DETERMINANTS OF IMPORTS DEMAND IN ZAMBIA

BY

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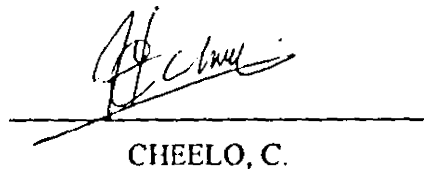
Research paper submitted to the Department of Economics, University of Nairobi, in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Economics.

DECLARATION

This paper is my original work and has not been submitted for a degree in any other University.



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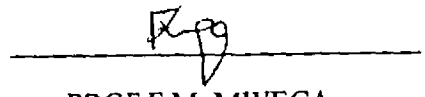
We the undersigned declare that this research paper has been submitted for examination with our approval as University supervisors.



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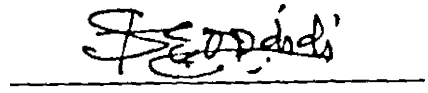

MR S. ODIDI

DEDICATION

This research paper is dedicated to my loving and ever-supportive parents, Mr and Mrs Cheelo.
I also dedicate it to the love of my life, Ms. Sophia Kitundu and our beautiful baby boy, Momba Cheelo.

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ABSTRACT

This study utilizes an error correction model to examine the determination of aggregate imports and components in Zambia between 1965 and 1997. The estimation results indicate that, in the short-run, (lagged) foreign exchange receipts, international reserves, real income and previous imports all significantly determined the behaviour of aggregate imports over the reference period. Findings also show that aggregate imports were not significantly responsive to relative import prices. The non-significance of the relative price elasticity suggests that trade policies that concentrated overly on expenditure-switching such as tariff and non-tariff restrictions or devaluations did not, over the study period, effectively assist trade policy reform efforts. On the other hand, the significance of the foreign exchange receipts, international reserves and real income elasticities suggest that policies which directly enhance foreign exchange availability and promote stabilization are likely to have a greater impact on import volumes than policies that only act on the aggregate demand for imports. Thus, policy-makers aiming to significantly influence imports demand would do so more effectively through the latter policies.

CHAPTER ONE

1.0 INTRODUCTION

International trade is widely acknowledged as an essential element in broadening the prospects for economic expansion. To this extent, international trade has been described as an engine for economic growth. It promotes domestic efficiency, international specialization and international competitiveness, ultimately leading to greater levels of global output. Undoubtedly, the process of global expansion critically depends on foreign trade activities.

In addition, the process of economic expansion or growth sets in motion a growing demand for capital and consumer goods as well as raw materials to sustain the expansion. Harrod and Hague (1963) have stressed the need to sustain increasing levels of consumption, investment and production as growth progresses. Clearly, economic growth necessitates the provision of additional resources as it occurs. However, the provision of these extra resources cannot be sustained out of domestic supply alone, implying that imports of foreign resources are necessary to fill the gap between a growing domestic aggregate demand and a limited supply. Imports are therefore introduced as a vital component in international trade and economic development.

The vital role played by imports in foreign trade and development is perhaps what generated the current widespread interest in explaining the determinants of imports in developed (DCs) and less developed countries (LDCs) alike. The result was the development of various import demand models most, of which utilized diverse model specifications to explain import behaviour. Several authors have acknowledged that while traditional import models relating import demand to relative import prices and economic activity performed relatively well in explaining import behavior in DCs, these models had little relevance in the context of LDCs. They point out the prominence of internal rigidities (such as foreign exchange constraints, policy interference and failure, borrowing constraints, and so on) and external shocks (such as commodity price fluctuations, weather shocks, world recessions, and the like) in affecting the capacity of LDCs to import. Contemporary import models have therefore been proposed which are more relevant to LDC cases. For instance, Moran (1989) develops and estimates two models that explain import behaviour under a foreign exchange constraint, arguing that such models are more appropriate representations of import behaviour in

LDCs. His study therefore emphasizes the role of foreign exchange availability in foreign trade and development.

This current study focuses on examining the determinants of aggregate imports and major components in Zambia for the period 1965-97. Considering that time-series data usually have time characteristics, the study utilizes tests for stationarity and cointegration analysis to develop a short-run (dynamic) error correction model of import demand. The role of relative import prices, foreign exchange availability and economic activity are duly considered in this paper.

The layout of this paper is as follows: Chapter one gives the introduction (Section 1.0) and provides a background analysis of Zambia's historical trade profile (Section 1.1) as well as the evolution of exchange rate and trade policies in Zambia. In Section 1.2, the statement of the problem is made. In Section 1.3, the objectives of the study are delineated, while the justification is given in Section 1.4. Chapter two discusses the literature review, taking into account both theoretical (Section 2.1) and empirical issues (Section 2.2). Chapter three outlines the methodology that is employed in the study, highlighting the theoretical framework (Section 3.1), the model specification (Section 3.2), the variable definitions and data sources (Section 3.3), and the estimation procedure (Section 3.4). Section 4.0 gives the regression results of the aggregate and component import demand equations as well as their interpretation. In Chapter five, a summary of the research findings is given and the concluding statement is made.

1.1 BACKGROUND

1.1.1 DESCRIPTIVE ANALYSIS OF ZAMBIA'S TRADE PROFILE

Foreign trade is definitely one of the most important sets of economic activity that has shaped the Zambian economy since independence in 1964. Several important economic and socio-political events in the country's history can be linked directly or indirectly to major foreign trade issues and events:

1. Foreign trade in primary commodities (i.e. copper and cobalt) has constituted the main means by which the country earns foreign exchange. In 1964, copper export earnings contributed 91

per cent to total export earnings, a percentage that grew to an all-time high of 96 per cent in 1970 and declined to a low of 83 per cent in 1986 (Aron and Elbadawi, 1992). By 1996, copper contribution to exports had however declined to approximately 58 per cent[1] (Ministry of Finance, 1999). Overall, it was the favorable metal prices and high mineral production, and the resulting build-up of international reserves during the copper boom period (1964-74) that enabled the country to construct the post-independence socioeconomic infrastructure.

2. Changing patterns of world commodity demand and consumption have considerably changed the domestic structure of the Zambian economy over time. For instance, the inheritance from the colonial era of copper as the key export commodity in the 1960s transformed Zambia into an export-enclave mono-cultural economy that became progressively more dependent on copper exports for foreign exchange. This translated into a precarious external dependence of the economy, given the instability of world commodity prices.

3. The precarious position of the Zambian economy with respect to external shocks, which was exposed by the adverse effects following the end of the copper boom (around 1974), can be linked to Zambia's trade profile. Some of the major problems to emerge partly through the foreign trade sector include: the accumulation of short-term trade arrears and the associated debt crisis, a persistent balance of payment (BOP) deficit with the associated run-down of foreign reserves, an increasingly overvalued domestic currency which was due to a fixed exchange rate and foreign exchange controls (until 1992), and a highly inefficient industrial sector.

4. Attempts to transform the Zambian economy into a diversified, modernized economy were largely centred on international trade policies. For example, the import-substitution strategy of the late 1960s and especially the 1970s involved considerable direct and indirect trade controls including a highly differentiated tariff structure with high tariffs as well as several administrative controls. Domestic manufacturers, being heavily import- dependent were also heavily subsidized to cushion them from the effect of the price-wedge created between foreign (suppliers') prices and domestic prices of imports. Similarly, the attempts to change the Zambian economy into a progressively mixed economy in the 1980s were characterized by trade liberalization efforts (among other reforms). The International Monetary Fund (IMF) negotiated economic reforms under Structural Adjustment Programmes (SAPs), though spotted with reversals, played their role in influencing economic transformation. Also, in the 1990s, the

radical reforms taken to drive the economy towards being a free market economy featured trade liberalization as a prominent policy reform.

The foregoing outline, though a summary of Section 1.1.2 below, is meant to highlight the significance of foreign trade activities in Zambia's economic development since independence and to expose Zambia's critical dependence on trade issues. Some of the salient issues underlying the outline include the behaviour of imports in response to influences of the exchange rate, foreign exchange availability and the level of economic activity. These factors were in turn variously affected by changes in the government's exchange rate and trade policies as well as external factors.

Therefore, the next section provides a detailed discussion of the historical evolution of Zambia's exchange rate and trade policies in response to domestic needs and external shocks. Here, emphasis is primarily on the implications for imports of the changes in relative import prices, foreign exchange availability and economic activity that resulted from the various external shocks, and exchange rate and trade policy reforms.

1.1.2 THE EXCHANGE RATE, TRADE POLICIES AND SHOCKS IN ZAMBIA

RELATIVE PROSPERITY: 1964-73

During the early years of independence, Zambia pursued relatively passive exchange rate and trade policies. Most policies proceeded along the lines laid down in the colonial period (before 1964) and would, according to the *White Paper on Industrial Policy of 1964*, be capitalist oriented.

At the dissolution of the federation of Northern Rhodesia, Southern Rhodesia and Nyasaland (1953-63) for instance, Zambia (formally Northern Rhodesia) had been the only country of the three to relax foreign exchange restrictions imposed in 1961. This liberalization measure that, in fact has been described as 'minor', was accordingly adopted at independence and maintained until the early 1970s (Aron and Elbadawi, 1992).

At independence, a fixed exchange rate was adopted. The Zambian Pound, which was later replaced by the Zambian Kwacha on 16th January 1968, was pegged to the Sterling Pound and was fully

convertible. An official exchange rate of K0.714/US$ or K1.4/ST was established and maintained as a fixed rate from 1964 until the early 1970s (Andersson and Kayizzi-Mugerwa, 1993)

Originally, import licensing was devised only to avoid congestion following the closure of certain transport routes in the 1960s, not to control import levels *per se*. The import licensing structure was not changed much during 1964-71, while the relatively low tariffs (especially on capital goods) adopted at independence were similarly maintained during the period.

At the same time, the favourable copper prices stimulated high mineral production during the copper boom period, resulting in increases in mineral incomes and an accumulation of international reserves. Consequently, this altered domestic consumption patterns, first as a result of habit formation arising from the newly acquired capacity to import, and second, due to the impact of the 'international demonstration effect'[2] via the consumption habits of the affluent classes in both government and industry (Anderson and Kayizzi-Mugerwa, 1993). For imports, the implication was that the altered patterns of domestic consumption caused continual increases in the volume of imports starting in 1964.

Active exchange rate and trade policies in Zambia emerged primarily because of radical economic reforms that were undertaken in the boom period. These economic reforms began in 1968 with the *Mulungushi Reforms*[3]. The capitalist orientation that had been adopted at independence was discarded with emphasis being focused instead on self-reliance, government nationalization and industrialization via import substitution. Government nationalization of the mining companies as well as a number of foreign-owned firms saw the expansion of the public sector's share of capital investments from $180.4 million (or 42.3%) during 1954-64 to $281.8 million (or 67.7%) in 1966-70. Conversely, private sector capital investments shrunk from $245.7 million (or 57.7%) to $147.5 million (or 34.3%) during 1954-64 and 1966-70, respectively (Kabwe, 1989). Concomitantly, in pursuit of economic diversification, industrialization was vigorously followed at the expense of the traditional agriculture sector. According to Seshamani (1992), "Zambia's industrial strategy...favored the growth of luxury – and semi-luxury-goods industries which satisfy the demands of people in the upper-tax brackets"(p.51). With a rigidly capital intensive mining sector, the result of nationalization and industrialization was that imports of both intermediate and capital goods which were rudimentary to the sector increased considerably. Import substitution, which was

successful in the manufacturing sector, could not be realized in the mainstay-mining sector of the Zambian economy.

Given that Zambia was still experiencing the copper boom, the government adopted price controls together with subsidies to both parastatals and urban consumers. The subsidies were meant to sustain the import-boost caused by industrialization as well as the domestic consumption patterns that emerged out of habit formation.

In 1971, as a result of a negative copper price shock, the government tightened foreign exchange controls in an attempt to protect international reserves. However, by 1972, with total capital outflows around 2.5 times higher than the capital inflows (during 1970-74), Zambia's impressive stock of foreign reserves, nonetheless started to decline (Ndulo and Sakala, 1987). Therefore, tightening exchange controls alone at this stage was perhaps a futile exercise.

Similarly, mineral incomes to the government declined from a high of 71 per cent of the fiscal budget in 1965 to a 19 per cent low in 1972 (Aron and Elbadawi, 1992).

In 1972, a restrictive import licensing system was therefore introduced. Certain categories of imports were banned, but capital and intermediate goods were liberally licensed to maintain support of the import-substitution industrialization strategy.

The resulting overall economic difficulties that were to follow after 1973 were therefore not wholly to blame on the impact of mineral dependence or external shocks. The unsustainable strategy of 'subsidy-supported' import-substitution bears much of the blame. This latter strategy, together with mineral dependence and external shocks are the main factors accounting for the extensive use of trade policies such as quantitative import restrictions (enforced through stringent foreign exchange controls) and highly differentiated tariff structures characterized by high tariffs as well as administrative exchange rate management after 1971.

SHOCKS AND ECONOMIC DECLINE: 1974-83

The mid-1970s marked a sharp discontinuity in the development of Zambia's economy due partly to a weak foreign trade structure. The economy's terms of trade fell sharply following the first oil

crisis and the associated world economic recession. The economy's structural limitations in terms of extreme dependence on copper, a fragile manufacturing base and a neglected agricultural sector were exposed. The relative openness of the economy ensured that the effects of external shocks would be readily transmitted into the economy.

A number of shocks were reportedly experienced starting in 1973. Oil prices increased threefold in 1973/74 resulting in the unit value of imports (price index) rising by 30 per cent, while copper prices raised the unit value of exports by only 20 per cent. The following year (1975) import prices continued to rise but copper prices crashed, falling by 40 per cent. With 1975 as a base year of 100, Zambia's terms of trade deteriorated only to 92 in 1974, but dropped to 47 a year later (Caves and Jones, 1994). Therefore, in 1975, the trade balance turned negative[4] for the first time following the decline of the value of exports and consequently, the current account registered a deficit of 30 per cent of gross domestic product (GDP) (Adersson and Kayizzi-Mugerwa, 1993). A drop in imports of almost 75 per cent in real terms was subsequently registered as well as a fall in per capita GDP of some 35 per cent (Todaro, 1992). Better copper prices and the reduction of imports turned the trade balance positive in 1976, but this was short-lived as a second oil crisis of 1978/80 set in, resulting in a sharp decline of the terms of trade. This led to a weakening impact on the BOP, eventually transforming the BOP problem into a crisis.

Treating the crisis as temporary, the government increased its borrowing from bilateral and multilateral sources and further ran-down foreign reserves. Reportedly, although reserves were reduced to less than K100 million, just sufficient to cover eight weeks of imports, the government only managed to reduce the deficit by 10 per cent (Andersson and Kayizzi-Mugerwa, 1993).

As real export revenues continued to decline, while import prices rose, the government effected a number of policy reforms. With the objective of reducing aggregate imports, the restrictive import licensing system introduced in 1972 was reformed and tightened. Thus, starting in 1975, an elaborate system of import licensing was operated in conjunction with a highly differentiated tariff structure featuring generally high tariff rates. According to Colclough (1988) (quoted in Caves and Jones, 1994), in practice the system grew too complex and unwieldy to run smoothly. Nonetheless the effected measures continued to be strictly enforced until the liberalization reforms of the early 1980s came into effect. Also, the stringent foreign exchange controls initiated in 1971 were further tightened and continued to be strictly applied.

Aiming to improve the cash-flow situation in the mining companies as well as to reduce imports and improve the competitiveness of Zambian exporters, exchange rate adjustments were undertaken in 1976 and 1978. Exchange rate policy was therefore passive during the entire period (1974-83) save for the two devaluations and another one in January 1983 (see Table 5b in Appendix 1). The continued administrative management of the exchange rate meant that in-between adjustments, the domestic currency would become overvalued, leading to parallel markets for foreign currency (Aron and Elbadawi, 1992).

In 1978, Zambia for the first time received financial assistance under an IMF negotiated action programme. The programme was aimed at helping to restore BOP equilibrium and reducing the rate of inflation. This marked the beginning of a long Zambia-IMF relationship.

The recession, the continual increase in import prices and the associated external imbalance together with Zambia's industrial strategies had an adverse impact on the import-substitution efforts. Though the 'second stage' of import-substitution had been embarked on, the escalating cost of capital and intermediate goods inhibited further progress for the heavily import dependent manufacturing sector. Although import reductions arising from increased import prices did not directly affect the backbone mining sector of the economy, they did increase the cost of machinery and other inputs, thus affecting the profitability of copper extraction. Also, increased import prices did directly affect other sectors of the economy. Seshamani and Samanta (1985) (quoted in Seshamani, 1992) estimated the import content of manufactures at 46.5 per cent in 1970, 71.9 per cent in 1975, and 53.0 per cent in 1981. Seshamani (1992) uses these (and other) statistics to argue that the following features characterized Zambia's industrial structure by 1982: import substitution, heavy import orientation (or dependence), little export orientation and minimal linkages with the rest of the economy. Thus, extensively discussing the impact of import substitution industrialization (ISI) on various sectors of the economy, Seshamani opines that because of Zambia's particular industrial structure, external dependence was merely shifted and not eliminated by the ISI strategies. For example, some firms simply shifted their imports from high-cost capital goods to spare parts. Ultimately therefore, "industrialization and the attendant growth of the manufacturing sector [had] achieved some sectoral diversification, but by and large failed to live up to its major objectives of regional diversification, reduction in import dependence, and the promotion of employment and linkages within the domestic economy" (Seshamani, 1992; p.5).

Thus, although the action programme negotiated with the IMF (1978) was relatively successful, by 1982, budgetary and continued BOP difficulties were highly accentuated by the effects of: failing ISI strategies, unprecedented increases in subsidies to maize[5] consumption and increased food imports due to two years of drought. The Zambian economy therefore continued to face severe internal and external problems almost two decades after independence.

