Import Demand in Ghana: Structure, Behaviour and Stability

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Contents

List of tables

List of figures

List of abbreviations

ADF	Augmented Dickey-Fuller
AERC	African Economic Research Consortium
AIC	Akaike Information Criterion
ECOWAS	Economic Community of West African States
ERP	Economic Recovery Programme
GDP	Gross domestic product
GNP	Gross national product
IMF	International Monetary Fund
LAVOF	Log of animal and vegetable oils and fats
LBT	Log of beverages and tobacco
LCH	Log chemicals
LCMIEF	Log of crude materials indelible except fuel
LDCs	Least developed countries
LFA	Log of foreign assets
LFER	Log of foreign exchange reserves
LFLA	Log of food and live animals
LM	Log of total imports
LMFLRM	Log of minerals, fuels, lubricants and related materials
LMGCM	Log of manufactured goods classified chiefly by material
LMMA	Log of miscellaneous manufactured articles
LMTE	Log of machinery and transport equipment
LREER	Log of real effective exchange rate
LY	Log of income
OLS	Ordinary least squares
PP	Phillips-Perron
SAP	Structural Adjustment Programmes
SITC	Standard International Trade Classification
ARDL	Autoregressive distributed lag

Abstract

This study analyses the structure of, and model demand for imports into Ghana using time series data from 1967 to 2004. Also, it assesses the long-run and short-run elasticities of aggregate imports and their components, and determines whether the import demand function has shifted during the period under consideration as a result of trade liberalization. Cointegration and error correction models are used to estimate parsimonious models for aggregate imports and three other categories. The results indicate that domestic income, foreign exchange reserves and trade liberalization all play significant roles both in the short-run and long-run import demand levels in Ghana. We also find that there is general parameter stability in the import demand functions over the study period. Therefore, trade policy authorities who aim at reducing imports to correct balance-of-payments imbalances in the long run should focus their efforts on policies that will increase the per capita income at the macroeconomic level and implement policies that will ensure an even distribution of per capita income to reduce poverty.

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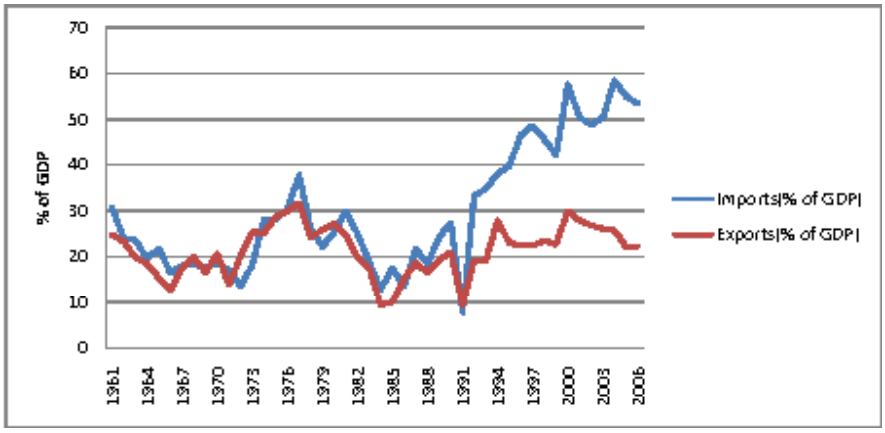
1. Introduction

It is generally accepted that developing economies require increasing quantities of certain imports they cannot produce themselves efficiently, especially capital goods, certain intermediate goods and many raw materials. Vigorous import substitution only tempers the economy, but does not eliminate the growing demand for imports. The importance of foreign trade in the development process has been stressed in the two-gap model developed by McKinnon (1964). Imports are a key part of international trade and the import of capital goods in particular is vital to economic growth. Imported capital goods directly affect investment which, in turn, constitutes the engine of economic growth. For Ghana, such goods include heavy machinery and equipment, intermediate inputs and other raw materials, such as crude oil.

Initially, most developing countries could place orders with suppliers for any quantity or value of imports.By the early 1970s, they began experiencing chronic foreign exchange problems, which exemplified the looming economic crisis (Mwase, 1990). Thus, in the previous decades, the capacity to import for some developing countries, including Ghana, had declined or stagnated while import demand continued to grow. Before the inception of the Economic Recovery Programme (ERP), a period characterized by trade restrictions, Ghana's exports and imports of merchandise grew at almost an equal rate, with exports exceeding imports in value. The inception of the ERP in 1983 saw faster growth in imports, as shown in Figure 1.Ghana's negative trade balance continued to rise in this period.

Figure 1: Export and import of Ghana's merchandise, percentage of GDP (1961–2006)



Source: Calculated from UNCTAD and World Development Indicators (online version)

Problem statement

As in most African economies, Ghana and the Bretton Woods institutions jointly devised and implemented structural adjustment programmes (SAPs) in Ghana, of which trade liberalization was a component. These programmes and policy measures sought to reduce external disequilibrium while strengthening production capacity. Among the principal measures to bring about external balance, the policies attempted to influence imports.The authorities also became more preoccupied with mobilizing external financial assistance, thereby incurring debt.The debt burden, however, has engendered a decrease in public investment spending and an increase in budgetary deficits. Ghana has also undergone real devaluation and undertaken substantial trade liberalization in an effort to improve its balance-of-payments situation. This has necessitated knowledge of the determinants of import demand and how each determinant influences import demand, both in the long and short run. It has also become necessary to determine whether the pattern of import demand has changed due to these policy changes.

Objectives of study

The study generally analyses the structure of, and model demand for imports of goods into Ghana. It also assesses the elasticity of import demand with respect to the various determinants of aggregate imports and their components, and determines whether import demand functions had shifted during the period under consideration. In order to achieve this general objective, the following specific objectives are pursued:

- Estimating import demand functions for Ghana and analysing elasticities from the model;
- Examining the stability of the import demand functions;
- Testing the effect of trade liberalization on import demand in Ghana over the study period 1967 to 2005; and
- Deducing policy implications.

Hypotheses

In order to achieve the stated objectives, the following hypotheses are tested:

- The income elasticity of import demand (all types of imports) is positive. This hypothesis is based on the assumption that, all other variables remaining the same, an increase in real income leads to an increase in real consumption with an unchanged distribution of income, and more foreign goods are purchased. Secondly, an increase in real income also leads to an increase in real investment and output, which means that investment and intermediate goods not produced domestically have to be bought from abroad.
- Foreign exchange availability is positively related to all types of imports. This hypothesis assumes that import purchases are only possible with foreign exchange.

- The a priori sign of a lagged real import coefficient is positive, as demonstrated in the literature.
- The price elasticity of demand for imports (all types) is negative.
- The import demand function did not shift and the parameters are stable over the period of study.

Significance of study

There are two conflicting issues concerning imports in developing countries. Firstly, for balance-of-payments reasons it may be necessary to restrict imports. A deterioration in balance-of-payments and terms of trade make it necessary for developing countries to restrict imports. Secondly, the restriction of imports does not only cause tariff revenue to fall but can also lead to an exacerbation of inflationary tendencies in the domestic economy. In some cases, some of the policies designed to restrict imports or increase revenue may have the opposite effect. Import demand stability is, in fact, a prerequisite for an effective trade policy (Arize and Afifi, 1987). In other words, effective trade policy formulation requires that the change in import demand as a result of changes in import price, national income and other variables that explain imports do not change significantly over a long period. To achieve efficient policy formulation it is necessary for the authorities to know not only the signs, but also the magnitude and stability of the response of the relevant variables that are required for policy decision making. The derived estimates can be used not only as an analytical tool in decision making, but also as an instrument for economic forecasting (Ajayi, 1975).

The estimation of import demand functions has more than an academic motivation. The choice of suitable policy measures about imports requires an accurate understanding of the specific import demand function of a country. The estimation results can be used to assist the government tax revenue collection agencies in forecasting the level of tax revenue from import sources, as knowledge of the behaviour of imports will inform the behaviour of import tax revenue. The study also provides a basis for the formulation of international trade policy coordination in Ghana for both bilateral and multilateral trade relations, as well as useful input for macroeconomic modelling of the Ghanaian economy.

2. Evolution of international trade and exchange policies in Ghana

Ghana has experienced two major trade and payment policy regimes since independence. At independence in 1957, there was a relatively free international trade and payments system. This was replaced in the early 1960s by a restrictive foreign exchange regime involving licensing and exchange controls. Since then the country has experienced various trade and payment regimes.

Krueger (1978)identified five phases of trade regimes in a cycle. Accordingly, Jebuni et al. (1994) demonstrate that Ghana experienced two cycles, and in both cycles Ghana's trade regime went through all five phases, as indicated below.

Cycle I:	1950–1961	Phase V, Liberal trade regime
	1961–1963	Phase I, Introduction of controlled regime
	1963–1966	Phase II, Breakdown of control system
	1966–1967	Phase III, Attempted liberalization
	1967–1971	Phase IV, Import liberalization
Cycle II:	1972	Phase I, Introduction of controlled regime
	1973–1983	Phase II, Breakdown of control system
	1983–1986	Phase III, Attempted liberalization
	1986–1989	Phase IV, Import liberalization
	1989 onwards	Phase V, Liberal trade regime

Two main trade regimes can be identified in Ghana's trade cycles. In both cycles,Phases III, IV and V can be described as liberalized trade regimes, while Phases I and II can be considered controlled trade regimes.

Ghana's trade regime changed alongside the political developments. At independence in 1957, there was a liberal trade regime instituted by the colonial administration to facilitate the export of raw materials to Europe. There were no restrictions on exports, imports and payment systems in this era. However, when Ghana became a republic, the Kwame Nkrumah administration pursued an aggressive import substitution industrialization strategy which led to restrictions on the import of goods which could be produced locally. Other exchange restrictions, such as limits on foreign exchange transfers, were introduced to curb possible capital flight. This is called Phase I of Ghana's trade regime.

