demand model estimated. The next sub-sections discuss the data used. Data sources, the period of analysis and calculations done on the data are discussed. The unit root test results are shown and explained. The rest of the section focuses on the South African specific import demand model, estimation and discussion of results. The discussion of results involves comparing elasticities for different sectors and those of other studies.

4.1 The Micro-Foundations for the Import Demand Function

The aggregate import demand of a country can be derived mathematically under the assumptions of an indefinitely living representative consumer, as shown in Senhadji (1997). This mathematical formulation of the import demand concentrates on the utility function of the consumer as discussed below.

Given the expected lifetime utility function of domestic and foreign goods:

$$U_0 = E_0 \sum_{t=0}^{\infty} (1+\mathbf{d})^{-t} u(d_b, m_t)$$

U_0 is the expected utility at $t = 0$. \mathbf{d} is the personal discount rate. The greater δ is, the lesser the household values future consumption relative to current consumption. Expected utility of the representative consumer depends solely on the consumption of domestic endowment, d_b , and consumption of imports m_t . The maximization problem becomes:

$$\sum$$

$$\text{Max}_{\{d_t, m_t\}} E_0 \sum_{t=0}^{\infty} (1+r)^{-t} u(d_t, m_t)$$

subject to the budget constraint $b_{t+1} = (1+r)b_t + (e_t - d_t) - p_d m_t$

for $e_t = (1-\rho)\underline{e} + \rho e_{t-1} + \xi_t$, $\xi_t \sim (0, \sigma^2)$

$$\text{and } \lim_{T \rightarrow \infty} (b_{T+1} / (1+r)^T) = 0$$

The budget constraint ensures that the domestic holding of foreign bonds at $t+1$ will equal the holding at t including the accumulated interest from t to $t+1$ plus the excess domestic endowment after consumption, $e_t - d_t$, minus the value of import spending, $p_d m_t$. The budget constraint is simply a national account equation, where the financial side of a trade surplus/deficit $b_{t+1} - (1+r)b_t$ must equal the value of the trade surplus/deficit, $(e_t - d_t) - p_d m_t$. The relative price of imports can be depicted as p_d/p_m .

The domestic endowment e is stochastic and follows an AR (1) process with the unconditional mean \underline{e} and variance $\sigma^2/(1-\rho^2)$. ξ_t is a normal distributed innovation parameter. The last condition is the transversality condition. It is necessary to impose the maximization problem so as to rule out the possibility for the consumer to generate an infinite trade deficit (Ponzi game). This incentive to generate an infinite trade deficit arises from the assumption of an infinite time horizon together with the assumption of a perfect international capital markets.

The model further assumes that the exchange rate is perfectly flexible, and that the world's commodity market absorbs the excess domestic production, and also provides the domestic market with demanded import goods. In this context, the representation holds the assumption of perfect capital markets, where the country can borrow an unlimited amount in the fixed world market interest rate. This, therefore, enables the country to adjust or rather smoothen its inter-temporal preferences. In this regard, the model represents an infinite maximization problem.

The representative consumer has an incentive to accumulate an infinite debt. Consequently, it is necessary to impose a budget constraint, transversality condition, which rules out the possibility to generate an infinite budget debt. The transversality condition states that the discount value should, at all times, equal zero or be less than zero.

The instantaneous utility function can be defined as

$$u(d_t, m_t) = A_d d_t^{1-a} (1-a)^{-1} + B_m m_t^{1-b} (1-b)^{-1}$$

In which case the representative consumer's utility maximization problem can be calculated in the *Lagrange* optimization form:

⌘

$$L = E_0 \dot{\mathbf{a}}(1+\mathbf{d})^{-t} [A_t d_t^{1-\mathbf{a}}(1-\mathbf{a})^{-1} + B_t m_t^{1-\mathbf{b}}(1-\mathbf{b})^{-1}] - \mathbf{I}[b_{t+1} - (1+r)b_t - (e_t - d_t) + p_t m_t]$$

$$t=0$$

$$\mathbb{L}/\mathbb{I}d_t = (1+\mathbf{d})^{-t} (A_t d_t^{-\mathbf{a}}) - \mathbf{I} = 0$$

$$\mathbb{L}/\mathbb{I}m_t = (1+\mathbf{d})^{-t} (B_t m_t^{-\mathbf{b}}) - p_t \mathbf{I} = 0$$

B

$$A_t d_t^{-\mathbf{a}} = B_t m_t^{-\mathbf{b}}/p_t$$

B

$$m_t = p_t^{-1/\mathbf{b}} A_t^{-1/\mathbf{b}} B_t^{1/\mathbf{b}} d_t^{-\mathbf{a}\mathbf{b}}$$

