THE RELATIONSHIP BETWEEN IMPORT AND GDP GROWTH IN ETHIOPIA: An Empirical Analysis

BY

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Abstract

In this study, the relationship between import and GDP growth, and the contribution of imported intermediate and capital goods to economic growth during the period 1960/61-1999/2000 in Ethiopia is studied. Cointegration and error correction mechanisms are used so as to separate the long run and short run relationship between import and GDP. The effect of imported intermediate and capital goods on economic growth (measured by real GDP) is also studied using the same procedure.

The estimated cointegrating vectors using Johansen's cointegrating approach indicates that the long run elasticity of imports with respect to real GDP is positive but it is insignificant at 5 percent level of significance. On the other hand, real international reserve is found to affect imports positively and significantly. However, the short run elasticity of imports with respect to real GDP is positive and significant. The policy implication of the short run high-income elasticity of imports is that policies of aggregate demand or stabilization may not improve the balance of payment position.

The results of the estimation of imported intermediate and capital goods on economic growth indicate that in the long run imported intermediate goods positively and significantly affect real GDP. However, in the short run, the change in imported intermediate goods before one year has a positive and significant effect on the change in current real GDP.

CHAPTER ONE

1.1 Background

Ethiopia is one of the least developing countries in Africa. The Gross National Income (GNP) per capita is US $100 in 2000, which is one of the lowest in the world (World Development Indicator, 2002). The major economic sector, agriculture, contributed about 50 percent of the country's GDP on average during the period 1991/1992-1999/2000. The outputs of this sector depend on the weather condition and as the result of this domestic income fluctuate following the change in weather. The performance of agricultural sector is low to provide raw materials required by the industrial sector (Getachew, 1994). As the result of this and low domestic capacity the industrial sector of the country depends on imports of capital and intermediate goods. About 65 percent of total import spent on importation of these goods.

The current account deficit has deteriorated from year to year as the result of low export earnings and rising merchandise imports, although positive non-factor service receipts (Getachew, 1994). To reduce such problem, the government followed different strategies. For instance, the trade policy during the period 1973 /74-1990/91 was import substitution with the purpose of encouraging domestic industries by controlling import with high tariff, and others quantitative measures. The maximum import tariff during this period was about 230 percent. Despite this, the average expenditure on importation of goods was on average14.5 percent of GDP. After October 1992, the situation has changed; Ethiopia adopted the

structural adjustment program (SAP) with the belief that liberalization of trade and payments remove anti-export bias, and this promotes the export sector and therefore leads to the improvement of foreign earnings and growth of GDP. The program focused on economic stabilization and structural reform measures; one of these measures includes the liberalization of trade, as the result of which the import tariff rate was reduced from 230 percent to 40 percent. The birr was also devalued by 142 percent.

In general, the measures aimed at encouraging exports and reducing imports.

1.2 Statement of the Problem

The Ethiopian economy exhibits huge import dependency like any other developing country. The local manufacturing firms depend heavily on imported capital and intermediate goods, which directly affect investment, which is the motor of economic expansion. But, the country has low level of capital stock and intermediate goods. It is argued that lack of sufficient amount of capital and intermediate goods directly reduce investment, in turn leading to lower economic growth. The country's exports are mainly primary goods (agricultural products). Fluctuations in production and earnings in these sectors leads to fluctuation in overall output of the economy which also result in swings in imports and the balance of payments position.

The country often exposed to external shocks. For instance, the price of oil increased in 1973-74 and 1979-80 globally and the same was observed in Ethiopia. As it is well known, the most serious problems caused by the sharp rise in oil prices are an increase the manufacturing cost of other products the countries import, and this takes a tremendous chunk

of precious foreign exchange (Klein, 1990). To avoid this problem, countries often took out loans to pay for their now more expensive imports. This shows that the rise in the oil price, in turn resulted in a serious debt problem in these countries. This problem is mainly aggravated in developing countries, which are heavily reliant on export of agricultural products and, on the one import manufactured goods. Ethiopia, as one of these developing countries has faced the same problem. Much of the countries' trade is an exchange of primary products for manufactured goods. However, it has been variably claimed that as world income grows, the demand for primary goods decline while the demand for manufactured goods increase, so that the relative price of the latter declines; markets of primary goods are competitive while that of manufactured goods are characterized by monopolistic nature (Kreinin, 1995). This lowers the price of the former, and increases the earnings of the producers of the latter as the result of increased productivity; the expansion of synthetic substitutes lowers the demand for many primary goods and thereby slows down their prices (Klein, 1990).

It is known that developing countries import many goods at world prices since they are not sufficiently available domestically. Increase in the world price of these goods leads to an increase in the domestic prices further aggravating inflationary problems. It is also argued that the ratio of the export price index to the import price index of developing countries has been declining or deteriorating over the long run, implying that these countries have faced a chronic balance of payment problems as the result of the unfavorable world price. From this it can be concluded that major aspects of Ethiopian economic policy such as import substitution have been influenced by the availability of foreign exchange and the intensity of external disequilibrium.

Under both the DERG and Haileselasse regimes the country implemented the policy of import substitution, high tariffs and non-tariff barriers were imposed on imported goods so as to expand domestic production and replace imports. Such protectionist policy had several impacts on the economy. The first is that much capital was invested in industries that could not have survived without protection. The second is that this policy reduces the demand for imports, by raising the prices of import competing goods. This leads to a shift of resources from the export industry to the import competing industry, in turn that make it more difficult to export primary or manufactured products. Thus, the policy discriminates in favor of import competing industries and against export industries. Indeed, policies were biased against the farm sector, thereby lowering agricultural output, depressing rural income, and reducing exports.

Furthermore, as the result of the policy measures followed during these periods, the country had faced a secular decline in its balance of payment. Earning from exports could not cover the rising imports. For example, export-GDP ratio was 8 per cent on average over the period 1970/71-1979/80 while import-GDP ratio was 10.4 percent in the same period. Similarly, from 1980/81-1989/90 export-GDP ratio was 6 percent on average while import-GDP ratio was 14.8 percent in the same period[1]. Thus, it is important to study the effects of GDP growth on imports in Ethiopia, and the contribution of imported intermediate and capital goods to make appropriate policy announcements.

[1] Source:National Bank of Ethiopia Quarterly Bulletin

1.3 Objectives of the Study

The main objective of this paper is to analyze the relationship between imports and real GDP growth. The study on imports rests on the basis of the fact that it contributes to the national economy and on the view that it is essential to study the development of Ethiopian imports overtime.

The specific objectives are

1. To assess empirically the effect of GDP growth on Imports.
2. To identify the effects of imported intermediate and capital goods on economic growth (measured by real GDP growth).

1.3 Significance of the Study

It is agreed that investment is important for economic growth. As such for countries like Ethiopia, which has no capacity to produce its own investment goods, it is essential to import relevant items used in this respect. On the other hand, dependence on imports for every type of consumption is considered to be unproductive. By investigating the association between imported intermediate and capital goods, and GDP growth, this study helps us to see these impacts. The study will definitely contribute to the existing empirical literature on the effects of GDP growth on imports, and the contribution of imported intermediate and capital goods to economic growth (measured by real GDP). In this context, it also helps us to draw an important policy lesson.

1.5 Limitations

In Ethiopia, evaluating the quality of data, there is no adequate, consistent data in domestic sources. For example, there is a discrepancy of GDP data reported by IFS yearbook and the current Ministry of Finance and Economic Development. In addition to this, different sources of data use different calendar year. Some sources of data use Gregorian calendar others use Ethiopian fiscal calendar. The limitations of model used here are that it assumes the volume of imports is determined by an explicit optimization problem. Furthermore, it assumes that the long run level of international reserves is positively related to the long run import level; it also assumes that the current level of foreign exchange receipts is a proxy for the long run level.

1.6 Organization of the study

The rest of the paper is organized as follows. Chapter two reviews the theoretical and empirical literature regarding the effect of GDP growth on imports, and the contribution of imported intermediate and capital goods on GDP growth. Chapter three reviews the trade policy and import control measures in Ethiopia. Chapter four presents descriptive analysis made on imports. Chapter five presents model specification and regression results. The last chapter gives conclusions and policy implications.

CHAPTER TWO: SURVEY OF THE LITERATURE

The main purpose of this section is to review the theoretical framework and empirical literature so that it can help us to analyze the relationship between imports and GDP growth.

2.1 Theoretical Literature

The dominant economic doctrine during 17th and 18th century was mercantilism, which was highly nationalistic (Sodersten and Reed, 1994). In view of this, the most important way in which a nation could grow rich was by exporting more than it imported. Exports were viewed as favorable because they help to obtain precious metals, which are indicators of richness and powerfulness of the country, while imports were considered as unfavorable in view that they reduce the country's true source of richness, namely precious metals, and thereby hinder growth of output. On the basis of this, they argued that the governments should discourage imports and encourage exports. This view is not relevant for Ethiopia because its industry depends on imports of intermediate and capital goods. In addition, its agricultural sector depends on imports of fertilizer and agricultural machines. Even the transport sector depends on the imports of spare parts, vehicles and machineries. Thus, all these sectors will be affected if we impose restriction on imports, leading to lower income.

Contrary to the mercantilism argument, Adam Smith (1776) formulated the classical trade theory of absolute advantage. The idea of Adam Smith is that trade between two countries is

based on absolute advantage (Salvatore, 1990). This means that a nation can produce one commodity cheaply while it can produce another commodity expensively. This nation has absolute advantage in producing the first commodity while it has absolute disadvantage in producing the second commodity. Therefore, this nation can benefit by exporting the commodity, which it produces cheaply or efficiently and import that commodity which it produces inefficiently. By this process, resources are utilized effectively and the output of both commodities will increase and thereby both countries will benefit more from free trade than restricted trade. According to smith, import is important for economic growth.

David Ricardo's (1817) idea of comparative advantage argument modified Smith's view. According to Ricardo, a country should export the commodity in which its absolute advantage is greater and import the commodity in which its absolute advantage is smaller. In the real world, the assumption of homogeneous labor is not valid since the level of skills of labor is different and labor is not the only factor of production. Ricardo did not mention the other factor of production, capital. Thus, absolute advantage depends not only on labor value but also on capital value. In his view, import assists output growth if a country imports a commodity in which its absolute disadvantage is greater.

Haberler (1936) modified the law of comparative advantage with opportunity cost theory (cited in Salvatore, 1990). In his view, a nation has a comparative advantage if the cost of producing a commodity is lower than other commodity in that nation than it is in other countries. Countries are different in resources. In his view, developing countries like Ethiopia have a lot of low-skilled labor relative to capital and skilled labor. The implication of this is

that these countries will benefit if they produce goods which need relatively large amount of low skilled labor, and exchange with a capital and a skilled labor intensive goods produced by their developed counter parts and as such it is argued that they have a comparative advantage in producing labor-intensive goods and services. Even if a country is less productive than its trading partner in almost everything, there is a possibility of trade by specializing in a commodity in which its productivity disadvantage is smaller and exchange with its trading partner. This process brings development by enabling countries to gain more through importation than could be achieved from domestic production (Humpage, 2000). This implies that the existence of free trade between countries is crucial for development. But, there were only few economists against free trade and laissez-faire (minimum government intervention). They argued that protection of home industry (by restricting imports) is important for economic development and to lower trade deficit in the country's balance of payments (the shortage of foreign earnings over the country's expenditure abroad) leading to substitution of imports with domestic production.

During the 1950s and 1960s, the policy of industrialization through import substitution[2] was dominant strategy for economic development. The infant industry argument was the oldest argument in this area. The aim of the argument is to protect home industry from foreign producers in the initial stages of production until it could compete with low cost foreign producers (Singh, 1985). It is also stressed that, at the initial stage of production, cost per unit of output is high and therefore protection is essential in order to able to be withstand the competitive conditions. Protection is not, however, considered to continue forever. It is

argued that it should be avoided after the domestic industries are able to compete with foreign producers and achieve economies of scale. Contrary to this argument, it is argued that restriction of import leads to the decline of imported inputs essential to the export sector, further discouraging export promotion and therefore leading to the decline of the growth of GDP (Jebuni, *et al*, 1994). Thus, the policy of import substitution affects the export sector in less developing countries like Ethiopia and this policy has anti-export bias where the industry is import dependent (Lyakurwa, 1991). The other view is that the protected industry expands at the cost of other industries, and its production growth is less than the fall in production elsewhere (Salvatore, 1990). Therefore, the net effect may be negative. Even empirically, there is weak evidence that support import substitution strategy (Dornbush, 1992). Though, formerly, there was a support for import substitution strategy, currently the situation is changing. There appears to be an agreement that trade promotes growth by enabling countries to acquire goods that they have no capacity to produce. Thus, liberalization of trade and payments removes anti-export bias, and this promotes the export sector and therefore leads to the improvement of foreign earnings and growth of GDP. Therefore, import liberalization is important to help export sector, given the fact that a country like Ethiopia, among the developing countries, is highly dependent on imports from developed countries. In broad classification, most of the goods imported by these countries include capital, intermediate and consumer goods. It is widely argued that the importation of capital and intermediate goods has substantial impact for the development of these economies. However, the effect of imported consumer goods on GDP growth is not clear. In the next part of this paper, the relationship between growth and each category of imports will be discussed.

[2] Import substitution mean replacement of imports by some suitable home product not exactly the same as the

Capital Goods

High-technology imports like capital goods[3] are helpful for high production and industrial development. The role of capital goods in the manufacturing sector can be seen from two "main stream" perspectives. These are growth oriented and innovation-oriented approach (Baark, 1988). The first approach focuses on the role of capital goods in economic growth. Here, it is said that capital goods help to achieve new manufactured goods and affect the three main sectors of the economy, namely, agriculture, industry and transport. Import of machines that are related to agricultural and industry increases a country's output as inputs into production. Similarly, efficient transport system is essential to facilitate the movement of goods at low cost.

> "A reduction in transportation costs exerts technological improvement in manufacturing through increased demand for manufacturing products. Because the gain from creating new goods are related to their market size, lower transportation costs will lead to innovation in the form of more manufacturing goods in equilibrium"(Asillis and River-Batiz, 1994:21).

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imported commodity (Singh, 1985).

[3] Capital goods are defined as produced commodities, which serve as inputs in the production of other commodities (Baark, 1988). A meaning of capital goods as produced means of production is associated with the classical economists. They broadly consist of three main goods namely transport, agriculture and industrial equipment.

Thus, the development of these three factors leads to the growth of GDP. Imports of capital goods are also influenced by the investment policy of the government. An increase in industrial growth in turn requires substantial additional imports of capital goods.

The second approach is an innovation-oriented approach, which considers the importance of capital goods as supply of new technology to the manufacturing sector. The import of capital goods supplies efficient machines that occupy new technology, which is obtained from the research and development in developed countries. Thus, diffusion of embodied technology to domestic industry from developed country is important to increase productivity growth throughout the economy and this raises domestic output, in turn, leading to growth of GDP. A good example in this category of imports is import of computer hardware and software. This increases the efficiency of labor by reducing time spent on production and hence raises production, in turn leading to growth of GDP.

Intermediate Goods

Intermediate goods[4] are input for the production of other commodities. Imports of these goods from developed countries bring new technology to developing countries, which in turn enhance the productivity of factors and leads to the growth of output (Coe, *et al*, 1997). This implies that these new technologies increase efficiency and thereby raise the scale of production and which in turn reduces the cost of production. The benefit is more if developing countries like Ethiopia import from an industrial country that has a large 'stock of

[4] Intermediate goods are composed of raw materials, semi-finished goods and fuel.

knowledge'. For instance, keller(2000) argued that developing country stands to gain more in terms of both the product that it can import and the direct knowledge it can acquire than it would import from another developing country .This implies that importing a new (or better) type of intermediate goods will increase the degree of specialization in the production of other products. One example, which is sighted in this respect, is import of crude fertilizer, which constitutes high-technology imports from developed countries to developing countries. This is a transfer of foreign technology that helps us to increase productivity in the agricultural sector.

Imported Consumer Goods

The effect of imports of consumer goods[5] on economic growth (measured by GDP growth) may be ambiguous. Imports of consumer goods like medical and pharmaceutical goods are important to make worker healthy and healthy workers are more productive than unhealthy workers, in turn leading to growth of GDP. Imports of non-durable consumer goods like food have adverse effect on real GDP growth if there is sufficient amount of domestic production since the shift of demand toward imports would reduce the demand for domestic goods; hence production of domestic goods, in turn leading to slower growth in food production (Jaeger, 1992). On the other hand, if there is no enough domestic production, import of these

[5]Consumer goods are defined as economic goods that directly satisfy human wants or desires. Consumer goods imports are composed of durable consumer goods such as radio and television, tyres, cars and other vehicle and non-durable consumer goods (cereals, other food, medical and pharmaceutical, Textile Fabrics and others).

goods is important for economic development since workers need food to be strong and productive. Consumer goods like radio, TV contribute information for society.