REFORMS, POLICY REVERSALS AND FURTHER DECLINE: 1983-92

The continued economic decline forced the government to embark on a multifaceted SAP negotiated with the IMF in 1983. Seshamani (1992) states that the SAP had the objectives of diversification of exports and promotion of economic growth, correction of price distortions by encouraging market determined prices, decontrol of interest rates, reform of the trade and tax systems, and reduction of administrative controls and tariffs. The switch of administrative controls for market forces posed a considerable problem for the government because it directly threatened certain interest group that had been in charge of control-enforcement and benefited from 'rent-seeking' (Kabwe, 1989).

The SAP also resulted in a foreign currency auctioning system, which became full-fledged by 1984. Aron and Elbadawi explain that: "during 1984 and 1985 the importance of the role of the exchange rate as an economic policy instrument to induce the required structural adjustment was increasingly emphasized, culminating in the foreign exchange auction {episode 4 (1985:4-1987:2)}" (see also, Table 5b in the Appendix 1). According to Seshamani (1992), in the first week after the introduction of auctioning, the value of the Kwacha fell from 2.42 to 5.01 to the US dollar, and the rate steadily declined thereafter.

A depreciating domestic currency, accelerating inflation and loss of purchasing power by fixed-wage-earners made the auctioning system unworkable, and together with food riots in two of Zambia's largest cities in December 1986, put increasing pressure on the government to abandon the liberalization effort. In May 1987, Zambia abandoned all IMF supported SAPs and introduced the *New Economic Recovery Programme* (NERP), reversing the earlier liberalization attempts. According to Caves and Jones (1994) among the policies advocated for were:

1. A fixed exchange rate, which was to be determined by a foreign exchange allocation committee (FEMAC);

2. Foreign exchange controls, with all allocations of foreign exchange and issue of import licenses decided by FEMAC;
3. Price controls of strategic commodities like maize;
4. Fixed interest rates; and
5. A ceiling on debt servicing to 10 per cent.

The new system of foreign exchange allocation (aforementioned) was biased in favor of the traditional business, implying that the generally inefficient parastatals would be kept going by the system. Few new comers managed to enter the market.

By early 1989, various problems including the complete withdrawal of the IMF, the World Bank and other donor agencies' assistance as well as persistent macroeconomic imbalances forced the government to re-introduce the liberalization package of the early 1980s. This however, did not translate into a complete liberalization drive. For instance, price and interest rate controls as well as substantial subsidies continued to be a prominent feature in the Zambian economy. All the same, the exchange rate policy was again drastically changed with a crawling-peg system being adopted in 1989 and a dual exchange rate system being introduced later in 1990. The dual system comprised two windows, the 'official rate'[6] and the 'market rate'[7]. During the year (1990) more and more items were transferred to the second window and FEMAC, which had been maintained despite new liberalization efforts, was cancelled.

The mix of IMF/World Bank and 'own' policies had little to show in terms of achieving economic growth or diversification. "The failure of aspects of the period's economic reforms relating to foreign exchange auctioning and exchange rate management were direct outcomes of macroeconomic policy laxity." {Pinto, 1987 (quoted in Aron and Elbadawi, 1992:p.2)}. The combined effect of external shocks and domestic policy failures kept the Zambian economy struggling with problems of a huge debt burden, high inflation and external imbalances, leading eventually to a switch to multiparty democracy and the establishment of a new government in November 1991.

RENEWED LIBERALIZATION EFFORTS AND CONTINUED PROBLEMS: 1992-2000

According to Andersson and Kayizzi-Mugerwa (1993), even in the context of the sub-Saharan African performance, Zambia's economic decline was rather extreme. As a result of Zambia's particular pattern of economic evolution, by 1992 the economy was facing several problems (as delineated above). To this extent, economic reform to facilitate structural adjustment featured prominently in the advice given to the 'new' Zambian government by economic observers and international institutions. Among the reforms advocated for, privatization and trade liberalization were greatly emphasized with the objectives of:

1. Promoting private sector participation in economic activity;
2. Reducing public sector dominance in commercial activities;
3. Compressing imports;
4. Encouraging international competitiveness, diversification and exports; and
5. Improving general economic performance and external balance in particular.

To realize the aforesaid as well as other objectives, a *Policy Framework Paper for 1992-94* was adopted in February 1992, outlining extensive reforms that would be gradually implemented during 1992-94. Other reforms would be implemented through subsequent policy framework papers. A characteristic feature of these policies designed with respect to the new SAPs, particularly those relating to trade liberalization and BOP stabilization was that they were negotiated with and heavily supported by the IMF and World Bank.

In 1992, prices and interest rates were completely decontrolled so that they were essentially market-determined; while the 'subsidy-system', which had started being rationalized in 1989, was completely abolished in 1992, and massive privatization and parastatal reform efforts ensued. Consequently, all parastatals were privatized, liquidated or rationalized (downsized) (Ministry of Finance, 1996).

Also in 1992, a floating exchange rate system was introduced, making the exchange rate market-determined except for situations where the Bank of Zambia would intervene in the foreign exchange market to smoothen sharp short-term exchange rate fluctuations. This reduced the role of the exchange rate as a policy instrument and subsequently, the overvalued Kwacha depreciated considerably from K24/US$ in December 1989 (under the managed float) to K958/US$ and

K1220/US$ in 1992 and 1993, respectively (Bank of Zambia, 1994). The main factors reportedly responsible for the Kwacha's drastic depreciation in the second half of 1993 were fiscal deficit overruns in 1992 and accelerated money growth early in 1993. However, persistent stabilization efforts supported by the IMF resulted in: a decline to inflation of 35 per cent after six years of annual inflation in excesses of 100 per cent, increases in holdings of Kwacha-denominated financial assets by the public, and a subsequent fall in demand for foreign exchange. Eventually the exchange rate stabilized[8].

All domestic and external trade, except petroleum, was left to the private sector, while the levels and dispersion of customs duties were reduced. The maximum tariff was reduced to 40 per cent and the minimum tariff was generally increased to 20 per cent (Ministry of Finance, 1997). Despite this reform however, trade policies still made it difficult for non-traditional exporters and many import-competing firms to be competitive because they were heavily dependent on imported capital and intermediate goods that faced duties of between 20 to 30 per cent. The government also made attempts to improve the duty drawback system to relieve exporters from domestic indirect taxes, but this did not provide any substantial effective relief. Similarly, many import-substitution activities continued to face difficulties as they received lower nominal protection on their outputs than the customs duty rates paid on imports (Ministry of Finance, 1996).

In 1996 therefore, Zambia adopted an integrated package of customs duty reductions and removal of most exemptions. The main feature of this reform was to lower customs tariff rates on most goods by 15 per cent, resulting in a tariff structure ranging from 0 to 5 per cent for most capital goods, 10 to 15 per cent for intermediate goods and 20 to 25 per cent for final products. The difference between the highest and lowest tariffs was therefore 25 percentage points (Ministry of Finance, 1997). A 5 per cent import declaration fee (IDF) introduced in 1992 was still in effect in 1998, accounting for about 10 per cent of total foreign trade tax revenue (Bank of Zambia, 1999). The IDF was indefinitely maintained despite reiterations in 1996 that it would be cancelled. Revenue considerations are perhaps the main explanation for its continued maintenance.

In 1994, all remaining foreign exchange controls on all external transactions (current and capital) were removed, with all import and export licensing being abolished. The elimination of direct controls on trade however, exempted a short list of items that were controlled for environmental, health or security reasons.

Attempting to realize external viability, Zambia built-up its gross foreign reserves from only four weeks of imports in 1991 to just over ten weeks of imports by the end of 1994. Foreign reserve accumulation was however, rather problematic during the 1990s because the economy continued to be heavily dependent on copper and cobalt for foreign exchange. In 1998, copper and cobalt accounted for over 85 per cent of total export earnings, but prospects for increasing these earnings were very low, given generally low metal prices and considerable declines in mineral production since the early 1970s. Performance in the mining sector continued to be poor as real value added decreased by 24.8 per cent (in 1998). The constrained copper and cobalt production has been attributed to many years of lack of investment at Zambia Consolidated Copper Mines (ZCCM)[9] as well as the depressed metal prices. Overall, copper production, which had declined from over 700 thousand tonnes in 1974 to 441 thousand tonnes in 1990, dropped further to 298 thousand tonnes in 1998 (Aron and Elbadawi, 1992; Ministry of Finance, 1999). With non-traditional exports contributing only a meager 14.4 per cent of total export earnings, the capacity to build up international reserves was severely constrained.

Similarly, with an external debt of approximately US$6.9 billion in 1998 (Ministry of Finance, 1999), the BOP continued to be weak because of the large debt service burden and the continued vulnerability of the economy to external shocks such as drought, fluctuating copper prices and interruptions of IMF-supported BOP assistance. To this extent, the current account balance (excluding net capital grants) improved only marginally from a deficit of US$513 million in 1991 to US$501 million in 1998 (the World Bank, 1999).

Some observers argue that the lower inflation and a market-determined exchange rate due to the SAPs improved the climate for both traditional and non-traditional exports. For instance, positive trade balances of K44 billion, K189 billion and K241 billion were registered in 1993, 1994 and 1995, respectively. A substantial negative balance of K625 billion was however registered in 1996 because of a drought in the 1995/96 farming season (Bank of Zambia, 1999).

Unfortunately, the economy continued to face problems of external shocks and domestic policy failures, and still exhibited severe macroeconomic imbalances. With an inhibited capacity to increase exports significantly, the ability of the economy to build up international reserves remained constrained. Similarly, the market determined exchange rate continually exhibited a considerable amount of volatility, requiring constant Bank of Zambia intervention. Finally, economic activity

remained rather depressed. The combined influence of all these factors has obviously had implications for imports in Zambia.

1.2 STATEMENT OF THE PROBLEM

Given the vital role played by imports in foreign trade and economic development, it is unfortunate that in Zambia only scanty empirical evidence exists to explain import behaviour. For instance, from the literature surveyed (Section 2.2.), Aron and Elbadawi (1992) are the only analysts found who consider import behaviour in Zambia. They consider imports within a wider trade model. Being primarily concerned with the impact of the parallel foreign exchange market, they do not draw specific import policy implications from their evidence. In this respect, policy-makers have struggled to devise import strategies that promote growth without a significant deterioration in the trade balance. Being unable to adequately predict the response of imports to external and domestic shocks in the presence of foreign exchange constraints, the import strategies have not achieved their desired goals. Thus, although exchange rate and trade policies have been extensively used in Zambia to facilitate structural change and to prevent (or correct) imbalances, their effectiveness in actually achieving these objectives is perhaps marginal, judging from the persistent problems the economy continues to face. This suggests that there has been an 'information gap' with respect to evidence-guided policy design.

With the problem of an existing 'information gap' in mind, a study of the behaviour of imports is worth pursuing. Considering that the Zambian economy is fairly open[10] and heavily import-dependent, the behaviour of imports has strong implications for external balance. The foregoing background analysis of Zambia (Section 1.1) clearly exposes the weakening impact of imports (and other factors) on the BOP as evidenced by a persistent current account deficit (excluding net capital grants) of US$264 million in 1988, US$ 513 million in 1992 and US$ 501 million in 1998 (the World Bank, 1999).

This study therefore aims to adequately explain the determinants of aggregate official imports and components in Zambia, explicitly showing the role of exchange rate and trade policies as well as external factors in influencing imports. The estimation of a stable import demand function as well as the associated policy implications is an important step in providing a foundation for rational,

evidence-guided decision-making, partially filling the information gap and aiding policy-makers to predict the response of imports to shocks under foreign exchange constraints.

1.3 OBJECTIVES OF THE STUDY

1.3.1 GENERAL OBJECTIVES

The general objective of this study is to explain the determinants of aggregate (official) imports and major components in Zambia for the period 1965-97 taking account of the time characteristics of the data and therefore, possibly utilizing an error correction model.

1.3.2 SPECIFIC OBJECTIVES

The specific objectives of the study are:

1. To find out to what extent economic activity {proxied by real income or Gross Domestic Product (GDP)} influences imports in Zambia by estimating an income elasticity of demand for imports.

2. To find out the extent to which relative import prices influence imports by estimating a respective elasticity of import demand.

3. To find out the extent to which foreign exchange availability (proxied by international reserves and foreign exchange receipts) impacts on imports by estimating respective import demand elasticities.

4. To find out to what extent previous imports influence imports in Zambia by estimating a respective import demand elasticity.

5. To demonstrate how and possibly to what extent changes in exchange rate and trade policies influenced imports in Zambia.

6. To draw policy implications for imports from the empirical findings.

1.4 JUSTIFICATION OF THE STUDY

The rationale of this study is based on the predication that it is perhaps the first comprehensive study specifically explaining the determinants of aggregate imports and major components. Considering the vital role of imports in foreign trade and development, it is necessary to explain imports demand behaviour in a Zambian context and thereby contribute to the empirical economic literature on Zambia.

Additionally, given that the exchange rate and trade policies followed in Zambia were primarily pursued to improve the BOP position, to raise revenue for the government and to encourage the development of the industrial sector, the effectiveness of these policies is worth considering. It is unfortunate that only scanty analytical and empirical information exists in the country for rational policy guidance in the area of import behaviour. The policy implications drawn from this study are therefore significant in terms of their contribution to informed decision-making.

From an academic point of view, the study is important because it employs econometric techniques that have gained considerable currency in recent times, utilizing stationarity tests, cointegration analysis and an error correction model. The findings of this study are therefore significant because they add to the econometrics literature with respect to the case of Zambia.

CHAPTER TWO

2.0 LITERATURE REVIEW

Imports have continually been given a considerable amount of attention in economic literature, both in relation to macroeconomic adjustment and within the broader context of international trade. The literature relevant to this study of the determinants of imports demand include:

1. Books and articles discussing import behaviour within the wider sphere of international trade theory; and
2. Journal articles and research papers assessing import behaviour from a primarily empirical perspective.

Essentially, trends in both theoretical and empirical literature concerning import determinants are reviewed.

2.1 THEORETICAL LITERATURE

There is a large volume of theoretical economics literature on import behaviour, most of which concerns the economic implications of trade policies on imports and the associated influence of imports on international trade and economic growth. This literature has seen notable patterns of change in focus. From the import demand function contained in the Keynesian General Theory of Employment to the current/contemporary version of the import demand function, focus has changed from the role of national income to the role of relative import prices and trade policies in determining imports. We therefore outline the features of import behaviour emphasized traditionally and those emphasized in contemporary economics theory.

2.1.1 IMPORT BEHAVIOUR IN THE KEYNESIAN GENERAL THEORY

Traditionally and from a strictly economics standpoint, the traditional variables, namely economic activity (usually proxied by national income) and relative import prices are purported to be overly important determinants of import demand in DCs and LDCs alike.

Sodersten and Reed (1994), Hardwick, et al. (1994), Harrod and Hague (1963), Salvatore (1993) and many other scholars of international economics have used an 'Engel Curve'[11] theoretical representation to assert the simple relationship between imports and national income, stressing however that it holds only under certain (restrictive) assumptions[12]. For instance, it is widely postulated that imports are an increasing function of national income, given that the assumptions (referred to above) hold. Furthermore, given these assumptions, the average and marginal propensities to import can be derived and the income elasticity of imports deduced (see, Sodersten and Reed, 1994; Hardwick, et al., 1994). Sodersten and Reed however, acknowledge that these parameters are not constant. They change considerably if the restrictive assumptions are relaxed so that the influence of other economic factors is allowed for. For example, the role of relative import prices (also proxied by the real exchange rate) is significant in determining import demand from a theoretical perspective (see also Pilbeam, 1998; Salvatore, 1993). The traditional import demand function in its conventional form therefore postulates an inverse relationship between the quantity of imports demanded and relative import prices, assuming that real income (representing economic activity) is held constant.

Allowing for the influence of other factors on imports sets precedence for incorporating into theory the influence of trade policy on import behaviour.

2.1.2 IMPORT BEHAVIOUR AND TRADE POLICY

Perhaps the largest volume of economic literature on imports and international trade is that which contains considerations of trade policy.

Arguing, as Collier and Gunning (1994), that trade policy essentially comes down to protection and therefore to government intervention particularly in an LDC context, we note several aspects of restrictive trade policy.

Firstly, Rodrik (1995) observes that though trade policies are, for some reason or other, politically efficient, they are economically inefficient and cause sizeable deleterious effects on economic growth.

Some observers have focussed on the political efficiency[13] of trade policy. Noting that trade policies are generally anti-trade biased and import restricting rather than being pro-trade biased and export promoting. Anderson (1994) and Magee (1994) for instance, separately attempt to determine why international trade is not free when this has obvious adverse effects on economic growth. Magee has surveyed an extensive literature and has made substantial contributions from a political economic point of view. His literature survey identifies rent-seeking, lobbying by politically influential interest groups and the associated political superiority of protection such as re-distributive policy as well as revenue collection as some of the reasons for the political efficiency of trade policies. This partially explains why international trade is generally not free.

On the other hand, Collier and Gunning (1994) have considered the issue of restrictive trade policy from the viewpoint of trade shocks and macroeconomic policies. Paying particular attention to the case of LDCs, they highlight the salient point that negative macroeconomic and trade shocks tend to trigger permanent increases in protection. Thus, for example, the operation of endogenous trade policies (i.e. varying trade policies in response to trade shocks, particularly negative ones) explains why LDCs are generally so heavily protected. This implies that LDCs generally suppress their imports below desired levels.