Taking the logarithmic form of the above representation, the equation becomes:

$$\ln m_t = -(1/\mathbf{b}) \ln p_t - (1/\mathbf{b}) \ln A_t + (1/\mathbf{b}) \ln B_t + (\mathbf{a}/\mathbf{b}) \ln d_t$$

$$\text{for } B_t = e^{b_0 + \mathbf{e}_{B,t}}$$

$$\text{and } A_t = e^{a_0 + \mathbf{e}_{A,t}}$$

$$\begin{aligned} m_t &= -(1/\mathbf{b}) \ln p_t - (1/\mathbf{b})(a_0 + \mathbf{e}_{A,t}) + (1/\mathbf{b})(b_0 + \mathbf{e}_{B,t}) + (\mathbf{a}/\mathbf{b}) \ln d_t \\ &= -(1/\mathbf{b}) \ln p_t + (\mathbf{a}/\mathbf{b}) \ln d_t + (1/\mathbf{b})(b_0 - a_0) + (1/\mathbf{b})(\mathbf{e}_{B,t} - \mathbf{e}_{A,t}) \\ &= -(1/\mathbf{b}) \ln p_t + (\mathbf{a}/\mathbf{b}) \ln d_t + c_0 + \mathbf{e}_t \end{aligned}$$

$$\text{Let } d_t = \text{GDP}_t - x_t$$

B

$$\ln d_t = \ln(\text{GDP}_t - x_t)$$

Which results to the import demand equation that can be written as:

$$\ln m_t = c - (1/\mathbf{b}) \ln p_t + (\mathbf{a}/\mathbf{b}) \ln(\text{GDP}_t - x_t) + \mathbf{e}_t$$

where $\ln m_t$ refers to imports of goods and non-factor services, $\ln p_t$ as relative prices computed as the ratio of unit value imports to domestic prices, and $\ln(\text{GDP}_t - x_t)$ as the scale variable, that is real GDP less exports, theoretically similar to real gross domestic expenditure used in the present study.

The import demand function derived above postulates that economic activity positively correlates to import demand where as relative prices, in the form of unit value imports divided by domestic prices, negatively correlate to import demand. The current estimation uses a similar specification with economic activity variable specified as real gross domestic expenditure or real GDP less exports and relative prices as ratio of import prices to domestic prices.

The derivation of the import demand model as illustrated above relies on the number of assumptions, also mentioned above, which may not hold in the real trade situation. Although the use of the model falls short of a true representation of the real world, it is sufficient for the current study as it gives background to the models estimated and it is compatible with theory. For instance, the model largely depends on the two-commodity, two-country assumption which becomes very critical when estimating regressions for certain sectors. Above this, there may be other influential factors not taken into cognizance that would significantly affect the demand for imports.

Perhaps the high significance of the residuals in the dynamic equation and the relatively low R-squared are testimony to the importance of other factors not included in the regression. However, different diagnostic tests, such as specification and stability tests, suggest that the specification is correct, at least for the majority of models. It should also be noted that estimation of elasticities has been subjected to many criticisms because of the reliance of the exercise on certain assumptions⁶.

4.2 Data Sources and the Period of Estimation

4.2.1 Aggregate Import Demand Data

The aggregate data for production prices and unit values of imports and exports (free on board -f.o.b.) were taken from the International Monetary Fund's International Financial Statistics (IFS). The total economy gross domestic expenditure series, the GDP and the exports were taken from various issues of the South African Reserve Bank Quarterly Bulletin. The basic early objective of the study was to go as far back in time as possible. However, this objective has been constrained by the limited published economic series, especially on a quarterly basis. As a result, the data only goes back to 1960(1). The same series could not be found prior to 1960, especially not in the same format. The same applies with regard to up-dating the series to the present. These data could not be found after 1996(4). However, 1960(1) to 1996(4) still amounts to enough observations in a time-series context.

There were possibilities of using other related series as proxies, but this seemed to affect the consistency of the series. For instance, the import prices published in the South African Reserve Bank Quarterly Bulletin would have been used instead of unit value imports in order to up-date the series to the latest quarter of 1998. However, import prices in the Bulletin were a little understated compared to unit value imports published in the IFS. In fact, comparing similar years, say 1990 to 1996, import prices in the Bulletin were fairly low relative to unit value imports in the IFS yearbooks.

⁶ Amongst others, see Maquez's (1994) detailed discussion of the problems with estimating elasticities. Maquez (1994:471) questions assumptions that 'trade elasticities are autonomous parameters, that both cross-price effects and simultaneity biases are absent, and that expenditures on domestic and foreign goods can be studied independent of each other'.

These data were therefore transformed to fit the purposes of the study. Firstly, a similar base period had to be fixed. All the series, except imports (fob), were re-based to 1990 prices. 1990 was chosen as the base period for the sake of convenience and this was done because 1990 was viewed as a relatively latest year that many series were based on. During the process of data gathering and processing many series were identified to be based on 1990 prices as well. This therefore meant that other series which were based to previous years, such as unit values based to 1970, 1975, 1980 and 1985 had to be re-based to 1990 prices by splicing the indices as discussed in Mohr et al (1988: 20-21). In addition to that, imports (f.o.b.) and gross domestic expenditure data were given in current prices.

These were converted to real terms through deflating the series by respective price indices, gross domestic expenditure deflated by domestic production prices and imports deflated by unit value imports. The GDP and aggregate exports were given in 1990 prices from the Bulletin. Thus, the base year is 1990 for all series used in estimating import demand functions.

4.2.2 Selected Sectors Import Demand Data

There were a few problems with getting sectoral import data, especially in a format similar to the aggregate import demand function data discussed above.