Most durable goods are luxury items that are required to keep the welfare of society. Food imports are one of the main non-durable consumer goods in Sub-Saharan Africa.

> "Based on recent literature, the growth in Africa's food import is widely assumed to be caused by slow growth in production resulting from a deterioration of productive capacity; poor performance domestically has led to an increase in imports to meet the growing gap between demand and domestic production, and leading to a growing food dependence on industrial countries (Eicher, Johnston, Serageldin)"(cited in Jaeger,1992:20).

According to Jaeger (1992), the causal direction between imports of food and domestic production is ambiguous. If domestic foods are not perfect substitute for imported foods, then rising demand for imported food could be the result of higher income. The reduction in domestic production can be the result of policies, which have constrained productivity growth (Jaeger, 1992). Furthermore, during drought food import increases as the result of aid in Africa.

The demand theory of import is that when income increases, people will have more money and the purchasing power rises so that they tend to buy more domestic and foreign goods and services. Hence, imports also increase. Theoretically the income elasticity of demand for imports is positive. In some cases, it may be negative theoretically if imports are lower in consumption. "If imports are the excess of domestic consumption over domestic supply, then income elasticity for imports could be negative if domestic supply is more income elastic than domestic consumption" (Egwalkahide, 1999:13-14).

2.2 Empirical Literature

In this section we review the empirical literature on Ethiopia and other countries regarding the effect of GDP growth on imports, and the contribution of imported intermediate and capital goods is made.

Coe and Helpman (1993) studied the contribution of imported intermediate goods to economic growth. They conducted a study on productivity of foreign research and development on a pooled data set of 22 countries during the period 1970-1990. In his model, the measure of foreign research and development capital stock was import share-weighted average of trade partners' domestic research and development. This means technology is

gained by buying intermediate goods. The result suggests that foreign R &D (measured by import flow) for developing country has influential effect on domestic productivity and; it is much stronger if the economy is more open to foreign trade. But, unlike developing countries for a developed country, the domestic research and development is stronger than foreign research and development.

Coe ***et al*** (1997) studied the effect of foreign research and development on productivity based on data for 77 developing countries over the period 1971-90. The result showed that imports of machinery and equipment from industrial countries positively and significantly affect total factor productivity in developing countries and a one percent increase in the research and development embodied in capital stock in the industrial countries leads to an average of 0.1 percent increase in output in the developing countries. In his view, United States is the most important industrial country trade partner for many developing countries and therefore the spillovers is the largest from this country.

Keller (2000) found results similar to the above studies. He conducted a study on productivity of imports of intermediate goods that embody new technology using industry-level data for eight OECD countries (Sweden and G-7 countries) during the period 1970-1991. The result showed that productivity of foreign research and development (measured by import of intermediate goods) is less for developed countries.

Connolly (1998) showed that high technology imports from developed country have a positive influential effect on real per capita growth than domestic technology. His study was based on forty countries during the period 1970 - 1985.

The effect of income (measured by real GDP) growth on imports has been analyzed in estimating import demand model. The earlier works in this area are that of Khan (1974), Goldstein and Khan (1976), and Moran (1989). Recent works in this area are that of Lopez and Thomas (1990), Mwega(1993), Yuan and Kochhar (1994) ,Senhadji(1997),Umo and Fakiyess(1995), and Egwaikhide (1999) . The other argument is that of Hemphill (1974) that relates import with foreign exchange and international reserve .On the basis that there is high restriction on imports and the change in real income and relative price can be measured by change in foreign exchange, he indicated that imports in developing countries might not depend on income and relative prices.

The earliest empirical work on the relationship between import and GDP growth was that of Khan (1974). He tried to analyze the determinants of imports in fifteen developing countries using a two-stage estimation procedure for the period 1951-69. The model he used was based on traditional import demand function that relates a country's import demand to real GDP and relative prices (the ratio of unit value of imports of the country to domestic price levels). In his result, all except for six countries, income elasticity of import is significantly different from zero and has positive sign at the five per cent level of significance in the long run. However, in the short run, income elasticity of import is significant and positive for four countries, but not for the other countries.

On the other hand, Goldstein and Khan (1976) estimated traditional import demand model for 12 industrial countries during the period 1955-1975 based on quarterly data using OLS and two-step estimation procedure. In this result, the income elasticity of import is significant and has a positive sign both in the long and short run. The weakness in the above models is that they are based on the assumption that there is no import restriction and hence supply equals demand. But, most LDCs use import restriction. Therefore, excluding this restriction variable from the model may lead to biased result.

Hemphill (1974) gave attention to import capacity and import restriction. He estimated import demand function for eight developing countries based on the traditional import model. The model relates import demand with foreign exchange receipts and foreign exchange reserve. The result was consistent with the theory that import is highly dependent on capacity variables, namely foreign exchange receipts and foreign exchange reserve. But, this approach does not consider the effect of demand side factors like GDP growth and relative price on imports.

According to Moran (1989), LDC's import depends on both the demand side and capacity factors. He estimated the general import model, which incorporated both traditional and Hemphill import model, using pooled cross-section time-series data for twenty-one developing countries during the period 1970-83. Real income is considered, as determinant of imports but its significance, measured by the corresponding t-values, is smaller than the significance of foreign exchange receipts and international reserves. The short run income

elasticity of import is also generally statistically significant. The estimates of the traditional model showed that the income elasticity of import is statistically significant and it is higher than the corresponding elasticity in the general model. In his result, the general import model dominates the traditional and Hemphill model. He concluded that an import model that neglects either the traditional or Hemphill variables will give biased result for developing country imports. The other interesting result is that the measure for import capacity is more dominant for developing countries group as compared to all others. Moran used the foreign exchange stock and flows as a measure for import capacity. But, Lopez and Thomas (1990) argued that this is equivalent to estimating something very close to identity.

Lopez and Thomas (1990) estimated import model for the seven Sub-Saharan Africa countries with slight modification from that of Moran (1989) using OLS estimation procedure for the period 1966-86. The major difference of their model from that of Moran (1989) is that they used export-debt ratio as an indicator for import capacity, absorption as a percentage of GDP as another very influential demand variable, in addition to the real GDP, and real effective exchange rate instead of the relative price. In this study, real income (measured by GDP) elasticity of import has the expected sign and is statistically significant except for two countries.

On the other hand, Mwega (1993) estimated the generalized import demand of Moran (1989). He used an error correction model to estimate demand elasticity for aggregate imports and components in Kenya over the period 1964-1991. In this result, real income is not significant in the long run in the import of food, beverages and tobacco, which are

consumer goods. In his view, the reason for this is that, as the economy expands, domestic production substitutes these goods. Similarly, real income does not have a significant influence in the long run on mineral fuels and lubricants imports, which are part of intermediate goods. In his view, the reason for this is that, real income is highly correlated (0.84) with relative import prices. Machinery and transport equipment that are part of capital goods are significantly influenced by real income

Yuan and Kochhar (1994) also estimated Moran (1989) type general model for China during the period 1980-1992 based on quarterly data, using Johansen's cointegration estimation procedure. The difference of this model from Moran (1989) is that international reserve is ignored and industrial output is used instead of GDP. The result shows that output elasticity of aggregate import is positive and significant in the short run as well as in the long run, and that the short run output elasticity of import is greater than the long run .In their view, the reason for this result is that import substitution strategy has played an important role over the sample period. In addition to this, they also identified the causality relationship between industry output and GDP growth. The result in this case suggested that the causal relationship between imports and GDP is in both directions.

On the other hand, Umo and Fakiyesi(1995) examined the determinants of components of import in Nigeria, based on OLS estimation procedure for the period between 1950 and 1988. They tested for structural break by partitioning the years. The regression result shows that the import of machinery is negatively related to real per capita income in the period 1955-1972. This means that an increase in per capita income is not spent on purchase of machinery or

investment. According to his view, the reasons for this relationship could be due to the problems of ineffective planning and civil war. The import of invisible goods is positively related to real income, but it is not statistically significant. The researcher's explanation is that it may be collinear with the population variable. Per capita income is not significant in the import of food and durable consumers items. Similarly, raw materials, which are intermediate goods, are not related to per capita income. The weakness of this study is that it is based on Engle Granger two-step procedure in which the DF and ADF tests generally suffer from parameter instability.In addition, the power of these tests is low, and the standard errors of the cointegrating vector are biased and cannot be used for hypothesis testing (Enders, 1995).

Senhadji (1997) conducted a study on the determinants of import in 77 countries. His model was similar to the traditional import demand model except that he used GDP minus export instead of GDP as an explanatory variable. The result shows that the long run income elasticity of import for a large majority of countries has a positive sign, and is statistically significant in most cases. He also compared industrial and developing countries and concluded that industrial countries tend to have significantly higher income elasticity of imports than developing countries.

Egwalkahide (1999), on the other hand, estimated a generalized import model for Nigeria, during the period 1953-1989 using Engle-Granger cointegration method. In his model, industrial output instead of GDP is used as a regressor. The study shows that in the short-run

change in output of the industrial sector has a positive influence on the import of raw materials.

In Ethiopia, Girma(1982), Muluneh (1982), Alem(1995), Solomon(2000) and Tura(2001) have studied the effect of GDP growth on imports.

Girma (1982) estimated value of import as a function of GDP only in Ethiopia during the period 1970 to 1978, based on OLS estimation method. In his result, GDP is significant and positively affect import of goods.

Muluneh (1982) estimated import demand in Ethiopia during the period 1965-1980, based on OLS estimation method. In his model, the explanatory variables were GDP and foreign exchange reserve. The results show that income elasticity of aggregate import is negative and significant; that means as income increases import of goods decreases. In his view, the reason for this negative relation can be attributed to "the nature of Ethiopian economy where there is no free market operating on its own and the quantity and quality of imports is determined by the government at the central level". In other words, there is a positive income elasticity of imports of semi-finished and capital goods, but income elasticity of imports of raw materials, fuel and consumer goods is negative and all are significant. The weaknesses in the above three studies are that they used small sample, and they did not test stationarity of the data. Small sample size may give biased results while using non-stationary data may give highly significant result, which is spurious (Gujarati, 1995).

Alem (1995) has shown the impact of income (real GDP) on import using generalized import model during the period 1969-1991, based on Engle-Granger cointegration method. In his result, income elasticity of imports is negative and weakly significant (at 10 per cent) in the long run but it is not significant in the short run. In his view the reason for negative income elasticity of import is that as income increases, domestic goods substitutes imported goods. The weakness in this model is that he used small sample data, which as indicated above may give biased result. Also the Engle-Granger method used in the study does not test if there are more than one cointegration relationships.

On the other hand, Solomon (2000) estimated import demand based on Engle-Granger and Johansen estimation procedures for the period 1960-1995 in Ethiopia. In his result, real income is statistically significant and positively affects aggregate import both in the short and long run. Similarly, real income positively and significantly affects the import of fuel, chemical, raw materials and manufacturing commodity in the long run. But, in the short run except raw materials and chemical import, all are not determined by real income. Food, beverage and tobacco imports are not determined by real income both in the short and long run. Machinery transport and equipment import is positively and significantly affected by real income in the short run but not in the long run.

Tura (2001) estimated the generalized import demand for Ethiopia, using Johansen Cointegration estimation procedure during the period 1970/71-1999/2000 based on quarterly data. The result indicates that real income does not have a significant effect on imports in the long run although it has a positive influence on imports. He reasoned out that whenever

income increases most people increase spending on domestic goods to satisfy their basic needs, as the Ethiopian economy is highly subsistent. The study shows that in the short run real income significantly affect imports while in the long run change in real income affect fuel import which is part of intermediate goods. The long run income elasticity of fuel is larger than the short run. For imports of machinery, real income is weakly significant (significant only at 10 percent).

From the above empirical literature, the effect of GDP growth on imports is mixed in Ethiopia. Two of the studies we have, Muluneh(1982) and Alem(1995) have found that the impact of real GDP on imports are negative and significant. On the other hand, Solomon (2000) has found a positive and significant effect in the short and long run. But, Tura (2001) has found a positive effect but it is not significant in the long run. However, it is significant and positive in the short run. Therefore, it is difficult to conclude the relationship between import and GDP growth from these studies. More importantly, these studies they did not see the effect of components of imports on GDP growth. This study tries to see the effect of GDP growth on imports, and the contribution of imported capital and intermediate goods on GDP.

CHAPTER THREE

Trade Policy and Import Control Measures in Ethiopia

Import substitution industrialization, which was reinforced by the infant industry argument, has been used by developing countries in support of their industrialization process. Ethiopia, like other developing countries, adopted this policy to encourage domestic industries and to save foreign exchange. This was shown in the Third Five Year Development Plan from 1968/1969 1972/73 G.C[6]. In this plan, the strategy was to promote import substitution industries with the primary objective of saving substantial foreign exchange by encouraging use of locally available raw materials, particularly agricultural and mineral products, for the internal and export market. This process continued up to the end of 1991. After the year 1992/93, the transitional government of Ethiopia (TGE) adopted the policy of trade liberalization supported by both IMF and World Bank with the belief that free market helps to increase and expand exports, make the domestic economy more efficient and competitive, and results in strong and continuous growth. The instruments to protect and encourage import substitute industries are tariffs, non-tariff barriers such as quota, import license, exchange control, devaluation, subsides, technical, administrative, and other regulations. The following section, focuses on the main import control instruments that were adopted in Ethiopia.

[6] Source: The current Ministry of Finance and Economic Development

Import tariff: -Tariffs[7] is among the most important forms of import control mechanisms. At theoretical level, when a tariff is levied on imported goods, their price increases in the home market by the amount of the tariff (Kreinin, 1995). As the price of imported goods increases, the demand for them declines, and this may bring about a shift to domestically produced substitutes by consumers. Increased consumption of home product would encourage domestic industries to increase production and become more competitive. There is however a controversy about the effect of tariff in developing countries. One issue in this case is that if the exporting countries get subsidy from their governments, the effect of tariff may be neutralized to that extent (Singh, 1985). Thus, in order to make tariff effective, the importing countries set tariff rate at prohibitively high levels. This high tariff rate affects export industry because of high price of imported raw materials and also increases the degree of monopoly in the countries, thereby reducing productive efficiency, punishing consumers by charging high price, and lowering economic growth (Kreinin, 1995). Therefore, taxes or subsidies are better than tariff since they do not bring domestic distortions.

In Ethiopia, ad valorem[8] and specific[9] types of tariffs are levied on imports. The basic strategy of the tariff protection was to create larger competitive efficiency in production relative to international cost and price levels while simultaneously giving the protection level necessary to infant industries[10]. As shown in table 3.1, import control during 1976-1981 was

[7] Tariffs are a tax or duty levied on the traded commodity as it crosses a national boundary.

[8] Ad valorem tax is a fixed proportion of the value of the commodity.

[9] Specific duty is a fixed sum of money per physical unit of the commodity.

[10] See the Third Five-year development plan (1968/69-1972/73 G.C)

mainly liberal with some restrictions as per the necessity of the economy. Import taxes in this period were lower for most imported goods. The ad valorem rates were below fifty percent and about half of

the total value of import was free from tax. The maximum rate of 100 percent is that of luxury items applicable to less than a dozen items. This high restriction on luxury items is expected to discourage import of these goods and to save foreign exchange. Petroleum products were also free from import tax. In this period, approximately 75 per cent of imported goods bore rates between 10 percent and 40 per cent.

As shown in Table 3.1, tariff rates during the period 1977-1988 were more restrictive than the previous period. Restriction on import of luxury items increased from 100 percent to 200 percent. But, capital goods were free from import tax in this period. This shows that the government of Ethiopia gave attention to promote manufacturing industries by supplying low cost equipment.

During the period 1988-1992 import tariffs on most consumer goods were the same as the previous period but rate on luxury consumer goods increased to 209 per cent. As shown in table 3.1, tariff on imported capital goods and grants to certain organizations were free from tax. During this period, the tariff rate on import of petroleum products varied between 12.3 and 46.9 percent. Similarly, tariff on import of iron and steel was between 12.6 and 30.4 percent. On the other hand, tariff rate on soft drink was high compared to the others. Capital goods that are essential for industries were free from import tax. In general, the tariff rates

were low for commodities, which are important for economic development. In contrast, imports of non-essential goods like luxury items were prohibitively taxed.