In addition, Collier and Gunning have further given a detailed discussion of the standard theory of protection. Highlighting costs of tariffs and non-tariff barriers, costs of rent-seeking and costs of choice restrictions, they explain why GDP would be lower in a protected economy. Therefore, the economic inefficiencies of restrictive trade policy are adequately exposed.

Similarly, Anderson (1994) uses the principle of targeting to criticize the use of protection. The principle asserts that trade restriction (or distortion) is inferior to an instrument which acts directly on the target. Direct instruments would include wage subsidies for employment, lump-sum taxes to raise revenue or stabilization policies for BOP support. Even the often "less than coherent protectionist sympathies of development economists such as the infant-industry argument or the strategic trade policy[14] argument have not survived rigorous scrutiny, failing to support protection as superior" (p.134). Anderson therefore maintains that targeted policies are superior because they provide policy instruments that achieve economic objectives without causing side effects.

Furthermore, Rodrik (1992), Dornbusch (1992) and Collier and Gunning (1994) variously consider the difficulties of dismantling protectionist trade policies once these have been initiated. Rodrik outlines the adverse consequences of aid-driven liberalization (as opposed to unilateral liberalization) as well as the problems of coordination, pace and sequencing associated with trade liberalization in general. Dornbusch, and Collier and Gunning explain the diverse potentially harmful effects of macroeconomic instability on liberalization efforts, emphasizing that instability must be countered somehow.

Finally, the various trade policy issues that have been identified above may be arranged as follows:

1. Economically, restrictive trade policies are inefficient, translating into substantial welfare losses for any economy employing them;
2. Politically, restrictions on trade are efficient due to the reasons outlined above (among other reasons), especially in an LDC context;
3. Once restrictions are initiated they tend to become permanent and difficult to dismantle;
4. Dismantling restrictions through trade liberalization may be deleterious to the economy, causing macroeconomic instability if it is done in a haphazard manner.

Given this outline covering aspects of both traditional and current trends of economic thought, the following contemporary theoretical postulates concerning import determinants may be made:

1. Following the assertions of the traditional theory of imports demand determinants (i.e. the Keynesian General Theory), scholars maintain that national income is an important determinant of imports in any open economy. Furthermore, a positive relationship between imports and national income is often postulated. However, the traditional import demand postulate has a microeconomic foundation, as it is based on the consumer theory of demand, which states that the aim of the consumer is to maximize satisfaction. This argument is extended to the demand for imports such that the demand for imports by a consumer is influenced by income, import prices *per se* and prices of other commodities. The sum of individual demand for imports constitutes the aggregate imports demand for the economy (Harrod and Hague, 1963). Theoretically therefore, it is possible to have negative income elasticity of demand for imports, though evidence of this is hard to come by[15]. Since imports are the excess of domestic consumption over domestic supply, the income elasticity of imports could be negative if domestic supply is more income elastic than domestic consumption.

2. From the microeconomic foundation, import prices are similarly asserted to be important in determining imports demand. Cave and Jones (1994) postulate that if the price of imports rises, three ingredients contribute to a decline of import demand: (a) a substitution effect in consumption (less is demanded); (b) an income effect (the rise in the price of imports lowers real income and therefore lowers imports); and (c) a production effect (the rise in import price serves to attract resource from other industries to the import-competing industry, so that importables decrease). An import demand elasticity relating the relative extent of import reduction to the initial price rise can be derived.

3. According to Pilbeam (1998), and Collier and Gunning (1994), the domestic price of importables can be related to the exchange rate and foreign prices assuming a purchasing power parity (PPP)[16] exists. Thus for instance, an overvalued domestic currency would artificially cheapen imports in relation to domestic substitutes, with increased imports as a direct consequence. This argument therefore highlights the idea that in influencing imports, there is a significant role for the exchange rate to play. Also there is room for using exchange rate policy in influencing imports.

4. Several economic observers and scholars argue that imports demand can be influenced directly through trade policies such as tariffs and non-tariff barriers (quotas, import licensing, bans etc). For instance, the operation of import controls creates a wedge between the import (suppliers') price and domestic price of the imports. This translates into an increased domestic price of imports and a resultant fall in import demand (Musgrave and Musgrave, 1989) as described in (3) above. On the other hand, it has been argued (Kindleberger, 1973) that a BOP effect may occur, causing import controls to ultimately lead to an increase in imports. Tariffs for instance, cut spending abroad and presumably imply increased spending at home (i.e. assuming funds not spent abroad are not saved). The increase in domestic spending due to cutting down on imports expenditure raises domestic income until it spills over into additional imports sufficient to restore the BOP. With accelerators therefore, one can have a decline in imports through a tariff ultimately lead to an import surplus. The foregoing therefore suggests that the effect of trade policies cannot be determined *a priori*.

5. Considering that trade liberalization issues have gained considerable currency among economic observers and international agencies in recent times, it would be useful to briefly discuss a potential effect of liberalization on imports. Dombusch (1992) argues that the domestic price of importables is related to the exchange rate and trade policy (or restrictions) through the following expression:

   $P_d = E.P_w (1+t)$

   Where, t = nominal rate of protection,

   P_d = domestic price level

   P_w = price level in the rest of the world, and

   E = exchange rate defined as the price of domestic currency of one unit of foreign currency.

   Hence, it is quite possible to coordinate trade liberalization policy and exchange rate policy such that the domestic price of importables is unaltered. In this case, it would be expected that liberalization will gradually increase real income and so the BOP should not deteriorate. Underlying this argument is the fact that imports would not necessarily increase. Often however, LDC governments are resistant to exchange rate depreciation and therefore cause imports to be artificially cheapened. Therefore, liberalization often causes unprecedented increases in import levels.

Given the contemporary theory postulates outline above, we turn to a consideration of the empirical literature.

2.2 EMPIRICAL LITERATURE

There is a similarly vast body of empirical literature on the determinants of imports demand. This study therefore limits the review of the literature to articles that are directly relevant to the study. For convenience, empirical evidence on Zambia is considered first. From the literature surveyed, no study was found that specifically examines the determinants of imports demand in Zambia.

However, an important study, Aron and Elbadawi (1992) examines the determinants of imports in Zambia within a wider trade model. Aron and Elbadawi begin by arguing that the presence and size of parallel foreign exchange markets signals the presence of considerable foreign exchange

constraints in the economy. A black market premium, which is directly related to the size of the parallel market, is defined and estimated. Postulating that the premium represents a reduced capacity to import and therefore, a reduction of official (recorded) imports, Aron and Elbadawi incorporate the premium into an import demand model specified along the lines of Moran (1989). Thus, the demand for imports is functionally related to the premium, the real exchange rate, national income (GDP), foreign trade taxes as indicator variables for enforcement and commercial policy, lagged foreign exchange reserves and lagged imports. Their estimations find significant real exchange rate (-0.18), lagged international reserves (0.22) and lagged imports (0.72) elasticities over the period 1970:q3-87:q4 (using quarterly data). The premium (0.09) and real income (0.63) elasticities are only marginally significant at the 10 per cent level, while the foreign trade taxes (indicator variables) are found non-significant. Aron and Elbadawi thus conclude that: (a) official real appreciation will lead to increased demand for recorded imports; (b) the effect of foreign exchange constraints is an important factor in the determination of the levels of reported imports; and (c) there is presence of considerable inertia in the demand for reported imports.

A major limitation of the study by Aron and Elbadawi is that it does not take into account the time properties of time-series data. Without such consideration, statistical influence may not be valid. Also, imports are not disaggregated into components to analyze the impact of policy changes and shocks on various import categories.

Empirical investigations carried out elsewhere are numerous and a chronological survey of the literature is appropriate for ease of exposition.

Traditionally, simple import demand models were estimated with real income (representing economic activity) and relative import prices as the explanatory variables. Being inadequate in terms of explaining import behaviour in LDCs, such models were generally considered to be of little relevance to LDCs. Nonetheless, scholars such as Khan (1974) utilized such models and justified their applicability to the case of LDCs by arguing that although the role of quantitative restrictions (government interference) was not explicitly captured, the degree of autocorrelation served as an indicator of quantitative restrictions having been omitted. Thus, Khan considering a cross-section of 15 countries interprets the high degree of autocorrelation as being indicative of the importance of the omitted variable (restrictions) in determining imports.

Since Khan (1974), other scholars have made similar observations about the importance of previously omitted variables such as trade policy or the 'capacity to import' in determining imports, with many of them making diverse contributions to empirical investigation[17]. The result was that import demand models rapidly evolved in their functional specification over time. Naturally, the results obtained by various authors from the different model specifications were also diverse.

According to Learner and Ster (1974) (quoted in Egwaikhide, 1999), there are no well-defined criteria for choosing a particular functional specification. Rather, it is the researcher who decides what functional form to use (which is perhaps influenced by the theoretical position chosen) provided the choice is not harmful to the results obtained. Similarly, Diaz-Alejandro (1975) (quoted in Rodrik, 1992) asserts that any bright graduate student, by choosing his assumptions regarding distortions and policy instruments carefully, can produce a consistent model yielding just about any policy recommendation he favored at the start.

The foregoing is meant to stress the fact that it is up to the objectivity and prudence of the researcher to develop or adopt (and appropriately estimate) a functional specification that is particularly representative of a given case or given cases. It is therefore only logical for us to survey literature that is directly relevant to the case of Zambia and that takes into account recent developments in estimation procedure and model building.

Therefore, from the vast body of literature, we survey the works by Hemphill (1974), Moran (1989), Mwega (1993) and Egwaikhide (1999) because of their particular relevance to the current study.

Due to the presumed importance of foreign exchange earnings as a measure of the 'capacity to import', Hemphill (1974) departs from tradition and develops a somewhat unorthodox import demand model. He develops a model, called the stock adjustment import-exchange model, which ignores real domestic income and relative import prices that were included in the traditional import models. Drawing data from eight developing countries, he obtains results that suggest consistency with the expected relationship between imports and foreign exchange receipts. Thus, this study supports the hypothesis that foreign exchange earnings are an important factor in determining aggregate imports in developing countries.

Noting the importance of international trade in economic expansion and the significant role of exchange rate and trade policies in influencing foreign trade, Moran (1989) considers the behaviour of imports under a foreign exchange constraint. He develops two main import demand models that consider the economic factors responsible for foreign exchange shortages that have direct influence on total imports. Thus the models, framed in the experiences of LDCs particularly in the 1980s, incorporate government policy measures such as exchange rate and tariff policies that directly influence imports.

The first of Moran's models combines the basic traditional and Hemphill import demand models. It functionally relates imports to real income, relative import prices, foreign exchange receipts and international reserves and therefore, encompasses both the traditional and Hemphill models. An F-test is used to test whether the general (encompassing) model dominates both the sub-models in the various country groups examined. Findings suggest that both models are indeed special cases of the general import demand specification.

The alternative model is developed, in which both import volumes and relative prices are determined endogenously. Again, the findings of the model are quite consistent with the hypothesized relationships across the various country groups. Notably, from the quantitative estimates of the different country groups, Moran concludes that while real income and relative prices are important in the determination of aggregate import, the role played by a foreign exchange constraint is more fundamental in influencing imports in LDCs.

Moran points out a number of limitations of his study as areas for further research. One limitation is that the estimation method employed does not take into account the time characteristics of time-series data. This element is an important consideration of contemporary econometric techniques, having implications for statistical inference.

Mwega (1993) and Egwaikhide (1999) separately make important contributions to the empirical literature by taking into account the limitations of Moran (1989) in their studies. They maintain the argument that if variables are non-stationary, statistical inference may not be valid. Further, they assert that testing and correcting for data non-stationarity is crucial to ensure that econometric estimations do not yield 'spurious results.' Stationary tests, cointegration analysis and error correction models (ECMs) are utilized to justify their assertion and avoid the spurious results

problem. Therefore, pursuing frameworks consistent with Moran, Mwega and Egwaikhide use ECMs to estimate demand elasticities for aggregate imports and components in Kenya and Nigeria, respectively.

Using annual data for the period 1964-91, Mwega (1993) finds non-significant or marginally significant short-run relative price (-0.156) and real income (0.888) aggregate import demand elasticties for Kenya. On the other hand, aggregate imports are significantly responsive to previous imports (0.181), to lagged foreign exchange reserves (0.16) and to foreign exchange receipts (0.129). The ECM coefficient (-1.02) is found significant, validating the ECM specification and suggesting that errors are fully corrected within the year. Mwega therefore concludes that for Kenya, the estimation results suggest that policies which directly increase export earnings and access to external capital inflows are likely to have a larger impact on import volumes than policies concentrating primarily on aggregate demand and exchange rate management.

Egwaikhide (1999) draws annual data from 1953-89 and reports the following short-run aggregate import demand elasticities for Nigeria: (a) previous imports are found non-significant; (b) lagged foreign exchange earnings (0.308), relative prices (-0.895) and real income (0.587) are found to strongly influence total imports in Nigeria; and (c) a significant ECM coefficient (-0.411) validates the ECM specification and suggests that errors are not fully corrected within the year. Egwaikhide therefore concludes that for the case of Nigeria, all the significant variables aforementioned play an important role in influencing import behaviour. However, the effects of foreign exchange availability are found particularly remarkable. It is thus suggested that to increase total imports, it would be essential to implement a set of macroeconomic and sector-specific policies that considerably relax the binding constraint on foreign exchange availability. Also, the near unity of the price elasticity of import demand suggests the high sensitivity of demand of imports. Therefore, assuming neutrality of other economic policies, he suggests that devaluation can reduce the demand for aggregate imports.

Given that no empirical investigation specifically examining the determinants of imports demand in Zambia has yet been done, this current study is important in generating new information. It highlights the implications of exchange rate and trade policy reforms for imports demand in Zambia, taking into account recent developments in time-series analysis.

CHAPTER THREE

3.0 METHODOLOGY

3.1 THEORETICAL FRAMEWORK

On the basis of economic theory, we postulate that the demand for real imports in the long run, (M), is a positive function of real income or GDP, (Y), on the assumption that imports are normal in consumption and that it is a negative function of relative import prices (P_w/P_d), where P_w/P_d is measured by the ratio of import prices (P_w) to domestic prices (P_d). It is also assumed that foreign (suppliers') prices (P_w^*), the exchange rate (E) and tariffs (1+t) have similar impacts on import demand, a hypothesis that is empirically supported elsewhere (see, Mwega, 1993). Therefore, the relationship relating the domestic price of importables to the exchange rate, foreign prices and trade restrictions may be expressed following Dornbusch (1992), as:

$$P_d = E.\ P_w^*(1+t) \qquad (1)$$

$$P_d = E.\ (P_w^* + tP_w^*)$$

$$P_d = E.\ P_w \qquad (2)$$

Where, $P_w = (P_w^* + tP_w^*)$, which denotes import prices that take into account both tariff and non-tariff measures. Furthermore,

$$E = P_d / P_w \qquad (3)$$

Where, E is the price in domestic currency of one unit of foreign currency. Therefore $E^{-} = P_w/P_d$ is the real exchange rate measured as the price in foreign currency of one unit of domestic currency. Thus, the real exchange rate and relative import prices are used interchangeably in this paper.

To take into consideration trade restrictions, which suppress national imports below demand, foreign exchange availability is added as an explanatory variable to the traditional import demand model (Moran, 1989; Aron and Elbadawi, 1992; Mwega, 1993).

This theoretical framework is completely consistent with the theoretical foundation in Moran (1989).

3.2 MODEL SPECIFICATION

Given a theoretical foundation that is consistent with Moran (1989), the model specification is derived from the Hemphilll (1974) and traditional import demand models as modified by Moran (1989). The model thus begins by assuming that the basic objective of economic agents is to minimize the cost of deviation of actual imports from both the short-run and long-run desired levels of both imports and foreign reserves. To solve the optimization problem therefore, an explicit quadratic cost function expressed as follows is assumed:

$$C_t = \beta_1(M_t - M_t^*)^2 + \beta_2(R_t - R_t^*)^2 + \beta_3(M_t - M_{t-1})^2 + \beta_4(M_t - M_t^d)^2 \quad (4)$$

Where: M and M^* represent actual (short-run) and long-run equilibrium levels of imports, respectively; M_{t-1} denotes previous short-run import levels, while M^d denotes desired short-run level of imports; R and R^* depict current and desired long-run levels of foreign reserves. It is expected that in a long-run stationary equilibrium situation the current and long-run equilibrium levels of imports will be equal and will both equal the long run equilibrium foreign exchange receipt (F^*), i.e.

$$M_t^* = F_t^* = M_t^d = M_t \quad (5)$$

Where F^* is equal to export earnings plus net capital inflows. According to Moran, the last two equations may not hold in the short-run due to the presence of past and current shocks. This implies that in the short-run, actual imports can be suppressed below their desired level through deliberate policy changes or through external shocks.

Economic decision-makers are assumed to aim to minimize the costs of deviations of imports from their long-run equilibrium levels. It is expected that foreign reserves are held essentially to finance the difference between imports and foreign exchange receipts (i.e. to smooth imports over time), not to pay for imports *per se*. In this sense, it is expected that in the long-run the desired level of reserves will be positively related to the long-run level of imports, i.e.

$$R_t^* = \alpha_0 + \alpha_1 M_t^*, \ 0 \leq \alpha_1 \leq 1 \quad (6)$$

Furthermore, it is expected that the desired level of foreign reserves is positively related to the level of foreign receipts implying that trade clears in the long-run, i.e.

$$R_t^* = \gamma 0 + \gamma_1 F_t^*, \ 0 \leq \gamma_1 \leq 1 \quad (7)$$

From equations (6) and (7) therefore, in the long-run $F^* = M^*$ while in the short-run, both variables are related through the balance of payments identity:

$$M_t + \Delta R_t = F_t$$

$$\text{Or } \Delta R_t = F_t - M_t \tag{8}$$

Where: F denotes short-run foreign exchange receipts and Δ is the first difference operator.