These data were not available prior to 1986 and were not available for all economic sectors even after 1986⁷. As a result, the selection of the sectors for the study was constrained by data. For many sectors data begins in 1988 and it's monthly. This therefore meant that, for those sectors selected or which had data, the series had to start in the first quarter of 1988 for the sake of consistency and comparability. These data were published by the Central Statistical Service, Pretoria. The trade statistics release P 6161 encompassed data on the quantity of imports, import volumes, unit value imports, the price statistics release P 0142.1 publishes the production price index, and the statistical release P3041.2 has the index of physical volume of manufacturing production.

During the time of completion of the research, CSS was no longer producing trade statistics P 6161. As a result, the import demand function data for selected sectors, including the main economic sectors but not services, goes only to the fourth quarter of 1996, as in the case aggregate import demand data. Customs and Excise data would have been used to update the series to the latest quarter of 1998 but the classification is far different from the trade data produced by the Central Statistical Service, and there are even further changes currently taking place in ISIC codes which also hamper the up dating of the series to a more recent quarter. Another potential source would have been the Industrial Development Cooperation (IDC). However, the IDC sectoral trade data includes other SACU countries and is generally given only on an annual basis. This may affect the models in that there are a few observations and that it is not really South

⁷ Kahn (1987) acknowledges the similar problems with data in estimating the import demand functions and import penetration ratios for South Africa.

African specific trade data. The quarterly import data published in the recent IDC's quarterly publications on trade do not have the corresponding unit values and only begin from 1990 which also leaves the study with a few observations which may lead to finite sample bias using time-series techniques.

A procedure similar to that described in the case of the aggregate import demand function data section above, was followed with regard to transforming the series to a same base period and converting series to constant 1990 prices and also converting current price to constant price data. The economic activity variable chosen is the physical volume of manufacturing production because there was not any specific activity variable for each sector.

The physical volume of manufacturing production did not, however, prove significant as an activity variable for many sectors. As a result, as physical volume of manufacturing production proved to be not effective to capturing the level of economic activity, for many sectors, the gross domestic expenditure was therefore used.

Lastly, the variables named above, such as imports, unit value imports, domestic prices, gross domestic expenditure, GDP less exports and index of manufacturing production, were chosen largely because many studies have used them for the similar estimation objectives. The logic behind the choice of these variables was simply that they captured the relationships meant for estimation. The variables entering the import demand function, both at the aggregate and disaggregated levels, were transformed to logarithmic and first difference forms. This was done because the study intends to assess the elasticities in terms of by how much does a percentage change in one variable affect the other. In addition to that, the study uses a time-series approach which begins with thorough assessment of the characteristics of the data, diagnostic tests, estimation, and the validity of the model.

4.3 Unit Root Test Results

The main aim of this section is to ascertain whether the series are stationary or not. Table 9 shows the results of the Augmented Dickey-Fuller unit root tests that were conducted using the general-to-specific approach. Initially a number of 8 lags were assigned to each variable in order to 'test-down' and ascertain the number of lags to be included in a formal ADF unit root test. The first lag length significant at 5% level was taken to be the lag length to be assigned to a variable when the formal individual variable unit root test was conducted. As it is apparent, for all variables in levels the lag length was found to be four and for first differences the lag length was ascertained at three.

Table 9: ADF unit root tests⁸

Level			First differences				
Variables	Number Of observations	Lags	ADF-stat	Variables	Number of Observations	Lags	ADF-stat
LPPI	143	4	-2.82	DLPPI	143	3	-2.51..
LUVALUE	143	4	-2.38	DLUVALUE	143	3	-4.54**
LMPORTS	143	4	-2.88	DLMPORTS	143	3	-7.97**
LGDE, XGDP	143	4	-2.18	DLGDE	143	3	-4.99**
LRPRICE	143	4	-2.04	DLRPRICE	143	3	-6.18**
LRMPORTS	143	4	-2.49	DLRMPORTS	143	3	-7.85**

With the exception of domestic prices, all variables entering the aggregate import demand function proved to contain a unit root in levels and not in first differences. The critical values are shown above at 5% and 1% both for variables in levels and variables in first differences. The critical values show that all variables, except LPPI, are integrated of order one, denoted as I(1). The significance levels of the ADF-statistic is signified by * at a 5% level and ** at a 1% level. This basically means that the null hypothesis that there is a unit root is rejected at a 1% significance level for all variables in first differences, except LPPI which becomes stationary when differenced twice.

The ADF unit root test results for economic sectors show that variables are I(1), although at different levels of significance. The same line of analysis can be followed, just like in the case of the aggregate import demand model. The next step is to estimate the long-term static regression in levels, save residuals and test for a unit root in residuals. If the ADF-unit root statistic rejects the null of a unit root the residuals will be incorporated into the short-term dynamic regression as an error-correction term.

⁸ For variables in levels: LPPI= log of domestic prices, LUVALUE= log of unit values of imports, LMPORTS= log of nominal imports, LGDE= log of real gross domestic expenditure, LRPRICE= log of relative prices, LRMPORTS= log of real imports. For variables in first-differences, the series are defined the same way as in the case of variables in levels, except that first-differenced variables have been differenced (as prefixed by alphabet D). The critical values for variables in levels are -4.025 and -3.442, at a 1% and 5% level respectively. The critical values for variables in first differences are -3.477 and -2.882, at a 1% and 5% level respectively. The rejection of a null hypothesis of non-stationarity is signified by ** at a 1% level and by * at a 5% level.