After 1992/93, the Ethiopian government adopted the structural reforms and began the implementation of this program with the support of the International monetary Fund and World Bank as well as other multilateral and bilateral donors; and this program focused on stabilizing the economy and deregulating economic activities, which were previously characterized by central planning[11]. One of these structural reform programs is trade liberalization. This means liberalizing trade barriers or reducing tax on import and export of goods and services.

During the period1992/93 -1998/99,Ethiopia's trade regime went through three phases. From 1992/93-94/95,the Ethiopia government undertook the first phase of structural and economic reform. In this reform, the government reduced import tax and introduced new tax systems. The ad valorem tariff rates on import of raw materials, capital goods, pharmaceuticals and chemicals were ranging from 0-20 percent. It was reduced from the maximum tariff rate of 50 to 20 percent in this period. Similarly, the maximum tariff rates on import of durable and non-durable consumer goods which were100 percent in the previous period were reduced to 50 percent. In the previous period, the maximum tariff rate was that on luxury goods imports, which were 230 percent, reduced to 80 percent in this period[6]. There were many imported goods that were free from import tax (see table 3.1).

[11] See The Policy Frame Work Paper, Sep 28/ 1998

The second phase of economic policy reform was implemented during the period 1994/95-1996/97. One of the objectives of this phase was to promote the competitiveness of the industrial and agricultural sectors by following more liberal external trade and foreign exchange policies[11]. In the same period, the maximum import tariff on luxury items, which was 80 percent in the first phase, was reduced to 50 percent in this period.

Table3.1 Summary of Import Tax in Ethiopia

Regulation No			
1. Tariff regulations No. 42 of 1976, effective sep 2, 1976 (1977 Continued)			Exemptions are also granted to certain organizations.
			Crude petroleum destined for further processing within Ethiopia; Petroleum products sold to Ethiopian government airlines navy, railways, electricity production; petroleum products for use in minerals exploration. Molasses of sugar
2. Tariff regulations No. 42 of 1976,52/1977,58/1979 (as of March 1982-as of July 15,1988 Continued)	**Exemptions and Deductions** Most items subject to specific excises, such as petroleum products, are exempt from import duties. Many other exemptions exist; about half the total value of imports benefit from customs duty exemptions.		
3.Tariff regulations Nos. 42 / 1976,52/1977,58/1979,14/1990 (As of Feb., 1993 Continued)			
	Capital goods are exempted		
			Import Tax (%) The tariff rates includes Ad valorem and specific rates; in a few cases both types of rate apply to the same product. For most
	Capital goods are exempted		

items, the ad valorem rates are below 50 per cent. Approximately 75 percent of items bear rates between 10 percent and 40 percent. The maximum rate is 100 per cent, applicable to less than a dozen items.

Intermediate goods tax rates mostly below 50 percent. Most consumer goods are taxed 100 per cent, and luxury consumer goods 200 per cent.

Intermediate goods subject to tax rates of mostly are below 50 percent. Most consumer goods are taxed 100 per cent, and luxury consumer goods 209 per cent.

3.1. Ad valorem tax levied on import or manufacture of petroleum products

Regular benzene	46.89%
Super benzene	46.74%
Naphtha, diesel oil	12.32%
Kerosene	12.32%
Lubricating oils	13.00%
Light petroleum gas	19.23%

3.2. Ad valorem tax levied on import of iron and steel products

Iron and steel rods And bars	12.55-24.55%
Iron and steel sheet	18.37-30.37%

3.3. Ad valorem tax levied on import of Matches

Boxes of 50 matches	Per box 119.12%

3.4 Ad valorem tax levied on import Soft drinks

Size of container	Rate(per cent)
Up to 250cc	116.56
251-350cc	137.45
351-1 liter	39.93
Mineral water (Up to1 liter)	127.62

4. Tariff regulation No.122/1993

(As of June 1994 concluded)

Diplomatic and Consular missions, personal effects, grants and gifts for Ethiopia, fire-fighting instruments and appliances, trade samples, defense and security equipment, materials and equipment for handicapped. Exemptions and concessions are granted to certain organizations and items.

5. Tariff regulation No.122/1993,67/1993,11/1996
(As of June 30,1997 continued)

Diplomatic and Consular missions, personal effects, grants and gifts for Ethiopia, fire-fighting instruments and appliances, trade samples, defense and security equipment, materials and equipment for handicapped, and sheath contraceptives are exempted. Exemptions and concessions are granted to certain organizations and items

6. Tariff regulation No.122/1993,67/1993,25/1997
(As of May 31,1999 concluded)

Diplomatic and Consular missions, personal effects, grants and gifts for Ethiopia, fire-fighting instruments and appliances, trade samples, defense and security equipment, materials and equipment for handicapped, and sheath contraceptives are exempted. Exemptions and concessions are granted to certain organizations and items

Source: IMF staff reports on Ethiopia varies issues

3.5. Ad valorem tax levied on import of sugar

Per 100kg	90.97%

3.6 Ad valorem tax levied on import of Textiles

Type of textile	Rate
Cotton yarn	37.24
Cotton fabrics	27.00
Silk, nylon fabric	77.00

Ad valorem duty consisting of 10 rates raging from 0-80 percent are imposed on imports

	Tax rate (%)
4.1 Raw materials, Capital goods, Pharmaceuticals, Chemicals	0-20
4.2 Durable and Non-durable Consumer goods	20-50
4.3 Luxuries goods	60-80

Ad valorem duty consisting of 8 rates raging from 0-50 percent are imposed on imports

	Tax rate (%)
5.1 Raw materials, Capital goods, Pharmaceuticals, Chemicals	0-20
5.2 Durable and Non-durable Consumer goods	20-40
5.3 Luxuries goods	40-50

Ad valorem duty consisting of 7 rates raging from 0-50 percent are imposed on imports

	Tax rate (%)
6.1 Raw materials, Capital goods, Pharmaceuticals, Chemicals	0-20
6.2 Durable and Non-durable Consumer goods	20-40
6.3 Luxuries goods	30-40

The maximum tariff rate of durable and non-durable consumer goods import declined from 50 percent to 40 percent in this period. Tariff rates on import of raw materials, capital goods, pharmaceuticals, and chemicals did not change from the previous period. This phase was more liberal from the first phase.

The third phase of the reform covered the period 1996/97-1998/99. This phase was more of a liberated import regime than the previous period in general. The import duties were lowered on some selected luxury goods. The maximum import duty on luxury items, which was 40-50 percent in the second phase, was reduced to 30-40 percent in this phase. Import duties on the rest of the goods were the same as before.

To sum up, during the period 1973/74-1990/91, there was strict import control, which was in contrast to the liberalization process begun in 1993. After 1993, liberalization on import continued. As shown in Table 3.2,the average real import growth was 8.3 per cent per annum during the period 1973/74-1990/91. Comparing the period 1973/74-1990/91 with 1991/92-1999/2000, real value of imports rose by 11 percent on the average. On the average, the

balance of payments position deteriorated further as the net monetary movement showed a deficit of birr 53 million per annum during the period 1973/74-1990/91 compared with a deficit of birr 462.9 million per annum recorded in the period 1991/92-1999/2000.

Table 3.2: The annual growth of real import and the average nominal value of balance of payment

Period	Real import growth (%)	Balance of payment (Nominal value per year)
1973/74-1990/91	8.3	-53.0
1991/92-1999/2000	20.1	-462.9

Note: Calculated based on the data of National Bank of Ethiopia Quarterly bulletin

Import quota: -import quota is one of the non-tariff barriers that are imposed on importation of goods. At theoretical level, it is argued that a government can reduce the volume of import directly by lowering import quota (Singh, 1985). As the volume of import decreases, the domestic price of import rises due to high domestic demand for imported goods. Thus, the demand for imported goods decreases, and consumers shift to less desirable domestic substitutes. The consequence of this is that domestic production of import competing goods increases, leading to a rise in out put. There is debate about the advantage of quota over an equivalent tariff. It is argued that tariff may be preferable to an equivalent quota since it does not generate revenue to the government if the government is not a supplier, however it benefits the quota holders, but also creates administrative complications and corruptions (Singh, 1985). Contrary to this, reduction of import with tariff creates domestic distortions and retaliation of foreign supplier.

> " With a given import quota, an increase in demand will result in a higher domestic price and greater domestic production than with an equivalent tariff. On the other hand, with a given import tariff, an increase in demand will leave the domestic price and domestic production unchanged but will result in higher consumption and imports than with an equivalent import quota'' (Salvatore, 1990:348).

Hence, according to this argument, import quota may be preferable to an equivalent tariff. In Ethiopia, import license is used instead of import quota.

Import license: - Import License is another instrument of import control mechanisms.

A government can reduce import by directly reducing value of import license[12]. The difference between quota and import license is that quota is imposed on volume of import while value of import license is levied on foreign exchange.

From information provided in Table 3.3, in Ethiopia, the value of license issued for industrial goods increased by 96.6 percent during 1981/1982 to the period 1983/84- 1988/89 on the average. It declined during 1990/91-1991/92 on the average. After this period, it increased substantially because of liberalized import policy of the government. The average value of import license for raw materials and semi-finished goods, Spare parts, grains and miscellaneous import continued to decline until 1990/91-1991/92 from 1981-1982. The average value of license on consumer goods and fuel was fluctuating in this period. After this period, average value of import license of all goods increased in very large amount. But, the value of import was higher than value of import license. (See table 3.4).

Table 3.3. The Average value of import License Authorized by End- Use (million of birr)

Type of Commodities	1981-1982	1983/84-1989/90	1990/91-1991/92	1992/93-1996/97
Industrial goods	200.9	394.9	220.1	1000.8
Fuel	381.8	319.0	347.4	1065.8
Raw materials and Semi-Finished goods	268.3	259.5	153.7	572.5
Consumer goods	152.5	205.5	186.4	2019.9
Spare parts	217.6	147.2	84.4	723.1
Fertilizers and Insecticides	382.6	60.4	81.1	338.2
Grains	7.4	17.9	4	1.4
Miscellaneous	108.8	63.9	31	102.3

[12] Values of license are the amount of birr permitted by the government to import goods.

Total	1374.5	1468.0	1107.8	5671.8

Note: Calculated based on the data of National Bank Quarterly Bulletin

Table 3.4: The average value of import and import license

Period	Average value of license (1)	The actual expenditure on importation (2)	2/1 in percent
1981-1982	1375.4	1578.3	114.7
1983/84-1990/91	1436.4	2261.7	157.3
1991/92-1996/97	4893.1	5300.6	122.4

Note: Calculated based on the data of National Bank of Ethiopia Quarterly Bulletin

Exchange control: -Exchange control is one of the import control measure. In order to reduce import, the government of a country gives foreign exchange in small amount. This means, the government directly controls the foreign exchange in order to maintain the balance of payment.

In Ethiopia, pre-reform trade regime payments for all kinds of foreign trade had to be approved by the exchange controller, whose office was a department of National Bank of Ethiopia. In order to give foreign exchange, information was needed by the National Bank of Ethiopia about the level of stocks available whose commodities importation was being sought. Furthermore, the Ministry of Foreign Trade had authority to disallow, limit, or control imports and exports. At the beginning of 1973, the exchange controller (NBE) used to allocate available foreign exchange in accordance with its own order of priorities. Later on, the allocation of foreign exchange was withdrawn from the National Bank of Ethiopia and left in the hands of the Ministry of planning[13]. For instance, in 1973, there was a liberalized

[13] IMF staff report on Ethiopia

trade regime in the sense that no import licenses were required, while payments for import have need of exchange licenses, these were usually approved freely. In 1974, the NBE was not granting foreign exchange for the import of passenger cars with engines is over 1300 cc. In 1978, the granting of foreign exchange was forbidden for the importation of some foodstuffs, alcoholic beverages, and other consumer goods. In the same period, the granting of foreign exchange was also denied for an additional 16 imported consumer goods. In 1987, granting of foreign exchange for importation of goods from South Africa was denied. In sum, in this period, there was a strict foreign exchange licensing system for private use.

After 1992/93, the government of Ethiopia liberalized control on foreign exchange and foreign exchange was available for licensed importer through the auction market.

Devaluation: -Devaluation[14] is an instrument of import control. It is argued that a reduction in the exchange value of a country's currency restricts imports and expands exports (Kreinin, 1995). This means, as a result of devaluation, the prices of export product imported by foreign buyers are lowered, while the prices of imports increased. Thus, as the result of high price of import, the consumption of imported goods decline and consumers shift from imported goods to domestic substitutes; due to low price of export, the demand for export increases, thereby improving foreign trade balances and increasing domestic output. In contrast to this argument, in developing countries devaluation may be unsuccessful in increasing exports and lowering imports (Singh, 1982). This is because developing countries cannot easily increase their export even if the world demand for their goods increased and at the same time the

[14] Devaluation is a reduction in the exchange value of a currency of a country.

world demand for their export is inelastic with respect to income and price; " most imports of developing countries are inputs into production and the elasticity of substitution in production between imports and domestic value added is essentially zero"(Ghei and pritchett, 1999:468). Therefore, devaluation has little role in achieving macroeconomic balance. The other argument is that if both imports and exports are highly responsive to changes in real exchange rates, devaluation improves balance of payment problems and economic growth. In practice, the effect may be different, that is, devaluation may not increase the supply of import substitutes and export in developing countries where trade is liberalized at the same time of devaluation; however, devaluation can increase the supply of import substitutes in developing countries where trade is not liberalized at the same time of devaluation (Ghei and pritchett, 1999).

In Ethiopia, devaluation is one of the reform measures adopted by the government in 1992. The birr was devalued by 142 percent (from Birr 2.07 per US dollar to Birr 5.00 per US dollar). As part of the reform program, the devaluation was followed by continuous liberalizing measures of the external sector as cited before. The effect of liberalization in Ethiopia is that it improved economic growth (measured by real GDP) and resulted an import boom relative to its previous position.

CHAPTER FOUR

The Structure of Imports and their Trends with GDP Growth

The Ethiopian customs office classifies imports based on their use. These classifications of imports are capital goods, consumer goods, raw materials, semi-finished goods and fuel. The remaining imports are categorized under miscellaneous imports. In general, imports are classified under three main groups namely, capital, consumer and intermediate goods (Fuel, raw materials and semi-finished goods). The detail of each is presented in Appendix 1.

Trends in Import and GDP

At the theoretical level, there are many economic factors (tariff, quantitative restrictions, economic development, foreign exchange earnings, price of imports, consumer preference

and so on) and non-economic factors (social structure, natural distortions) that determine imports. Among economic variables real GDP is the main determinant of imports. The following descriptive analysis explains the trend of imports and GDP in Ethiopia.

During 1960/61 to1999/2000, the nominal value of merchandise imports grew by 4917.5 percent while the nominal value of GDP increased by 1706.0 percent as shown in figure 4.1 and 4.2, there is weak relationship between import and GDP growth. From 1960/61 up to 1999/2000, Ethiopia went through three stages of economic systems, which are discussed in the following section.

During 1960/61 to 1972/73 (Impire regime) was a period of fairly free market and loose inward looking economic framework. In this period, the growth rate of imports and GDP was fluctuating with the growth rate of imports hovering between negative 6.8 and 20.7 percent while that of GDP staying between 0.9 and 9.4 percent in nominal terms. In this period, Ethiopia had spent on average 14 percent of GDP on imports.

As can be seen from table 4.3, the agricultural sector contributed about 68.4 percent of the country's GDP on average between 1960/61 and 1972/73, with maximum value of 75.8 percent at the beginning of the period and 62.5 percent at end period. The industry sector, service sector and other service contributed on average 9.1, 11.4 and 10.9 percent of the country's GDP respectively. During this period, the growth rate of industry and services are much higher than the agricultural sector. The growth rate of GDP and import was very low in 1971/72 because of decline in agricultural and industry sector; coffee earning also decreased due to the fall in volume and price of coffee (see Appendix 2). The real GDP growth rate in this regime was encouraging and it was on average 3.8 percent.