Between 1963 and 1966, when the unification of Africa was at the top of the political agenda, most restrictions on trade, although not removed, were not enforced in practice. This was the phase of the breakdown of control systems. When the military took power in 1966 there were attempts to remove all trade barriers introduced by the previous administration. This liberalization process could not be completed before a civilian government was voted into office in 1967. This short period of the military

regime's attempt at trade and payment liberalization, Phase III, was modified by the new government with an emphasis on import liberalization. This emphasis was necessitated by the shortage of basic necessities in the economy at the time. This phase, Phase IV of Ghana's liberalization, lasted for about three years whereafter the military took over and reintroduced a controlled regime, thereby starting the cycle again.

Between 1972 and 1989 there was experimentation with different trade policies, as listed above in Cycle II, until 1989 when the trade liberalization programme was realized.

Our study period (1967–2004) coincided with Phase IV (1967–1971) of Cycle I, which was a liberalized trade regime, and Cycle II, which was characterized as a controlled regime (1972–1983) and a liberalized trade regime (1983–2004), and was the beginning of ERP implementation.

Trade and payment policies in pre-ERP era

Before independence, Ghana exported only primary products such as minerals, cocoa, and timber, and the economy was primarily agrarian. Soon after independence, Ghana improved its infrastructural base to transform the economy to a modern industrial one through an import substitution strategy.

Output grew considerably, and value added in agriculture as a percentage of GDP increased from 40.8 in 1960 to 60.7 in 1978. Soon after the introduction of this strategy, certain structural rigidities emerged that were associated with this approach to development. Export prices declined in the face of huge import bills leading to a sharp deterioration in the balance-of-payments situation, a depletion of foreign exchange reserves and an acute foreign exchange shortage. This called for stringent restrictive trade and payment policies. The Exchange Control Act (Act 71) was promulgated in July 1961 as a measure to curb importation.

Soon after the overthrow of the government in February 1966, the military regime embraced IMF/World Bank policies and the economy was steered away from socialist ideas towards a more market-oriented economy. In fact, the allocation of import licences was altered considerably. This regime attracted foreign aid and some debt relief in the face of increasing cocoa prices, resulting in an improved balance-of-payments position.

In the latter part of 1969, the military government handed over power to the democratically-elected government, which continued with the trade liberalization policies of the military regime, but complemented them with import surcharges. The authorities also devalued the cedi from 1.02 cedi to a US dollar to 1.82 cedi to the US dollar in December 1971. Unfortunately, these policies did not cure the balance-of-payments problems or the other economic malaises plaguing the country, which proved to be politically fatal as the government and its policies were overthrown in another military takeover in January 1972. As preliminary trade and payment policy measures, the nominal exchange rate was revalued in February 1972, leading to a net devaluation of 20%.

In fact, the period 1972 to early 1983 (a period of four governments) was characterized by a series of strict import controls. Instruments used to constrain imports varied from exchange controls, multiple exchange rates, quotas, import licensing and tariffs and, above all, the use of quantitative restrictions. Restrictions were implemented through issuance of three import licences: Open general licences (allowing registered importers to import

items specified on the licence without any restraint); special unnumbered licences (issued to importers with access to their own foreign exchange); and specific licences (which required authorization before importing any item). By the end of 1972, about 150 items were either restricted or banned, and by 1973 the list of banned items increased to 170.

Trade and payment policy reforms

The major trade policy reforms were brought about by the trade liberalization that was begun in 1983. The basic objective of these reforms was to remove all barriers to trade and payments in the country. As a result, in 1986 there was a re-classification of import licences into three main categories. This move was intended to improve the import licensing system that was introduced before the ERP. In January 1989, the import licensing system was completely abolished. This resulted in the elimination of the special development levy that accompanied it.

Consequently, the cost of importing was reduced for most categories of commodities. On average, there was a decrease of between 5 and 10 percentage points in the tax rate for all importing categories, except luxury goods.

Following a removal of the 17.5% "special import tax" in 1999, and the lowering of the highest tariff rate of 25% to 20% in 2000, mainly on consumer goods, the simple average applied most-favoured-nation (MFN) tariff rate was 13% in early 2000. Ghana has a four-tier tariff structure, with rates of zero, 5%, 10% and 20%. However, the "temporary" introduction of another "special import tax" of 20% in April 2000, mainly on consumer goods and covering 7% of tariff lines, effectively added a fifth tariff rate of 40% and raised the average applied MFN tariff to its current rate of almost 15%. Ghana applies MFN tariffs to all trading partners, except for duty-free imports from ECOWAS members (WTO, 2001).

With the sharp reduction in tax rates, the abolishment of import licences, and the outflow of foreign exchange liberalized under the ERP, the government began to appreciate the critical importance of facilitating a rapid expansion of foreign exchange earnings through the pursuit of a vigorous export drive. In addition to maintaining most components of the pre-ERP export incentive packages, the government introduced a more generous foreign exchange retention scheme, as well as a duty drawback on imported inputs. To benefit from this, an exporter needed to be registered with the Ghana Export Promotion Council and obtain a letter of exemption from the National Revenue Secretariat.

Exchange rate policy reforms

There was complete reform on the exchange front as well. Before the policy reforms, Ghana's foreign exchange market was characterized by an extremely overvalued official exchange rate, a flourishing foreign exchange black market and the allocation of official foreign exchange based on import licensing arrangements. The reforms, therefore, started with the introduction of bonuses and surcharges on foreign exchange. This resulted in the birth of a multiple exchange rate system. The weighted average value of these rates was 2.75 cedi to one US dollar.

On 19 September 1986, a system was introduced where the exchange rate was market-determined by a weekly auction. This resulted in a fixed exchange rate system, called window 1, and a flexible exchange rate system, called window 2. Window 1 was determined by the authorities and was intended for official transactions. The window 2 rate, which basically applied to non-official foreign exchange transactions, was determined through a "Dutch" pricing system in a weekly auction held by the Bank of Ghana. With the exception of foreign exchange earnings from exports of cocoa, residual oil, imports of petroleum products, essential drugs and service payments on government debt contracted before the beginning of 1986, all foreign transactions that went through the official banking system were subjected to the auction rate.

However, the two windows were unified in February 1987 and the auction market was applied to all officially-funded transactions as well. At the same time, the incorporation of customer goods into the auction market was announced, and by 1988 it was fully implemented. In the latter part of the year, a system permitting the establishment of privately-owned foreign exchange dealing units, called forex bureaux, was introduced.

In April 1990, the government merged the auction and bureaux rates, thereby narrowing the difference between these rates to less than 10%. The narrowing of the gap between the official and parallel market rates accelerated the elimination of incentives for trade malpractices that the two rates provided. The flexible exchange rate policy continues to be the exchange policy in Ghana to date, in line with the liberalization policy.

The result of all these policy reforms is that the nominal exchange rate depreciated from 2.75 cedi to the US dollar in April 1983 to about 2250 cedi to the dollar by December 1997, and further to 9,130.42 cedi to the US dollar by December 2005. Over the period of implementing the above exchange rate policies, the parallel market premium, which reached 1,718.18% in 1981, was almost completely eradicated to 1.97% by 1997.

3. Structure and sources of imports

The import figures reveal that, on average, the imports of machinery and transport equipment dominated aggregate import over the study period, except for the 1960s. This is followed by manufactured goods, chemicals, and food and live animals, respectively. This import distribution pattern has not changed significantly over the period (see Table 1).

Table 1: Structure of import by section (average of percentage of total imports)

	1967–1969	1970–1979	1980–1989	1990–1999	2000–2005
Food and live animals	12.80	11.01	6.09	8.43	12.43
Beverages and tobacco	6.42	1.07	0.65	0.23	1.12
Crude materials, (excl. fuels)	0.35	2.91	1.92	4.10	3.21
Mineral fuels, lubricants and related materials	30.13	15.80	16.13	15.45	9.64
Animal and vegetable oils, fats and waxes	0.66	1.23	0.57	0.30	0.96
Chemicals	6.05	14.94	13.15	9.82	12.87
Manufactured goods classified chiefly by material	28.50	18.64	16.35	16.35	19.97
Machinery and transport equipment	8.48	28.76	31.65	39.65	30.39
Miscellaneous manufactured articles	5.28	3.07	8.09	8.43	9.40
Commodities and transactions not classified elsewhere in the SITC	1.33	2.57	4.00	0.04	0.00
	100	100	100	100	100

Source: Calculated from Ghana Statistical Service's *Quarterly Digest of Statistics*

The immediate determinants of this pattern can be attributed to a number of factors. A key factor could be the import substitution industrialization policy that was vigorously pursued by the Kwame Nkrumah regime in the late 1950 and 1960s. This strategy, which is commensurate with industrial development, relied mainly on imported inputs, particularly raw materials and machinery, for the agricultural sector. Of course, this meant dependency on imported machinery and equipment that were basic to production in the economy. The gradual relative decline in the imports of consumer goods was due largely to the foreign exchange crisis, which was precipitated by the collapse of cocoa prices in the world market. Following this was the implementation of import control measures. In this respect, a review of Ghana's trade and exchange rate policies, with particular emphasis on import control measures, will certainly sharpen an understanding of the determinants of import behaviour (see Table 2).