There are many other tasks associated with this approach and these were undertaken during time-series analysis. It was observed that there were sharp spikes in the 1970s and that needs to be corrected for, in this case by the use of dummies. It was also observed that the sectoral data depict seasonal patterns and some structural breaks for certain periods. It has also been proven that the data analyzed above contain a unit root in levels and are stationary in differences. Given all this, the estimation took into account the time-series properties of the data. The major concern for this study is to separate long-term from short-term elasticities and also by all possible means avoid spurious regression problem.

4.4 Regression Results

Following the Engle-Granger two-stage technique within a general-to-specific framework, the long-run equilibrium import demand elasticities reveal a normal result which is very much in line with economic theory governing demand relationships. In short, out of many different regressions estimated the dominant result is that import demand as a dependent variable is significantly positively related to economic activity. And relative prices, import prices divided by domestic prices, are less significantly negatively related to import demand. The demand for imports in South Africa could be influenced by economic activity and other factors, which may not be quantifiable or factors whose direct impact can not easily be identified. The import price variable is more significant than domestic price variable, even when the domestic price variable is differenced twice. Long-term elasticities for import demand with respect to relative prices and income provide better results than short-term regressions as depicted by moderate R^2 and low t-values of the short-term results.

The signs of relationships are correct as envisaged in theory. However, the long-term regression depicts unreliable results because of non-stationary data. With reference to the Engle-Granger approach there is a cointegrating relationship present between variables of the import demand regressions. The ADF unit root tests on residuals, as explained above, reject the null hypothesis of no cointegration. The static long-term regression specified as:

$$\ln m_t = c - (1/\beta) \ln p_t + (\alpha/\beta) \ln(GDE_t) + \varepsilon_t \quad (4)$$

where $\ln m_t$ = log of imports, c = constant, $\ln p_t$ = relative prices, $\ln(GDE_t)$ = log of real gross domestic expenditure and ε_t = the disturbance term. Equation 5 shows that the income elasticity to import is significant at a 1% level whereas the price elasticity to import is significant at a 5% confidence level, signified by t-values in parentheses. This implies that the demand for imports increases by 1.06% as income rises by a single percentage point, near unit elasticity. Basically, the SA imports are highly sensitive to an income change and less sensitive to a price change.

$$\ln m_t = -6.76 - 1.56 \ln p_t + 1.06 \ln(GDE_t) \quad (5)$$

(-4.56) (-2.51) (7.78)

$$R^2 = 0.36$$

$$\text{Durbin-Watson} = 0.39$$

The basic aim of estimating regression 5 is to get residuals. The residuals taken from regression 5 reveal that there is a cointegrating relationship in the regression. The ADF unit root test shows that the residuals are stationary at a 1% significance level which means that the null hypothesis of a unit root or no cointegration is rejected. The ADF unit root statistic is -2.90 and the critical value is -2.58 at a 1% level. Other tests confirm this as well. The plots of residuals and parameter stability tests show that residuals (R1) are stationary. In the E-G approach the residuals are therefore incorporated into the short-term differenced regression and should be negative and significant.

$$\text{Dln}m_t = -0.06 - 1.0 \text{Dln}p_t + 1.63 \text{Dln}(\text{GDE}_t) - 0.25 \text{R1}(-1) \quad (6)$$

$$(-0.22) \quad (-1.44) \quad (3.02) \quad (-4.63)$$

$$R^2 = 0.20$$

$$\text{Durbin-Watson} = 2.19$$

Equation 6 contains variables similar to equation 5, except that these variables are in first-differences (as prefixed by D). R1 (-1) refers to the lagged residuals taken from the result of equation 5. The short-term income elasticity is as significant as in the long-term result. A 10% increase in economic activity in the short-run leads to a 16% increase in import demand. Equation 6 suggests that a change in relative prices does not affect the demand for imports. The R^2 and the D-W statistics are relatively meaningless because the long-term regression contains non-stationary variables and the short-term regression contains a lagged variable. The reporting format of results in this paper is a replication of the way that other econometric papers represent their results.

The results of the short-term elasticities of imports with respect to income and prices, for disaggregated import demand models, are very much similar to the aggregate import demand model results. The approach and the technique are the same as in the estimation of long-term elasticities. A static long-term regression was estimated for each sector and then residuals saved and unit root tests done on residuals. The general observation is that all regressions had a long-run cointegration relationship. Prior to the sector by sector analysis, there are a few observations that are important to mention. Like in the aggregate import demand case, residuals were stationary and significant for some sectors at a 1% and for others at a 5% level. Long-term results are more significant than short-term results for many sectors.

Another observation is that dynamics do not improve regression results. In many occasions introducing lags in variables and introducing dummies does not change a result. Table 10 below presents results of the eleven sectors estimated. This includes the three main economic sectors and sub-sectors of the manufacturing sector as shown in the table below.