The period 1973/74-1990/91(Derg regime) was characterized by an excessive government intervention and centrally planned management. There was a disappointing economic performance during this period. The growth rate of real GDP declined by 1.9 percent from the previous regime while payments on import has increased. The real growth rate of payments on merchandise import in this period was 8.3 percent on average while real GDP growth rate was 1.89 percent. From the previous period, expenditure on import increased two

times but real GDP growth rate declined, and it was negative in six of the eighteen years of the reign of this regime. Compared to the previous period, agriculture, industry, and service sector declined respectively. The only sector that showed improvement was that of the other service sector. The economic performance of this period was lower than the previous period. The main reason for this weak economic performance was due to the policy of the government and external shocks. In this period, there was strong government interventions and minimization of the private sector. The government monopolized all sectors and they were inefficient and this resulted in reduction of output growth. In addition, this period was exposed to external shocks, which affected the economic performance. The first oil shock in 1973/74 had adverse effect on the economy of Ethiopia. The oil price increased from 4.3 U.S. dollar per barrel in 1973 to 11 U.S. dollar per barrel (See Appendix 5). Following the oil shock, the price of imported goods increased. For example, Appendix 3 shows that the world fertilizer price index increased between 1972/73 and1974/75. Similarly, the world food price index increased in 19972/73 and 1973/1974. Due to high price of import goods, import that are important for economic sector (agricultural, industry and service sector) declined and therefore this affected the agricultural, industry and service sector. The growth of these sectors declined continually from 1973/74 to 1974/75,in turn, leading to a fall in GDP growth (See Appendix 6). During this period, the economies of many developing countries were affected by oil price increase (Fried and Schutze, 1975). In this period, the growth rate of real GDP continued to decline until 1975/76, and real growth rate of import declined as well (except for the year 1973/74). In 1973/74, the real growth rate of import increased because of high price of imported intermediate goods. The oil shock was short-term phenomenon, and this was rapidly overtaken by the rise of coffee price in 1976/77(see Appendix 2). This

resulted in an increase in real GDP growth from 0.7 percent in 1975/76 to 1 percent in 1976/77, leaving real import rising from negative 21.1 to 24.7 percent in the same period. The coffee boom was a short-term period, followed by the second oil shock of 1979/80, which lasted until late 1983/1984. In 1980/81, both real import and GDP declined from the previous period. In 1983/84, value of real import increased from the previous years, reflecting the purchase of two airplanes by Ethiopian Air lines[15]. This was followed by the severe drought in 1984/85. The growth of real GDP and import declined in 1984/85 from the previous year due to the decline in agricultural sector.

During the period 1991/92 –1999/2000, a transitional free market economy was under way presumed to transform the country from command to liberalized economy. In this round, the average growth rate of real GDP and import were 4.6 and 20.1 percent respectively. The average contribution of agriculture, industry, service and other service sector was 49.6, 10.8, 13.9 and 25.7 percent of the country's GDP respectively. Compared to the previous periods, both real GDP and imports growth were higher in the third regimes. But, the contributions of all except other service were lower than the Derg regime. However, the average growth rate of these sectors was higher than the Derg regime. The growth of import in this period was due to the expansion of coffee earning and the relaxation of import control. In this period, the volume and price of coffee increased from the Derg regime (See Table 4.1)

[15] See IMF Staff reports on Ethiopian (1987).

Table 4.1 Annual Rate of Growth in Coffee Volume and Price

Period	Rate of growth in Volume (%)	Rate of growth in price (%)
1973/74-1990/91	4	10
1991/92-1999/2000	13	26

Table 4.2 The Growth Rates of Import and GDP

Period	Nominal growth (%)		Real growth (%)	
	GDP	Imports	GDP	Imports
1960/61-1972/73	6.1	5.9	3.8	4.0
1973/74-1990/91	7.0	10.4	1.9	8.3
1991/92-1999/2000	11.9	23.9	4.6	20.1
Total average	7.9	12.1	3.1	9.7

Note: Calculated based on the data from the NBE and the current Ministry of Finance and Economic Development.

Table 4.3 Sectoral Contributions

Period	Sectorial contribution to GDP (%)							
	Agriculture	Rate of growth	Industry	Rate of growth	SERV	Rate of growth	Other Serv	Rate of growth
1960/61-1972/73	68.6	2.1	9.1	7.5	11.4	8.3	10.9	7.3
1973/74-1990/91	55.9	1.5	11.4	1.4	14.3	1.5	18.4	4.9
1991/92-1999/2000	49.6	1.8	10.8	7.3	13.9	7.3	25.7	8.1
Total average	58.6	1.8	10.5	4.6	13.3	4.8	17.6	6.4

Note: Calculated on the basis of data from the current Ministry of Finance and Economic Development.

Figure 4.1 Log of Real GDP and Import

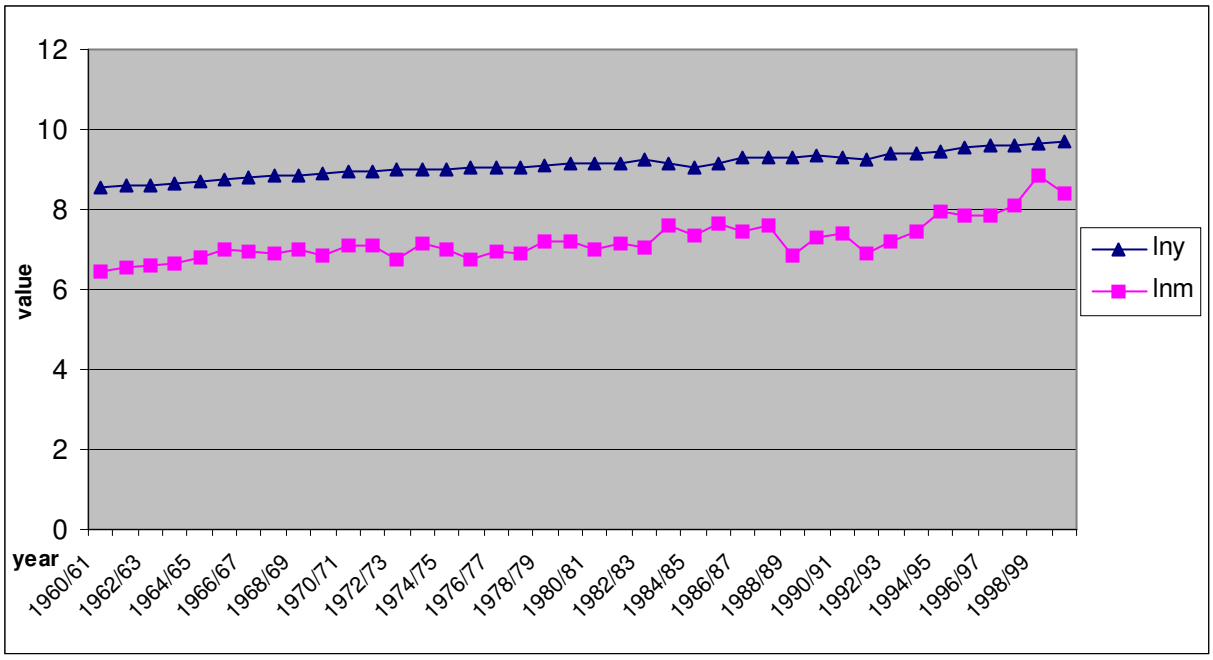
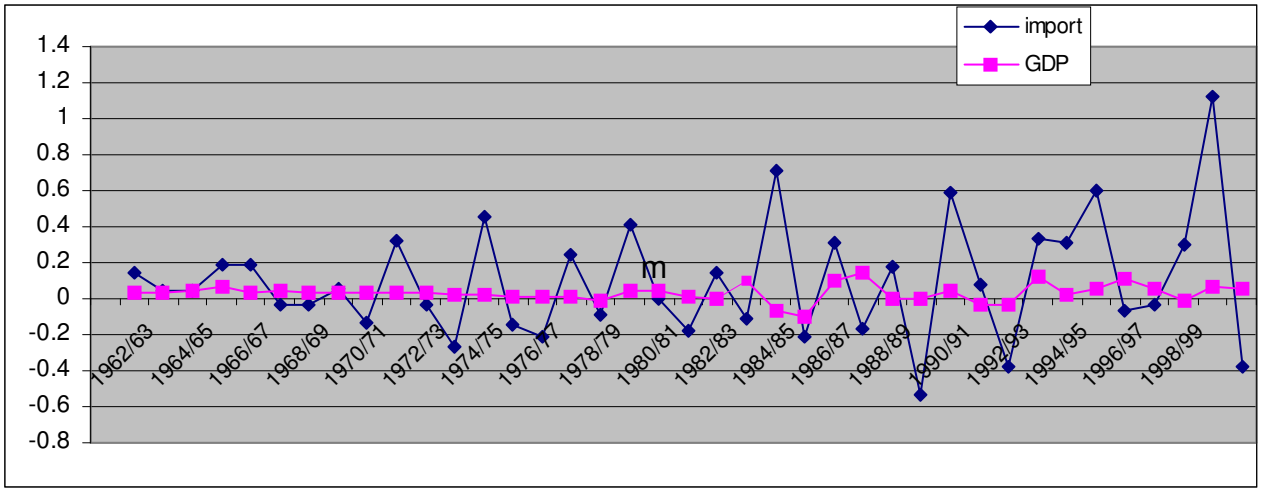


Figure 4.2 Annual Growth Rates of Real Import and GDP



Trends in Components of Imports

During the period 1960/61-1972/73, the average share of consumer, intermediate and capital goods import was 33, 28.4 and 37.4 percent of total import respectively. In this period, the import of consumer goods was higher at the beginning due to insufficient domestic production; it declined later on, reflecting the substitute of non-durable consumer goods with domestic production and expansion of the domestic industry, while importation of intermediate and capital goods was continually increasing. On the average, in this period, 4.6, 4.1, and 5.5 percent of GDP were spent on import of consumer goods, intermediate and capital goods respectively. The import of capital goods increased in 1971/72 due to work on the Finches dam, but decreased in the following year due to the completion of this project and the general economic activity[16].

[16] See IMF Staff report on Ethiopia (1977)

During the Derg regime, the average share of nominal consumer, capital and intermediate goods to GDP was 4.4, 5 and 4.9 percent respectively. But, on the average, the growth rate of intermediate, capital and consumer goods increased from the previous period (See Table 4.5). This is because of the increase in oil, fertilizer and food price in the world market (see Appendix 2). Compared to the previous period, expenditure on imports of consumer goods and capital goods decreased. Furthermore, the structure of import changed. That is, import of intermediate goods dominated aggregate import; capital goods were the next.

During the period 1991/92-1999/2000, the structure of import did not change from the previous period, with the import of intermediate goods leading and followed by capital goods.

However, on the average the growth rate of these goods was higher than the previous two periods. In this period, the average share of consumer goods declined from the last two.

As shown in figure 4.3, 4.4 and 4.5,log of real value of consumer goods and GDP, log of real value of intermediate goods and GDP, and log of real value of capital goods and GDP appeared to move together. This shows that as agricultural output increases, the import of non–durable consumer goods decreases. The annual growth rate of intermediate and capital goods are also positively related to industrial output, suggesting that as industrial output increases, the imports of these goods increase.

Table 4.4 Percentage Shares of Components of Import to GDP and Total Import

Period	Share of GDP (%)				Share of import (%)		
	Consumer goods	Intermediate goods	Capital goods	Total import	Consumer goods	Intermediate goods	Capital goods
1960/61-1972/73	4.6	4.1	5.5	14.4	32.2	28.6	38
1972/73-1990/91	4.4	5.0	4.9	14.5	30.4	35.2	33.6
1991/92-1999/2000	6.0	7.1	7.0	21.0	29.4	34.2	33.6
Total average	4.8	5.2	5.6	15.9	30.8	32.9	35

Table 4.5 Annual Percentage Growth Rates of Components

Period	Annual Rate of Growth					
	Consumer goods		Intermediate goods		Capital goods	
	Real	Nominal	Real	Nominal	Real	Nominal
1960/61-1972/73	1.8	3.9	5.9	7.7	6.1	7.9
1972/73-1990/91	7.2	11.3	7.8	9.8	15	16.2
1991/92-1999/2000	26.1	25.4	21.4	30.4	19.2	21.6
Total average	9.7	12.1	10.1	13.7	13.1	14.8

Note: The source of the data in the above table is the same with table 4.1-4.2.
Figure 4.3 Log of Real GDP and Import of Consumer Goods

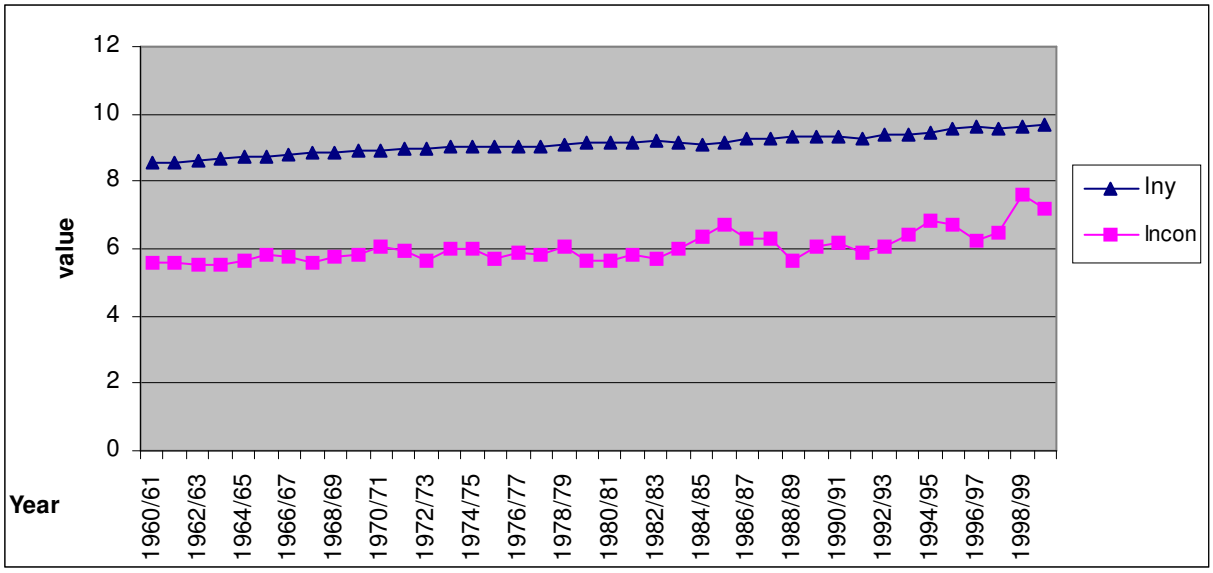


Figure 4.4 Log of Real GDP and Real Capital Goods Import

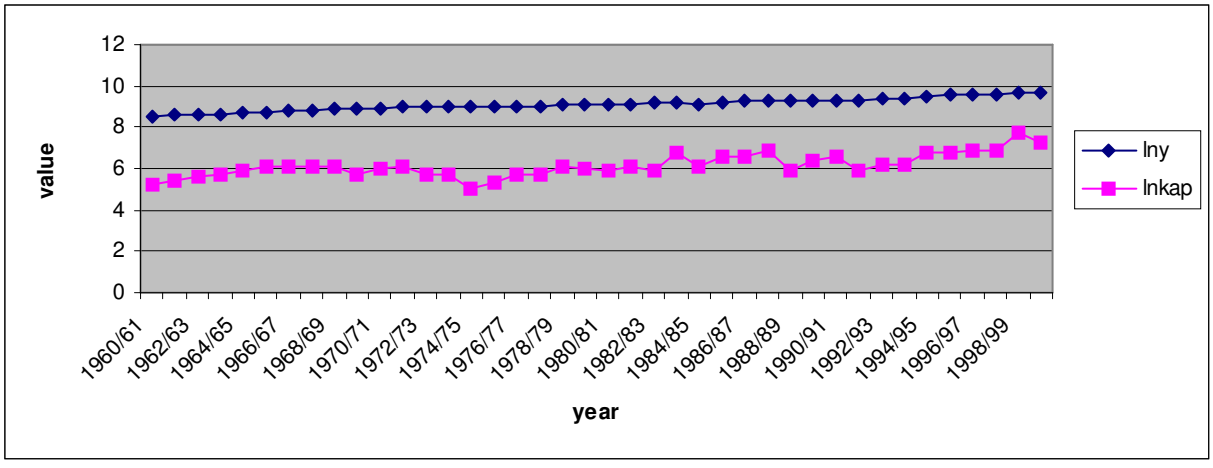
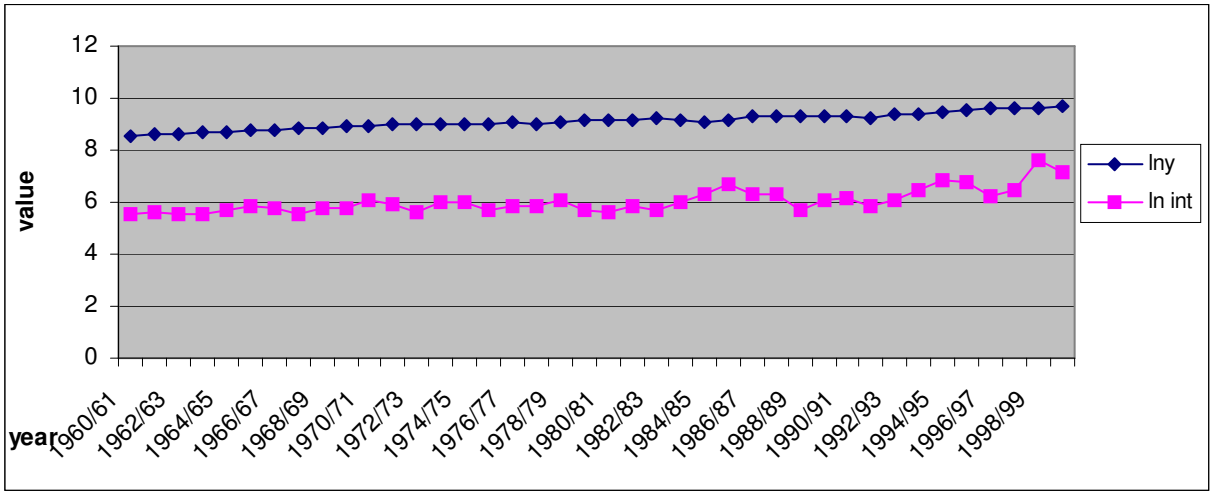


Figure 4.5 Log of Real GDP and Real Intermediate Goods Import



The Origin of Import

Ethiopia imports from different countries. Industrial and developing countries like Africa, Asia, Europe and Middle East and Western Hemisphere, and U.S.S.R. Among these countries, the majority of imports come from industrial countries for the period 1981-1999. On average, imports from industrial countries account for 58 percent of total merchandise imports during the period, while developing countries account for over 23 percent of total merchandise imports. During the period 1981–1990, industrial countries were the major origin of imports followed by the U.S.S.R, but import from U.S.S.R declined and became very little following its collapse. Imports from developed countries continued to increase up to 1986 from 61.9 to 72.1 percent of total import and continued to decline until it became 45.4 percent during 1999 while import from developing countries continued to increase from 12.8 percent in 1981 to 54.2 percent of total import in 1999 (See Appendix 4).