Table 2: Sources of import by region (average of percentage of total imports)

	1960–1969	1970–1979	1980–1989	1990–1999	2000–2006
World	100	100	100	100	100
Developing economies	10.97	19.78	35.01	36.60	51.82
Economies in transition	4.38	2.98	0.45	0.21	0.79
Developed economies	83.69	73.41	63.94	62.76	46.42
Developing economies: Africa	5.38	11.49	23.74	21.09	25.30
Eastern Africa	0.09	0.05	0.26	0.16	0.13
Middle Africa	0.03	0.07	0.02	0.08	0.83
Northern Africa	0.94	2.58	2.67	0.52	0.49
Southern Africa	0.50	0.28	0.02	1.49	3.92
Western Africa	4.30	8.51	20.83	18.83	19.93
Developing economies: America	1.28	2.59	2.44	4.12	4.34
Caribbean	0.56	1.43	1.68	2.40	0.97
Central America	-	0.09	0.02	0.02	0.03
South America	0.72	1.07	1.02	1.70	3.33
Developing economies: Asia	4.31	5.69	8.84	11.39	22.18
Eastern Asia	2.40	3.64	7.17	6.29	12.39
Southern Asia	1.40	0.98	1.23	1.46	3.80
South-Eastern Asia	0.08	0.57	0.34	2.87	4.94
Western Asia	0.44	0.51	0.10	0.78	1.04
Developing economies: Oceania	-	-	-	0.01	0.01
Economies in transition: Asia	-	-	-	0.01	0.04
Economies in transition: Europe	-	-	-	0.17	0.75
Developed economies: America	13.50	16.17	11.14	9.95	7.98
Developed economies: Asia	7.05	6.35	4.48	4.35	2.08
Developed economies: Europe	62.59	49.85	47.94	47.21	34.92
Developed economies: Oceania	0.55	1.05	0.38	1.25	1.44
Unallocated, unspecified or other economies	0.97	3.83	0.59	0.43	0.97

Source: UNCTAD *Handbook of Statistics*

Ghana's imports are mainly from Europe and America, with European imports constituting as much as 62.6% in the 1950s, decreasing gradually to about 35% in the 2000s. While the imports from Europe decreased over the years, they increased from Asia and the rest of Africa. Imports from Asia increased to over 20% in the 2000s from about 5% in the 1960s to about 22% in the 2000s, while imports from the rest of Africa

increased from an average of 5.4% in the 1960s to 25.3% in the 2000s.

According to Brafu-Insaidoo and Obeng (2008), imports from ECOWAS member countries rose in importance, accounting for about 25% of total imports (c.i.f. value) in 1990. However, 1991 and the 1993–1996 period witnessed a dip in the relative importance of imports from ECOWAS. The sudden resurgence in the importance of imports from the community in 1997 to about 16% of total imports could be attributed to the duty-free preferential treatment applied to a wide range of products imported from the subregion. The relative importance of imports from ECOWAS member countries rose substantially in 2000 and 2002, recording about 17.4% and 21% of total imports in the respective years.

4. Literature review

Theoretical framework

The major strands of the import demand model can be classified according to three distinct groups: The traditional (benchmark) import model, the import-exchange model and the monetarist model.

The traditional import model formed the main theoretical framework for initial studies on import demand. The model suggests an analysis of import demand relations based on the consumer theory of demand. The traditional formulation of an aggregate import demand equation relates the real quantity of imports demanded by a country to the ratio of import prices to domestic prices (assuming a degree of substitutability between imports and domestic goods) and to domestic real income, all in period t (Arize and Afifi, 1987). Khan (1974, 1975) did the leading work on this model. From economic theory, the import demand function can be written as:

$$M_{it} = f(Y_t, PM_{it}, PD_{it}) \quad (1)$$

Y_{it} = the real gross domestic product
M_{it} = quantity or volume demanded of the ith commodity
PM_{it} = the price of the ith import commodity
PD_{it} = the price of the ith domestic commodity

Traditional models work on the assumption that standard demand functions are

homogenous of degree zero in prices and income, implying the absence of money illusions.

In order to estimate Equation 1, two types of formulations are considered: Linear and log-linear. Many studies have shown that the log-linear specification is preferable (Khan, 1974; Arize and Afifi, 1987) because of two main reasons:(i) The log-linear specification allows imports to react in proportion to a rise and fall in the explanatory variables; and (ii) assuming constant elasticities avoids the problem of drastic falls in the elasticities as imports rise (Khan, 1974).

Generally, two versions of this basic model are considered in the literature: The equilibrium model, and the disequilibrium model.

Khan (1974) first developed the equilibrium model. This model has the following basic hypothesis: There is no delay in the system so the adjustment of imports and prices to their respective equilibrium values is instantaneous. Thus, the adjustment is realized entirely within a year. The import demand can then be written as follows:

$$\log M_{it} = a_0 + a_{1i} \log Y_t + a_{2i} \log P_{it} + e_{it} \tag{2}$$

where

P_{it} = relative import price *i.e* $P_{it} = \left(\frac{PM}{PD}\right)_i$
log = the natural logarithm
Y_t = real gross domestic product
t = the time subscript
i = commodity subscript
e = the error term assumed to be randomly and normally distributed, and $a_{1i}>0$ and $a_{2i}< 0$.

For the estimation of Equation 2, two specific assumptions are made associated with the problem of aggregation and measurement errors (Khan, 1974): Importers always adhere to their demand functions, i.e., demand for imports equals actual imports, and supply price elasticities are infinite.

The disequilibrium model approach takes into account the potential sources of bias by specifying a partial adjustment process. Therefore, the change in imports is related to the difference between import demand in period t and actual imports in period t-1. This adjustment introduces the following equation:

$$\Delta \log M_t^d = \lambda\left(\log M_t^d - \log M_{t-1}^d\right) \tag{3}$$

where $0 < \lambda < 1$

D$logM^d_{it}$ = l$(logM^d_{it} - logM_{it-1})$ demonstrates a distributed lag structure with geometrically declining weights into the determination of imports. l is the adjustment coefficient ($0<l<1$). If the difference is 0, then the adjustment coefficient equals 1 and the short-run elasticity becomes the equilibrium elasticity. Equation 3 takes into account the costs involved in the adjustment of imports to a desired flow and the fact that only part of the adjustment is achieved within a period. Similarly, many imports are associated with contracts extending over a period of time and may not respond immediately to changes in demand.

Equation 3 assumes that import prices are determined abroad, that is, the price of imports relative to the domestic price level is exogenous to the importing country and quantities are adjusted domestically (Khan, 1974; Arize and Afifi, 1987).

Substituting Equation 2 forEquation 3 and solving for imports in period t yields Equation 4, where la_1 and la_2 are the short-run price and income elasticities, respectively.

$$\log M_t = \lambda\alpha_0 + \lambda\alpha_1 \log\left(\frac{M}{P}\right)_t + \lambda\alpha_2 \log Y_t + (1-\lambda)\log M_{t-1} + \lambda\beta_t \quad (4)$$

The strength of this model lies in its simplicity and intuitive appeal. However, the traditional model has some weaknesses and, based on casual empirical work, various alterations have been made to the benchmark model. The traditional model implicitly assumes the absence of binding import quota restrictions and the income variable can be used to approximate the role of expenditure (domestic absorption). However, empirical economists have defended the existence and impact of import quotas. Quantitative restrictions do affect the magnitude of both price and income elasticity of import demand, as well as import levels (Bertola and Faini, 1991). Relevant indicators used in the literature include, among other things, the following proxies for foreign exchange constraints: Import duties, debt, export receipts; international reserves; and parallel market premia (Sachs, 1981 and 1982). This model is not directly relevant to Ghana because of the changes in trade regimes where trade restrictions, in the form of import quotas, were used for some years. These weaknesses led to the proposition of the import-exchange framework.

Hemphill (1974) first proposed the import-exchange framework which was further developed by Chu et al. (1983), Winters and Yu (1985), Sundararajan (1986) and Moran (1989). The development of the framework attests to the growing inability of the traditional framework to track and explain the slowdown in imports of developing countries that have a foreign exchange shortage (Mirakhor and Montiel, 1987).

Hemphill (1974) argued that import demand functions are related to foreign exchange constraints. In the model's reduced form, the lagged level of international reserves and foreign exchange receipts in real terms are the principals of import demand. The justification for the relationship is usually that demand for foreign exchange exceeds supply at the existing exchange rate, and that the stock of reserves is small (Hemphill, 1974). In these circumstances, if export earnings fall or if capital inflows are reduced, the authorities have little choice other than to tighten restrictions on imports in the short

run; similarly, the restrictions on imports may be eased if exports or capital inflows were increased.

According to this framework, Hemphill (1974) specified the model as:

$$m_t = b_o + b_1 f_t + b_2 r_{t-1} + b_3 m_{t-1} + u_t \quad (5)$$

where m_t, f_t, r_{t-1}, m_{t-1} and u_t are the current volume of imports, lagged level of international reserves, lagged level of imports and error term, respectively. The Hemphill model ignores relative prices and domestic income, which are important determinants of imports in developing countries such as Ghana.

Moran (1989) expanded this approach by introducing traditional variables, i.e., domestic income and relative prices, to explain import demand. The essence of Moran's approach is to alleviate biases due to the omission of relevant variables and to interpret the interaction of variables that affect import demand and the country's capacity to import. In addition to the inclusion of the additional variables, Moran re-specifies the model in a log-linear form as:

$$\log m_t = b_0 + b_1 \log f_t + b_2 \log r_{t-1} + b_3 \log m_{t-1} + b_3 \log \left(\frac{M}{P} \right)_t + b_3 \log y_t + \mu_t \quad (6)$$

where $\frac{M}{P}$ and y_t are relative price and domestic income, respectively.

Thus, Moran developed an important model of import demand for and supply of a given country.From Moran's import equation, we can conclude that the traditional and Hemphill models are special cases of the general import model. The two models, the standard function and the relation based on exchange receipts, would effectively coincide.

The Moran (1989) model seems to be more realistic and a more complete import demand model for developing countries such as Ghana, because it includes the foreign exchange constraints typical of these countries. This model, however, excludes money-market variables.

Essentially motivated by the exclusion of money-market variables from the traditional specification of import demand, Ozo-Eson (1984) introduced the state of equilibrium in the money market (Exm) as a major determinant of import demand. He derived a reduced form model of import demand, with the distributed lag of money supply as an argument, by assuming a partial adjustment mechanism for demand for real money balances.According to the monetarist approach, pure income elasticity of import demand is the sum of the income elasticity suggested by the traditional framework and the income elasticity of money demand. This implies that the traditional model of import demand underestimates the pure income elasticity of import demand. Similarly, the

appropriate specification of the import function is the one suggested by the reduced form model of the monetarists' framework. However, a reduction in money supply is likely to reduce aggregate import in any economy, as suggested by the policy implications in the framework.

The inclusion of the money market in the import demand model makes it convincing and more applicable across different economies. Our study is based on this model.