A relationship that describes how short-run foreign exchange receipts adjust to their long-run equilibrium levels is assumed. In general, it is assumed that F^* is estimated from recent data, implying the hypothesis that the future is likely to reflect events in the past. Therefore, if short-run foreign exchange receipts (F) remain fairly constant over time they can be related to their long-run counterparts by:

$$F_t^* = F_t + \lambda \Delta F_t \tag{9}$$

Where: λ depicts the manner in which changes in foreign exchange receipts are perceived by the decision-makers. A positive λ implies that changes are viewed as permanent and are extrapolated, while a negative value means that changes are viewed as transitory and are discounted.

For simplicity and following Moran in arguing that λ cannot be properly identified, we take its value to be zero (i.e. $\lambda = 0$). Therefore, short-run foreign exchange receipts are assumed to be an appropriate proxy for their long-run level (see, Moran, 1989). Therefore:

$$F_t^* = F_t = M_t^* \tag{10}$$

The specification of the traditional short-run desired aggregate import demand function, which Moran argues to be a special case that is more appropriate for estimating imports demand in a DC context is generally expressed in a linear form as:

$$M_t^d = a_0 + a_1 Y_t + a_2 (P_w/P_d)_t \tag{11}$$

and $a_2 \leq 0$, $a_1 \geq 0$

Where all variables are as defined before (see, section 3.1)

To merge the traditional and Hemphill (1974) import models into a general, encompassing specification, Moran derives the optimal import level by solving an optimization problem.

Therefore, following the motivation of Moran further, an encompassing import demand equation is derived by substituting equations (6) and (11) into equation (4) and minimizing this function subject to foreign exchange constraints represented by equation (8)[18]. The final derivation of the optimization problem is expressed thus:

$$M_t = b_0+b_1F_t+b_2R_{t-1}+b_3M_{t-1}+b_4(P_w/P_d)_t+b_5Y_t \qquad (12)$$

and $b_1, b_5>0$; $0\leq b_2, b_3\leq 1$; $b_4\leq 0$

Equation (12) is the estimation equation specified by Moran (1989) in which the traditional and Hemphill import demand models both become special cases of the general import demand function. When the equation is estimated in logarithmic form, the coefficients b_1, b_2, b_3, b_4 and b_5 are interpreted directly as short-run elasticities of import demand.

In the current study, the main modifications to this model (equation 12) include the following:

1. The general import demand model is modified into a general autoregressive distributed lag (ADL) structure (Enders, 1995).

2. The general import demand model is expressed in a log-linear form so that the coefficients are read directly as elasticties of import demand. This is not a departure from Moran's estimation.

3. Considering that in the Zambian case, a number of external shocks were experienced during the study period, we expected that some of these experiences had significant impact on import behaviour. The incorporation of step and/or impulse dummy variables to capture the influence of external shocks such as drought, commodity price shocks or world economic recessions was therefore considered as a modification.

The general model specification is therefore re-written as:

$$m_t = \sum_{i=0}^{k} c_{1i} f_{t-i} + \sum_{i=0}^{k} c_{2i} r_{t-i} + \sum_{i=0}^{k} c_{3i} \left(\frac{P_w}{P_d}\right)_{t-i} + \sum_{i=0}^{k} c_{4i} y_{t-i} + \sum_{i=1}^{k} c_{5i} m_{t-i} + \sum_{i=1}^{t-1} c_{6i} D_i \qquad (13)$$

or

$$c_5(L)m_t = c_1(L)f_t + c_2(L)r_t + c_3(L)\left(\frac{P_w}{P_d}\right)_t + c_4(L)y_t + \sum_{t-1}^{t-1} c_{6t}D_t \qquad (14)$$

and c_1, $c_4 > 0$; $0 \leq c_2, c_5 \leq 1$; $c_3 \leq 0$; c_6 cannot be determined a priori.

Where: D_i depict step or impulse dummy variables to capture the impact of external shocks, lowercase letters denote logarithmic representation of the variables and $c_5(L)$, $c_1(L)$, $c_2(L)$, $c_3(L)$, and $c_4(L)$ denotes lag specification. All variables are as defined before. Since we are interested in determinants of real imports, appropriate deflators are utilized to deflate all the nominal variables (this aspect is considered in Section 3.3 below).

With respect to estimating disaggregated imports (i.e. components), slight modifications are made to equation (14) to take into account the changes in the proxy measure of the dependent variable. Aggregate imports are decomposed into consumer goods imports (MC), raw material imports (MR) capital goods imports (MK) (including all manufactured inputs) and fuel imports (MF). The following variations of the general import demand model (14) are considered:

1. Imports of consumer goods (MC) are expected to depend on GDP (Y) and the ratio of import to domestic prices (P_w/P_d), which captures the trade-off between imported consumer goods and their domestic counterparts. The (lack of) availability of foreign exchange {captured by foreign exchange receipts (F) and foreign reserves(R)} could be a constraining element even if private consumption increased and suggested potential for imports of consumer goods to increase. Thus, foreign exchange availability is assumed to (still) be an important determinant of consumer goods imports demand. Therefore:

$$d_5(L)mc_t = d_1(L)f_t + d_2(L)r_t + d_3(L)\left(\frac{P_w}{P_d}\right)_t + d_4(L)y_t + \sum_{t-1}^{t-1} d_{6t}D_t \qquad (14a)$$

and d_1, $d_4 > 0$; $0 \leq d_2, d_5 \leq 1$; $d_3 \leq 0$

where {as in equation (14)} lowercase letters denote logarithmic representation of the specification. All variables are as defined before.

2. Imports of raw materials (MR) are functionally related to the availability of foreign exchange, relative import prices and output (i.e. GDP). Therefore:

$$g_5(L)mr_t = g_1(L)f_t + g_2(L)r_t + g_3(L)\left(\frac{P_w}{P_d}\right)_t + g_4(L)y_t + \sum_{i=1}^{t-1} g_{6i}D_t \qquad (14b)$$

and $g_1, g_4>0$; $0\leq g_2, g_5\leq 1$; $g_3\leq 0$

where all variables and notational representations are as defined before {see definitions under equations (14) and (14a)}.

3. Capital goods imports (MK) are assumed to be non-competitive imports for which there are virtually no local substitutes. This is a plausible assumption for the Zambian case because the economy has virtually no sector that produces capital goods (see, Seshamani, 1992; Andersson and Kayizzi-Mugerwa, 1993). Imports of capital goods are therefore functionally related to the determinants of imports demand as follows:

$$h_5(L)mr_t = h_1(L)f_t + h_2(L)r_t + h_3(L)\left(\frac{P_w}{P_d}\right)_t + h_4(L)y_t + \sum_{i=1}^{t-1} h_{6i}D_t \qquad (14c)$$

and $h_1, h_4>0$; $0\leq h_2, h_5\leq 1$; $h_3\leq 0$

Where all variables and notational representations are as defined before {see equations(14) and (14a)}.

4. Fuel imports (MF)are functionally related to the availability of foreign exchange, relative import prices and income (i.e. GDP) as:

$$n_5(L)mf_t = n_1(L)f_t + n_2(L)r_t + n_3(L)\left(\frac{P_w}{P_d}\right)_t + n_4(L)y_t + \sum_{i=1}^{t-1} n_{6i}D_t \qquad (14d)$$

and $n_1, n_4>0$; $0\leq n_2, n_5\leq 1$; $n_3\leq 0$

Where all variables and notational representations are as defined before

It is worth emphasizing that equations (14) to (14d) only have minor variations, particularly in the measure of the dependent variable. Also, appropriate deflators are used to deflate all nominal variables because we are interested in the determinants of real imports.

Disaggregated imports are classified into the four broad categories, namely consumer goods, raw materials, capital goods and fuel imports because these categories are expected to be fairly independent, containing fairly homogeneous commodities. This means that we can assume that the cross-price elasticities of import demand are zero, given fairly independent import categories or components. The four categories also allow us to make aggregations from the Standard International Trade Classification (SITC) published in the Yearbook of International Trade Statistic by the United Nations (see, Section 3.3 below).

Equation (14), (14a), (14b), (14c) and (14d) are therefore over-parameterized import demand equations, which are simplified until parsimonious models with theory-consistent and data-coherent results are derived.

3.3. VARIABLE DEFINITIONS AND THE DATA

The following variable definitions apply:

Real imports (M) are defined as nominal imports (NM) deflated by the import price index (IPI) [19].

Real foreign exchange receipts (F) are defined as the sum foreign exchange of the monetary authorities (FE) (reflecting export earnings) and net capital inflows to the monetary authorities (NCI) deflated by IPI.

Real international reserves (R) are defined as foreign assets of the monetary authorities (FA) deflated by the IPI.

Relative import (Pw/Pd) prices are defined as the IPI deflated by the GDP deflator (GDPD). For the various import components, the IPI was weighted by the value of the respective components to take into account the differences in import price movement for the various groups. For estimation purposes, relative import prices were re-defined in terms of notational representation to correspond to their respective import categories. Thus, aggregate imports relative prices, consumer goods imports relative prices, raw materials imports relative prices, capital goods imports relative prices and fuel imports relative prices are denoted as Pm, Pc, Pr, Pk and Pf, respectively.

Real income (Y) is defined as nominal GDP (NGDP) deflated by the GDPD.

Annual data for aggregate imports and for all the independent variable were collected from the International Financial Statistics published by the IMF.

Data on the four import categories, namely consumer goods import (MC), raw materials import (MR), capital goods imports (MK) and fuel imports (MF) were derived from the various SITC categories published in the Yearbook of International Trade Statistics. The SITC is based on 625 Sub-groups (identified by code numbers of four digits) which are combined progressively into 177 Groups (identified by three-digit code numbers), 56 Divisions (identified by two-digit code numbers) and 10 Sections (also identified by two-digit code numbers). A five-digit code number defines a specific Item of which there are 1137 published in the Yearbook of International Trade Statistics. The 10 Sections are: (0) Food and Live Animals; (1) Beverages and Tobacco; (2) Metals, Ores and other Crude Materials except for Fuels; (3) Mineral Fuels and Lubricants; (4) Animal and Vegetable Oils and Fats; (5) Chemicals; (6) Manufactured goods classified primarily by Materials; (7) Machinery and transport Equipment; (8) Miscellaneous Manufactures; (9) Total Imports.

The SITC categories were combined as follows:

1. Consumer Goods Imports, MC, were defined as the sum of Food Imports and Other Consumer Goods Imports. According to the World Bank SITC definition of Consumer Goods Imports, all Food Imports are part of Consumer Goods and are defined as the sum of SITC Sections 0,1 and 4. Other Consumer goods are defined as the sum of SITC Section 8, Division 55, Groups 541 and 725, Sub-groups 7321, 7322 and 7341 and Item 73311 (where, Division 55 includes all perfumery, cosmetics, dentifrice, soaps, cleansing and polishing preparations, etc; Group 541 includes all medicinal and pharmaceutical products; Group 725 includes all domestic electrical equipment; Sub-group 7321 includes all passenger motor vehicles excluding buses; Sub-group 7322 includes buses; Sub-group 7341 includes air crafts excluding air craft spare parts; and Item 73311 includes bicycles, non-motor vehicles, etc).

2. Raw Materials Imports, MR, were defined following the UN International Standard Industrial Classification definition for all economies as the sum of Primary Intermediate Goods Imports and manufactured Goods Imports. This is the sum for SITC Sections 2, 5 (less Division 55 and

Group 541) and 6, and Sub-groups 7327 and 7328, and Item 73492 (where, Sub-group 7327 includes lorry, truck, bus chassis, spares, parts, etc.; Sub-group 7328 includes other motor vehicle spares, parts, etc.; and Item 73492 includes all air craft spares, parts, etc.).

3. Capital Goods Imports, MK, were defined according to the World Bank SITC definition of Capital Goods Imports as SITC Section 7 less Sub-groups 7321, 7322, 7327, 7328 and 7341, and Items 73311 and 73492 (all categories are as defined before).

4. Fuel Imports, MF, were defined according to the World Bank SITC definition of Fuel Imports as SITC Section 3.

Annual data for 1965-97 were utilized.

3.4. ESTIMATION PROCEDURE

The model specification of the estimation equations (14), (14a), (14b), (14c) and (14d) suggest the assumption that the independent variables are at least weakly exogenous. To test the validity of this assumption, the Granger causality test is done on the individual independent variables of equation (14) at a 5% significance level to test for strong exogeneity. We test for strong exogeneity because the presence of strong exogeneity necessarily implies that weak exogeneity also exists (Johnston and DiNardo, 1997). The test is a simple autoregressive distributed lag test for the significance of adding the history (lags) of the dependent variable to the independent variable in a bivariate regression equation. The test is against the null that the dependent variable does not Granger-cause the independent variable (i.e., implying that the independent variable is strongly exogenous) (Adam, 1992). The summarized results of the test are reported below:

Foreign Exchange Receipts (f_t):	$F(2, 26) = 2.7197$ [0.0846]
International Reserves (r_t):	$F(2, 26) = 1.1349$ [0.3685]
Real Income or GDP (y_t):	$F(2, 26) = 0.9649$ [0.3940]
Relative Import Prices (Pm_t):	$F(2, 26) = 1.4251$ [0.2621]

The critical value is $F(2, 26) = 3.37$ at the 5% level so that none of the F-values are significant (see, Appendix 2a for the complete Granger causality test).

The results show that the dependent variable does not Granger-cause any of the independent variables. This, therefore, reveal that Zambia has not experienced strong feedback effects from real aggregate imports to foreign exchange receipt, international reserves, relative import prices and real income. Thus, the assumption of weak exogeneity is validated.

Therefore, to finally arrive at parsimonious models, time-series analysis, which has gained considerable currency in recent times, is pursued.

3.4.1 TIME-SERIES ANALYSIS

We note the following arguments in support of time-series analysis. A major problem associated with time-series data is that they often exhibit time characteristics (i.e. non-stationarity of variables/series) that may lead to spurious regression results and therefore, make statistical inference invalid. Spurious results imply obtaining a spurious or 'nonsense' correlation among series. Simply put, a spurious correlation involves observing from a regression, a large correlation coefficient that exists merely because the variables share a common trend-like movement over time (i.e. variables are non-stationary), not lending support to a theory that ties them together (i.e. variables are not cointegrated) (see, Enders, 1995; Johnston and DiNardo, 1997). Non-stationarity of series, given that these series are not cointegrated implies that any regression involving them would yield spurious results.

Spurious results suggest that the mean and variance computed from non-stationary variables (in levels) would be biased estimates of the unknown population mean and variance. This is because:

1. There is no long-run mean to which non-stationary series revert; and
2. The variance is time-dependent and goes to infinity as time approaches infinity.

Therefore, there is no long-run economic relationship among variables. Hence, the argument is upheld that using one or more non-stationary series in a regression produces biased estimates (spurious results), thereby leading to invalid statistical inference when the series are estimated in levels, except in the case of a cointegrating relationship.

If series are cointegrated, it is most appropriate to apply an error correction model because it encompasses other models (Mwega, 1993).

To determine and take into account the time-series properties of model variables, thereby avoiding the problem of spurious results, it is necessary to explore time-series analysis. Thus, the Pc-Give and Eviews econometric packages are used to test for stationarity of series and the existence of cointegration among series as well as to estimate an error correction model.

3.4.2 TESTING FOR STATIONARITY

Testing for stationarity involved the use of the Dickey-Fuller (DF), the Augmented Dickey-Fuller (ADF) and the Phillips-Parron (PP) tests. The DF, ADF and PP procedures involve testing whether variables/series in a model are stationary or testing the order of integration through unit root tests.

The DF test is a test against the null hypothesis that there is a unit root series integrated of order one {i.e., I(1)}. The test equation is of the form:

$$\Delta X_t = \alpha_0 + \rho X_{t-1} + \alpha_1(t) + \varepsilon_t \tag{15}$$

The ADF test is the same as the DF, except that here augmentations in terms of lags of ΔX_t are incorporated. The test equation is of the form:

$$\Delta X_t = \alpha_0 + \rho X_{t-1} + \alpha_1(t) + \sum_{i=1}^{k} \beta_i \Delta X_{t-i} + \varepsilon_t \tag{16}$$

The PP test is the same as the DF except that there is no requirement that the error term (ε_t) be serially uncorrelated. The restrictive assumptions of independence and homogeneity of the error term under the DF test are relaxed under the PP test. The test equation is of the same form as equation (15).

These tests therefore use the t-statistic on the coefficient of the lagged level of X_{t-1} (i.e., ρ) and the result obtained are compared with a critical t-value given in the Dickey-Fuller distribution table.

The results of the three tests are summarized in Table 1 (pp. 38-9) below. All the tests were run at a 5% level of significance. The ADF test was run on four lags and an attempt was made to strengthen the test by systematically eliminating insignificant lags to finally establish the optimal lag-length. All the lags considered under the lag-reduction exercise were found to be insignificant except for capital goods imports (mk_t), relative import prices of mk_t (Pk_t) and real income (y_t) where the

optimal lag-lengths were found to be one, two and one, respectively for the variables in levels, and relative import prices of mc_t and mk_t (i.e., Pc_t and Pk_t, respectively) and y_t where the optimal lag-lengths were found to be one, one and two, respectively, for the variables in first differences. Thus, the ADF results are generally reported as those from the tests that were run on one lag. The PP test was run on three truncation lags as suggested by Newey-West (1998).