CHAPTER FIVE

Econometric Analysis

5.1 Model Specification

The early theoretical import demand models showed that the main determinants of imports are real activity variables such as GNP or industrial output, and relative prices (the ratio of unit value of imports of the country to domestic price level). However, for most less developed countries, the effect of foreign exchange is a very important factor in the determination of imports. In addition, these countries employ trade and exchange restrictions either due to inward oriented policies or lack of capacity to import that would directly affect both the relative price and the volume of imports (Hemphill, 1974). Thus, foreign exchange reserves and foreign exchange inflows should be included in the determinants of import (Hemphill, 1974 and Moran, 1989). The import model of Hemphill (1974) excludes the relative price and real activity variables such as GNP or industrial output. According to Hemphill(1974),the change in relative prices and real economic activity can be measured by the change in foreign exchange reserves since changes in imports cannot be fully explained by changes in relative price and real economic variables in the presence of import and exchange restrictions. The weakness in this model is that it ignores the demand side factors as another extreme end of the traditional model. However, in real world, developing countries' import depends on both capacity and demand factors (Moran, 1989).

The theoretical import demand model modified by Moran (1989), which is used here, incorporates both the traditional and Hemphill (1974) models. The model of Moran(1989)

begins by assuming that the main objective of economic authorities is to minimize the costs of deviating from the actual and desired levels of both imports and international reserves, which is stated in a quadratic cost function as (see Hemphill ,1974:651 and Moran ,1989:281).

(1) $$C_t=\phi_1(m_t-m_t^*)^2+\phi_2(R_t-R_t^*)^2+\phi_3(m_t-m_{t-1})^2+\phi_4(m_t-m_t^d)^2$$

Where m_t and m_t* show actual and long-run import volume at time t respectively; R_t and R_t^* represent current and desired level of real international reserves respectively; m_t^d is short-run notional or desired level of import volumes, and C_t represent cost of deviation from actual and desired level of both imports and international reserves; and the $\phi i_{,s}$ are all expected to be positive. All nominal variables are deflated by the import prices in order to consider determinants of real imports. In the long run steady state, it is expected that the current, the long run and desired levels of import will equal to the long-run foreign exchange receipts (Moran, 1989), that is, $m_t^*=F^*_t=m^d_{t=}\ m_{t.}$

Where F^*_t is the long run level of foreign exchange receipts.

In the short-run, however, the actual and desired volume of imports may not be equal because of the presence of past or current shock.

The argument suggests that economic decision-makers tend to minimize the cost of adjustment to the long-run level of imports by employing reserves to smooth imports.

It is further hypothesized that the desired level of international reserves is an increasing function of the long-run import level, so that:

(2) $$R_t^*=B_o+B_1m_t^*,\ 0\leq B_1\leq 1$$

In the long run, $F^*=m^*$; however, both variables are related through the balance of payments identity in the short run as:

(3) $\Delta R_t=F_t-m_t$

Where Δ is the first difference operator and F_t is the current level of (real) foreign exchange receipts.

The aggregate import demand function that relates imports with relative prices and real gross domestic product can be expressed as

(4) $m_t^d=\alpha_o+\alpha_1(P_m/p)_t+\alpha_2 y_{t;}\ \alpha_1\leq 0;\ 0\leq\alpha_2$

Where m_t^d is demand for real imports, P_m is the import prices, which includes domestic taxes (tariff and non tariff barriers): P_t is an aggregate price index of domestic goods (the GDP deflator); y_t is real GDP; α_1 and $\alpha 2$ are the price and income elasticities of imports.

To get the model, an explicit assumption is required about the long-run level of foreign exchange receipts, F_t*. According to Moran (1989), it is specified as

(5) $F_t^*=F_t+\Lambda\Delta F_t$

Where Λ shows how the authorities perceive changes in foreign exchange receipts.

According to Moran (1989), if the value of Λ is positive, then the changes in foreign exchange receipts are supposed to be permanent; but if the changes in foreign exchange receipts are transitory, then the value of Λ is negative. For simplicity, and following Moran (1989), the current level of foreign exchange earnings is equated with the long run receipts; this shows that $\Lambda=0$.

Moran (1989) derived import demand model by substituting equations (2) and (4) in to equation (1) and minimizing equation (1) subject to the constraint imposed by available foreign exchange (equation 3) and remembering that $m_t^* = F_t^* = F_t$

The result becomes

(6) $$m_t = b_o + b_1 F_t + b_2 R_{t-1} + b_3 m_{t-1} + b_4 (P_m/P) + b_5 y_t$$

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

This constitutes the general import model by Moran (1989), which modified Hemphill's model by explicitly including the traditional import model variables namely, real economic variables and relative price. Following Moran (1989), setting $b_1=b_2=0$ in equation 6, gives the traditional import demand model as:

(7) $$m_t = b_o + b_1 (P_m/p)_t + b_2 y_t + b_3 m_{t-1};\ b_1 \leq 0,\ 0 \leq b_2,\ 0 \leq b_3 \leq 1$$

The Hemphill model, which relates import with foreign exchange constraints, can be obtained by setting $b_4=b_5=0$, gives (Moran, 1989)

(8) $m_t=b_o+b_1F_t+b_2R_{t-1}+b_3m_{t-1}\ ; 0\leq b_{1;}\ 0\leq b_{2\ ;}\ b_3\leq 1$

To get the elasticity of coefficients, I changed equation 6 into log linear form.

The log-linear form of equation 6 is written as:

(9) $lnm_t=b_o+b_1lnF_t+b_2lnR_{t-1}+b_3lnm_{t-1}+b_4ln(P_m/P)_t+b_5ln\ y_t$

The model used here is specified in the form:

(10) $Lnm_t=b_o+b_1lnF_t+b_2lnR_{t-1}+b_3lnm_{t-1}+b_4ln\ (P_m/P)_t+b_5ln\ y_t+e_t$

Where m_t is real value of imports; y_t is real GDP, F_t real foreign exchange receipts; e_t is white noise errors; R_{t-1} is lagged real international reserve (see descriptions of the variables in the Data Appendix).

The model which is used here incorporates all the variables that the traditional and Hemphill (1974) model identified as determinants of import. The traditional model ignores the capacity variables such as international reserve and foreign exchange receipts. While the Hemphill(1974) model ignores the demand side factors. Thus, omission of important variables gives biased and inconsistent estimates (Ogbu (1994) cited in Tura (2001)).

A separate model is also considered to see the effect of imports on economic growth (measured by real GDP). Among the wide category of imports emphasis is given to intermediate and capital goods import.

The role of capital and intermediate goods in production is well known. As discussed in chapter two, capital goods affect output both through their direct contribution and effects on

knowledge (Romer, 2001). Imported intermediate goods are inputs in production, which also have a similar effect on production. To analyze the effect of imported capital and intermediate goods on economic growth, the Solow type growth model outlined in Appendix 9 can be employed. The Solow growth model is represented as below.

$$Y=f(X, t)\text{----------}(1a)$$

Where Y is output; X is vector of different inputs used in production; t is time and is used to measure technology. In most empirical work, equation (1a) is approximated by a Cobb-Douglas type of technology (see Deverjan, 1993, and Baffers and Shah, 1993). The Cobb-Douglas type of technology assumes fixed returns to scale.

The model used in this study to test the effect of imported intermediate and capital goods traces its roots to Solow type growth model. It is stated that research and development(R&D) expenditure creates new intermediate and capital goods in developed economies, and if these goods are imported to developing countries, they increase productivity in developing countries in turn leading to economic growth (Keller, 2000). To see this effect, two categories of capital, imported and local capital, are included in addition to labor input in equation (1b) in Appendix 9; Intermediate goods are also introduced as input in addition to the above two. Active labor force is used instead of population growth.

In the usual notation the production function can be written as follows:

$$y=f(L_t, dk_t, int_{t-1,} kap_{t-1})\text{----------}(2a)$$

Where y_t is gross domestic product (GDP); L_t is active labor force (age group 15-60);

dk_t is domestic capital which is approximated by gross capital formation(investment) less lagged imported capital goods since there is no data for domestic capital ; int_{t-1} and kap_{t-1} is lagged imported intermediate and capital goods respectively. Imported intermediate and capital goods are lagged by one year since the current import of these goods may not directly used in the production process due to lag of time.

We assume the production function to be an extended Cobb-Douglas function:

$Y=A_t L_t^a dk_t^b kap_{t-1}^c int_{t-1}^d e_t$---------- (3a)

Where e_t is white noise error term.

Taking log of equation (3a) we have the following regression equation:

$Lny=c+\delta_1 lnL_t+ \delta_2 lndk_t+ \delta_3 lnint_{t-1}+ \delta_4 lnkap_{t-1}+ \delta_5 t+u_t$

Where u_t is an error term assumed to be a white noise, the δ_i's(i=1..4) are output elasticities with respect to the variables and are expected to have positive signs.

The weakness of this model is that it uses a Cobb-Douglas type of technology which assumes fixed returns to scale, which means if we double the amount of input, the amount of output also double; it also assumes the elastiticity of substitution equal unity. Although a translog production function solves these problems, the sample size does not allow estimating cointegration using the Johansen method since there are large parameters to be estimated and this significantly reduces the degree of freedom. Therefore, in this paper, the Cobb-Douglas type of production is applied.

5.2 Data and Methodology

Data Source

Yearly data covering the period 1960/61-1999/2000 are used to test the relationship between import and GDP growth in Ethiopia. The data were obtained from different sources. It is important to use specific sources for different kinds of data in order to guarantee consistency and comparability among the data. However, there is no adequate and consistent data. Therefore, we are forced to use different sources of data. The domestic sources are the annual and quarterly bulletin of the National Bank of Ethiopia, and Statistical Abstract published by Central Statistical Authority, the current Ministry of Finance and Economic Development, IMF's International Financial Statistics and Direction of Trade Statistics has been used to analyze the relationship between merchandise imports and GDP, and the contribution of imported intermediate and capital goods on real GDP growth.

One of problems in data collection is that different sources use different calendar year. Since it is difficult to compare different calendar year data effort has been made to convert data from different calendar years into the same calendar year. The other problem is that data like import unit price index after 1980 is not available from domestic source. Thus, I calculated import unit price index using the formula of Fishers index (See Data Appendix). There is no data for capital stock in Ethiopia. Therefore, we take investment as a proxy for capital stock

following Salisu and Sapsford (1999), and Netsanet (1997). Accordingly, the local capital stock is approximated by investment less lagged imported capital goods.

Methodology

The first step in time series regression analysis is to test the order of integration of each variable. A variable is said to be of order d, denoted as I (d), if we difference d times in order to make stationary of that variables (Rao, 1994). A variable is stationary if its mean, variance, and covariance are independent over time (Harris, 1995). The need to test stationarity of the variables arises because estimating regression using non-stationary variables based on ordinary least squares (OLS) leads to spurious and inconsistent result (Gujarati, 1995). In addition, if variables are non-stationary, it is difficult to conduct hypothesis testing as the classical assumptions on the property of the error term, namely that it has zero mean, constant variance, and is non-auto correlated is violated (Rao, 1994). Therefore, stationarity test is important.

There are different ways of testing stationarity. In this paper, the two widely applicable (and most available in statistical software) tests of unit root, namely the Dickey–Fuller (DF) and Augmented Dickey –Fuller (ADF) are used.

A)Dickey-fuller (DF) – the null hypothesis of this test is that a variable is non-stationary. This test is based on the following three different regression equations.

(i) $\Delta y_t = b y_{t-1} + U_t$

(ii) $\Delta y_t = \mu + by_{t-1} + U_t$

(iii) $\Delta y_t = by_{t-1} + \mu + ¢t + U_t$

Where y_t shows the variable to be estimated; μ shows constant; $¢$ is the trend coefficient; U_t is normally distributed random variable and t is a time trend. The difference between the three regressions concerns the presence of the deterministic elements μ and $¢t$. The first is without constant and trend, the second includes an intercept or drift term, and the third includes both a drift and linear time trend. Two kinds of trend may appear in non-stationary time series data, namely stochastic trend and deterministic trend. y_t is said to be stochastic trend if $b=0$ and $¢=0$ in equation (iii). A stochastic trend is difference stationary, which means that it becomes stationary by first differencing. Hence, y_t is said to be difference stationary if $\mu=0$, $|b|=0$, and it does not display a tendency to return to the trend. Most of economic time series data are difference stationary (Thomas, 1997). y_t is said to be deterministic trend if $¢\neq 0$ and $b\neq 0$ and such trend can only be removed by regressing y_t on a time trend. The residuals from this regression will then be stationary. Therefore, y_t is trend stationary if $|b|<0$ and $¢\neq 0$, and non stationary if $|b|\geq 0$.

The null hypothesis is expressed as:

Ho: $b=0$ against H_1: $b<0$

The test statistic of this hypothesis is not based on the standard "t" test. The critical values are obtained from the Dickey-Fuller distribution table. If the null hypothesis is rejected, then we say that y_t is stationary. The weakness in the Dickey-Fuller test is that it assumes that the error term is an independently and identically distributed random variable with mean zero and constant variance. The limiting distributions and critical values obtained by Dickey and

Fuller cannot be assumed to hold if this assumption fails, however, this problem is solved by running ADF regression (Rao, 1994).

B. **Augmented Dickey-Fuller (ADF)-** The null hypothesis is similar to DF. The model needed to test the null hypothesis of non-stationary against the alternative of stationary is as follows.

$$\Delta y_t = \mu + c y_{t-1} + \sum_{i=1}^{p-1} d^i \Delta y_{t-i} + at + e_t$$

Where p is selected so the e_t is white noise, μ, c and d are parameters to be estimated. If the null hypothesis is rejected, then a variable is stationery if c is negative and significantly different from zero. The weakness in this test is that the power of the test may be adversely affected by misspecifying the lag length (Rao, 1994).

Differencing the respective variables and running regression on the same can handle the non-stationarity problem. However, this method, suffers from the problem that information about the long run relationship between the variables is lost, since in the long run, first difference of these variables are zero (Yuan and Kochhar, 1994). The concept of cointegration analysis suggested a way to improve this problem. Cointegration means that despite being individually non-stationary, a linear combination of two or more time series can be stationary. Cointegration of two (or more) time series suggests that there is a long run, or equilibrium, relationship between the variables (Rao, 1994).