Table 10: Disaggregated import demand elasticities for South Africa (long-term results)⁹

Sectors	R ²	D.W.	C	LGDE	LSPPI	LSUVALU E	LSRPRICE
Agriculture	0.599	1.04	30.071 [2.016]	-3.257 [-2.268]	2.276 [4.809]	-0.583 [-1.189]	
Mining & quarrying	0.297	0.93	-27.611 [-2.820]	2.530 [2.845]			0.313 [0.996]
Manufacturing	0.763	1.03	-21.497 [-7.967]	2.357 [9.807]			-0.364 [-1.549]
Other manufacturing	0.748	1.70	-28.208 [-7.766]	2.626 [7.957]			0.293 [0.150]
Chemicals	0.677	1.61	-25.683 [-7.456]	2.581 [8.206]			-0.301 [-0.863]
Electrical Machinery	0.899	1.75	-39.473 [-10.674]	3.669 [10.384]	-0.312 [-1.281]	0.481 [-2.543]	
Machinery	0.561	1.94	-49.893 [-5.876]	4.756 [6.125]			-0.113 [-0.165]
Iron & steel	0.234	0.979	-7.415 [-0.981]	1.026 [1.374]	0.413 [1.284]	-1.014 [-2.283]	
Metals	0.875	1.64	-27.369 [-10.635]	2.708 [11.577]	0.385 [2.577]	-0.638 [-3.392]	
Paper	0.664	2.06	-24.876 [-4.499]	2.380 [4.386]	0.796 [4.065]	-0.777 [-2.871]	
Transport	0.508	1.27	-16.427 [-2.216]	2.055 [2.862]	1.202 [4.856]	-1.707 [-5.613]	

⁹ Table 10 reports results of sectoral import elasticities. R² refers to the coefficient of determination for an each regression and D-W refers to the measure of auto-correlation termed the Durbin-Watson statistic. C= constant, LGDE = log of real gross domestic expenditure, LSPPI =log of domestic prices, LSUVALUE= log of unit values of imports and LSRPPRICE = log of relative prices. These variables are the same as the aggregate import demand function variables, except that these are for sectors (denoted by alphabet S).

As discussed above, long-term results are good for many sectors, as shown by t-values in parenthesis. The R-squared are generally significant, except for the mining and quarrying and iron and steel sectors. These are natural resource based and export-oriented sectors. As a result, intermediate goods and capital equipment may have to be imported, in spite of prices and incomes, so as to sustain production and exporting. In short, the main economic sectors show that relative prices are not that influential in deciding on imports, the same result as in the total economy import demand model. The similar applies in the case of other selected sectors, except the metals, paper and transport sectors which reflect quite significant results both in terms of overall significance of the models and in terms of significant coefficients as shown by very significant t-values.

The observations made above also hold for the sectors' short-term regressions. There are no apparent structural breaks and there are no clear mis-specification, auto-correlation, heteroskedasticity, and other statistical problems. The diagnostic tests reject the null hypotheses of autocorrelation, mis-specification, and others, barring paper product and the transport sector that seem to have non-normal distributed errors at a 95% confidence level. The diagnostic tests conducted using econometric views include the Breusch-Godfrey Serial Correlation LM test, Ramsey Reset tests, the White heteroskedasticity test, and recursive estimates on residuals. The final results of regressions estimated are shown in table 11 below.

Table 11: Disaggregated import demand elasticities for South Africa (short-term results)¹⁰

Sectors	R ²	D. W	C	DLGD E	DLSP PI	DLSUVAL UE	DLSRPRI CE	DLSRMPO RTS (-1)
Agriculture	0.42 6	2.1 0	0.014 [0.037]	0.489 [0.334]			-0.894 [-2.051]	0.409 [2.427]
Mining & quarrying	0.47 5	1.8 8	0.017 [0.472]	2.865 [2.024]				0.073 [-2.541]
Manufacturing	0.57 1	2.3 2	-0.000 [- 0.059]	2.671 [5.363]			-0.028 [-0.102]	
Other manufacturing	0.73 8	2.0 4	-0.006 [0.362]	3.376 [5.310]			-0.495 [-1.499]	
Chemicals	0.32 7	1.9 8	0.008 [0.493]	0.849 [1.131]				

¹⁰ Variables are as explained in table 10, except that short-run regressions variables are in first-differences (as shown by an alphabet D). DLSRMPORTS (-1)= lagged DLSRMPORTS, DLSRPRICE= lagged DLSRPRICE and R(-1) = lagged R (residuals).

]]				
Electrical Machinery	0.758	1.83	0.008 [0.717]	2.746 [6.152]			-0.259 [-0.670]	
Machinery	0.521	2.00	-0.007 [-0.164]	4.859 [2.817]			0.237 [0.281]	
Iron & steel	0.682	2.06	-0.057 [-1.824]	-0.801 [-1.370]	2.770 [2.650]	-0.280 [-0.896]		0.652 [5.422]
Metals	0.785	1.86	-0.009 [-0.968]	2.562 [5.887]			-0.829 [-4.421]	
Paper	0.613	1.80	0.002 [0.113]	2.982 [4.285]			-0.135 [-0.642]	
Transport	0.595	1.95	-0.019 [-0.827]	2.579 [2.902]			-1.290 [-4.083]	

4.5 Interpretation of the results

Starting with the total economy import demand, all estimated equations show a significant income elasticity of the import demand. Taking the main long-term regression for aggregate import demand, the income variable is significant at a 1% level whereas the relative prices variable are insignificant. The long-run regression implies that a 10% change in economic activity would increase import demand by 10.6%. The short-run aggregate import demand function shows that only income and lagged residuals are significant. It implies that a 10% increase in economic activity, in the short-term, will lead to a 16% increase in the demand for imports.