Table 1a:

Unit Root Test Statistics of Variables in Levels (at 5% significance level)

Variable	DF	ADF (lags)	PP	Order of Integration
Aggregate Import (m_t)	-0.213	-0.815 (1)	-0.395	I(1)
Consumer Goods Imports (mc_t)	-1.558	-1.468 (1)	-1.584	I(1)
Raw Materials Imports (mr_t)	-2.845	-1.924 (1)	-2.808	I(1)
Capital Goods Imports (mk_t)	-0.621	-0.749 (1)	-0.623	I(1)
Fuel Imports (mf_t)	-2.259	-1.926 (1)	-2.311	I(1)
Aggregate Imports Relative Prices (Pm_t)	-0.327	-0.809 (1)	-0.685	I(1)
Consumer Goods Imports Relative Prices (Pc_t)	-1.505	-1.559 (1)	-1.291	I(1)
Raw Materials Imports Relative Prices (Pr_t)	-2.194	-1.690 (1)	-2.224	I(1)
Capital Goods Imports Relative Prices (Pk_t)	-1.517	-1.181 (2)	-1.388	I(1)
Fuel Imports Relative Prices (Pf_t)	-1.669	-2.045 (1)	-1.700	I(1)
Foreign Exchange Receipts (f_t)	-0.814	-0.968 (1)	-0.804	I(1)
International Reserves (r_t)	-0.785	-0.816 (1)	-0.814	I(1)
Real Income or GDP (y_t)	-2.855	-2.993 (2)	-2.865	I(1)
Critical Values*:	-3.50	-3.56	-3.50	

*The critical values were obtained from the EVIEWS Econometric package and are equivalent to the critical t-values given in the Dickey-Fuller distribution table in Enders (1995).

It is evident from the results that all the variables are unambiguously found to be integrated of order one {i.e. I(1)}. The only exceptions are the ADF test results for f_t, which boarders on the margin of a unit root, and mc_t, m_t and Pm_t, which support the presence of a unit root after running the test with variables in their first differences. The DF and PP tests however unambiguously call for us to reject the null-hypothesis of a unit root for all the variables. Since none of the lags of the ADF test were found to be significant, adding augmentations to the test perhaps weakened it.

Table 1b:

Unit Root Test Statistics of Variables in First Differences (at 5% significance level)

Variable	DF	ADF* (lags)	PP	Order of Integration**
Aggregate Import (m_t)	-3.906	-3.560 (1)	-3 845	I(0)
Consumer Goods Imports (mc_t)	-4.554	-2.870 (1)	-4.534	I(0)
Raw Materials Imports (mr_t)	-8.354	-4.052 (3)	-9.099	I(0)
Capital Goods Imports (mk_t)	-5.044	-3.763 (1)	-5.013	I(0)
Fuel Imports (mf_t)	-6.183	-3.710 (1)	-6.204	I(0)
Aggregate Imports Relative Prices (Pm_t)	-4.060	-3.487 (1)	-4.014	I(0)
Consumer Goods Imports Relative Prices (Pc_t)	-5.178	-5.423 (1)	-5.242	I(0)
Raw Materials Imports Relative Prices (Pr_t)	-6.858	-4.365 (1)	-6.985	I(0)
Capital Goods Imports Relative Prices (Pk_t)	-7.272	-6.043 (1)	-7.589	I(0)
Fuel Imports Relative Prices (Pf_t)	-4.712	-4.660 (1)	-4.629	I(0)
Foreign Exchange Receipts (f_t)	-5.206	-3.600 (1)	-5.189	I(0)
International Reserves (r_t)	-5.683	-3.682 (1)	-5.682	I(0)
Real Income or GDP (y_t)	-4.761	-3.720 (2)	-4.633	I(0)
Critical Values:	-3.50	-3.56	-3.50	

*The ADF test statistics reported here were derived from ADF tests that were run on one lag only except for the test statistics for mr_t and y_t.

**The Order of Integration was determined base on the two most reliable tests.

To avoid over-differencing of the variables therefore, we ignore the suggestion by the ADF test that some of the variables are integrated of orders higher than one. Instead, based on the more reliable results of the DF and PP tests, we assume that all the variables are I(1). This assumption is consistent with econometric theory, which postulates that most macroeconomic variables would exhibit unit roots, becoming stationary after first differencing. Otherwise macroeconomic variables would likely be stationary (Enders, 1995). Furthermore, this assumption is later validated by testing for the existence of cointegration of the variables in the respective long-run ADL equations where the variables m_t, mc_t, Pm_t and f_t appear (among the other equations). Since these variables are indeed I(1), the residuals generated from their respective equations are found to be stationary (see, Section 3.4.3 below). We note that a necessary condition for stationarity of the residuals is that all non-stationary variables in the respective ADL equations be integrated of the same higher order. For the current study, this implies that all the variables became stationary after first differencing.

3.4.3 COINTEGRATION ANALYSIS

Although economic variables may be individually non-stationary, they may be cointegrated. It may therefore be relevant to consider a simple definition of cointegration: non-stationary variables are said to be cointegrated if a linear combination of these variables assumes a lower order of integration, rendering the linear combination stationary {or I(0)}. This suggests the existence of a mechanism or theoretical-link that prevents some of the variables from diverging significantly from each other. The existence of a cointegrating relationship implies that the regression of non-stationary series in their levels will yield meaningful, not spurious results. However, as noted above, for integration to exist the non-stationary series must be integrated of the same (higher) order. By testing for and establishing cointegration, we verify the assumption made in Section 3.4.2 above that the necessary condition {of all variables being I(1)} was indeed established.

Testing for cointegration involved using the Engle-Granger two-step procedure due to its simplicity. Other cointegration test procedures[20] exist which are in fact superior to the Engle-Granger procedure. These procedures were however not explored due to their complexity. Instead, we employed the Engle-Granger procedure, estimating static (long-run) ADL models for the cointegrating equations in the first step of the procedure. In the second step, the residuals generated from the static models were individually evaluation in terms of their orders of integration (the same unit root tests considered in Section 3.4.2 were utilized to test the residuals). The normality characteristics of the residuals were also examined. The residuals (Error Correction Terms) generated from equations (14), (14a), (14b), (14c) and (14d) are ecm_{t-1}, $cecm_{t-1}$, $recm_{t-1}$, $kecm_{t-1}$ and $fecm_{t-1}$ (the complete Engel-Granger procedure of estimating static ADLs, simplifying them to get the solved long-run models and generating the residuals is reported in Appendix 3a). Tables 2a and 2b, respectively show the cointegration and normality test results on the residuals.

The three cointegration tests unambiguously show the residuals from the various equations to be stationary, therefore supporting the existence of cointegration. Furthermore, all the residuals except for $recm_{t-1}$ are found to be normally distributed based on the consistent failure to reject the null-hypotheses of normality under the Jarque-Bera test (complete normality test results are appended to Appendix 2b).

Table 2a:

Cointegration Test Statistics

	DF	ADF (lags)	PP	Order of Integration
Aggregate Imports Residual, ecm_{t-1}	-6.038	-4.516 (1)	-6.101	I(0)
Consumer Goods imports Residual, $cecm_{t-1}$	-5.399	-4.475 (1)	-5.382	I(0)
Raw Materials Imports Residual, $recm_{t-1}$	-6.857	-4.199 (2)	-7.061	I(0)
Capital Imports Residual, $kecm_{t-1}$	-6.509	-5.053 (1)	-6.899	I(0)
Fuel Imports Residual, $fecm_{t-1}$	-6.689	-4.722 (1)	-7.106	I(0)
Critical Values*:	-2.64	-2.64	-2.64	

* The critical values were obtained from the EVIEWS Econometric package. They are called the Mckinnon critical values for rejection of the hypothesis of a unit root and are the most reliable critical values when testing for unit roots in residuals (i.e., because they test at a 1% significance level).

Table 2b:

Normality Test Statistic**

	$\chi^2_{(2)}$	[χ^2 p values]
Aggregate Imports Residual, ecm_{t-1}	0.231	[0.890]
Consumer Goods imports Residual, $cecm_{t-1}$	0.161	[0.923]
Raw Materials Imports Residual, $recm_{t-1}$	0.444	[0.801]
Capital Imports Residual, $kecm_{t-1}$	3.497	[0.174]
Fuel Imports Residual, $fecm_{t-1}$	0.897	[0.639]

** The Normality Test Statistic is the Jarque-Bera Statistic.

Stationary {I(0)} residuals supports the existence of a cointegrating relationship in all the estimation equations and verify the assumption made in Section 3.4.2 that all the variables in the various models are I(1).

3.4.4 THE ERROR CORRECTION MODEL (ECM)

The existence of cointegration among variables suggests that there is a long-run economic relationship among variables, implying that it is most efficient to apply an ECM. The ECM is superior to other model specifications because:

It provides a more general and less restrictive lag structure, allowing for (partial or full) adjustment as a special case; and

It captures both the long-run equilibrium and short-run dynamic relationships associated with a model, making it encompassing.

"general-to-specific" methodology is adopted in this paper. In addition, the short-run forms of ie import estimation equations are tested for stability and structural breaks using recursive least quares (Johnston and DiNardo, 1997). This gave due consideration to some of the modification oncerns raised in Section 3.2 (i.e., the concerns regarding the incorporation of dummy variables nto the model).

CHAPTER FOUR

4.0 REGRESSION RESULTS

4.1 LONG-RUN (COINTEGRATION) IMPORT DEMAND ELASTICITIES

The static ADL equations that were used to generate the Error Correction Terms (discussed in Section 3.4.3) using PC-GIVE were also used to derive solved static (cointegration) equations for aggregate imports and components. The estimations were done at a 5% significance level in each case {the results of the reduction of the ADL and the generating of the solved static (long-run) equation are appended to Appendix 3a}.

4.1.1. AGGREGATE IMPORTS (m_t):

As evidenced by equation (17) below, aggregate imports are, in the long-run, significantly responsive to all the independent variables and all the independent variables have the expected signs:

m_t	=	-0.440	+0.303 f_t	+0.079 r_t	+0.545 y_t	-0.496 Pm_t
(SE)		(0.078)	(0.036)	(0.026)	(0.036)	(0.127)

(17)

$R^2 = 0.998$ $F(6, 23) = 2742.2$ [0.0000] DW = 2.43
The standard errors (SE) are in parentheses.

The static equation reveals that the elasticities are all inelastic. These results are fairly consistent with the elasticities for Zambia's aggregate import demand function estimated by Aron and Elbadawi (1992). For instance, their study found a real exchange rate elasticity (equivalent to a relative import price elasticity) of -0.18, a real income elasticity of 0.63 and a real international reserves elasticity of 0.22. Slight disparities are observed in the relative import price elasticity, which is found to be substantially larger in the current study and in the real international reserves elasticity, which was found to be more elastic by Aron and Elbadawi. {Aron and Elbadawi derive their elasticites utilizing a linear logarithmic equation using quarterly data from 1970:3-1987:3}. Both studies however find inelastic elasticities. The results of the current study also compare fairly well with studies on import demand done elsewhere in LDC contexts. In estimates from Kenya

using annual data over 1964-91 for instance, Mwega (1993) found a long-run income elasticity of 0.454, a price elasticity of -0.398, a lagged forex reserve elasticity of 0.157 and a forex receipts elasticity of 0.342. Similarly, Moran (1989) estimated import demand elasticities for twenty-one LDCs using pooled data over 1970-83. He found long-run price elasticities ranging between -0.3 and -0.1, income elasticities ranging between 0.2 and 0.4, lagged international reserve elasticities ranging between 0.5 and 0.8 and foreign exchange receipt elasticities around 0.1.

4.1.2. INDIVIDUAL IMPORTS CATEGORIES:

The results in Table 3 report the solved static long-run (cointegration) equation elasticities for the various import categories (with variables in their levels). In each case, the elasticity was derived from a static regression run on significant non-stationary independent variables for each dependent variable (insignificant variables were not included in the regressions).

Table 3*:

Estimated Static Long-Run (Cointegration) Elasticities

Import category	f_t	r_t	y_t	$(Pw/Pd)_t$ **	constant	R^2
Consumer Goods Imports (mc_t)	0.769	-	0.162	-	-2.597	0.996
(SE)	(0.114)	-	(0.090)	-	(0.178)	
Raw Materials Imports (mr_t)	0.282	-	0.676	-0.919	-1.346	0.994
(SE)	(0.086)	-	(0.095)	(0.299)	(0.210)	
Capital Goods Imports (mk_t)	0.349	-	0.620	-0.911	-1.288	0.997
(SE)	(0.044)	-	(0.047)	(0.158)	(0.097)	
Fuel Imports (mf_t)	-	-0.118	0.778	-	-2.938	0.993
(SE)	-	(0.029)	(0.032)	-	(0.103)	

* The table is a summary of the static regression results appended to Appendix 3a.

** (Pw/Pd)t are the relative import prices-Pc_t, Pr_t, Pk_t and Pf_t-with respect to their corresponding import categories.

The results show the following:

1. Consumer goods imports (mc_t) are in the long-run significantly responsive to foreign exchange earnings, and real domestic income. International reserves do not have a significant influence on consumer goods imports (mc_t), perhaps because the authorities, over the study period, gave special preference to mc_t such that they liberally financed mc_t using real reserves. A non-

significant long-run relative price elasticity was observed, perhaps suggesting that extensive exemptions from and concessions on tariff and non-tariff restrictions existed for this category of imports over the study period.

2. Raw material imports (mr_t) are, in the long-run, significantly influenced by foreign exchange receipts, real income and relative prices. Thus, these factors were constraints on mr_t in the long-run. International reserves were not a significant determinant of mr_t demand, perhaps because mr_t received special preference from the authorities such that the readily allowed for mr_t to be financed real reserves. Therefore, although there is most likely a high correlation between foreign exchange receipts and real reserves, real reserves were found non-significant in the long-run.

3. Capital goods imports (mk_t) are significantly responsive to foreign exchange earnings, real income and relative import prices. International reserves were, in the long-run, not constraining factors of mk_t, perhaps because some capital imports are imported as components of external project financing and are therefore defined as capital inflows (i.e., part of receipts). This also suggests that foreign receipts and real reserves are most likely high correlated.

4. Fuel imports (mf_t) are constrained by international reserves and real income. Foreign exchange receipts, in the long-run, do not have a significant influence on mf_t, perhaps because fuel imports received high priority in allocations of foreign exchange (although foreign exchange receipts are most likely highly correlated with international reserves). Thus, although the authorities perhaps permitted mf_t to be readily financed through foreign exchange earnings, they did not liberally run down real reserves for mf_t financing. mf_t are, in the long-run, not significantly responsive to relative import prices, perhaps reflecting the existence of extensive exemptions from and concessions on tariff and non-tariff restrictions for this group of imports over the study period.

4.2. SHORT-RUN (DYNAMIC) IMPORT DEMAND ELASTICITIES

To derive the short-run elasticities, over-parameterized ECM versions of equations (14), (14a), (14b), (14c) and (14d) were estimated. The Error Correction Terms (ECTs) were derived as the

lagged residuals generated from the solved static long-run equations. All the variables in the over-parameterized (ADL) import demand models except for the ECTs were set at two lags to economize on the degrees of freedom. The results of the over-parameterized models are reported in Appendix 3b.

4.2.1 AGGREGATE IMPORTS: Short-Run Import Demand Elasticities (by OLS)

Using the Information Criteria as guides, the estimated equations were reduced to a more preferred specification. Table 4 reports the results of the aggregate imports demand equation:

Table 4:

The Short-Run Aggregate Imports Demand Model

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-0.014869	0.022699	-0.655	0.5196	0.021000	0.0200
DLm_2	-0.29464	0.058564	-5.031	0.0001	0.059846	0.5465
DLf_1	0.20927	0.031499	6.644	0.0000	0.027397	0.6776
DLf_2	0.24787	0.028818	8.601	0.0000	0.026981	0.7789
DLr	0.11776	0.027966	4.211	0.0004	0.026399	0.4578
DLy	0.58853	0.10266	5.733	0.0000	0.084088	0.6102
ecm_1	-1.3570	0.17145	-7.915	0.0000	0.18933	0.7489
dum90	0.21811	0.096654	2.257	0.0348	0.037337	0.1952

$R^2 = 0.965117$ $F(7, 22) = 83.003$ [0.0000] $\sigma = 0.0831443$ DW = 2.10
RSS = 0.145172353 for 8 variables and 30 observations

Information Criteria: SC = -4.36822; HQ = -4.62728; FPE = 0.00882

AR 1- 2F(2, 19) = 0.22591 [0.7999] ARCH 1 F(1, 19) = 0.26364 [0.6135]
Normality χ^2 (2) = 0.80107 [0.6700] RESET F(1, 20) = 2.9664 [0.1004]

The reported diagnostic tests include:(a) the Hetreroscedastic Consistent Standard Errors (HCSE); (b) the Partial R^2 which shows the correlation between the independent and the dependant variable; (c) the equation standard error (σ); (d) the various information criteria which decline as the model becomes more parsimonious; (e) the LM tests statistic base on the LM test for serial correlation; (f)

the Autoregressive-Conditional Hetreoscedasticity (ARCH) test statistic; (g) the Jarque-Bera normality test statistic; and (h) the Regression Specification Error Test (RESET) test statistic

Utilizing recursive least squares, the aggregate import equation was tested for stability and structural breaks. Stability was tested for because the Zambian economy, over the study period, experienced a fairly large number of internal and external shocks, some of which were expected to have significant influence on imports and affected the imports demand stability. The internal shocks included structural and adjustment policy changes such as trade liberalization, foreign exchange and exchange rate controls and other policies employed by the authorities. On the other hand, external shocks included erratic aid inflows, changes in the terms of trade and changing weather conditions. These factors had a significant impact on the stability of the aggregate import demand model based on the one-step Chow test (see Appendix 4, Figure 1). The test shows the presence of an outlier in 1990 and a dummy variable was incorporated into the model to capture the influence of instability in 1990 (the explanation of this shock is discussed after discussing the other results of the preferred aggregate model). The dummy variable has a significant impact on imports demand at the 5% level.