C. Approches of Testing Cointegration

The two widely employed approaches for testing cointegration relationships are the Engle-Granger (1987) two-step procedure and Johansen (1988) maximum likelihood approach. In the Engle-Granger approach the first step is to estimate the cointegrating regressions and then to test whether the residual obtained from the cointegrating regressions is stationary or not; if the residual is stationary, then the independent and dependent variables have long run relation ships (Rao, 1994). The drawback of this procedure is that it is difficult to determine the number of equilibrium relationships if the variables are more than two. In addition to this, it needs priori information that the dependent variables are endogenous and the independent variables are weakly exogenous. In cointegration relationship estimating a single equation is potentially inefficient since information is lost unless each endogenous and weakly exogenous variable is clearly identified (Harris, 1995). In this paper, the Johansen Maximum likelihood procedure is used in testing for cointegration since it offers solutions for the above problems.

Johansen procedure starts by defining a general polynomial distributed k-lag model of a vector of variable y (Hall, 1989).

$$y_t = \Pi_1 y_{t-1} + \ldots + \Pi_k y_{t-k} + \Phi D_t + e_{t,\, t=1\ldots T}$$

Where y is a vector of N variables of interest; Π_i is an (NxN) matrix of parameters; and e_t is assumed an independently identically distributed N dimensional vector with mean zero and vector of variance Σ.

i.e. $e_t \sim IN(0, \Sigma)$. The deterministic term D_t shows a vector of a constant, various dummies and other regresses that are fixed and non-stochastic.

This model can be reformulated into a vector error-correction (VECM) as:

$\Delta y_t = \Gamma_1 \Delta y_{t-1} + \ldots + \Gamma_{k-I} \Delta y_{t-k+1} + A y_{t-1} + e_t$

Where $\Gamma_{i=}-(I- \Gamma_{1-\ldots-} \Gamma_i)$, (I=1,…,k-1), and $A=-(I- \Pi_1 - \ldots - \Pi_k)$. Δy_t is assumed to be I (0) vector. I is NxN identity matrix; the A matrix contain information about the long run relationships; while the estimate Γ_i shows the short run adjustment. Therefore, the number of distinct cointegrating vectors, r, is given by the rank of A (NxN matrix). If the rank r of A is zero, no stationary linear combination can be identified hence the variables in y_t are not cointegrated. If A has full rank this means the rank of A equals to the number of rows or colums, then the variables are stationary in level (Harris, 1995). In general, if y is integrated of order one or I (1) variable, then the number of cointegrating relations, r, is not more than N-1 i.e $r \leq N-1$. In this case, we can decompose A in two matrices α,β both of which are Nxr such that $A= \alpha\beta'$ (Hall, 1985). Where α represents the speed of adjustment to disequilibrium while β is a matrix of long run coefficients that makes $\beta' y_t$ stationary although y_t is non-stationary.

The two widely used test statistic to test the number of cointegration vectors in the Johansen procedure are the λ-trace test and λ-max test (Harris, 1995). The λ-trace test statistic for the hypothesis that there is at most r cointegrating vector is

$$\lambda\text{-trace}\ (r) = -T \sum_{I=r+1}^{n} \log\ (1-\hat{\lambda}_I)\ r=0,1,2,..,n-2,\ n-1$$

The maximal test statistic for the hypothesis that there are r cointegration vectors against the alternative that r+1 exist is

$$\lambda\text{-}_{max}\ (r) = -T \log(1-\hat{\lambda}_{r+1})\ ,\ r=0,1,2,\ldots,n-2,n-1$$

Where λ_i's is eigenvalues[17] obtained from the estimated A matrix; T is the number of observations. The weakness of the Johansen procedure is that it over-rejects the null hypothesis if the sample size is small when the null is true (Harris, 1995). However, Reimers((1992) cited in Harris(1995)) suggested a way to improve this weakness. He suggests taking account of the number of parameters to be estimated in the model and making an adjustment for the degree of freedom by replacing T in the above test statistics by T-nk, where T is the sample size, n is the number of variables in the model and k is the lag-length.

5.3 Estimation results

Time series properties of the Data

5.3.1.Tests for stationarity

The current thinking in time series econometrics about economic variables is to test stationarity (also called I(0) series) as discussed in section 5.2. Testing for stationarity(order of integration) already defined is a necessary condition prior to estimating regression. Many test procedure are available for testing for a unit root in a time series. However, in this paper, this is conducted by the two widely applied test procedure, namely DF and ADF tests as already discussed. The relevance of using DF and ADF statistics together is to provide a crosscheck for the test. The orders of integration of each variable are tested and the results of the test statistics are reported in Table 5.1. The natural logarithm of the real value of each

[17]Let M be a pxp matrix. We let |M| be the absolute value of the determinant of M, and let I be an identity matrix. The eigen values of M are the solutions to the equation $|\lambda I-M|=0$

series is used in the analysis[18]. The test was done for three alternative specifications; i.e. the equation is estimated without constant and trend, with constant but no trend, and with constant and trend (See section 5.2). The results from this test show that the null of a unit root, or non-stationarity is not rejected for all the variables.

The DF and ADF statistics of the logarithmic first difference of these variables are significantly high, thereby rejecting the null hypothesis that their first difference is non-stationary. Therefore, the variables are stationary (I (1) series). As already discussed, information about the long run relationship between the variables is lost by running regression using a differenced data; and this is solved by conducting cointegration analysis.

Given that all the variables in the model are I(1), the Johansen maximum likelihood procedure which is superior to Engle-Granger method as discussed in section 5.2 , is applied to determine cointegrating relationship between the dependent and independent variables.

Table 5.1: **Tests of stationary of the variables**

Variable	DF			ADF					
				Lag 1			**Lag 2**		
	With out drift	With drift	With drift and trend	Without drift	With drift	With drift and trend	Without drift	With drift	With drift and trend
Lny	3.66	-0.17	-2.40	3.05	-0.18	-2.72	4.46	-0.03	-1.61
Lnm	0.83	-1.53	-3.12	1.53	-0.14	-1.62	1.79	0.36	-1.07
LnR	-0.04	-1.70	-1.71	-0.14	-2.18	-2.14	-0.21	-2.79	-2.73
LnF	0.55	-2.15	-3.41	0.92	-1.22	-2.59	1.19	-0.66	-1.95
$Ln(p_m/p)$	-2.49	-3.02	-3.70	-1.83	-2.26	-2.81	-1.46	-1.75	-2.03
Lnint	0.94	-1.5	-2.71	1.50	-0.62	-1.75	1.72	-0.28	-1.41
LnKAP	0.49	-2.02	-3.31	1.09	-0.66	-1.85	1.21	-0.42	-1.64
LnL	11.82	-.47	-1.99	5.82	-0.50	-1.66	3.66	-0.52	-1.93

[18] See data appendix

lndk	-0.23	-2.58	-2.99	0.07	-2.52	-2.95	0.20	-2.04	-3.45
ΔLny	-4.40	-5.78	-5.71	-4.05	-6.74	-6.64	-1.79	-3.19	-3.14
ΔLnm	-8.49	-8.78	-8.81	-5.34	-5.79	-5.91	-3.66	-4.19	-4.35
ΔLnR	-5.08	-5.01	-4.97	-3.35	-3.30	-3.29	-3.41	-3.36	-3.35
ΔLnF	-7.83	-7.88	-7.86	-5.82	-5.99	-6.01	-4.15	-4.39	-4.37
$\Delta Lnpc(p_m/p)$	-8.14	-8.02	-7.95	-6.44	-6.36	-6.34	-5.29	-5.23	-5.23
ΔLnint	-7.87	-8.18	-8.10	-5.06	-5.49	-5.48	-3.63	-4.13	-4.16
ΔLnL	-2.06	-6.97	-6.90	-0.89	-4.24	-4.20	-0.67	-4.04	-3.95
ΔLndk	-10.74	-5.58	-5.99	-6.63	-3.52	-3.95	-5.87	-3.04	-3.55
ΔLnkap	-9.14	-9.25	-9.24	-5.27	-5.46	-5.52	-3.82	-4.06	-4.12
Critical value (1%)	-2.62	-3.62	-4.23	-2.62	-3.62	-4.23	-2628	-3.62	-4.23
Critical value (5%)	-1.95	-2.94	-3.539	-1.95	-2.94	-3.539	-1.95	-2.94	-3.539

5.3.2 Determination of the Lag Length

After the order of integration is determined, the next step in estimation of the long run relationship using the cointegration technique based on Johansen's estimation technique is to determine the appropriate lag[19] length which gives white noise residuals, as the Johansen estimation technique is based on the assumption of white noise errors (Rao, 1994).The issue of setting the appropriate lag-length is that there are variables that only affect the short run behavior of the model and if they are omitted will become part of the error term and this leads to residual misspecification problem (Harris, 1995).Thus, the levels systems were estimated with an initial choice of lag 2 since the long run model is estimated based on the

[19] Indicates the past value

level. An intercept term is included since non-zero drift is believed to be present in the systems. As shown in Table 5.2, the null hypothesis that information at period t-i is not significant in determining the current period value of the dependent variable is tested based on the F-test. The results of F-test indicate that the second-period lag is significant in the real import and real relative price variables in explaining imports. Therefore, the significant information in the model is contained principally at the second lag and cointegration analysis requires the model to have a common lag-length, and hence lag-length 2 is appropriate in our cointegration analysis.

Table 5.2: Test statistics for lag length in the VAR

Lag length	Real value of import	Real GDP	Real foreign receipts	Relative price	One period lag Real international reserve
2	2.99(0.03)*	1.73(0.17)	0.891(0.48)	3.55(0.02)*	
1	2.285(0.089)	5.92(0.0018)**	3.526(0.021)*	3.167(0.03)*	4.33(0.0089)**

** Rejects null hypothesis at 1 per cent significance level; * rejects null hypothesis at 5 per cent significance level. The values in parenthesis are probabilities

Thus, lag-length 2 is important in the cointegration systems. To confirm lag-length 2 is acceptable, we need to perform diagnostic test of residual. This test is carried out using PC-FILM in each equation of the levels vector auto regression. A series of diagnostic tests have been used to indicate that the assumptions required for OLS are not violated. These assumptions include non-auto correlated and homoscedastic error term. The results proved that there is no residual auto correlation as shown by AR test, absence of heteroscedasticity as shown by the F-test; and the residuals are approximately normally distributed at 1 percent level of significance as indicated by the normality test. Therefore, our choice of lag-length 2 is acceptable (See Table 5.3).

Table 5.3: Test Statistics for diagnostic test

Diagnostic test	**Statistics**
AR	$F_{ar}(32,64)= 1.1607[0.3038]$
Normality test	x^2 (8)= 15.305[0.053]
Heteroscedasticity test	$F_{het}(180,20)= 0.336[0.999]$

5.3.3 Estimation of cointegrated model

We now consider the use of the likelihood ratio tests of Johansen in order to test the number of cointegrating relationship among the variables real value of import, real GDP, real foreign exchange receipts, relative price and lagged international reserve. The variable lagged international reserve is taken exogenous in the cointegration equation because the monetary authority may not have effect on it for a long period as result of fixed exchange rate taken for a long time (see Garatt ***et al*** (1999), cited in Tura (2001)).

Here, the number of cointegrating vectors is tested. This is done by the two likelihood ratio tests of cointegration such as maximal eigenvalue test (λ_{max}), and trace test (see section 5.2). The test statistics are summarized in Table 5.4 and Table 5.5. The results of Table 5.4 reports the maximal eigenvalue test of the null hypothesis that there are at most r cointegrating vectors against the alternative of r+1 cointegrating vectors. This test indicates that the null hypothesis that there are no cointegration vectors(r=0) against the alternative the one(r=1) is rejected since the test statistic (30.49) is greater than the 95 percent critical value (27.1), and it concludes that there is at least one cointegrating vector. The null hypothesis of $r \leq 1$ against r=2, however, cannot be rejected, suggesting that there is a unique cointegrating vector.

Table 5.5 reports the trace tests of the null hypothesis that there is at most r cointegrating vectors against the alternative that there is more than r. Both the null of r=0 against r≥1 and the null of r≤1 against r≥2 are rejected. However, the null of r≤2 against r≥3 cannot be rejected indicating that there are at most two cointegrating vectors. However, the trace test is less powerful than the maximal eigenvalue test and therefore we conclude that there is one cointegrating vectors among the variables based on the most powerful test of maximal eigen value test (Yuan and Kochar, 1994, Tura, 2001). This means among the variables real import, real international reserve, real income, foreign exchange receipts there is one long run relation ships. The long run elasticity of the cointegrated vectors is presented in Table 5.6 (i).

Table 5.4: Tests for the number of cointegrating vectors based on maximal eigenvalue test

H_o:rank=r	H_1	n-r	Eigen value	Test statistic	95% critical value
r=0	r=1	4	0.536	30.49*	27.1
r≤1	r=2	3	0.124	17.22	21.0
r≤2	r=3	2	0.069	8.376	14.1
r≤3	r=4	1	0.0013	4.921*	3.8

Table 5.5. Tests for the number of cointegrating vectors based on trace test statistics

H_o:rank=r	H_1	n-r	Eigen value	Test statistic	95% critical value
r=0	r≥1	4	0.536	61.01**	47.2
r≤1	r≥2	3	0.124	30.52*	29.7
r≤2	r≥3	2	0.069	13.3	15.4
r≤3	r≥4	1	0.0013	4.92*	3.8

Note: r denotes the number of cointegrating vectors
** denotes rejection at 1% level of significance
* denotes rejection at 5% level of significance

Now, we have found that there is one cointegrating vector; the next step is to impose restriction on the first column of the α-matrix to identify which entries of the first column of α-matrix is statistically zero. This helps us to identify weakly exogenous variables in the system and can enter on the right hand side of VAR. Thus, there is no loss of information by modeling weak exogenous variables (Harris, 1995).

Table 5.6. Output of Cointegrating Analysis for Aggregate Imports (from **PCFIML**)

(a) Standard β' Eigenvectors

lnm	lny	lnfx	lnpc	$lnres_{t-1}$
1.00	-0.681	-0.036	-1.11	-0.363

(b) Standard α-coefficients

lnm	-0.46	0.51	-0.29	.0.022
Lny	-0.006	-0.07	-0.042	-0.055

Lnfx	-0.195	1.05	-0.45	-0.10
Lnpc	0.26	-0.35	0.295	-0.19

Number of lags 2, variable entered unrestricted: constant, and variable lnR_{t-1} entered restrictively

Table 5.7: Tests for Zero restrictions on α-coefficients for import model

	lny	lnfx	lnpc
α-Coefficients	-0.46	-0.006	-0.195
Lr-test x^2 (≈1)	0.0602	0.639	3.435
P-value	0.806	0.42	0.063

It is clear from Table 5.7 that the null hypothesis of weak exogeneity is not rejected for all the variables. Thus it is possible to normalize cointegrating vector by choosing lnm conditioning on the other variables. The normalized long-run import demand from table 5.6 (a) is:

$$Lnm= 0.68lny_t + 0.036\ lnF_t +1.11ln(p_m/p)_t+0.36\ lnR_{t-1}\text{----------1b}$$

The coefficient of equation (1b) has the natural interpretation as the long run effect of the independent variables on the dependent variable. Before discussing the coefficient of the long run equation, it is important to discuss the speed of adjustment coefficients (α_{11}= -0.4627) at this stage. It shows that the adjustment towards the long-run equilibrium, has a negative sign as theoretically expected. Its interpretation is that economic agents adjust by about 46 percent to their long-run steady state whenever there is a shock in the system. The absolute value of the speed of adjustment indicates that in about two years the long run disequilibrium will be fully adjusted.

The next step is to test the significance of the long-run coefficients β in order to identify the unique cointegrating vector. These tests are summarized below in Table 5.8

Table 5.8:Tests for Zero restrictions on Long run coefficients for import Model

	lny	lnfx	lnpc	$Lnres_{t-1}$
β coefficient	-0.68	-0.036	-1.11	-0.36
[20]LR test $X^2(1)$	0.87	0.0048	7.057	12.596
P-Value	0.35	0.94	0.007**	0.0004**

** Rejection at 1% level of significance
* Rejection at 5% level of significance

As shown in Table 5.8, the relative price and international reserves are significant in the import model. The sign of long run coefficient of import with respect to relative price is positive and statistically significant at 1 percent level of significance contrary to expectation. This result is similar to the result of Solomon (2000) and Alem(1995), and they found positive price elasticity of import. This result suggests that in the long run devaluation of local currency may not reduce import demand because most of Ethiopia's import goods consist of capital and intermediate goods, which is important for domestic industry. Real GDP has the expected sign that is, positively affect import in the long run, but it is statistically insignificant at 5 percent level of significance. One possible reason for insignificant income elasticity of import is that as income increases, most people spend it on domestic goods to satisfy there basic needs (Egwaikhide, 1999).The long run elasticity of import demand with respect to foreign exchange receipts is statistically insignificant although it has the expected positive sign. In the long run, elasticity of imports with respect to one period lagged real international reserve is positive and statistically significant. This result

[20]The likelihood ratio (LR) test used to test zero restrictions on α- coefficients takes the form (Harris, 1995)

indicates that a decrease past year (lagged one period) level of real reserve leads to a decrease in current period imports, with the assumptions of other things constant. Thus, the result suggests that, in the long run, import depend positively on the value of real international reserve since in the long run imported intermediate and capital goods may be financed from the reserve.