Empirical literature on developing countries other than Ghana

The empirical studies of import behaviour in developing countries generally have concentrated on Asia and Latin America, while largely ignoring African countries. Many developing countries rely heavily on import controls for achieving adjustments in the balance of payments. In spite of that, most of the empirical analyses of imports of these countries have failed to address explicitly the issue of quantitative restrictions.What follows are some of the empirical studies conducted on import demand in developing countries.

Khan (1974) estimated the import demand function for 15 developing countries in Asia, Latin America and Africa for the period 1951–1969.According to Khan, the dependent variable was quantity of imports of country i (in logarithm) while the independent variables were real GNP (log) and the unit value of import of the country i over domestic price level. His estimation was done with the two-stage least squares method of two forms of equations of import demand. Initially, it is assumed that the adjustment of quantities to the variation of the explanatory variable is instantaneous (less than one year). In the second, the possibility of lag in the adjustment process is allowed. The empirical results indicated that prices appear to play an important role in the determination of imports. In a number of developing countries, the estimated price elasticities were found to be fairly high. In 1975, Khan again conducted an analytical (empirical) study on the import demand function in Venezuela for the period 1953–1970, but using an OLS method with the same variables. It showed that the simple specifications involving only relative prices and real income as explanatory variables are adequate to explain a large proportion of the variation of Venezuelan imports; this is true at the aggregated as well as disaggregated levels. With the exception of the imports of construction material and tobacco and beverages, all other categories of imports have price elasticities that are significantly different from zero, at the 5% level, and have the expected negative signs. Ajayi (1975) introduced some dynamism into the model by observing the behaviour of equilibrium through the specification of a partial adjustment mechanism for retained imports. He studied factors that are important in the determination of retained imports in Nigeria for the period 1960–1970.Using the OLS method, he found that relative prices and real income are important determinants of the demand for retained imports. When the retained import per capita was used as the dependent variable, relative prices, foreign exchange availability per population and real income were all found to be important determinants, which coincided with studies done by Khan.

Building on the traditional model, Moran (1987) used pooled cross section time series data to estimate a general import model. The results suggested that the import

model used by Moran (1987) explains import behaviour better than the traditional and Hemphill (1974) models (which exclude relative import prices and income). In fact, in order to avoid bias due to the simultaneity of import volumes and relative prices, and after studying import demand for 21 developing countries for the period 1970–1983, Moran (1989) formulated an empirical model where import volumes and relative import prices are determined endogenously. He argues that consistent estimates of demand elasticities can only be obtained by using a simultaneous equation procedure, such as the two-stage least squares model (see also Arize and Afifi, 1987). The empirical results show that although price and income effects are important in the analysis of imports in developing countries, it appears that foreign exchange constraints also play a critical role in determining imports. Import demand estimation should also account for the endogeneity of the domestic prices of imports. In an earlier work by Arize and Afifi (1987), utilizing the iterative Cochrane-Orcutt method to produce two-stage least-squares estimates in one large econometric study, the import demand functions of 30 developing economies are examined, including 27 countries in Africa. Their results show that import functions are stable for the entire sample. Price elasticities generally are large, and import demand appears to be more responsive to variations in domestic goods' prices than in import prices.

Instead of focusing on one economy, some analyses cover small or large groups of countries. Stern et al. (1976) and Sawyer and Sprinkle (1999) offer a comprehensive survey of empirical works conducted at both levels.

Moving from the static OLS model of earlier studies, which examines only the long-run relationships, other studies made use of the error correction model, which examines both the short-run and long-run relationships. For example, Senhadji (1997) elaborates and estimates import functions for 77 countries during the period 1960–1993. For most of the countries, a unique long-run relationship between import demand and its determinants is found. The cointegrating vector is estimated efficiently using the fully modified technique suggested by Phillips and Hansen (1990). The price elasticity is generally close to zero in the short run and slightly larger than 1 in the long run, while income elasticity is smaller than 0.5 in the short run and rises to around 1.5 in the long run. Industrialized countries exhibit higher incomes and lower price elasticities than developing countries.

Using an error correction model and CHOW test to estimate the elasticities for aggregate import and its components, and testing for stability of import demand during trade liberalization in Kenya for the period 1964-1991, Mwega (1993) shows that short-run relative price and real aggregate import demand elasticities are weakly significant. Conversely, aggregate imports are strongly responsive to lagged foreign assets and foreign receipts. The CHOW test reveals the stability of the function. Egwaikhide (1999) also estimates an error correction specification for an import demand model for Nigeria and indicates that foreign exchange earnings, relative prices and real income all significantly determine the behaviour of total imports in the reference period. Findings also show that short-run import decisions are determined by the dynamics of foreign exchange, which are tied to the long-run effect through the feedback mechanism. The results of the disaggregated imports reveal the importance of foreign exchange. Dutta and Ahmed (1999) also use cointegration analysis and error correction models to examine

the aggregate import demand function in Bangladesh. They identify a unique and stable relationship between the variables and propose a substantial influence of income on import demand. Their models satisfy almost all diagnostic tests conducted.

Gumede (2000) examines aggregated and disaggregated import demand for South Africa in a framework of cointegration analysis. He obtains the long-run relationship among the variables with the two-step Engle-Granger technique and introduces it into a short-run dynamic model. Income elasticity is found to be much larger than price elasticity. The literature confirms that the characteristics of the import demand function differ markedly between countries. As such, accurate and specific import functions need to be derived for the selection of appropriate policy measures.

Tang and Nair (2002) evaluate the stability of the import demand function in Malaysia using the bounds test. Import demand, income, and relative price are found to be cointegrated. Their study derives long-run income and relative price elasticities of 1.5 and 21.3, respectively. In the same fashion, Razafimahefa and Hamori (2005), using a UECM-based "bounds test" to investigate cointegration, analyse the long-run relationship among the variables in the aggregate import demand functions of Madagascar and Mauritius in order to evaluate the appropriateness and effectiveness of the SAPs. The study confirms the existence of a cointegration relationship, and therefore concludes that the stabilization and devaluation policies under the SAPs can be effective in reducing import demand.

Empirical literature on Ghana

The literature on import demand in Ghana is not vast compared with other African countries such as Nigeria. The literature available considers import demand for Ghana in a wider macroeconomic model.

As part of a wider study, Leith (1974) estimated an equation describing the behaviour of the import system in Ghana taking into account GDP and licensing, but not the price-level-deflated effective exchange rate facing importers, because the latter was not a restraining influence on imports during the period under study. The study finds that GDP in current prices and the licensing dummy of pre-devaluation continued to explain the level of imports. The system governing imports did not appear to have changed significantly with devaluation.

Using the traditional model in their general work on a macroeconomic model of the Ghanaian economy, Abbey and Clark (1974) estimate an import demand function for nine commodity classifications, and argue that there were benefits in estimating disaggregated imports rather than a single aggregate import function. The sample period consisted of two subperiods: 1956 to 1961, in which there were no import quotas, and 1962 to 1969, when import quotas were applied. For the no-quota period, imports of all commodities, except minerals, fuel,and machinery and transportation equipment, were explained by real disposable income, either on their own or with relative price. They argue that, according to Leith (1974), the quotas were not effectively applied during the quota period. Most of the quotas were not commodity-specific but instead permitted buyers to import a wide range of commodities. As a result, there was no way of knowing what the value of imports would be for a specific commodity classification. Building on

Leith (1974) and Abbey and Clark (1974), Jebuni, Sowa and Tutu (1994) considered the trade sector as part of a wider macroeconomic model for Ghana, in which they estimated an aggregate import demand for the country. The model used in this study was based on Khan and Knight (1988), except that relative prices replace the real exchange rate. Using an OLS model they indicate that the real exchange rate has a significant effect on imports, but with an unexpected sign. The results show that real devaluation increases the level of imports, which they claim was as a result of the fact that the country was highly dependent on imports that were very significant for key sectors such as industry, mining and timber. Also, they found that liberalization had led to an increase in import volumes and real import values.

In studying the East Asia Crisis and its impact on the Ghanaian economy, Dordonu and Sackey (1998) found that overall imports depended on Ghana's income earnings from exports (capacity to import) and exchange rate. They also found that there is a positive relationship between imports of capital equipment and raw materials, and variables such

as domestic income, and earnings from exports and terms of trade. However, a negative relationship was observed between capital imports and the exchange rate variable. An important issue emanating from their regression results is the positive causal relationship between capital imports and export earnings. Their results also show a similar positive causal relationship between Ghana's imports of consumer goods and export earnings.

As indicated in the literature, classical models of import demand in LDCs rely on a standard specification, with income and relative prices as the determinants of import demand. To capture the strictness of the control regime a more general model, including the levels of reserves and foreign exchange availability, was developed by some authors, for example, Diaw (1995). For others, such specifications are inadequate as it is not clear in these types of models whether the foreign exchange constraint is binding.

5. Methodology

In this section, we consider the theoretical and empirical models to be used for estimating import demand functions for Ghana. The theoretical model used is derived from the traditional equilibrium model by Khan (1974), but employs an error correction model, not only to determine the dominance of import demand but also to estimate the elasticities of the factors.

The import demand model

In this paper, the model used to study import demand is based on consumer demand theory in the context of imports for a country. Khan (1974), Hemphill (1974), Ozo-Eson (1984) and Moran (1989) provide a theoretical basis, as discussed in the previous section. In analysing import demand, we study one of the behavioural relationships in economic theory. This relationship is an aggregate of the individual behaviour for a given country, state, and/or territory (Olayide, 1968). The simplest formulation of an aggregate demand equation relates the quantity of imports demanded to the ratio of import prices to domestic prices (assuming a degree of substitutability between import and domestic goods) and to domestic real income, all in period t (Khan, 1974). The adopted equation system for aggregate import demand, based on economic theory is:

$$M_t^d = \alpha_0 \left(\frac{PM}{P} \right)_t^{\alpha_1} Y_t^{\alpha_2} e^{\mu_t} \tag{7}$$

In log-linear terms the estimating equation becomes:

$$LogM_t^d = a + \alpha_1 \log \left(\frac{PM}{P} \right)_t + \alpha_2 \log Y_t + \mu_t \tag{8}$$

where

a = log a_0
M = value of retained imports, that is imports adjusted for re-exportation
PM = unit value (price) of imports
P = consumer price index
Y = real gross domestic product
u_t = error term

Subscripts *d* and *t* show demand and time period, respectively, and a_1 and a_2 are relative price and income elasticities, respectively, where $a_1 < 0$, $a_2 > 0$. An increase in the relative price makes imports more expensive so we expect import demand to reduce with the relative increase of imports. However, an increase in the domestic income increases the capacity of a country to import, so import demand will rise as a result.