In terms of sectors, the elasticities are comparable to the aggregate import demand elasticities. Like in the total economy regression, short-term elasticities are not as significant as long-term elasticities. This makes sense because it generally takes a while before any change in income and/or prices gets translated into consumer behaviour. For the agricultural sector and the mining sector, the elasticities are not significant, implying that the import of such commodities does not depend on any of the variables in the model. For manufacturing and other manufacturing, the import demand only responds into changes in income and not into price changes. Except for paper and transport sectors, import elasticity with respect to relative prices is insignificant. Short-term elasticities give similar results. Over all, like in the case of total economy, mainly income drives imports. For instance, the result for agriculture and mining sectors depict insignificant elasticities

except lagged imports and lagged residuals. Normally, residuals are significant for all properly specified regressions. The significance of the coefficient of lagged imports basically suggests that the last period imports influence current period imports, which is very appealing. For manufacturing and other manufacturing, income variable is significant at a 1% confidence level. The result suggests that, for total manufacturing, a 10% increase in economic activity sparks manufacturing imports by 26%. The other manufacturing sector import elasticities imply that a 1% increase in relative prices will reduce imports of other manufacturing by 4%. For the rest of the sectors studied, except for chemical products, metal products, and electrical machinery, elasticities of the demand for imports with respect to both income and prices are insignificant.

As briefly indicated above, the findings of the current study are quite similar to results found by different authors using the recent time-series approach. The findings of the current study are somehow different from results of studies of the import demand done in South Africa (refer to appendices). The most notable issue is that studies using recent time-series methods (for example Senhadji, 1997) have results similar to the current study. That is, for instance, looking at South Africa, Kenya and Argentina, the propensity to import with regards to income is more significant than that of relative prices. For studies using traditional methods (for example, Houthakker et al, 1969 and Khan, 1974) price elasticities are relatively more significant than those of incomes. In the case of Khan (1974), Argentina and Turkey have more significant price elasticities of import demand than that of income. Similarly, Houthakker et al (1969) shows results where South Africa has a very significant import demand elasticity with respect to real income.

The similar result is found in Kahn (1987), for all sectors studied, either price elasticities are as significant as income elasticities or the propensity to import with regards to prices is higher than that of income.

Looking at results from a different perspective it transpires that the results of capital-intensive sectors are slightly different from the results of labour-intensive sectors. The same applies between sectors that are import competing and export oriented. It is also observed that most labour-intensive sectors are non-natural resource based whilst many capital-intensive sectors are natural resource based. For capital-intensive sectors the price elasticity of the import demand is relatively insignificant compared to the price elasticity of the demand for labour-intensive commodities. For example, the average response of relative prices to import demand of capital-intensive commodities is -0.71 with a t -value of -2.36 whilst the response to import demand for labour-intensive goods is almost -3.00 with a t -statistic of -2.07 . This can be interpreted to mean that a 10% rise in relative price of capital-intensive goods reduces imports of these goods by 7% whilst an increase of labour-intensive goods relative price by the same percent reduces imports of labour-intensive goods by almost 30%. The results also show that economic activity is more responsive to labour-intensive goods than capital-intensive goods. On average, a rise in economic activity by say 10% will increase the demand of labour-intensive commodities by 33% whilst the demand of capital-intensive goods rises by 14%.

It also seems that the natural resource-based sectors' import demand does not necessarily depend on relative prices. This is shown by the overall economy import demand regressions that showed insignificant relative price elasticities. The manufacturing sector as a whole also shows the same result. The main economic sectors combined and averaged show that a 10% rise in relative prices will decrease demand for imports by 4% whilst an increase in economic activity by the same percent will increase imports by 23%. These results show that a rise or a decrease in prices does not really affect the current account in South Africa.

5. POLICY CONCLUSIONS

The summary result is that the income elasticity is generally elastic compared to the price elasticity to import. The description of the South African import performance also highlights the dependency of SA economy on imports. This is acknowledged in many studies and it taken as common knowledge. Also noted in other research papers is that South African exports have not grown sufficient enough in the past so as to ease the foreign exchange problem. All these points highlight the dilemma faced by the SA economy as regards sustainable economic growth and job creation.

The empirical results suggest that the exchange rate policy does not have any major influence in curbing unnecessary imports. This calls for more direct policy interventions that may somehow be unpopular to other economic agents but beneficial for the entire economy in the longer-term. Also clearly suggested by results is that a change in economic activity influences the demand for imports. In fact, the model results imply that if the SA economy grows faster (even at about 3% level) South Africa will experience the balance of payments crisis that in turn will retard economic growth.

In policy terms, the foreign exchange shortage must urgently be dealt with. It is obviously both inconsiderate and unrealistic to suggest that the income policy should limit the level of economic activity. It is also better said than done to suggest that the government trade and industry policy should increase South African exports. Increasing exports sufficiently enough to evade or solve the foreign exchange constraint depends on a number of factors that may be beyond the control of the SA government such as world demand for SA commodities. The results also highlight an important point that certain groups are going to be affected more in the future than in the past, particularly given some adverse effects of globalization. Given the pace of trade liberalization in South Africa and high income elasticity to import, it seems logical that imports are going to increase faster with no means to eradicate the balance of payments constraint.