Vector Error Correction Model

The cointegration tests assured that the existence of the long run relationship among non-stationary variables (I(1) variables) and the parameters are also estimated. However, a particular long run relationship may be compatible with many short run adjustment processes. To finalize the analysis in the Johansen method, the coefficients of the short run dynamics are estimated below. The short–run structure of the model gives information on the short-run adjustment behavior of economic variables that is important for policy implementation. The short–run dynamics is estimated through the estimation of a general to specific model selection technique to obtain vector error correction model (VECM).

The following results are obtained from PC-FILM for the import equation in the Short–run. The policy dummy variable defined in the data appendix was used to capture trade liberalization policy of the period. The results of the short-run dynamic import equation are presented below:

-2 log (Q)=$T\Sigma^{r}_{I=1}$ log $\{(1-\lambda_I^{*})/(1-\lambda_I)\}$, where Q =(restricted MLE/ unrestricted MLE), T is number of observations, λ_i and λ_I^{*} are eigenvalues as defined before for unrestricted and restricted model respectively and r is rank.

Table 5.9 The short run dynamic equation for import

Dependent variable Δlny_t

Variable	Coefficient	t-value	P-value
Constant	-0.053	-0.910	0.373
Δlnm_{t-1}	-0.059	-0.340	0.737
Δlnm_{t-2}	0.211	1.108	0.281
Δlny_{t-1}	1.147	2.003	0.058
Δlny_{t-2}	-0.589	-0.934	0.361
ΔlnR_t	-0.003	-0.063	0.950
ΔlnR_{t-1}	0.081	1.722	0.100
ΔlnR_{t-2}	0.117	2.480	0.020
ΔlnF_t	0.270	3.155	0.005
ΔlnF_{t-1}	0.095	-0.899	0.379
ΔlnF_{t-2}	-0.065	-0.591	0.561
$\Delta L(P_m/p)_t$	-0.616	-5.509	0.000
$\Delta L(P_m/p)_{t-1}$	-0.304	-1.961	0.063
$\Delta L(P_m/p)_{t-2}$	0.247	1.494	0.150
D_{t1}	0.073	1.515	0.145
$VECM_{t-1}$	-0.445	-3.151	0.005

R^2=0.94804, F(16,20)=22.807(0.000), DW=1.87, Rss=0.1749

Where Δ denotes difference, the figures in parentheses denotes P-values. $VECM_{t-1}$ denotes the error correction term based on the cointegration regression using Johansen's approach, and it measures the average at which import equation adjust to changes in equilibrium conditions. A testing down procedure is used in which insignificant lags are dropped and the following parsimonious result is obtained:

$$\Delta lnm_t = \underset{(0.80)}{-0.008} + \underset{(0.006)}{1.38}\Delta lny_t + \underset{(0.000)}{0.32}\Delta lnF_t \underset{(0.000)}{-0.59}\Delta ln\, p_m/p_t \underset{(0.038)}{-0.25}VECM_{t-1} + \underset{(0.77)}{0.011}D_{t1}$$

R^2=0.87,DW=2.25, Rss=0.414

AR (2,29)=0.44(0.6451), ARCH 1(1,29)=0.345(0.56),

Normality X^2 (2)=3.34(0.188), RESET F (1, 30)=0.7907(0.38)

The various diagnostic tests are performed to assure the adequacy of the model. A linear regression model, which is estimated by ordinary least squares (OLS) assumes the error term

non auto correlated and homoscedastic, and correct specification of the conditional mean function, i.e. no omitted variables and appropriate functional form. The null hypothesis that the error term is normally distributed is not rejected as indicated by normality test; no problem of misspecification, and no problem of heteroscedastic are not rejected as indicated by RESET and ARCH test respectively at 1 percent level. The coefficient of vector error correction term (VECM) has a negative sign as expected and statistically significant at 5 percent level of significance. Thus, our model is correctly specified.

In the parsimonious model, the lagged international reserve is dropped since it is insignificant. The coefficients of the remaining variables show that the short run import model elasticities having the expected sign and statistically significant. The results indicate that in the short run elasticity of import with respect to real GDP is positive and statistically significant. One percent change in real GDP leads to 1.38 percent change in imports. The change in relative price and import demand has negative relationship and statistically significant at 1 percent level of significance, but it is inelastic. The other important variable that determines import demand in the short run is foreign exchange receipts and the elasticity of import demand with respect to foreign exchange receipts is 0.32, which is statistically significant at 1 percent level of significance. A one percent change in current real foreign receipts leads to 0.32 percent change in current imports. Trade liberalization policy measured by dummy variable has a positive sign but it is not statistically significant.

5.3.4 The Effect of Imported Capital and Intermediate Goods on Real GDP Growth

In this section, using the same procedure with that of import model the effect of capital and intermediate goods on real GDP growth is analyzed.

As shown in Table 5.1, the order of integration tests indicate that the variables real GDP, real value of imported intermediate goods, real value of imported capital goods and local capital goods are I (1). Thus, the next step is to determine the lag length. The level system was estimated with an initial choice of lag 2. An intercept and trend is included. As shown in Table 5.10, the second lag of real GDP, real local capital, imported capital and trend is significant based on F-test. Thus, the lag-length 2 matters in the cointegration analysis. The vector multivariate tests show that there is no problem of auto correlation, and non-normality of residuals at 1 percent level of significance. But, the sample size is small for testing heteroscedasticity. The figures in Table 5.10 are the F-value and P-value in parenthesis.

Table 5.10 Test statistics for lag length in the VAR

Lag length	lny	lnL	Ln int	Ln kap	lndk	Trend
2	11.77(0.000) **	2.69(0.051)	0.50(0.767)	3.281(0.025) *	4.62(0.005)**	
1	4.70(0.0053) **	4.73(0.005)	0.816(0.551)	2.41(0.072)	1.21(0.338)	
						6.00(0.001) **

** denotes rejection at 1 per cent level of significance
* denotes rejection at 1 per cent level of significance

Vector AR 1-2F(50,44)=1.1408(0.329), Vector normality $X^2(10)$=9.9449(0.445)
Variables entered unrestricted: constant and dummy (d)
Variables entered restricted: trend

Considering the use of the likelihood ratio tests of Johansen the number of cointegration relationships among the variables is tested. The tests results for the number of cointegrating relationships are presented in Table 5.11.

Table 5.11 Tests for the number of cointegrated vectors based on maximal statistics

(a) Maximal eigenvalue test statistic

$H_{o:rank=r}$	H_1	n-r	Eigenvalue	Test statistic unadjusted	Adjusted Maximal test	95% critical value
r=0	r=1	5	0.83	66.19**	48.3*	37.5
r≤1	r=2	4	0.68	42.85**	31.27	31.5
r≤2	r=3	3	0.47	23.8	17.37	25.5
r≤3	r=4	2	0.20	8.33	6.083	19.0
r≤4	r=5	1	0.05	2.05	1.50	12.3

** denotes rejection at 1 per cent level of significant

(b) Trace test

H_0	H_1	n-r	Eigenvalue	Test statistic	Adjused trace	95%critical value
r=0	r≥1	5	0.83	143.2**	104.5**	87.3
r≤1	r≥2	4	0.68	77.04**	56.22	63
r≤2	r≥3	3	0.47	34.19	24.95	42.4
r≤3	r≥4	2	0.20	10.39	7.58	25.3
r≤4	r≥5	1	0.05	2.058	1.50	12.3

On the basis of the maximal eigenvalue and trace tests, it is possible to accept that there are two cointegration vectors since in both tests the null hypothesis of one cointegrating vector is rejected but the null hypothesis of two cointegrating vectors is not rejected at 1 per cent level of significance. However, using both Reimers (already discussed in section 5.2) adjusted trace and maximal eigenvalue statistics could not reject the null of one cointegration. Thus,

we conclude that there is one cointegrating vector since the sample size is small and the Johansen procedure rejects the null hypothesis when the null is true (Harris, 1995).

After we know the number of cointegrating vector the next step is to estimate the β-coefficients. Table 5.12 shows the long run β-coefficients or long run elasticity and α-coefficients.

Table5.12 Out put of Cointegrating Vector

(a) Standardized β' Eigen vectors

lny	lnL	Lnint	lnkap	lndk	Trend
1.00	0.43	-0.12	0.046	-0.012	-0.032

(b) Standardized α- coefficients

	lny	lnL	Lnint	lnkap	lndk
Lny	-0.53	-0.36	-0.017	0.017	0.011
LnL	-0.061	-0.19	-0.012	0.004	-0.003
lnint	1.22	-6.1	-0.18	-0.13	0.05
Lnkap	-2.81	3.77	-0.25	-0.21	-0.015
lndk	-2.44	-5.43	0.188	-0.03	0.019

Number of lags used in the analysis: 2, variable entered unrestricted: constant and dummy(d) variables entered restricted: Trend

Now, we have found that there is one cointegrating vector. The next step is to impose restriction on the first column of α-matrix to identify which entries of the first column of α-matrix is statistically zero. The test of weak exogeneity (restriction of the first column of α-matrix) shows that all variables are weakly exogenous (table 5.13). Therefore, it is possible to express real income as a function of the rest of the variables. The normalized long run relationships from Table 5.12(a) is

$$Lny_t=-0.43lnL_t+0.12lnint_t-0.046ln\ kap_t+0.012lndk_t+0.03Trend$$

Table 5.13 Tests for zero-restrictions on α and β coefficients.

	LnL	Ln int	lnkap	lndk	Trend
β-Coefficients	0.43	-0.12**	0.046	-0.012	-0.03
LR-test:x^2(≈1)	0.432	7.545	2.53	0.075	3.2806
P-value	0.51	0.006	0.116	0.783	0.070
α Coefficients	-0.061	1.22	-2.81	-2.44	
LR-test:x^2(≈1)	1.62	1.34	3.15	2.76	
P-value	0.202	0.24	0.07	0.096	

** denotes rejection at 1 percent level of significant

The long run results indicate that imported intermediate goods have positive and significant effect on real GDP growth at 1 percent level of significance. A one percent increases this goods leads to 0.12 percent increase in real GDP growth. Imported capital goods have negative and insignificant effect on real GDP growth. One possible implication of this is that there is inefficient utilization of these goods over longer period of time. The local capital goods have a positive effect on real GDP growth as theoretically expected but it is statistically insignificant. Active labor force is negatively and insignificantly affects real GDP growth. The possible implication of this is that labor is unproductive. This is not surprising for the economy where about 85% percent of labor force lives in the rural area at static land size.

Vector error correction model

Given that the variables are I(1) and they are cointegrated, the next step is to estimate the short run dynamics through the estimation of a general-to-specific model selection technique to obtain vector error correction model (VECM). In estimating the vector error correction model dummy for war is introduced (see data appendix)). The result of short-run dynamic equation is:

Table 5.14 The short run dynamic equation

Dependent variable Δlny_t

Variable	Coefficient	t-value	P-value
Constant	0.12	2.19	0.048
Δlny_{t-1}	0.60	1.17	0.26
Δlny_{t-2}	-0.79	-2.13	0.05
ΔlnL_t	-0.84	-0.96	0.35
ΔlnL_{t-1}	-2.1	-2.40	0.03
ΔlnL_{t-2}	-0.24	-0.21	0.83
$\Delta lnint_t$	0.024	0.46	0.65
$\Delta lnint_{t-1}$	0.056	1.06	0.30
$\Delta lnint_{t-2}$	0.043	1.034	0.32
$\Delta lnkap_t$	-0.078	-2.20	0.047
$\Delta lnkap_{t-1}$	-0.048	-1.04	0.31
$\Delta lnkap_{t-2}$	-0.012	-0.35	0.72
$\Delta lndk_t$	0.0009	0.013	0.98
$\Delta lndk_{t-1}$	-0.05	-0.69	0.50
$\Delta lndk_{t-2}$	0.098	1.24	0.23
VECM	-0.90	-1.16	0.26
d_t	-0.09	-2.24	0.04

R^2=0.80, F(21,12)=2.29(0.07), DW=2.04

AR(2,10)=0.285(0.75),ARCH1F(1,10)=3.3087(0.098),Normalityx^2(2)=0.498(0.779),RESET F(1,11)=0.018(0.89)

After dropping insignificant lags, we found the following parsimonious results. The values in brackets are p-values.

$$\Delta \ln y_t = \underset{(0.000)}{0.08} + \underset{(0.016)}{0.60}\Delta lny_{t-1} - \underset{(0.000)}{0.87}\Delta lny_{t-2} - \underset{(0.006)}{1.66}\Delta lnL_{t-1} + \underset{(0.034)}{0.06}\Delta lnint_{t-1} - \underset{(0.002)}{0.064}\Delta lnkap_t$$

$$-\underset{(0.096)}{0.038}\Delta lnkap_{t-1} + \underset{(0.003)}{0.11}\Delta lndk_{t-2} - \underset{(0.034)}{0.81}VECM_{t-1} - \underset{(0.000)}{0.08}d$$

R^2 =0.69, F(9,24)=6.06(0.000), DW=1.70
AR1-2F(2,22)=0.53 (0.59),ARCH1F(1,22)=1.32(0.26),Normalityx^2(2)=0.95(0.62),RESET F(1,23)=0.28 (0.59)

The various diagnostic tests have been performed. The test results indicate that in the short run model there is no problem of autocorrelation, normality, heteroscedasticity and misspecification. This test is carried out the test based on AR test, the test for normality based on skewness and kurtosis, the autoregressive conditional hetroscedastic test, and Ramsey's RESET test of misspecification respectively. The coefficient of vector error

correction term (VECM) has a negative sign as expected and statistically significant at 5 percent level of significance. Thus, our model is correctly specified. The results of the short run model indicate that the change in imported intermediate goods before one year (lagged one period) has a positive and significant effect on the current change in real GDP at 5 percent level of significance. A one percent change in this goods leads to 0.06 percent change in real GDP. The current and lagged one period change in real imported capital goods have negative and significant effect on the current change in real GDP at 1 and 10 percent level of significance respectively. However, the change in lagged two periods local capital goods has a positive and significant effect on the current change in real GDP at 1 percent level of significance.The change in lagged one period active labor force is negatively and significantly affects the current change in real GDP at 1 percent level of significance. The drought measured by dummy variable has a negative and significant effect on the current change in real GDP as theoretically expected. This shows that the drought has retarded economic growth.

CHAPTER SIX

Conclusions and Policy Implications

Conclusions

This paper has examined the relationship between imports and real GDP growth in Ethiopia. The model specification used in this study relates import with real GDP, relative prices, foreign exchange receipts and international reserves during the period 1960/61-1999/2000. This model is that of Moran (1989). The models are estimated using the cointegration and vector error correction methodology. Based on the Johansens procedure and maximal test indicates that there exists one cointegrating vector with the expected sign except relative price. Quantitative evidence indicates that short run coefficient of real GDP is higher than the long run coefficient, reflecting that import substitution is lower in the short run. The possible reason for this result is that as income increases most people spend their income on domestic goods.

The regression result also indicates that imports do not depend on real income in the long run, but on international reserve. In the short run, import depends positively on real GDP and foreign receipts, and negatively on relative price.

This study has also examined the effect of imported intermediate and capital goods on real GDP growth. The regression result indicates that imported intermediate goods positively and significantly influences real GDP growth in the long run. A one percent increase in these goods leads to 0.1 increase in real GDP growth. In the short run, the change in imported intermediate goods before one year has a positive and significant effect on the change in

current real GDP growth. The impact of drought measured by dummy variable has a negative and significant effect on real GDP growth in the short run.