Given that Ghana is a small importing country, we assume that the supply of imports is given and that the availability of foreign exchange acts as an instrument. In order to account for the role of quantitative restriction (QRs), most studies have included measures such as international reserves, exports receipts, overseas assets and exchange rate in the import equation (see, for example, Ajayi, 1975; Kubursi, 1974 and Olayide, 1968). The assumption underlying the use of these alternative measures is that the authorities vary restrictions inversely to the country's capacity to import, and this capacity can be measured with one of the above proxies.

Trade restrictions that suppress national imports below demand can be explained by foreign exchange availability, which is added as an explanatory variable to the traditional import demand model. Most studies of the import function of developing countries include a time trend (T) as one of their explanatory variables in explaining variations in the demand for imports (Kubursi, 1974). However, if any of the explanatory variables has a pronounced trend, it may be unnecessary to include the trend to avoid the problem of multicollinearity. According to Olayide (1968), the time trend (T) as a variable measures the effects of "shifters" such as taste, habit and formation. Political shocks and certain structural changes in the economy, such as trade liberalization, may also influence the demand for retained imports.

In order to achieve our objective of analysing the effect of trade liberalization, we

include a trade openness index in the final model.

Thus, the aggregate import demand equation, based on Moran (1989), can be written as:

$$\log M_t = \beta_0 + \beta_1 \log M_{t-1} + \beta_2 \log\left(\frac{PM}{P}\right)_t + \beta_3 \log Y_t + \beta_4 \log FA_{t-1} + \beta_5 \log FER_t + \beta_6 OPEN_t + e_t \quad (9)$$

where

M_t = real imports
M_{t-1} = lagged real imports
PM/P = relative import prices
Y_t = real income
FA_{t-1} = lagged foreign assets held by the monetary authorities
FER_t = current foreign exchange receipts from exports
$OPEN_t$ = total trade as percentage of GDP

The same equation (aggregate import demand equation) is employed as the disaggregated import demand equation for estimation. That is, the section-specific import demand equations are:

$$\log M_{it} = \beta_{0i} + \beta_{1i} \log M_{it-1} + \beta_{2i} \log\left(\frac{PM}{P}\right)_t + \beta_{3i} \log Y_t + \beta_{4i} \log FA_{t-1} + \beta_{5i} \log FER_t + \beta_{6i} OPEN_t + e_t \quad (10)$$

Where i = 1 ... 4 and 4 is the number of sections of import selected from the 10-section Standard International Trade Classification (SITC).

In addition to total imports, we consider four sections of imports in this study. These are the import of food and live animals; minerals, fuels, lubricants and related materials; machinery and transport equipment; and manufactured goods, classified chiefly by material. The selection of these sections of imports is based on their importance to the economy of Ghana, as can be seen in Table 1.

Measurement of variables

We first consider the appropriate measures of the variables included in the model.

Imports (M). Imports, both aggregate and disaggregated, are measured as the nominal value of retained imports per capita. The nominal value of imports was used due to the lack of an import price index or an appropriate proxy to deflate in order to calculate real values.

Relative price. ($\frac{M}{P}$). This is the price of domestic products relative to import prices. The import price index for Ghana used in this variable was discontinued, so we proxy this variable with the real effective exchange rate, in line with Jebuni et al. (1994) and Anaman and Buffong (2001).

Income (Y). For the real income variable, some measure of GDP is traditionally employed. This study considers the population effect by using real per capita GDP (Y = GDP/pop) to measure the income variable. The use of the ratios is preferred to simply incorporating population as an extra independent variable (Kubursi, 1974). This is partly because population and real income are highly enough correlated to create the problem of multicollinearity.

Foreign assets (FA). This is measured as current foreign exchange receipts from exports.

Foreign exchange reserves (FER). Foreign assets held by the monetary authorities in the previous year.

Trade liberalization (OPEN). This is measured as total trade, the sum of total exports and total imports, as a percentage of GDP. This is in line with Brafu-Insaidoo and Obeng (2008), who posit that trade liberalization basically consists of the liberalization of quantitative import restrictions, tariff liberalization, and the reduction or elimination of taxes on exports.

Estimation procedure

After establishing the vector of the variables of interest and their appropriate measurement, we consider the order of integration of each of the series using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Because of the time series characteristics of the data, econometric theory requires the variables to be stationary (i.e., integrated of order zero) if inferences are to be non-spurious. Therefore, all the variables in the aggregated and selected disaggregated import component equations are tested to determine whether they are influenced by economic factors of a relatively permanent nature, or whether they are self-correcting forces that indicate temporary elements in their dynamics. Following this, the non-stationary explanatory variables of the same order of integration in each equation are tested for cointegration with aggregate import demand and disaggregated import demand. The test for cointegration is done using the Johansen test. As the variables were found to be cointegrated, an error correction model is estimated. The use of the error correction model also ensures that both long-run and short-run information is used in modelling import demand.

The presence of lagged imports in the model presents a possible endogeneity problem if the error process is serially correlated. In this case, the OLS estimator is biased and inconsistent but if the error process is serially uncorrelated, the lagged dependent variable will be uncorrelated with the current period error and the OLS estimator will

be consistent. In order to ensure the correct estimation method for the long-run import demand function, we tested the serial correlation error process using the Durbin-Watson statistic and found that the error process is not serially correlated. Therefore, we use OLS as it is consistent and the t-test and F-test are valid. We used the t-test to determine the significance of the individual coefficients and the F-test for the overall significance of the models.

Stability tests

In order to test whether the import demand function is stable, we use the CUSUM test developed by Brown, Durbin and Evans (1975). The test is based on the cumulative sum of the recursive residuals and plots the cumulative sum together with the 5% critical lines over time. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines.

The CUSUM test is based on the statistic:

$$W_t = \sum_{r=k+1}^{t} \frac{w_r}{s} \qquad \forall t \in \{k+1, k+2, \ldots T\}$$

where w is the recursive residual defined above, and s is the standard error of the regression fitted to all T sample points. If the β vector remains constant from period to period, $E(W_t) = 0$, but if β changes, W_t will tend to diverge from the zero mean value line.

The significance of any departure from the zero line is assessed by reference to a pair of 5% significance lines, with the distance between them increasing with time. The 5% significance lines are found by connecting the points:

$$\left[k \pm 0.948\sqrt{(T-K)}\right] \text{and} \left[T \pm 3 \times 0.948\sqrt{(T-K)}\right]$$

Any movement of W_t outside the critical lines suggests coefficient instability.

Data

Annual data for the period 1967–2004 are utilized in this study. The data on aggregate import and the categories are derived from the *Quarterly Digest of Statistics and External Trade Bulletins* published by Ghana Statistical Service. Data on real effective exchange rates for the period 1980–2004 are extracted from International Financial Statistics, while the earlier years (1969–1979) are estimated, as these data are not available. All other variables are extracted from International Financial Statistics of the IMF (various issues).

6. Results

Descriptive analysis

Table 3 presents a summary of the variables used in the empirical estimation of the models. The average real effective exchange rate over the period was 706.67, with a minimum and maximum of 99.54 and 3,877.87, respectively. The per capita GDP averaged US$235.65 with a maximum of US$291.04 in 1971 during a civilian regime in which confidence was restored after a military coup had destabilized the economy for a number of years. Economic activity was brisk during this period, with a high GDP growth rate of 5.22%. The minimum of US$180.82 of real GDP per capita was reached in 1983, the worst year recorded in Ghana for all macroeconomic fundamentals, which was the result of a severe drought. Also during this period, the military took over the administration of the country and implemented unorthodox trade policies, which was reflected in the trade openness (OPEN) index that reached its minimum of 6.32% in 1982, a year before the inception of the trade liberalization. The economy has been fairly open at an average openness index of about 49% over the study period.

Table 3: Summary statistics of data

	REER	Y	FER	OPEN	M	FLA	MFLRM	MTE
Mean	706.6728	235.6500	22.01777	48.99377	76905072	9075709.	11221318	24810963
Maximum	3877.870	291.0497	74.14127	116.6986	4.99E+08	79036779	1.04E+08	1.53E+08
Minimum	99.54500	180.8206	3.702032	6.320343	471.5611	61.91584	24.67626	55.10476
Std. dev.	803.2729	29.97971	15.46787	29.45787	1.53E+08	20106255	25818365	46925040
Jarque-Bera	59.02665	1.296624	24.54048	3.433063	29.12044	60.11775	81.25595	25.55850
Probability	0.000000	0.522928	0.000005	0.179688	0.000000	0.000000	0.000000	0.000003
Obs	36	36	36	36	36	36	36	36

Unit root test

Before the cointegration analysis, the study looks at the unit root properties of the data using Augmented Dickey-Fuller and Phillips-Perron tests. Table 4 shows the level of the variables and their first differences for these tests. The order of integration of each of the variables is indicated in the last column of the table. The lag order selection for the ADF test is based on the Schwarz Information Criterion, and Newey-West is used for the bandwidth selection for the Phillips-Perron test.

Both tests give the same conclusions for all the series.The tests indicate that apart from LFER, which is I(0), the other variables are I(1). These results are also supported by the graphs of the variables as shown in Appendix A.