Also, as the graphs in Appendix 4 (Figure 3) show, the individual coefficients fell within the narrowest parts of the two standard error band, implying that they were stable in the 1980s and 1990s. The m_{t-2} and r_t coefficients tended to be fairly constant over the 1980 to 1997 period, while the other coefficients tended to generally decline (except for the f_{t-1} and y_t coefficients which increase). These movements perhaps reflect the gradual intensifying of the application of SAPs over the period. The N-step Chow test (see, Figure 1 in Appendix 4) however shows that this structural change was not significant enough to cause a structural break.

The results in Table 4 show that the OLS aggregate imports demand equation is not subject to serial correlation, ARCH or error non-normality. The RESET supports the functional specification, showing that no relevant variables were omitted. An R^2 of 0.96 suggests that the equation explains a large proportion of aggregate imports. The equation has a standard error (σ) of 8.3%.

As evidenced by the results, the following conclusion can be drawn. Firstly, previous (twice lagged) imports have a significant negative influence on current imports demand in the short-run. That is,

100% increase in the previous volume of imports reduces current demand for imports by 29.4%. This perhaps reflects the inventory policy, which was organized such that, over the study period, importers accumulated as much import-stock as possible when conditions for importing allowed it and reduced imports in subsequent periods when conditions did not permit. This finding is in contrast with a positive lagged imports elasticity of 0.72 reported by Aron and Elbadawi (1992). Since the results reported by Aron and Elbadawi were derived from a long-run model, perhaps significant previous imports elasticities over time offset each other to produce a positive long-run elasticity.

Secondly, aggregate imports have an average lagged real foreign exchange receipts elasticity of 0.23 and a real international reserves elasticity of 0.12, which is fairly close to the results reported in the previous study on Zambia (i.e., Aron and Elbadawi). Thus, aggregate imports are, in the short-run, significantly constrained by the availability of foreign exchange.

Imports are significantly influenced by real income (0.58), which is also consistent with the previous study on Zambia, where an income elasticity of 0.63 was found. The significant constraint imposed on imports by real income perhaps suggest that there is scope for import substitution in the Zambian economy.

The demand for imports in the short-run has a non-significant relative import price elasticity, perhaps because non-significant short-run relative price elasticities over time re-enforce each other to produce a significant but inelastic long-run elasticity of -0.496 {as evidenced by the long-run cointegration equation, (17)}. The inelastic relative price elasticity perhaps suggests that devaluation and other policies that concentrate on affecting aggregate demand or expenditure-switching (between tradables and non-tradables) have non-significant impact on the demand for aggregate imports.

The lagged error correction term (ecm_{t-1}) coefficient is significant, which further validates the ECM specification. It indicates a 135% speed of adjustment from actual imports in the previous year to the long-run level of imports, suggesting that errors are fully corrected within the year. The error correction term may also be interpreted as reflecting the speed at which goods imports where liberally allowed by the authorities and therefore reflects the fact that imports in general received a substantially high level of attention from the authorities. This argument is consistent with the hypothesis that imports are vital in the Zambian economy receiving high priority.

Lastly, the 1990 instability in the aggregate imports demand model, captured by the dummy variable (dum90), perhaps reflects an internal shock caused by a major exchange rate policy shift that started in mid-1989 and ended abruptly in 1991[21]. Economic agents perhaps perceived the policy shift, which caused imports to be artificially cheapened, as temporary. This resulted in agents increasing their demand for aggregate imports to take advantage of the situation before the policy was reversed.

4.2.2 INDIVIDUAL IMPORT CATEGORIES: Short-Run Import Demand Elasticities (by OLS)

The four import groups were individually functionally related as shown in Section 3.2 above. The results appended to Appendix 3b show the over-parameterized empirical import demand equations and their parsimonious counterparts.

The parsimonious model versions of the individual components' import demand functions are considered below. These equations were also derived by systematically setting non-significant coefficients of the over-parameterized OLS equations to zero and selecting their parsimonious form based on the models with the lowest values of the various information criteria. Also, the various diagnostic tests done on aggregate imports were similarly done on the components and are reported below the respective empirical models.

By recursive least squares, the various import models were individually tested for stability and structural breaks in the same manner as the aggregate imports equation (see, Figure 2 in Appendix 4). Only the one-step Chow test was considered for the import categories. All the import categories except mk_t were found to have some instability in the 1980s and 1990s based on the fact that outliers were detected. The impact of instability was therefore incorporated into the respective models using dummy variables. The empirical models of the various import categories are considered in turn.

CONSUMER GOODS IMPORTS (mc_t):

The preferred empirical model is:

$$\begin{array}{lllllll} \Delta mc_t = & +0.305\Delta f_{t-1} & +0.562\Delta f_{t-2} & +0.199\Delta r_t & -0.354\Delta r_{t-2} & -1.008\Delta Pc_{t-1} & -1.923\Delta Pc_{t-2} \\ (SE) & (0.053) & (0.106) & (0.049) & (0.096) & (0.499) & (0.550) \\ & -1.144ceem_{t-1} & +0.405dum90 & -0.0349 & & & \\ & (0.243) & (0.192) & (0.039) & & & \end{array} \quad (18)$$

$R^2 = 0.897571$ $F(8, 21) = 21.907$ [0.0000] $\sigma = 0.158171$ DW = 1.81

Information Criteria: SC = -3.0147; HQ = -3.30613; FPE = 0.0327823
AR 1- 2F(2, 19) = 0.65085 [0.5334] ARCH 1 F(1, 19) = 1.3094 [0.2675]
Normality Chi^2 (2) = 4.8512 [0.0884] RESET F(1, 20) = 0.018585 [0.8930]

The empirical equation shows that lagged and twice lagged real foreign exchange receipts have significant positive influence on current mc_t in the short-run, suggesting consistency with the long-run influence of real receipts

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Real international reserves have a direct significant impact on mc_t, while twice lagged real reserves have a perverse negative impact in the short-run, perhaps because real reserves elasticities over time offset one another to ultimately produce a non-significant long-run elasticity. This perhaps suggests that though the authorities may generally have reduced mc_t when building up reserves, they reversed this policy at times over the study period when domestic conditions did not permit increased domestic production of consumer goods. Generally, mc_t are significantly constrained by the availability of foreign exchange in the short-run.

Lagged and twice lagged relative import prices have significant negative influence on mc_t in the short-run, perhaps suggesting that, in the short-run, relative prices impact on mc_t in a similar manner as they do in the long-run. However, the short-run relative price elasticities were found to be significant, while, in the long-run, a non-significant relative price elasticity was observed.

The error correction term ($ceem_{t-1}$) has a significant impact on mc_t, suggesting a speed of adjustment of 82%. This implies that errors in the previous year were not fully corrected within the year.

Lastly, the dummy variable (dum90) that was incorporated to capture instability in the mc_t model had a significant positive influence on mc_t at the 5% level. This perhaps suggests that the exchange rate policy shift that was undertaken starting in mid-1989 and ended abruptly in early-1991 transmitted a direct significant shock to the mc_t demand system.

RAW MATERIAL IMPORTS (mr_t):

The preferred empirical model is given as:

$$\begin{array}{lllllll} \Delta mr_t = & 0.365\Delta mr_{t-1} & -0.257\Delta f_t & +0.231\Delta f_{t-1} & +0.280\Delta r_t & +0.502\Delta y_t & -1.127\Delta Pr_{t-1} \\ (SE) & (0.098) & (0.099) & (0.058) & (0.091) & (0.172) & (0.441) \\ & -1.525recm_{t-1} & +0.140dum84 & -0.075 & & & \\ & (0.186) & (0.186) & (0.365) & & & \end{array} \qquad (19)$$

$R^2 = 0.921854$ $F(7, 22) = 35.39$ [0.0000] $\sigma = 0.140596$ DW = 1.91

Information Criteria: SC = -3.31759; HQ = -3.57665; FPE = 0.0252203
AR 1-2F(2, 20) = 0.14024 [0.8700] ARCH 1 F(1, 20) = 1.0199 [0.3252]
Normality $Chi^2(2)$ = 1.7357 [0.4199] RESET F(1, 21) = 0.27205 [0.6077]

According to the empirical model, mr_t are, in the short-run, significantly responsive to lagged raw material imports. The less-that-unity elasticity suggests that perhaps import policy was organized such that it allowed importers to accumulate as much stock as possible when import conditions permitted and to import smaller amounts in subsequent periods when conditions were unfavourable. Foreign exchange receipts have a perverse negative influence on mr_t, while lagged foreign receipts have a direct significant influence. Therefore, perhaps significant foreign exchange earnings elasticities over time offset each other to produce a positive long-run elasticity of 0.303. The negative short-run mr_t response to foreign receipts perhaps suggests that, at times over the study period, there was most likely a significant negative correlation between traditional exports (which have a high mr_t content) and mr_t. Consequently, domestic production conditions that caused an increase in traditional exports also caused a reduction of mr_t, perhaps because raw materials were obtained from domestic sources. But when domestic sources proved to be insufficient to sustain production, mr_t increased with increases in traditional exports. Hence, previous (i.e., lagged) foreign exchange receipts posed a direct significant constraint on mr_t.

Real international reserves have a direct significant impact on mr_t in the short-run, though, in the long-run, their influence is non-significant. Inferring from the over-parameterized mr_t model (see,

Appendix 3b, EQ (7)}, positive and negative significant short-run real reserves elasticities perhaps offset one another over time to produce a non-significant average elasticity (in the long-run).

The variable mr_t has a positive significant short-run real income elasticity at the 5% level, which suggests consistency with the long-run elasticity of 0.676. Thus, there is perhaps some scope for import substitution for this group of imports. The variable mr_t also has a significant and elastic short-run relative price elasticity of 1.12, which perhaps suggests that short-run price responses are stronger that the long-run response (i.e., given a long-run relative price elasticity of 0.92).

A significant error correction term was observer, suggesting a speed of adjustment of 153%, perhaps reflecting a relatively high level of importance attached to mr_t by the authorities compared to other import groups.

Lastly for mr_t, the dummy variable (dum84), which was incorporated into the mr_t model to capture instability, was found to have a statistically non-significant coefficient.

CAPITAL GOODS IMPORTS (mk_t):

The preferred model is:

$$\begin{array}{lllll} \Delta mk_t = & -0.466\Delta mk_{t-2} & +0.223\Delta f_{t-1} & +0.285\Delta f_{t-2} & +0.899\Delta y_t \quad -1.307\Delta Pk_{t-1} \\ (SE) & (0.089) & (0.065) & (0.048) & (0.134) \quad (0.507) \\ & -1.284 kecm_{t-1} & -0.053 dum86 & -0.003 & \\ & (0.226) & (0.189) & (0.044) & \end{array} \qquad (20)$$

$R^2 = 0.921854$ $F(7, 22) = 35.39$ [0.0000] $\sigma = 0.140596$ DW = 1.91

Information Criteria: SC = -3.31759; HQ = -3.57665; FPE = 0.0252203
AR 1-2F(2, 20) = 0.14024 [0.8700] ARCH 1 F(1, 20) = 1.0199 [0.3252]
Normality $Chi^2(2)$ = 1.7357 [0.4199] RESET F(1, 21) = 0.27205 [0.6077]

The model shows that twice lagged capital goods imports have a negative influence on current mk_t in the short-run. This is perhaps because, over the study period, importers were able to "stock-pile" as much as possible when import policies permitted and reduced capital goods imports in subsequent periods when the policies were not favourable.

lagged and twice lagged foreign exchange receipts, in the short-run, have significant positive on mk_t at the 5% level. This suggests consistency between short-run and long-run foreign receipts influences and implies that mk_t are significantly constrained by foreign exchange earnings.

A significant and positive real income elasticity of mk_t demand was found, suggesting consistency with the long-run income elasticity of 0.62. Furthermore, this suggests that perhaps there is scope for import substitution in the economy.

A significant negative lagged relative price elasticity of mk_t demand of -1.30 was found in the short-run. This perhaps suggests that price responses are stronger in the short-run that in the long-run (i.e., based on the less-that-unity relative price elasticity of -0.90 in the long-run).

The error correction term ($kecm_{t-1}$) has a significant impact on mk_t, suggesting a speed of 119%. This perhaps reflects the fact that the authorities similarly attached a relatively great deal of priority to mk_t.

A dummy variable (dum86) was incorporated into the mk_t import demand model to capture a shock in 1986. The coefficient of dum86 was however found to be statistically non-significant.

FUEL IMPORTS (mf_t):

The preferred model is:

$$\begin{aligned}\Delta mf_t = {} & \underset{(0.058)}{+0.159\Delta r_t} \; \underset{(0.142)}{+0.639\Delta y_t} \; \underset{(0.499)}{-0.957\Delta Pf_{t-1}} \; \underset{(0.186)}{-0.921 fecm_{t-1}} \; \underset{(0.177)}{+0.487 dum84} \\ & \underset{(0.186)}{+0.613 dum90} \; \underset{(0.049)}{-0.039}\end{aligned} \qquad (21)$$

$R^2 = 0.856321$ $F(6, 23) = 21.853$ [0.0000] $\sigma = 0.161706$ DW = 2.22
RSS = 0.5752716071 for 7 variables and 30 observations

Information Criteria: SC = -3.10741; HQ = -3.33409; FPE = 0.0324605
AR 1- 2F(2, 21) = 0.95433 [0.4019] ARCH 1 F(1, 21) = 1.3964 [0.2512]
Normality $Chi^2(2)$ = 2.3776 [0.3046] RESET F(1, 22) = 0.79218 [0.3835]

As evidenced by the empirical model, real international reserves, in the short-run, have a direct significant influence on mf_t, suggesting consistency with their long-run influence and implying that mf_t are significantly constrained by the availability of foreign exchange.

A significant and positive real income elasticity of mf_t demand of 0.63 was found, which suggests consistency with the long-run income elasticity of 0.78. Thus, there is perhaps some scope for import substitution for this group of imports (i.e., assuming sufficient domestic sources of fuel or alternative energy-sources are identified).

A less-than-unity, negative and significant short-run relative price elasticity of 0.95 was found, perhaps suggesting that significant relative price elasticities over time offset one another to produce a non-significant average relative price elasticity.

The error correction term ($fecm_{t-1}$) has a significant impact on mf_t and shows that errors were not fully corrected within the year. An error correction speed of 92% was found.

Significant shocks with positive impacts on mf_t were experienced in 1984 and 1990. The 1984 instability perhaps reflects the end of the world oil crisis in 1983, which was initially perceived as temporary by economic agents in Zambia. This perhaps caused an influx of fuel imports to take advantage of the reduced oil prices, which were expected to be short-lived. When oil prices increased and oil supply was again restricted after 1984, fuel imports similarly declined sharply. On the other hand, the 1990 instability was considered in Section 4.2.1 above.

All the assumption on the individual models are supported by the various diagnostic tests except for the raw materials imports equation, which fails the RESET suggesting that some relevant variables were perhaps omitted in the functional specification. All the equations however explain a fairly large amount of imports of their respective categories with the R^2 ranging from 0.85 to 0.96.

It is also evident for the results that the most consistent determinant of imports across the various import groups was the error correction term. The generally high speeds of adjustment suggest that imports are very important in the Zambian economy, receiving a high level of attention from the authorities. In general, imports were over the study period liberally allowed such that errors were rapidly and, in most cases, fully corrected within the year.

CHAPTER FIVE

5.0 SUMMARY AND CONCLUSION

The objective of this study was to explain the determinants of imports demand in Zambia by estimating a dynamic import demand function utilizing an error correction model (ECM). A major limitation of the previous study on Zambia is that it did not take into account the time properties of time-series data. The results of the current study reveal that the variables in the import demand equation are I(1) and are cointegrated. Thus, an ECM was estimated because it is the most efficient model to utilize for dynamic estimation.

Estimations from an ECM specification of aggregate imports show that previous imports play an important role in influencing current imports demand; imports have a real income elasticity of demand which exerts significant influence on imports; they have significant foreign exchange receipts and international reserves elasticities of demand. The ECM specification was supported by all the diagnostic tests and validated by a significant error correction term coefficient. The results indicate that errors are fully corrected within the year.

The results suggest the following main implications. Firstly, the consistent significance of real income in influencing aggregate imports and components suggests that stabilization policies have had a significant impact in determining import behaviour in Zambia and there is scope for import substitution in the Zambian Economy.

Secondly, the significant influence of foreign exchange availability as a constraining factor in determining imports demand suggests that policies that increase foreign exchange availability will more readily influence import behaviour. Thus, policies would have to be oriented towards export promotion. The implications of the foregoing for Zambia are therefore that trade policies should move away from import-substitution towards export promotion in order to support economic growth through imports while minimizing the deleterious effects on the balance of payment.

Lastly, the non-significance and/or inelastic relative price elasticity of aggregate import demand suggests that exchange rate and trade policies that directly interfered with the market determination

import prices did not, over the study period, effectively influence aggregate imports in the desired direction. This implies that exchange rate and trade policies such as devaluation, and tariff and non-tariff restrictions did little to impact on the volume of imports.

The findings of the current study lend support to studies done elsewhere on imports demand. For example, Moran (1989) finds that in twenty-one LDCs the policies traditionally considered (i.e., policies that exclusively affect income or relative prices) will have a limited impact on imports demand. Thus, broader policies, which focus on affecting the availability of foreign exchange, should be pursued, as they are likely to yield a larger impact on the volume of imports.

However, as highlighted by Mwega (1993), the success of outward-looking policies that increase the availability of foreign exchange depends critically on access to external markets and on the ability to increase capital inflows. Without these pre-requisites being met, foreign exchange availability would continue to be a constraint. Underlying is the implication that policy-makers who are willing to increase imports would not be able to influence the behaviour of imports adequately.