In terms of policy suggestions, the study suggests that the SA's economic policy should aim at strengthening domestic industries and expanding the domestic market. It seems unlikely that SA trade policy at the present juncture will lead to higher exports. Equally

unlikely, is the bending of exchange rates to curb imports and escalate exports. It is therefore justifiable to argue that the affected sectors of the economy desire special attention. For instance, the importation of labour intensive commodities should be controlled and/or special, well-defined targeted programmes should focus on increasing productivity and competitiveness of the labour intensive industries. This involves upgrading of technology and human resources. This study is very conscious of an important role played by imports. Indeed South Africa needs imports of certain commodities. However, importation of commodities already produced domestically needs some careful consideration. The major challenge for the SA trade and industrial development strategy is to ensure that South African industries are able, in the longer-term, to replace goods produced by foreign firms.

In conclusion, there are some important findings that emanate from this study. The study argues for the need of a focus on the balance of payments question. The analysis shows that the South African imports are high. The study also tentatively confirms the import-investment nexus. An important result is that the demand for imports is more responsive to income than to relative prices.

In the literature review sections, it comes out that there remain some uncertainties with regards to proper methods used in modeling economic series. However, recent developments have provided invaluable inputs to modeling series properly. This study has shed some light on two fundamental topics.

It has made technical contributions in terms of the time-series techniques. And most importantly, it has highlighted very important points regarding South Africa's import demand.

It can be tentatively concluded that there is a high probability that South Africa's economic growth is constrained by the shortage of foreign exchange, at least during the period under investigation. The analysis shows that South Africa has a high import demand elasticity with respect to economic activity. This implies that every time the economy grows fast, imports rise faster thereby eroding insufficient foreign exchange. In turn, through a multiplier of effects that results to low gross domestic product. As argued above, if this is the case, the pace with which trade liberalization proceeds can bear negative effects to the economy. It is important to note this point, especially because section two shows that large portion of South Africa's imports are labour-intensive manufacturing.

Lastly, the study has not exhausted all relevant issues. As said in the introduction, the study was intended to focus on import demand elasticities and not trade or macro-economic issues in general. However, the discussion has occasionally alluded to other related issues. It can, possibly, be recommended that further research should be conducted in this area. First and foremost, there needs to be a substantial examination of the foreign exchange question. Perhaps one possibility would be to extend the analysis. That is to examine import demand and export supply elasticities with a well-tested econometric model so as to ascertain the effectiveness of the devaluation policies and

adjoin our comprehension of the South African balance of payments dynamics. In addition, results of section two suggest that further research should be conducted using data exploited in that section. For instance, some of the data can be used, once enough data observations are available, to calculate trade elasticities in terms of specific countries and/or group of countries, trading blocks, and commodity groups. The same data can also be utilized to calculate South Africa's trade balance in the manner that will increase our understanding of South Africa's real foreign trade position with countries and group of countries. In this way, studies can establish the main international markets for South Africa and the products with which South Africa has a comparative advantage or products South Africa could sell to those markets. Also, the relationship between imports and investments needs further investigation, particularly the mechanisms by which this relationship affects the current account of the balance of payments.

Section three also raises some important research needs. Most importantly, empirical studies on foreign trade should begin to explore other methods of analysis. For instance, import demand studies should examine not only relative prices and income when dealing with the determinants of the import demand. Studies should begin, amongst other things, to ensure synergy between the empirical work and macroeconomic theory, integrate the real and financial sectors, and take into account inter-country differences.

Lastly, in the mean time, the government needs to mobilize resources towards researching the constraints to faster growth of the South African economy. One other possibility, in the short-term, is to have a clear policy on appropriate intervention. There needs to be a policy on how to conserve scarce foreign exchange. The government can embark on a policy that discourages importation of products that are available in the South African market.

Another possibility is to find a means by which foreign exchange can be increased. That is, for example, the government or policy makers can embark on a policy that generates foreign exchange, perhaps through exports. A dilemma here is that there is no guarantee that exports will rise adequately enough to raise sufficient foreign exchange.

APPENDIX I
SELECTED RESULTS OF STUDIES REVIEWED IN SECTION 3
(Values in brackets denote t-statistics)

Time-series Estimation of Structural Import Demand Equations
Senhadji, 1997

Table 1: Import demand equations.

	m(-1)	p	gdp _x	AC	Ser	R-squared
South Africa	0.50 [3.96]	-0.53 [-3.43]	0.33 [3.39]	0.19 [1.10]	0.10	0.87
Kenya	0.47 [3.38]	-0.77 [-3.61]	0.55 [3.69]	-0.33 [-1.54]	0.12	0.75
Mexico	0.69 [5.22]	-0.37 [-2.18]	0.44 [2.37]	0.55 [4.50]	0.16	0.94
Argentina	0.42 [3.50]	-0.64 [-5.00]	0.80 [4.57]	0.19 [1.01]	0.16	0.80

Income and Price Elasticities in World Trade
Houthakker and Magee, 1969

Table 2: Import Elasticities 1951-1966.