Table 4: Dickey-Fuller and Phillips-Perron unit root tests*

Variable	Level of variables		First difference		Order of integration
	ADF	PP	ADF	PP	
LREER	0.2837	0.5980	0.0282	0.0602	I(1)
LY	0.9327	0.9707	0.0014	0.0002	I(1)
LFER	0.0519	0.0813	0.0000	0.0000	I(0)
OPEN	0.6944	0.7301	0.0002	0.0004	I(1)
LM	0.2149	0.1800	0.0000	0.0000	I(1)
LFLA	0.3449	0.4195	0.0013	0.0013	I(1)
LMFLRM	0.7729	0.7729	0.0006	0.0004	I(1)
LMTE	0.1431	0.1325	0.0000	0.0000	I(1)

* The figures presented areMacKinnon (1996) one-sided p-values

Test for cointegration

The fact that the variables are not stationary necessitates a test for cointegration to establish whether there is a long-run causal relationship between the dependent variable and the independent variables. We carry out the cointegration analysis within the Johansen (1992) framework using the maximum eigenvalue test. The Johansen approach is preferred because it offers the means to determine whether there is more than one cointegrating vector. First, the optimal lag order selection test is conducted to ensure that the sensitivity of the cointegration test to lag lengths is catered for in the results. The lag order selection is based on the Hannan-Quinn Information Criterion, in line with Harris and Sollis (2003), as the Schwarz and Akaike Information Criteria give different conclusions in most cases. The number of cointegrating vectors and the respective optimum lags are given in Table 5.

Table 5: Number of cointegrating vectors and optimum lag order

Variables	Number of coint vectors	Lag order
LM	1	1

LFLA	0	1
LMFLRM	0	1
LMTE	1	1

The maximum eigenvalue test indicates the presence of 1 cointegrating vector each for the aggregate imports (LM), and machinery and transport equipment (LMTE) models. The variables in the equation for the import of food and live animals (LFLA) and minerals, fuels, lubricants and related material (LMFLRM) imports do not cointegrate, suggesting that there is no long-run causal relationship between the endogenous variables in these models. This is expected because most of Ghana's food imports consisted of aid and, therefore, did not depend on the macroeconomic variables but rather on the shortage of local food production, which is exogenous to this model. Also, the products in the import category of minerals, fuels, lubricants and related materials are general necessities that are imported irrespective of the level of macroeconomic activity. The results of the cointegration test suggest that food and live animals (LFLA),and minerals, fuels, lubricants and related material (LMFLRM) imports do not have a long-run causal relationship while there is a long-run dynamic causal relationship between the endogenous variables in all the aggregate imports and in the import of machinery and transport equipment (LMTE) models.

To meet the objectives of this study, a normalizing restriction was imposed on the import variables to determine the cointegrating vectors (b)and the adjustment parameters (a). The cointegration vectors and the adjustment parameters for aggregate import are indicated in Equation 11, and that for LMTE in Equation 12. The cointegrating vectorshave log-run elasticities of aggregate import demand and the selected import categories with respect to the real effective exchange rate (LREER), real income (LY), foreign exchange reserves (LFER) and trade openness (OPEN). The cointegrating vectors are presented so that the first rows show the variables with the corresponding columns.

The long-run real effective exchange rate elasticity of aggregate import demand is 0.254086, and those of real income, foreign exchange reserves and trade openness are -16.88112, 1.478370 and 0.142015, respectively. All these elasticities, except those related to the real effective exchange rates (LREER), are statistically significant at a 5% level of significance. This shows that these variables are important determinants of aggregate import for Ghana in the long run, while real effective exchange rates are not. The t-statistics are in parentheses.

The negative impact of per capita income in import demand, which shows low import demand at higher incomes, is contrary to the traditional literature on import demand. This finding, however, is meaningful for poor developing countries in general, and Ghana in particular. High production costs in developing countries make local product prices high and unaffordable relative to cheaper foreign substitutes. As incomes rise, local products become more affordable, which leads to a reduction in import demand.

$$\beta' = \begin{pmatrix} LM & LREER & LY & LFER & OPEN \\ 1 & -0.254086 & 16.88112 & -1.478370 & -0.142015 \\ & (-0.92284) & (10.5424) & (-5.31608) & (-4.6342) \end{pmatrix}$$

$$\alpha = \begin{pmatrix} -0.253899 \\ -0.002385 \\ -0.017252 \\ 0.120846 \\ 5.403799 \end{pmatrix} \tag{11}$$

The real effective exchange rate (LREER) is not significant in the long-run import demand model for machinery and transport equipment (LMTE). The long-run income elasticity of machinery and transport equipment (LMTE) import demand is -14.32626, and those of foreign exchange reserves and trade openness are 1.662096 and 0.125039, respectively.

$$\beta' = \begin{pmatrix} LMTE & LREER & LY & LFER & OPEN \\ 1 & 0.176578 & \mathbf{4}.32626 & -1.662096 & -0.125039 \\ & (0.55120) & (7.69346) & (-5.01572) & \mathbf{-1}.0586 \end{pmatrix}$$

$$\alpha = \begin{pmatrix} -0.297069 \\ -0.007398 \\ -0.011089 \\ 0.176003 \\ 4.279793 \end{pmatrix} \tag{12}$$

Error correction models

As the variables cointegrate an error correction model needs to be developed to ascertain the short-run dynamics of aggregate and disaggregate import demand in Ghana. A "general-to-simple" methodology is adopted by specifying an over-parameterized error correction model, as in Equation 15 (see Appendix B for output).

$$\Delta M_t = \phi Z_{t-1} + \sum_{t=1}^{4} \Gamma_i \Delta Z_{t-i} + \varepsilon_t \tag{13}$$

where $Z_{t-1} = (LM_{t-1}\ \ LREER_{t-1}\ \ LY_{t-1}\ \ LFA_{t-2}\ \ LFER_{t-1}\ \ OPEN_t)$ and
$\mathrm{D}Z_t = (\mathrm{D}LM_{t-1}\ \ \mathrm{D}LREER_t\ \ \mathrm{D}LY_t\ \ \mathrm{D}LFA_{t-1}\ \ \mathrm{D}LFER_t\ \ \mathrm{D}OPEN_t)$

β is a vector of the parameters of the cointegrating vectors, βZ_{t-1t-1} is the long-run relationships, α is the vector of the speed of adjustment or equilibrium corrections, Γ_i is the vector of short-run parameters and ε_t the vector of the error terms.

The reduction of the model to a parsimonious error correction model is based on the Akaike Information Criterion (AIC) and other diagnostic criteria such as the F-statistic, and the Durbin-Watson and residual tests. The preferred model for aggregate import demand is given in Table 6, while that of the selected components is provided in Tables 7, 8 and 9.

The results indicate that the speed of adjustment of aggregate import demand to long-run equilibrium is -0.4, indicating a gradual adjustment to a long-run equilibrium of the short-run dynamics in aggregate import demand. Demand for aggregate imports in the short run depends negatively on the four years' lagged imports (DLM(-4)), and positively on the real effective exchange rate (LREER), dynamics of income (LY) and foreign exchange reserves (LFER), and trade openness (OPEN).

Lag imports indicate the import absorption capacity of the economy. The negative impact shows that high levels of imports in the previous years had led to a surplus and, therefore, import demand was reduced in the short run. The income variable has a positive impact with a lag and with the dynamics of foreign exchange reserves. Trade openness is also significant in the short run. The significance of trade openness, both in the long and the short run, is an indication of the significant impact of trade liberalization on aggregate imports.

The short-run elasticity of aggregate imports with respect to LREER is 0.699457, and that of income is -3.748142. The short-run elasticity of LFER is 0.294473.

Table 6: Preferred aggregate import demand model Dependent variable: DLM

Variable	Coefficient	Std. error	t-statistic	Prob.
ECM_{t-1}	-0.408012	0.098506	-4.142005	0.0005
DLM(-4)	-0.299073	0.141901	-2.107620	0.0473
DLREER(-2)	0.699457	0.311996	2.241880	0.0359
DLY	-3.735682	1.967555	-1.898642	0.0714
DLY(-1)	3.548142	2.262548	1.568206	0.1318
LFER	0.294473	0.151734	1.940725	0.0658
LFER(-1)	-0.320491	0.176387	-1.816976	0.0835
LFER(-3)	0.377450	0.169210	2.230662	0.0367
LFER(-4)	-0.183225	0.144928	-1.264244	0.2200
DOPEN	0.029760	0.009010	3.302808	0.0034
R-squared	0.584246	Mean dependent var		0.367488
Adjusted R-squared	0.406065	S.D. dependent var		0.509057
S.E. of regression	0.392316	Akaike info criterion		1.222197
Sum squared resid	3.232145	Schwarz criterion		1.684774
Log likelihood	-8.944056	Durbin-Watson stat		2.272716

Similar over-parameterized models are specified for the selected sections of import demand. The preferred models are derived using the Akaike and Schwarz Information Criteria as guides. These models are presented in Tables 7, 8 and 9. The models in Tables 7 and 8 are short-run Autoregressive Dynamic Lag (ARDL) models, as the cointegration tests indicate that there is no long-run relationship among the endogenous variables in

these models.

In Table 7 we present the short-run ARDL model of food and live animals (LFLA). The import absorption capacity has a negative impact on the level of import demand. This implies that, in the short run, if more food had been imported previously, less food is imported currently as a result of the surplus created by previous food imports. Similar to the other variables, the real effective exchange rate (LREER) has an impact through the dynamics of the previous years' rates. Even with a lag, trade openness is significant in this short-run model.