NOTES

1. This decline in copper contribution to exports was fundamentally due to the continually declining levels of copper production from 644 thousand tonnes in 1964 and 709 thousand tonnes in 1974 to 460 and 249 thousand tonnes in 1986 and 1996, respectively. (Aron and Elbadawi, 1992; Ministry of finance, 1999).
2. The international demonstration effect describes the effect whereby the affluent classes of an underdeveloped country mimic the consumption patterns and habits of their counterparts in a comparatively more industrialized, developed country. These adopted patterns or habits of the affluent are then transmitted to the rest of the 'satellite society.' (See, Nurke, 1953).
3. The Mulungushi Reforms marked the beginning of radical reforms to transform the Zambian economy into a predominantly command economy characterized by state-owned enterprise and extensive public sector participation in all spheres of economic activity.
4. This trade deficit can be compare to trade surpluses of around K400 million in both 1973 and 1974(Anderson and Kayizzi-Mugerwa, 1993), showing that the deficit was adverse indeed.
5. Maize is Zambia's staple food and is therefore give a considerable amount of attention in policy-design and decision-making.
6. The official rate would cater for metal exports, transactions of international organizations, donor project support and for all imports that came through the FEMAC import of industrial inputs and spares.
7. The market rate would service non-traditional exports, foreign private investment, donor BOP support and some non-FEMAC import of industrial inputs and spares
8. The real exchange rate stabilized, registering period averages of K687/US$, K667/US$ and K640/US$ in 1994, 1996 and 1998 (Ministry of Finance, 1999).
9. ZCCM was Zambia's state-owned monopolist mining conglomerate responsible for all metal transactions.
10. To determine the openness of the Zambian economy, a degree of openness index was computed. Acording to Edwards (1997), the degree of openness is measured as the ratio of imports to GDP. The degree of openness was found to be 0.268 (or 26.8 per cent) in 1974, 0.220 (or 22 per cent) in 1984, 0.237 (or 23.7 per cent) in 1991 and 0.209 (or 20.9 per cent) in 1997 {these statistics were computed using data from the IMF, International Financial Statistics (CD-ROM) March 2001}.

11. The Engle curve is an inverse demand function relating quantity demanded to income, assuming prices are held constant. For import demand, it is denoted as $Q_m = f(Y, p^-)$, where Q_m = quantity of imports demanded, Y = real income (proxied by GDP), and $P^- = P_w/P_d$, which denotes fixed relative prices.

12. The restrictive assumptions include: (a) fixed prices; (b) a fixed exchange rate; (c) no BOP adjustment (due to a fixed exchange rate); and (d) no taxation or government expenditure.

13. Political efficiency of restrictive trade policies means that these policies allow politically influential groups and those responsible for the administrative enforcement of controls to readily benefit from "rent-seeking". And rent-seeking refers to the activity of trying to secure the economic rents arising from price distortions and physical controls caused by excessive government intervention, e.g., quotas, foreign exchange controls and so on.

14. Strategic trade policy refers to new protectionist policies that have emerged in recent times. These policies are supported by several new theories that explain why a home country can potentially benefit from a tariff or other trade policy instrument. The distinguishing feature of these theories is that imperfect competition is assumed to exist in the industries under consideration, a departure from traditional analysis. A lot of skepticism surrounds strategic trade policy theories (see, Appleyard and Fields Jr., 1996 for elaboration).

15. Most empirical works take the income coefficient to be positive assuming that imports are normal in consumption.

16. In its simplest form, the PPP theorem assumes that the exchange rate (E) adjusts to the ration of the domestic price level (P_d) and the price levels in the rest of the world (P_w). That is :

    $E = P_d / P_w$ or $= P_d = E. P_w$

    Where, E is the price in domestic currency of one unit of foreign currency. The theorem is predicated on a number of assumptions (Sodersten and Reed, 1994; Dornbusch, 1992), which are not empirically supported (see also, Edwards, 1997)

17. For example, Burgess (1974), Hemphill (1974), Moran (1989), Yeats (1990), Sahay (1990), Beslet and Collie (1991), Quarcoo (1991), Umo (1991), Mwega (1993), Khan, F. (1994), Egwaikhide (1999) and many others have made significant contribution to the development of models explaining import behaviour.

18. See Moran (1989) for the derivation.

19. Because no data-set was found that presents a consistent IPI series specifically for Zambia, the IPI for non-oil exporting African countries was adopted as the best proxy of Zambia's import prices.

20. More sophisticated procedures would include the Cointegrating regression Durban-Watson, the Augmented Engle-Granger and the Johansen's Maximum Likelihood Estimation Procedures

21. In July 1989, the liberalization package of the early 1980s was reintroduced and the exchange rate was once again drastically changed. In February 1990, a dual (two-tier) exchange rate system was introduced: an official exchange rate was initiated at a rate of K27.80/US$, with the "market rate" at K40.00/US$. According to Aron and Elbadawi (1992), the Bank of Zambia sold foreign exchange through the first window (the official rate) under existing FEMAC procedures for imports, while the second window operated at the market rate and was for foreign exchange allocations under the Open General License system (OGL). Only 10 per cent of imports were eligible for OGL allocations at the inception of the system, implying that 90 per cent of imports received foreign exchange allocations at the official rate of K27.80/US$. During 1990, items were gradually transferred to the second window, due to the general expansion of the OGL to cover over 92 per cent of imports by January 1991.

Underlying the forgoing, is the fact that at the inception of the dual system in February 1990, 90 per cent of imports were allocated foreign exchange at an overvalued exchange rate, which artificially cheapened imports in relation to their local substitutes. Economic agents were perhaps able to predict that the policy was temporary and would be reversed. The sharp and sudden increase of imports was therefore a direct consequence of the overvalued Kwacha, which was perceived to be temporary by importers and other agents. The 1990 shock, however, petered-out quickly as the two-tier system was cancelled in February 1991, with the exchange rate being unified at a market rate of K89/US$. Thus, imports declined sharply by the end of 1991.

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Appendix 2b: Table 6:

Normality Test Results

Residual	Mean	Std.Devn	Skewness	Excess Kurtosis	Minimum	Maximum	Normality Chi^2 (2)
ecm_{t-1}	0.0000	0.08690	-0.18206	-0.46222	-0.17677	0.16817	0.23117 [0.8908]
$cecm_{t-1}$	0.0000	0.134106	0.100416	-0.664288	-0.295584	0.263045	0.16143 [0.9225]
$recm_{t-1}$	0.0000	0.194070	-0.01998	-0.175312	-0.455639	0.380285	0.44421 [0.8008]
$kecm_{t-1}$	0.0000	0.124722	-0.54392	-0.616135	-0.272573	0.205026	3.4972 [0.1740]
$fecm_{t-1}$	0.0000	0.199619	-0.15309	-0.018299	-0.488232	0.376865	0.8968 [0.6386]

APPENDIX 3

Appendix 3a: Long-Run (Cointegration) Import Demand Models

NOTE:

To allow for compatibility with PC-GIVE and EVIEWS, the variables were redefined so that capital letters denote representation of the variables in real terms and the letter "L" denotes logarithmic representation. _i denotes representation of the i^{th} lag. á = σ are the model Standard Errors of the individual equations.

1.Modelling LM by OLS (the over-parameterized model)

The present sample is: 1968 to 1997

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-0.49829	0.15379	-3.240	0.0055	0.14159	0.4117
LM_1	-0.33762	0.17460	-1.934	0.0722	0.14775	0.1995
LF	-0.51841	0.17424	-2.975	0.0094	0.17782	0.3711
LF_1	-0.12869	0.10117	-1.272	0.2228	0.11270	0.0974
LF_2	0.29328	0.12293	2.386	0.0307	0.13598	0.2751
LR	0.29615	0.11685	2.534	0.0229	0.098143	0.2998
LR_1	0.19474	0.091917	2.119	0.0512	0.093066	0.2303
LR_2	-0.099902	0.11301	-0.884	0.3906	0.13353	0.0495
LY1	-0.051898	0.096851	-0.536	0.5999	0.080278	0.0188
LY1_1	0.69705	0.17363	4.014	0.0011	0.15879	0.5179
LY1_2	0.41522	0.34061	1.219	0.2416	0.33304	0.0901
Pm	0.12426	0.19151	0.649	0.5262	0.17141	0.0273
Pm_1	-0.44572	0.62682	-0.711	0.4879	0.58764	0.0326
Pm_2	-0.46521	0.76526	-0.608	0.5523	0.73959	0.0240
	-0.71935	0.40430	-1.779	0.0955	0.44902	0.1743

R^2 = 0.999107 F(14, 15) = 1199.1 [0.0000] á = 0.105916 DW = 2.25

RSS = 0.1682718348 for 15 variables and 30 observations

Information Criteria: SC = -3.48277; HQ = -3.95924; FPE = 0.0168272

2.Modelling LM by OLS (the parsimonious model)

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R*Rý
Constant	-0.57468	0.10825	-5.309	0.0000	0.10158	0.5506
LM_2	-0.30507	0.073142	-4.171	0.0004	0.080288	0.4306
LF_1	0.17776	0.048972	3.630	0.0014	0.039391	0.3642
LF_2	0.21766	0.051295	4.243	0.0003	0.044942	0.4391
LR	0.10246	0.032483	3.154	0.0044	0.027164	0.3019
LY	0.71131	0.068225	10.426	0.0000	0.072528	0.8254
Pm_2	-0.64684	0.18427	-3.510	0.0019	0.23267	0.3489

R^2 = 0.998604 F(6, 23) = 2742.2 [0.0000] á = 0.106957 DW = 2.43

RSS = 0.2631163664 for 7 variables and 30 observations

Information Criteria: SC = -3.94274; HQ = -4.1651; FPE = 0.0141091

Solved Static Long Run equation

LM =	-0.4403	+0.303 LF	+0.07851 LR
(SE)	(0.07762)	(0.03556)	(0.0262)
	+0.545 LY	-0.4956 Pm	
	(0.03628)	(0.1271)	

Tests on the significance of each variable

Variable	F(num,denom)	Value	Probability
LM	F(1, 23) =	17.396	[0.0004] **
Constant	F(1, 23) =	28.184	[0.0000] **
LF	F(2, 23) =	30.202	[0.0000] **
LR	F(1, 23) =	9.9489	[0.0044] **
LY	F(1, 23) =	108.7	[0.0000] **
Pm	F(1, 23) =	12.322	[0.0019] **

(cont'd)

Lf_2						
Lr	0.14187	0.21027	0.675	0.5101	0.20185	0.0295
Lr_1	0.17367	0.16929	1.026	0.3212	0.12175	0.0656
Lr_2	-0.34501	0.21411	-1.611	0.1279	0.20025	0.1476
Ly	0.0013464	0.18037	0.007	0.9941	0.16253	0.0000
Ly_1	0.58688	0.31641	1.855	0.0834	0.24131	0.1866
Ly_2	0.71388	0.64341	1.110	0.2847	0.51281	0.0758
Pr	0.0040545	0.31652	0.013	0.9899	0.28075	0.0000
Pr_1	-1.1115	1.1564	-0.961	0.3517	0.99715	0.0580
Pr_2	-0.38904	1.3584	-0.286	0.7785	1.1022	0.0054
	-0.85284	0.75414	-1.131	0.2759	0.66423	0.0786

R^2 = 0.996975 F(14, 15) = 353.12 [0.0000] $\hat{\sigma}$ = 0.196069 DW = 2.12
RSS = 0.5766432033 for 15 variables and 30 observations
Information Criteria: SC = -2.25113; HQ = -2.7276; FPE = 0.0576643

EQ(6) Modelling Lmr by OLS (the parsimonious model)

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-1.3455	0.21032	-6.397	0.0000	0.16620	0.6115
Lf_1	0.28148	0.085622	3.288	0.0029	0.061354	0.2936
Ly	0.67570	0.094708	7.135	0.0000	0.065911	0.6619
Pr	-0.91988	0.29958	-3.071	0.0050	0.21288	0.2661

R^2 = 0.994073 F(3, 26) = 1453.5 [0.0000] $\hat{\sigma}$ = 0.208465 DW = 2.39
RSS = 1.12989836 for 4 variables and 30 observations
Information Criteria: SC = -2.82558; HQ = -2.95264; FPE = 0.049252

Solved Static Long Run equation

Lmr =	-1.346	+0.2815 Lf	+0.6757 Ly
(SE)	(0.2103)	(0.08562)	(0.09471)
	-0.9199 Pr		
	(0.2996)		

Tests on the significance of each variable

variable	F(num,denom)	Value	Probability
Constant	F(1, 26) =	40.927	[0.0000] **
Lf	F(1, 26) =	10.808	[0.0029] **
Ly	F(1, 26) =	50.902	[0.0000] **
Pr	F(1, 26) =	9.4286	[0.0050] **

EQ(7) Modelling Lmk by OLS (the over-parameterized model)
The present sample is: 1968 to 1997

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-1.8721	0.28686	-6.526	0.0000	0.25837	0.7396
Lmk_1	-0.15487	0.21651	-0.715	0.4854	0.22988	0.0330
Lmk_2	-0.45127	0.18496	-2.440	0.0276	0.17341	0.2841
Lf	-0.12148	0.13045	-0.931	0.3665	0.10974	0.0546
Lf_1	0.23013	0.16880	1.363	0.1929	0.15466	0.1103
Lf_2	0.36821	0.16021	2.298	0.0363	0.14319	0.2604
Lr	0.18417	0.12768	1.442	0.1697	0.10927	0.1218
Lr_1	-0.027943	0.15755	-0.177	0.8616	0.13907	0.0021
Lr_2	-0.085919	0.13115	-0.655	0.5223	0.12514	0.0278
Ly	0.72249	0.24867	2.905	0.0109	0.19788	0.3601
Ly_1	0.26338	0.48796	0.540	0.5973	0.47668	0.0191
Ly_2	0.037530	0.25860	0.145	0.8865	0.28407	0.0014
Pk	-0.049671	0.87815	-0.057	0.9556	0.80498	0.0002
Pk_1	-1.2007	0.98896	-1.214	0.2435	1.0608	0.0895
Pk_2	-0.32652	0.55836	-0.585	0.5674	0.56140	0.0223

R^2 = 0.998371 F(14, 15) = 656.84 [0.0000] $\hat{\sigma}$ = 0.14901 DW = 2.03
RSS = 0.3330598624 for 15 variables and 30 observations
Information Criteria: SC = -2.80003; HQ = -3.2765; FPE = 0.033306

results cont'd)

AR 1- 2F(2, 20) = 0.53309 [0.5949]
ARCH 1 F(1, 20) = 0.09602 [0.7599]
Normality $Chi^2(2)$= 1.6516 [0.4379]
RESET F(1, 21) = 2.5979 [0.1219]

EQ(3) Modelling DLm by OLS (the parsimonious model)

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-0.014869	0.022699	-0.655	0.5196	0.021000	0.0200
DLm_2	-0.29464	0.058564	-5.031	0.0001	0.059846	0.5465
DLf_1	0.20927	0.031499	6.644	0.0000	0.027397	0.6776
DLf_2	0.24787	0.028818	8.601	0.0000	0.026981	0.7789
DLr	0.11776	0.027966	4.211	0.0004	0.026399	0.4578
DLy	0.58853	0.10266	5.733	0.0000	0.084088	0.6102
ecm_1	-1.3570	0.17145	-7.915	0.0000	0.18933	0.7489
dum90	0.21811	0.096654	2.257	0.0348	0.037337	0.1952

R^2 = 0.965117 F(7, 22) = 83.003 [0.0000] $\hat{\sigma}$ = 0.0831443 DW = 2.10
RSS = 0.145172353 for 8 variables and 30 observations
Information Criteria: SC = -4.36822; HQ = -4.62728; FPE = 0.00882
AR 1- 2F(2, 20) = 0.22591 [0.7999]
ARCH 1 F(1, 20) = 0.26364 [0.6135]
Normality $Chi^2(2)$= 0.80107 [0.6700]
RESET F(1, 21) = 2.9664 [0.1004]

EQ(4) Modelling DLmc by OLS (the over-parameterized model)

The present sample is: 1968 to 1997

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	0.0064679	0.062936	0.103	0.9197	0.060269	0.0008
DLmc_1	0.17870	0.19592	0.912	0.3783	0.13270	0.0601
DLmc_2	-0.16586	0.20881	-0.794	0.4413	0.16406	0.0463
DLf	-0.14201	0.17460	-0.813	0.4307	0.20306	0.0484
DLf_1	0.24332	0.14367	1.694	0.1142	0.11701	0.1808
DLf_2	0.40643	0.16690	2.435	0.0300	0.14781	0.3133
DLr	0.33357	0.15011	2.222	0.0446	0.20426	0.2753
DLr_1	0.023482	0.15833	0.148	0.8844	0.12245	0.0017
DLr_2	-0.19126	0.13730	-1.393	0.1870	0.13009	0.1299
DLy	0.43568	0.28564	1.525	0.1511	0.24892	0.1518
DLy_1	-0.27354	0.36899	-0.741	0.4717	0.26953	0.0406
DLy_2	-0.0026517	0.25789	-0.010	0.9920	0.23305	0.0000
DPc	0.83926	0.69741	1.203	0.2503	0.53849	0.1002
DPc_1	1.3446	0.88010	1.528	0.1505	0.90765	0.1522
DPc_2	-2.3082	0.62612	-3.686	0.0027	0.70617	0.5111
cecm_1	-0.91673	0.35925	-2.552	0.0241	0.34993	0.3337