C	Income	Price	R-squared	D.W.
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South Africa	-0.21 [-0.09]	1.13 [5.42]	1.04 [1.60]	0.796 [0.0954]	1.42 [13.0]
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Income and Price effects in Foreign Trade Goldstein and Khan, 1985

Table 3: Long-run price elasticities of demand for total imports.

Country	Houthakker -Magee (1969)	Adams et al. (1969)	Taplin (1973)	Goldenstei n-Khan (1980)	Beenstock Minford (1976)	Samuelso n (1973)
Germany	-0.24	-0.85	-0.61	-0.25	-0.74	-0.92
France	....	-0.81	-0.39	n.a.	-1.31	-0.79
USA	-1.03	-1.16	-1.05	-1.12	-1.04	....
UK	-0.21	...	-0.22	...	...	...
Japan	-0.72	...	-0.81	n.a.	-1.21	...

Table 4: Long-run price elasticities of demand for total imports.

Country	Gylfason (1978)	Stern et al. (1976)	Armington (1970)	Geraci and Prewo(198 0)
Germany	-1.36	-0.88	-1.48	-0.60
France	-0.46	-1.80	-1.53	-0.33
USA	-1.12	-1.66	-1.73	-1.23
UK	...	-0.65	-1.38	-0.79
Japan	...	-0.78	-1.47	-0.72

Devaluation, Relative Prices, and International Trade Reinhart, 1995

Table 5: Import Demand, 1970-91.

Country	C	pm/p	y	R-squared
Kenya	1.960 [0.809]	-0.650 [0.340]	0.095 [0.391]	0.675
Hong Kong	-1.247 [0.623]	-1.280 [0.362]	1.402 [0.049]	0.985
Mexico	-3.360 [3.128]	-0.393 [0.143]	0.893 [0.388]	0.884

**Import and Export Demand in Developing Countries
Khan, 1974**

Table 6: Imports

Country	C	Price	Income
Argentina	-1.402 [1.85]	-0.850 [1.11]	0.143 [0.28]
Ghana	3.596 [0.08]	-1.057 [0.12]	0.238 [0.03]
Morocco	0.139 [0.30]	-0.981 [0.79]	0.213 [1.13]
Turkey	-1.793 [0.86]	-2.715 [1.32]	0.554 [1.15]

**APPENDIX II
SELECTED RESULTS OF STUDIES REVIEWED IN SECTION 3.11
(Values in brackets denote t-statistics)**

Table 1: *Manufacturing Sector (ISIC) - Almon Lag Equations 1974-1986*

Dependent Variables	Relative				R ²	SE	DW
	Constant	Prices	GDE	Time			
Import Volumes	-18,80 (-16,4)	1,15 (3,28)	2,16 (11,2)	-0,007 (-2,69)	0,092	0,05	1,85
IPR	-10,75 (-9,54)	1,40 (4,96)	1,02 (5,4)	-0,005 (-2,12)	0,91	0,05	1,78

Source: Kahn (1987: 244)

Table 2: *Manufacturing Sector (ISIC) - Partial Adjustment Model 1974-1986*

Dep.	Relative	Dep. Var.
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Var.	Const.	Prices	GDE	(-1)	R ²	SE
Import	-7,31	0,55	0,72	0,61	0,90	0,06
Volumes	(-5,19)	(5,33)	(4,90)	(8,15)		
IPR	-3,18	0,44	0,26	0,75	0,89	0,05
	(-3,09)	(4,19)	(2,60)	(11,5)		

Source: Kahn (1987: 245)

Table 3: Agriculture (ISIC)

(a) Almon Lag Model

Dep.	Const.	Relative Prices	GDE	Time	DUM	R ²	SE	DW
Import	-1,33	0,79	0,19	0,00	0,33	0,9	0,05	1,80
Volumes	(-1,09)	(3,22)	(1,09)	(0,07)	(10,9)			

(b) Partial Adjustment Model

Const.	Relative Prices	GDE	Imp. Vol(-1)	DUM	R ²	SE	h	Mean Time
-0,58	0,55	0,097	0,28	0,33	0,9	0,05	0,47	0,4
(-0,55)	(2,89)	(0,618)	(2,41)	(10,9)				
	0,76	0,135						

Source: Kahn (1987: 245)

Table 4: Chemicals (SITC) and Machinery and Transport Equipment (SITC)

Dep. Var.	Const.	Relative Prices	GDE	Time	R ²	SE	DW
Import	-7,97	1,37	0,70	0,01	0,73	0,08	2,13
Volumes (Chem.)	(-2,98)	(2,61)	(3,05)	(3,59)			
IPR (Chem.)	-5,85	1,55	0,37	0,001	0,25	0,09	2,33
	(-2,04)	(2,73)	(1,48)	(0,25)			
Imp. Volume (Mach)	-22,1	0,14	2,96	-0,02	0,92	0,06	1,72
	(-16,3)	(1,52)	(15,2)	(-4,98)			

IPR	-12,85	0,64	1,63	-0,01	0,91	0,06	1,73
(Mach)	(-9,50)	(2,41)	(8,45)	(-3,39)			

Source: Kahn (1987: 246)

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