Table 7: Preferred food and live animals import demand model
Dependent variable: DLFLA

Variable	Coefficient	Std. error	t-statistic	Prob.
DLFLA(-2)	-0.739743	0.162232	-4.559789	0.0005
DLFLA(-3)	-0.191191	0.116066	-1.647253	0.1235
DLFLA(-4)	-0.732854	0.123783	-5.920452	0.0001
DLREER(-1)	-0.949075	0.383491	-2.474830	0.0279
DLREER(-2)	1.253640	0.294097	4.262670	0.0009
DLREER(-3)	-1.488640	0.267149	-5.572324	0.0001
DLY	-3.507652	1.621692	-2.162958	0.0498
DLY(-1)	-4.530565	1.371324	-3.303789	0.0057
DLY(-2)	2.194698	1.506722	1.456605	0.1690
DLY(-3)	-7.552101	1.441498	-5.239064	0.0002
DLY(-4)	7.017990	1.984506	3.536392	0.0037
LFER(-1)	0.235030	0.145057	1.620264	0.1292
LFER(-2)	0.405175	0.144308	2.807702	0.0148
LFER(-3)	-0.652536	0.160962	-4.053976	0.0014
LFER(-4)	0.235192	0.119419	1.969470	0.0706
DOPEN	0.040130	0.007017	5.719056	0.0001
DOPEN(-1)	0.015933	0.008438	1.888171	0.0815
DOPEN(-2)	0.057296	0.010204	5.615108	0.0001

R-squared	0.887362	Mean dependent var	0.341340
Adjusted R-squared	0.740066	S.D. dependent var	0.528397
S.E. of regression	0.269397	Akaike info criterion	0.506989
Sum squared resid	0.943470	Schwarz criterion	1.339627
Log likelihood	10.14167	Durbin-Watson stat	2.659119

Table 8 reflects mineral, fuels, lubricants and related materials (LMFLRM), which is also a short-run ARDL model. Demand for LMFLRM is in the short run, which depends negatively on the import absorption capacity. The real effective exchange rate (LREER) is omitted from this model, which emphasizes the nature of this category of import as a necessity. This argument is further strengthened by the fact that income is not significant in this model. The availability of foreign exchange reserves, however, is significant in determining the level of imports of this category in the short run. Trade openness is significant as it indicates the importance of a trade liberalization programme for the level of imports in this category.

The preferred model for machinery and transport equipment (LMTE) import demand is shown in Table 9. The speed of adjustment of LMTE is rather rapid, at about 0.8165%. The short-run demand for the import of machinery and transport equipment (LMTE)

depends positively on the import level of the immediate past (DLMTE(-1)), although it is not significant, negatively on the distant past DLMTE(-4) and, as usual, on the dynamics of the real effective exchange rate, income, foreign exchange reserves and trade openness.

Table 8: Preferred minerals, fuels, lubricants and related materials import demand model
Dependent variable: DLMFLRM

Variable	Coefficient	Std. error	t-statistic	Prob.
DLMFLRM(-1)	-0.734260	0.228409	-3.214671	0.0038
DLMFLRM(-2)	-0.678346	0.197911	-3.427525	0.0023
DLMFLRM(-4)	-0.289962	0.149880	-1.934626	0.0654
DLY(-3)	-3.462212	2.390832	-1.448120	0.1611
LFER(-4)	0.353006	0.067832	5.204080	0.0000
D(OPEN)	0.020533	0.011835	1.734956	0.0961
DOPEN(-1)	0.070476	0.014098	4.999134	0.0000
DOPEN(-4)	-0.095891	0.014503	-6.611651	0.0000
R-squared	0.749164	Mean dependent var		0.268408
Adjusted R-squared	0.672822	S.D. dependent var		0.882497
S.E. of regression	0.504784	Akaike info criterion		1.688263
Sum squared resid	5.860553	Schwarz criterion		2.058324
Log likelihood	-18.16807	Durbin-Watson stat		1.975149

Table 9: Preferred machinery and transport equipment import demand model
Dependent variable: DLMTE

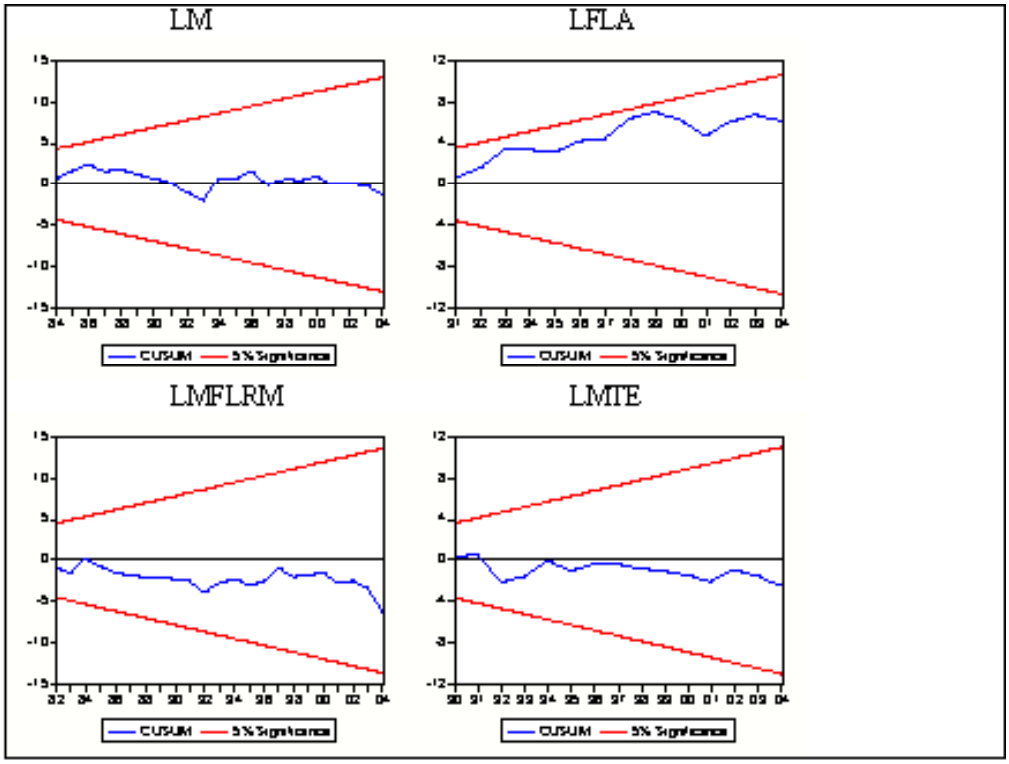
Variable	Coefficient	Std. error	t-statistic	Prob.
ECM_{t-1}	-0.809775	0.147651	-5.484389	0.0001
DLMTE(-1)	0.239953	0.164520	1.458503	0.1653
DLMTE(-4)	-0.607373	0.125208	-4.850894	0.0002
DLREER(-2)	1.955004	0.332213	5.884795	0.0000
DLREER(-3)	-0.712292	0.317129	-2.246060	0.0402
DLY	-5.419943	2.080606	-2.604983	0.0199
DLY(-1)	6.693991	2.013492	3.324568	0.0046
DLY(-2)	2.918541	1.541947	1.892764	0.0778
DLY(-4)	5.502335	1.606620	3.424788	0.0038
LFER	0.600769	0.133398	4.503584	0.0004
LFER(-1)	-1.023909	0.173081	-5.915792	0.0000
LFER(-2)	0.674523	0.148942	4.528756	0.0004
DOPEN	0.066733	0.007993	8.348633	0.0000
DOPEN(-1)	-0.029458	0.012009	-2.453025	0.0269
DOPEN(-3)	-0.015347	0.008386	-1.830044	0.0872
DOPEN(-4)	-0.028178	0.008263	-3.410067	0.0039
R-squared	0.876664	Mean dependent var		0.383595
Adjusted R-squared	0.753328	S.D. dependent var		0.514406
S.E. of regression	0.255485	Akaike info criterion		0.415018
Sum squared resid	0.979092	Schwarz criterion		1.155140
Log likelihood	9.567221	Durbin-Watson stat		2.423352

Stability tests

Parameter stability for each of the models is determined by using the CUSUM test (see Figure 1 for test results). The tests indicate that there is parameter stability over the whole period, including the pre- and post-trade liberalization programme periods, for the aggregate import demand model and all the other categories studied.

These findings are important for this study because they, together with the finding that trade liberalization is significant in all the import demand models, imply that the level of liberalization of trade in Ghana is significant in determining the level of import demand, but not for changing the demand function.

Figure 2: CUSUM test for LM, LFLA, LMFLRM and LMTE models



7. Conclusion and policy implications

Ghana has often been cited by the international community as one of the success stories of the Structural Adjustment Programmes (SAPs) implemented in developing countries with the support of the Bretton Woods institutions. Ghana's SAPs, of which trade liberalization is a major component, was started in 1983 and led to the relaxation or removal of many restrictions on international trade. However, perceptions of economists on the success of the changes in Ghana's trade policy are mixed. In this study, we attempted to establish the effect of the changes in trade policy and other macroeconomic variables on import demand in Ghana.

Conclusions

The conclusions of the study, based on the results, are as follows:

- The macroeconomic variables in the model: Income, real effective exchange rate, foreign exchange reserves and trade openness, do not explain changes in the import of food and live animals (LFLA) and minerals, fuels, lubricants and related materials (LMFLRM) in the long run, but only in the short run. This is expected because most of Ghana's food imports were by means of aid and therefore did not depend on the macroeconomic variables but rather on the shortage of local food production, which is exogenous to this model. Also, the products in the import category minerals, fuels, lubricants and related materials are general necessities which are imported irrespective of the level of macroeconomic activity.

- The level of aggregate import, however, is determined by all the macroeconomic variables in the long run, except in the case of the real effective exchange rate. Per capita income has a negative impact on import demand which implies that there is low import demand at higher income levels. This seems contrary to the traditional literature on import demand but it is meaningful for poor developing countries in general, and Ghana in particular. High production costs in developing countries make local product prices high and unaffordable relative to cheaper foreign substitutes. As incomes rise, local products become more affordable, which leads to a reduction in import demand.

- The real effective exchange rate (LREER) is not a significant determinant of import demand for machinery and transport equipment (LMTE), while income, foreign exchange reserves and trade openness are.
- There is parameter stability over the whole period, including the pre- and post-trade liberalization programme periods, for the aggregate import demand model and all the categories studied. This means that the response of import demand to changes in income, the real effective exchange rate, foreign exchange rate reserves and trade openness has not changed significantly over the study period. This conclusion, together with the findings that trade liberalization is a significant determinant of import demand models, implies that the level of trade liberalization in Ghana is

significant in determining the level of import demand but not in changing the demand function.

Policy implications

The results of the aggregate import demand and the components studied have some important policy implications. The components of imports studied were food and live animals (LFLA); materials, fuels, lubricants and related materials (LMFLRM); and machinery and transport equipment (LMTE).