R^2= 0.919668 F(15, 14) = 9.9218 [0.0001] $\hat{\sigma}$ = 0.173742 DW = 2.06
RSS = 0.3924216288 for 16 variables and 30 observations
Information Criteria: SC = -2.4449; HQ = -2.96301; FPE = 0.0468408
AR 1- 2F(2, 12) = 0.94733 [0.4173]
ARCH 1 F(1, 12) = 0.010157 [0.9215]
Normality $Chi^2(2)$= 1.2406 [0.5378]
RESET F(1, 13) = 1.0768 [0.3199]

EQ(5) Modelling DLmc by RLS

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	0.038840	0.041788	0.929	0.3632	0.036377	0.0395
DLf_1	0.31249	0.057061	5.476	0.0000	0.052984	0.5882
DLf_2	0.51958	0.11191	4.643	0.0001	0.084640	0.5065
DLr	0.23742	0.048805	4.865	0.0001	0.059225	0.5298

EQ(8) **Modelling DLmr by RLS**

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-0.070731	0.045747	-1.546	0.1370	0.044241	0.1022
DLmr_1	0.35491	0.095735	3.707	0.0013	0.096960	0.3956
DLf	-0.23608	0.093572	-2.523	0.0198	0.074460	0.2326
DLf_1	0.23834	0.056751	4.200	0.0004	0.059663	0.4565
DLr	0.25786	0.085387	3.020	0.0065	0.057075	0.3028
DLy	0.50345	0.16976	2.966	0.0074	0.16184	0.2952
DPr_1	-1.1006	0.43484	-2.531	0.0194	0.45923	0.2337
recm_1	-1.5689	0.17510	-8.960	0.0000	0.16625	0.7926

R^2 = 0.918525 F(7, 22) = 33.821 [0.0000] $\hat{\sigma}$ = 0.14833 DW = 2.14
RSS = 0.4620370022 for 8 variables and 30 observations
Information Criteria: SC = -3.2105; HQ = -3.46955; FPE = 0.0280712
AR 1- 2F(2, 20) = 0.22798 [0.7983]
ARCH 1 F(1, 20) = 0.0018217 [0.9664]
Normality $Chi^2(2)$ = 1.4721 [0.4790]
RESET F(1, 21) = 6.5192 [0.0189] *

EQ(9) **Modelling DLmr by OLS** (the parsimonious model)

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-0.075466	0.046648	-1.618	0.1214	0.044703	0.1157
DLmr_1	0.36546	0.097740	3.739	0.0013	0.10125	0.4114
DLf	-0.25705	0.098553	-2.608	0.0168	0.077924	0.2538
DLf_1	0.23070	0.058230	3.962	0.0008	0.061646	0.4397
DLr	0.28036	0.091295	3.071	0.0060	0.064259	0.3204
DLy	0.50171	0.17154	2.925	0.0084	0.16094	0.2996
DPr_1	-1.1267	0.44074	-2.556	0.0188	0.47965	0.2463
recm_1	-1.5253	0.18613	-8.195	0.0000	0.17381	0.7705
dum84	0.14040	0.18617	0.754	0.4595	0.10829	0.0277

R^2 = 0.920778 F(8, 21) = 29.057 [0.0000] $\hat{\sigma}$ = 0.149877 DW = 2.15
RSS = 0.4492612794 for 9 variables and 30 observations
Information Criteria: SC = -3.12242; HQ = -3.41386; FPE = 0.0294344
AR 1- 2F(2, 19) = 0.25364 [0.7787]
ARCH 1 F(1, 19) = 0.0044058 [0.9478]
Normality $Chi^2(2)$ = 1.0287 [0.5979]
RESET F(1, 20) = 6.126 [0.0229] *

EQ(10) **Modelling DLmk by OLS** (the over-parameterized model)
The present sample is: 1968 to 1997

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	0.018394	0.058296	0.316	0.7574	0.052694	0.0076
DLmk_1	-0.026370	0.19724	-0.134	0.8957	0.18170	0.0014
DLmk_2	-0.42038	0.16840	-2.496	0.0268	0.14327	0.3240
DLf	-0.065317	0.12389	-0.527	0.6069	0.11001	0.0209
DLf_1	0.11245	0.12079	0.931	0.3688	0.11209	0.0625
DLf_2	0.34312	0.12318	2.785	0.0155	0.10774	0.3738
DLr	0.13769	0.12392	1.111	0.2866	0.10287	0.0867
DLr_1	0.16318	0.13436	1.215	0.2461	0.13509	0.1019
DLr_2	-0.039225	0.11147	-0.352	0.7306	0.088918	0.0094
DLy	0.69330	0.25171	2.754	0.0164	0.16678	0.3685
DLy_1	-0.12632	0.37946	-0.333	0.7445	0.42637	0.0085
DLy_2	0.13666	0.23354	0.585	0.5685	0.24144	0.0257
DPk	0.076193	0.69954	0.109	0.9149	0.57054	0.0009
DPk_1	-0.92472	0.76912	-1.202	0.2507	0.80505	0.1001
DPk_2	-0.18217	0.53562	-0.340	0.7392	0.56333	0.0088
kecm_1	-1.1808	0.34724	-3.400	0.0047	0.26386	0.4708

results cont'd)
R^2 = 0.942039 F(15, 14) = 14.086 [0.0000] σ̂ = 0.153896 DW = 2.17
RSS = 0.3078919924 for 16 variables and 30 observations
Information Criteria: SC = -2.68748; HQ = -3.20559; FPE = 0.036751
AR 1- 2F(2, 12) = 1.4695 [0.2719]
ARCH 1 F(1, 12) = 0.74222 [0.4073]
Normality $Chi^2(2)$= 0.63285 [0.7288]
RESET F(1, 13) = 0.0081614 [0.9295]

EQ(11) Modelling DLmk by OLS

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-0.00042504	0.042460	-0.010	0.9921	0.041528	0.0000
DLmk_2	-0.47137	0.084473	-5.580	0.0000	0.050200	0.5860
DLf_1	0.23347	0.051395	4.543	0.0002	0.041032	0.4840
DLf_2	0.28512	0.047621	5.987	0.0000	0.065548	0.6197
DLy	0.89503	0.13059	6.854	0.0000	0.085647	0.6811
DPk_1	-1.3525	0.46998	-2.878	0.0087	0.40261	0.2735
kecm_1	-1.1994	0.22061	-5.437	0.0000	0.18507	0.5733

R^2 = 0.921567 F(6, 23) = 43.082 [0.0000] σ̂ = 0.137616 DW = 1.97
RSS = 0.4166411631 for 7 variables and 30 observations
Information Criteria: SC = -3.43003; HQ = -3.6567; FPE = 0.0235095
AR 1- 2F(2, 21) = 0.22535 [0.8002]
ARCH 1 F(1, 21) = 1.0609 [0.3153]
Normality $Chi^2(2)$= 1.7112 [0.4250]
RESET F(1, 22) = 0.35876 [0.5556]

EQ(12) Modelling DLmk by OLS (the parsimonious model)

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-0.0030039	0.044360	-0.068	0.9467	0.042179	0.0002
DLmk_2	-0.46565	0.088718	-5.249	0.0000	0.054266	0.5674
DLf_1	0.22292	0.064773	3.442	0.0024	0.061001	0.3606
DLf_2	0.28513	0.048652	5.861	0.0000	0.068093	0.6206
DLy	0.89946	0.13436	6.694	0.0000	0.091277	0.6809
DPk_1	-1.3072	0.50708	-2.578	0.0175	0.41854	0.2404
kecm_1	-1.1928	0.22662	-5.263	0.0000	0.18925	0.5688
dum86	0.052688	0.18944	0.278	0.7836	0.10966	0.0037

R^2 = 0.921854 F(7, 22) = 35.39 [0.0000] σ̂ = 0.140596 DW = 1.91
RSS = 0.4151120879 for 8 variables and 30 observations
Information Criteria: SC = -3.31759; HQ = -3.57665; FPE = 0.0252203
AR 1- 2F(2, 20) = 0.14024 [0.8700]
ARCH 1 F(1, 20) = 1.0199 [0.3252]
Normality $Chi^2(2)$= 1.7357 [0.4199]
RESET F(1, 21) = 0.27205 [0.6077]

EQ(13) Modelling DLmf by OLS (the over-parameterized model)
The present sample is: 1968 to 1997

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	0.068649	0.081296	0.844	0.4137	0.068471	0.0520
DLmf_1	0.54710	0.29114	1.879	0.0828	0.26674	0.2136
DLmf_2	0.20341	0.25266	0.805	0.4352	0.24043	0.0475
DLf	-0.10354	0.19040	-0.544	0.5958	0.15455	0.0222
DLf_1	0.19154	0.16457	1.164	0.2654	0.15080	0.0944
DLf_2	-0.19053	0.15350	-1.241	0.2365	0.10880	0.1060
DLr	0.30831	0.17076	1.806	0.0942	0.12665	0.2005
DLr_1	-0.12189	0.15174	-0.803	0.4363	0.16145	0.0473
DLr_2	0.25658	0.14722	1.743	0.1050	0.11715	0.1894
DLy	0.43772	0.32408	1.351	0.1998	0.22433	0.1231
DLy_1	0.0049486	0.43178	0.011	0.9910	0.39095	0.0000

cont'd)

DLy_2	-0.81373	0.33425	-2.435	0.0301	0.35475	0.3131
DPf	0.11122	0.89006	0.125	0.9025	0.82122	0.0012
DPf_1	-1.1212	0.87168	-1.286	0.2208	0.81433	0.1129
DPf_2	-0.93295	0.99048	-0.942	0.3634	0.81804	0.0639
fecm_1	-1.6976	0.37327	-4.548	0.0005	0.41006	0.6141

R^2 = 0.871574 F(15, 14) = 5.8817 [0.0013] $\hat{\sigma}$ = 0.198881 DW = 1.59
RSS = 0.5141997386 for 16 variables and 30 observations
Information Criteria: SC = -2.17462; HQ = -2.69273; FPE = 0.0613766
AR 1- 2F(2, 12) = 0.38188 [0.6913]
ARCH 1 F(1, 12) = 0.11979 [0.7358]
Normality $Chi^2(2)$= 0.87833 [0.6446]
RESET F(1, 12) = 17.043 [0.0014] **

EQ(14) Modelling DLmf by RLS

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-0.047138	0.062172	-0.758	0.4557	0.060889	0.0234
DLr	0.19800	0.075204	2.633	0.0146	0.064033	0.2241
DLy	0.73037	0.17908	4.078	0.0004	0.15708	0.4094
DPf_1	-1.4557	0.60848	-2.392	0.0249	0.62177	0.1926
fecm_1	-1.1221	0.22790	-4.924	0.0001	0.21219	0.5025

R^2 = 0.734516 F(4, 25) = 16.6 [0.0000] $\hat{\sigma}$ = 0.210452 DW = 1.91
RSS = 1.062960516 for 5 variables and 30 observations
Information Criteria: SC = -2.72567; HQ = -2.88758; FPE = 0.0519262
AR 1- 2F(2, 23) = 1.7359 [0.1995]
ARCH 1 F(1, 23) = 0.39462 [0.5363]
Normality $Chi^2(2)$= 1.7282 [0.4214]
RESET F(1, 24) = 0.84151 [0.3685]

EQ(15) Modelling DLmf by OLS (the parsimonious model)

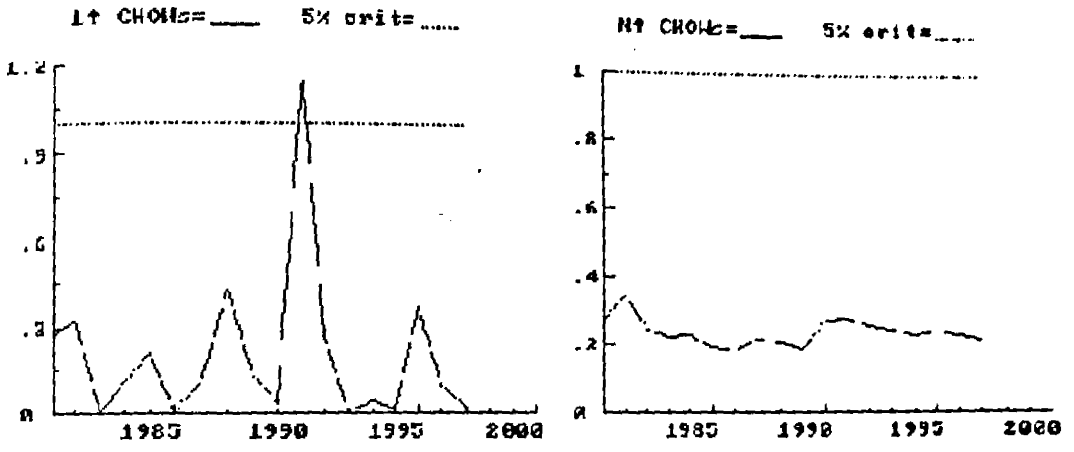
Variable	Coefficient	Std.Error	t-value	t-prob	HCSE	Part R^2
Constant	-0.038694	0.049579	-0.780	0.4434	0.052065	0.0269
DLr	0.15897	0.058822	2.703	0.0130	0.062947	0.2492
DLy	0.63977	0.14297	4.475	0.0002	0.13308	0.4765
DPf_1	-0.95708	0.49928	-1.917	0.0683	0.44060	0.1431
fecm_1	-0.92132	0.18585	-4.957	0.0001	0.17243	0.5276
dum84	0.48692	0.17698	2.751	0.0117	0.070768	0.2560
dum90	0.61313	0.18638	3.290	0.0033	0.091383	0.3297

R^2 = 0.856321 F(6, 23) = 21.853 [0.0000] $\hat{\sigma}$ = 0.161706 DW = 2.22
RSS = 0.5752716071 for 7 variables and 30 observations
Information Criteria: SC = -3.10741; HQ = -3.33409; FPE = 0.0324605
AR 1- 2F(2, 21) = 0.95433 [0.4019]
ARCH 1 F(1, 21) = 1.3964 [0.2512]
Normality $Chi^2(2)$= 2.3776 [0.3046]
RESET F(1, 22) = 0.79218 [0.3835]

APPENDIX 4

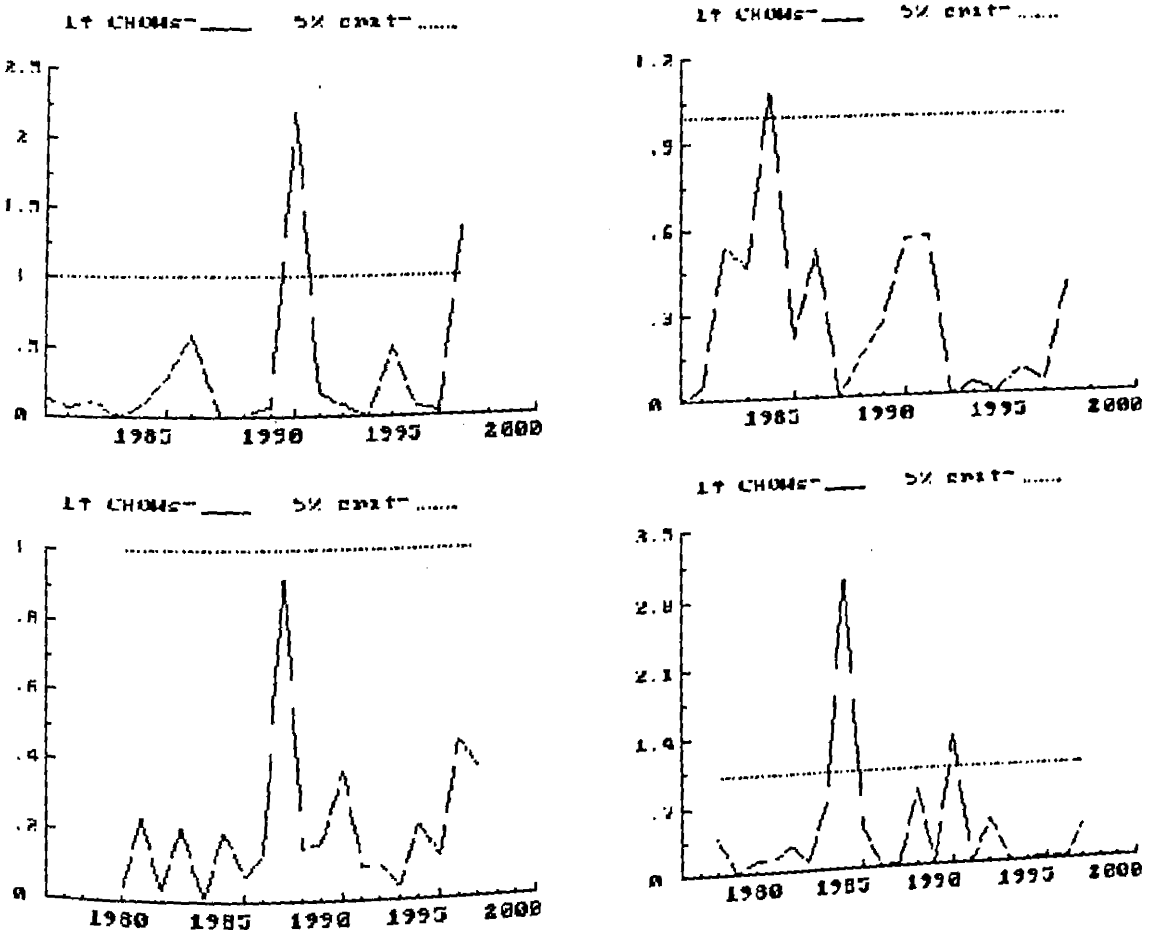
Appendix Figure 1:

One-Step and N-Step Chow Tests of Aggregate Imports equation Stability



Appendix Figure 2:

One-Step Chow Test of Import Components' Equations
(i.e., mc_t, mr_t, mk_t and mf_t, respectively)



Appendix Figure 3:

Stability of the Coefficients of the Aggregate Import Demand Equation