Firstly, trade policies that are aimed at reducing food, and minerals, fuels, lubricants and related materials import through domestic income; the real effective exchange rate; foreign exchange rate reserves; and trade openness will not be effective, as these variables do not affect these import categories in the long run. An effective policy will rather be one that is directed at increasing the domestic production of these products in order to ease the shortage.

Also, export promotion and removal of other international trade barriers to encourage exports will increase exports and raise export revenue to finance the ever-increasing exports. Policies that lead to increased foreign exchange reserves will be effective.

Finally, policy authorities who aim at reducing imports to correct balance-of-payments imbalances in the long run should target the efforts at policies that will increase the per capita income at the macroeconomic level, and implement policies that will ensure an even distribution of per capita income to reduce poverty. These will reduce the dependence on cheap imports and reduce import demand.

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Appendix A: Graphs of variables

Figure A1: Graphs of level of variables

Appendixes

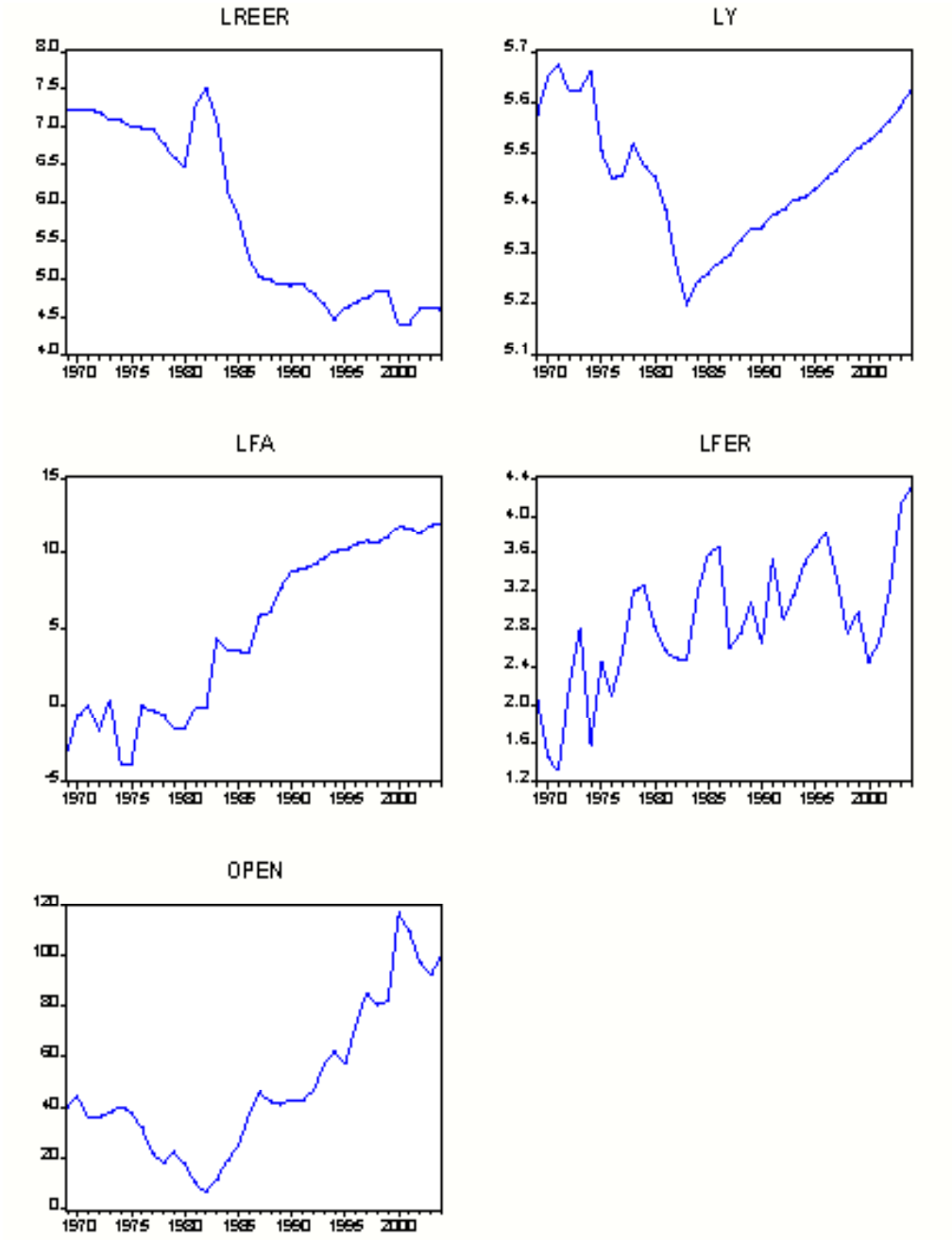
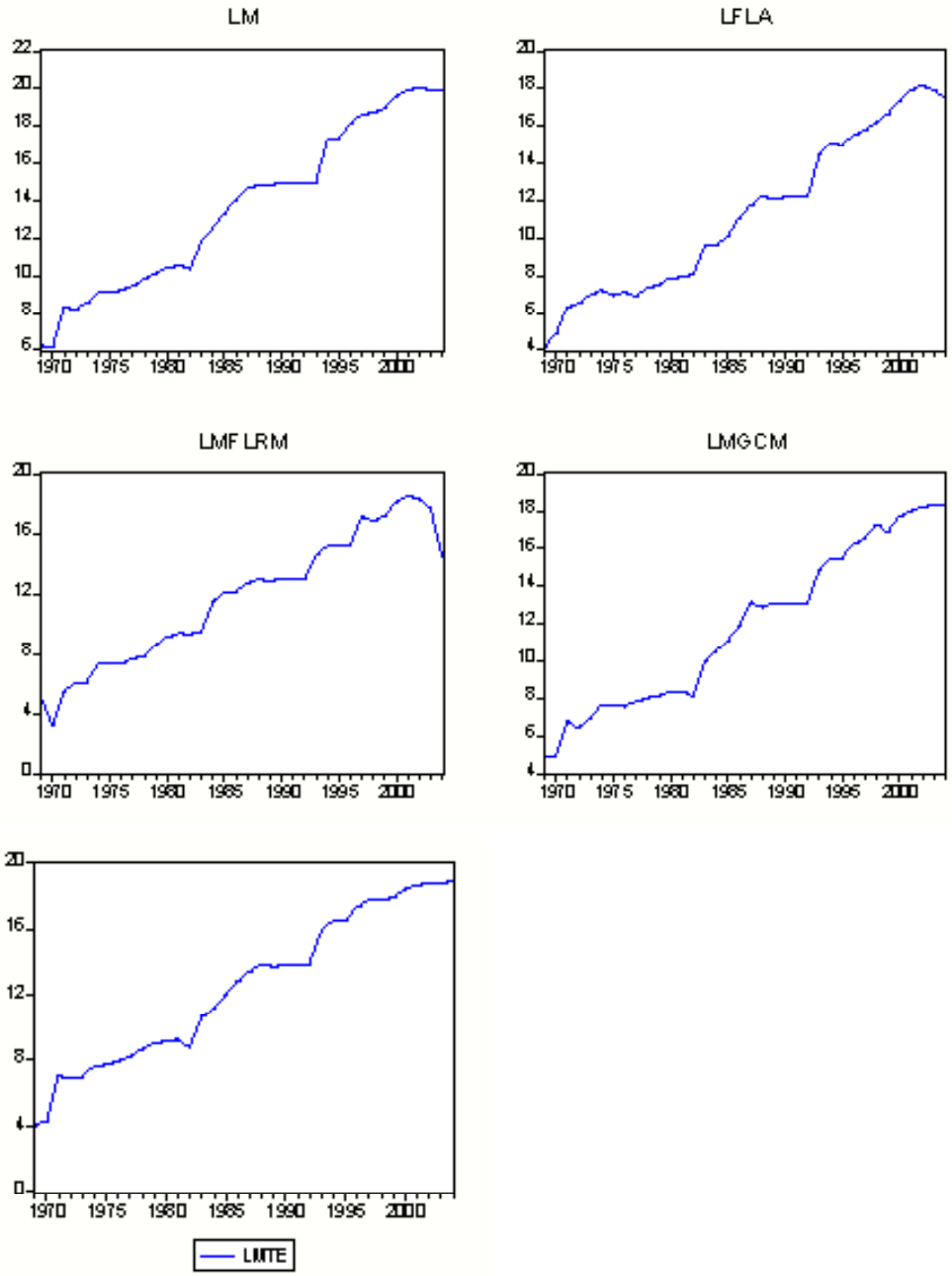


Figure A2: Graphs of variables at first differences



Appendix B: Over-parameterized

models

B1: Dependent variable: DLM

Variable	Coefficient	Std. error	t-statistic	Prob.
ECM_{t-1}	-0.717332	0.964308	-0.743882	0.4850
DLM(-1)	0.235593	0.767670	0.306893	0.7693
DLM(-2)	0.222114	0.562011	0.395214	0.7064
DLM(-3)	-0.062681	0.352782	-0.177677	0.8648
DLM(-4)	-0.355616	0.388235	-0.915982	0.3950
DLREER	-0.488247	1.183068	-0.412695	0.6942
DLREER(-1)	0.607392	0.923813	0.657484	0.5353
DLREER(-2)	0.761281	0.904983	0.841210	0.4325
DLREER(-3)	0.062761	0.962676	0.065194	0.9501
DLREER(-4)	0.317515	1.051417	0.301988	0.7729
DLY	-4.323951	5.105886	-0.846856	0.4296
DLY(-1)	8.929118	11.65862	0.765881	0.4728
DLY(-2)	0.396139	10.03503	0.039476	0.9698
DLY(-3)	4.749235	6.960252	0.682337	0.5205
DLY(-4)	1.465018	5.282044	0.277358	0.7908
LFER	0.303357	0.580560	0.522525	0.6200
LFER(-1)	-0.628186	1.185470	-0.529905	0.6152
LFER(-2)	0.201363	0.682528	0.295026	0.7779
LFER(-3)	0.492974	0.475156	1.037499	0.3395
LFER(-4)	-0.157883	0.470328	-0.335688	0.7485

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