Policy Implications

The results of this study have the following policy implications. The short run high-income elasticity of import is indicating that economic growth is likely to worsen Ethiopian's balance of payments difficulties, under ceteris paribus assumptions. This is because increased growth will likely result in a substantial increase in imports. This shows that a certain proportion of an increase in income will be spent on purchases of imports and given the low level of consumption and investment goods produced domestically, the higher demand may lead to higher imports. In the short run, the price elasticity of import is less than one (inelastic) suggests that policies to solve balance of payment problem such as devaluation of the local currency may not work when there is low level of industrialization and import substitutes (Ghei and Pritchett, 1999). The price inelasticity of import demand can be explained by the fact that the majority of Ethiopian's imports are essential goods such as capital and intermediate goods, for which there exists few domestic substitutes. Another important policy implication from the result is that reduction of foreign exchange receipts may reduce import demand keeping the other factor constant. From the results, it can, therefore, be inferred that the availability of sufficient amount of importation of intermediate goods is important for economic growth.

Data Appendix

y_t = real GDP (nominal GDP deflated by GDP deflator). Data were obtained From the current Ministry of Finance and Economic Development for the Period 1960/61-1999/2000.

p_m =Import unit value index. This data was collected from international financial Statistics for the year 1960-1963 and for the remaining years calculated based on disaggregated import data obtained from National Bank of Ethiopia Quarterlly Bulletin using Fisher's index formula (See Gupta 1981:400).

The formula is specified as:

Fisher's= $\sqrt{((\sum p_n q_o / \sum (p_o q_o)) x = (\sum p_n q_n / \sum (p_o q_n))}$

Where p_n=the current unit value, p_o=base year unit value

q_n=the current quantity, q_o=base year quantity

p_t =GDP deflator calculated by dividing nominal GDP by real GDP**.**

m_t= real value import (nominal value of import deflated by import unit value index).

Data were obtained from two sources. For the period 1960-1970, quarterly data are Collected from Ethiopian Custom Office and converted in to Ethiopian Fiscal year. For the remaining periods, data in Ethiopian fiscal year are collected from National Bank of Ethiopia Quarterly bulletin

F_t=real foreign exchange receipts (nominal foreign exchange receipts deflated by import price index).It is defined as the sum of exports of goods and services, net transfer, net factor income and net capital inflow and obtained from National Bank of Ethiopia Balance of payment table

R_t= real international reserve (deflated by import unit value index), obtained from the National Bank of Ethiopia Quarterly bulletin

Kap_t and **int_t**= real value of capital and intermediate goods import (both deflated by Import unit value index). Data were obtained from National Bank of Ethiopia Quarterly bulletin. From the period 1960 to 1970, the series was changed into Ethiopian fiscal year using the following formula.

$$\text{Value of } Kap_t \text{ in fiscal year} = \frac{\text{value of } kap_t \text{ in Gregorian year}}{\text{Total import in Gregorian year}} \times \text{Total import in Ethiopian fiscal year}$$

$$\text{Value of } Int_t \text{ in fiscal year} = \frac{\text{value of } int_t \text{ in Gregorian year}}{\text{Total import in Gregorian year}} \times \text{Total import in Ethiopian fiscal year}$$

L_t =active labor force from age 15-60 is obtained from World Development indicators CD-ROM 2000 for the period 1960/61-1998/99. For the period 1999/2000 is estimated based on growth rate of the pervious period.

dk_t = local capital goods is proxied by gross capital formation(investment) less one period lagged imported capital goods.

$D1_t$=policy dummy variable which takes one for the period 1992/93-1999/2000, zero otherwise.

d_t=dummy variable for the drought which takes one for 1973/74 and1984/85, zero otherwise

The data like foreign exchange receipts, international reserve and import unit value index were not available in Ethiopian fiscal year from the period 1960-1970.These data have been converted in to Ethiopian fiscal year by taking the average of two years.

Appendix 1: **The type of commodities in Components of imports**

No.	Structure of imports	Main Category	Type of commodities
1	Capitalgoods	Industrial	Finished structural parts, metal containers, metal working machinery and tools, Power generating machinery, office machinery, factory machinery, electrical machinery and appliances, scientific instruments, other industrial equipment
		Transport	Tyres for heavy weight road motor vehicles, heavy weight road motor vehicles, railway vehicles, rails and rail way construction materials, aircraft, ships and boats
		Agricultural	Cultivation and harvesting appliances, coffee grading-clearing machinery, cream and dairy machinery tractors, others
2	Intermediate goods	Raw materials	Tobacco, textile cotton fibers, textile ferrous ores, crude minerals, crude fertilizers, crude rubber, others
		Semi-finished	Iron and steel, non-ferrous metals, oils and fats, chemicals, fertilizers manufactured, wood, pulp and paper, textile materials, building materials, others
		Fuel	Fuel, wood and charcoal, coal and coke, petroleum, petroleum products, Gas natural and manufactured
3	Consumer goods	Non-durable goods	Foods cereals and flour, food others, medical and pharmaceutical, textile fabrics and clothing, printed matter, office stationary, paper material, others
		Durable goods	House hold equipment, radio and television sets, tyres for light weight cars, light weight cars, furniture and texture, wire products, others
	Miscellaneous	Miscellaneous	Radio active material, explosives, postal packages, miscellaneous articles, zoo animals, miscellaneous goods, others

Appendix 2: **The unit price and volume of coffee**

Period	Volume of Coffee In ton	Value of Coffee In (000)	Unit price Per ton In birr	Volume Change (%)	Price change (%)
1970/71	78727	179590	2281.17		
1971/72	77770	164686	2117.60	-1.22	-7.17
1972/73	81552	200289	2455.96	4.86	15.98
1973/74	61738	166121	2690.74	-24.30	9.56
1974/75	48999	117507	2398.15	-20.63	-10.87
1975/76	77112	297688	3860.46	57.37	60.98
1976/77	43011	409760	9526.86	-44.22	146.78
1977/78	57827	514523	8897.62	34.45	-6.60
1978/79	84275	532379	6317.16	45.74	-29.00
1979/80	80086	631646	7887.09	-4.97	24.85
1980/81	88405	524325	5930.94	10.39	-24.80
1981/82	121677	477215	3921.98	37.64	-33.87
1982/83	156443	497578	3180.57	28.57	-18.90
1983/84	97178	590444	6075.90	-37.88	91.03
1984/85	73829	466230	6314.99	-24.03	3.94
1985/86	69999	631065	9015.34	-5.19	42.76
1986/87	80216	526852	6567.91	14.60	-27.15
1987/88	71165	439180	6171.29	-11.28	-6.04
1988/89	92138	626448	6799.01	29.47	10.17
1989/90	89134	405103	4544.87	-3.26	-33.15
1990/91	78232	268451	3431.47	-12.23	-24.50
1991/92	32249	168324	5219.51	-58.78	52.11
1992/93	67375	536982	7970.04	108.92	52.70
1993/94	69160	718017	10381.97	2.65	30.26
1994/95	82200	1799034	21886.06	18.85	110.81
1995/96	87079	1724008	19798.21	5.94	-9.54
1996/97	123165.9	2307394	18734.03	41.44	-5.38
1997/98	120049.6	2889531	24069.48	-2.53	28.48
1998/99	101233	2112713	20869.81	-15.67	-13.29
1999/00	116558	2133646	18305.44	15.14	-12.29

Source: National Bank quarterly Bulletin

Appendix 3: World price index

Year	World food price index	World agricultural raw materials price index	World fertilizer price index
1970/71	39.31	19.58	25.95
1971/72	38.55	20.68	26.53
1972/73	55.22	27.85	29.45
1973/74	88.19	40.42	65.01
1974/75	86.79	31.64	153.41
1975/76	72.48	34.79	122.06
1976/77	71.72	43.65	78.52
1977/78	70.03	41.40	67.65
1978/79	82.85	51.86	72.31
1979/80	92.42	68.30	92.62
1980/81	102.75	63.55	112.54
1981/82	87.66	57.62	109.46
1982/83	78.87	55.38	93.31
1983/84	92.27	61.21	89.50
1984/85	78.34	53.77	86.55
1985/86	67.97	52.06	84.71
1986/87	61.81	58.93	80.60
1987/88	74.43	75.27	91.03
1988/89	90.13	73.91	100.39
1989/90	83.18	79.59	92.56
1990/91	76.29	77.11	99.22
1991/92	80.75	76.95	93.80
1992/93	77.26	84.10	85.10
1993/94	81.78	95.03	80.68
1994/95	83.31	104.89	88.76
1995/96	100.00	100.00	100.00
1996/97	94.49	100.15	108.13
1997/98	84.12	85.22	108.51
1998/99	71.40	77.66	109.39
1999/00	65.41	83.12	101.98

Note: New refers to the corresponding index as rebased as 1995/96=100.
Source: National Bank of Ethiopia

Appendix 4: The source of import in percentage

Year	Industrial Countries	Developing countries	U.S.S.R and others
1981	61.9	12.8	23.4
1982	56.2	12.4	30.3
1983	62.5	12.6	24.2
1984	63.3	9.9	26.3
1985	69.1	10.5	19.5
1986	72.1	10.3	16.7
1987	70.7	11	17.6
1988	70.3	11.1	18
1989	70.3	11.1	18
1990	68.2	15.3	16
1991	64.7	19.1	15.7
1992	64.6	20.3	14.5
1993	57	32.3	0
1994	59	37	0
1995	61.6	35.3	0.6
1996	53.1	45.1	0.2
1997	54.2	45.3	0.3
1998	43	56.2	0.2
1999	45.4	54.2	0.2
Average	58.36	23.09	12.09

Source: Direction of Trade statistics Yearbook

Appendix 5: Oil price per Barrel (U.S $)

Period	Price per Barrel of U.S $
16/10/73-30/11/73	3.00
1/12/73-31/2/73	4.392
1/12/73-31/12/73	4.321
1/1/74	11

15/6/72	19.614
2/7/79	19.213
2/10/79	23.001
12/1/80	29.217

Source: Ethiopian Petroleum Enterprise

Appendix 6: The share and rate of growth of structure of GDP in real terms

	Share of GDP				Annual real growth rate				Nominal growth		Real growth	
G.Y	Agr	IND	SERV	Other Serv	Agr	IND	Service	Other Service	Imports	GDP	M	GDP
1960/61	75.79%	6.98%	8.42%	8.81%								
1961/62	74.35%	7.37%	8.91%	9.37%	1.76%	9.6%	9.75%	10.36%	12.51%	4.16%	14.06%	3.7%
1962/63	73.73%	7.56%	9.21%	9.50%	2.95%	6.4%	7.32%	5.27%	5.24%	4.20%	3.95%	3.8%
1963/64	72.31%	8.01%	10.05%	9.63%	2.34%	10.6%	13.86%	5.75%	3.96%	9.40%	3.96%	4.3%
1964/65	70.58%	8.31%	10.90%	10.21%	3.74%	10.3%	15.29%	12.68%	19.85%	8.58%	18.40%	6.3%
1965/66	68.87%	9.07%	11.44%	10.62%	0.84%	12.8%	8.44%	7.48%	20.65%	8.21%	19.08%	3.3%
1966/67	68.43%	9.68%	11.07%	10.82%	3.39%	11.1%	0.69%	6.04%	-5.73%	5.92%	-3.03%	4.1%
1967/68	66.91%	9.88%	11.99%	11.22%	1.06%	5.5%	11.94%	7.12%	1.81%	6.30%	-2.83%	3.3%
1968/69	65.96%	10.07%	12.42%	11.55%	2.19%	5.7%	7.41%	6.74%	6.54%	5.83%	5.88%	3.7%
1969/70	65.29%	9.92%	13.04%	11.75%	2.39%	1.9%	8.62%	5.24%	-3.29%	8.86%	-13.28%	3.4%
1970/71	64.22%	10.43%	13.36%	11.99%	2.05%	9.1%	6.29%	5.81%	13.10%	5.95%	32.12%	3.7%
1971/72	63.25%	10.56%	13.67%	12.52%	1.57%	4.4%	5.51%	7.70%	2.94%	0.85%	-3.50%	3.1%
1972/73	62.48%	10.59%	13.85%	13.07%	1.44%	3.1%	4.07%	7.27%	-6.76%	4.43%	-26.90%	2.7%
1973/74	61.74%	10.33%	14.29%	13.65%	1.02%	-0.3%	5.45%	6.72%	19.77%	10.15%	45.17%	2.2%
1974/75	61.34%	10.05%	14.08%	14.53%	0.49%	-1.6%	-0.36%	7.64%	28.82%	0.21%	-14.66%	1.1%
1975/76	61.42%	9.36%	14.02%	15.20%	0.81%	-6.2%	0.25%	5.32%	0.88%	6.94%	-21.11%	0.7%
1976/77	61.04%	9.54%	13.80%	15.63%	0.39%	2.9%	-0.58%	3.90%	9.54%	14.53%	24.73%	1.0%
1977/78	61.60%	9.29%	12.52%	16.59%	0.35%	-3.1%	-9.79%	5.58%	7.20%	5.53%	-8.64%	-0.6%
1978/79	59.30%	10.16%	13.52%	17.02%	0.89%	14.5%	13.23%	7.46%	61.23%	11.77%	41.43%	4.8%
1979/80	59.17%	10.63%	13.59%	16.61%	4.62%	9.7%	5.40%	2.32%	6.50%	6.23%	-0.02%	4.8%
1980/81	57.75%	10.85%	13.86%	17.54%	-1.18%	3.4%	3.27%	6.93%	1.05%	2.16%	-18.25%	1.3%
1981/82	55.71%	11.78%	14.49%	18.02%	-3.62%	8.5%	4.39%	2.66%	18.94%	5.52%	14.94%	-0.1%
1982/83	57.49%	11.33%	13.53%	17.64%	13.60%	5.9%	2.78%	7.78%	6.20%	10.72%	-10.88%	10.1%
1983/84	53.66%	12.82%	14.48%	19.04%	-12.54%	6.0%	0.33%	1.09%	18.22%	-6.69%	71.34%	-6.3%
1984/85	47.01%	14.81%	16.19%	22.00%	-20.89%	4.3%	0.93%	4.35%	-14.35%	18.56%	-20.71%	-9.7%
1985/86	49.63%	14.36%	15.24%	20.78%	16.02%	6.6%	3.45%	3.81%	24.88%	4.21%	31.53%	9.9%
1986/87	51.68%	13.60%	15.37%	19.35%	18.76%	8.0%	15.05%	6.20%	1.17%	6.01%	-16.58%	14.0%
1987/88	50.28%	13.09%	15.90%	20.73%	-2.77%	-3.8%	3.37%	7.10%	1.69%	4.03%	17.31%	-0.1%
1988/89	50.63%	12.17%	14.98%	22.22%	1.03%	-6.7%	-5.47%	7.55%	-7.22%	5.15%	-52.83%	0.3%
1989/90	51.23%	11.15%	15.03%	22.59%	5.31%	-4.7%	4.43%	5.80%	-13.56%	6.88%	58.44%	4.1%
1990/91	55.90%	9.36%	11.93%	22.80%	5.17%	-19.1%	-23.50%	-2.72%	16.78%	14.08%	8.01%	-3.6%
1991/92	56.46%	9.03%	12.07%	22.44%	-2.74%	-7.1%	-2.52%	-5.24%	-14.99%	8.32%	-37.67%	-3.7%
1992/93	53.47%	10.36%	13.18%	23.00%	6.06%	28.4%	22.23%	14.81%	99.83%	28.28%	33.12%	12.0%

1993/94	50.65%	10.89%	13.76%	24.70%	-3.65%	7.0%	6.18%	9.20%	30.99%	6.21%	30.71%	1.7%
1994/95	49.70%	11.17%	13.90%	25.23%	3.39%	8.1%	6.44%	7.67%	38.10%	19.61%	59.95%	5.4%
1995/96	51.52%	10.64%	13.69%	24.15%	14.68%	5.4%	8.96%	5.85%	15.41%	11.96%	-6.84%	10.6%
1996/97	50.66%	10.83%	14.01%	24.49%	3.44%	7.0%	7.70%	6.71%	12.65%	9.30%	-3.06%	5.2%
1997/98	45.72%	11.21%	14.98%	28.09%	-10.80%	2.3%	5.62%	13.35%	9.71%	8.14%	30.16%	-1.2%
1998/99	44.66%	11.74%	14.58%	29.02%	3.84%	11.3%	3.49%	9.85%	25.32%	8.58%	112.01%	6.3%
1999/2000	43.26%	11.48%	14.86%	30.40%	2.15%	3.0%	7.51%	10.43%	-2.25%	6.96%	-37.57%	5.4%

Appendix 7: The share of components of import to total import

Period	Consumer	Intermediate	Capital
1960/61	41.65%	26.84%	29.98%
1961/62	38.39%	27.12%	32.81%
1962/63	34.96%	26.07%	37.51%
1963/64	33.42%	26.87%	38.33%
1964/65	31.84%	25.62%	41.38%
1965/66	31.10%	24.82%	43.00%
1966/67	29.83%	27.82%	41.44%
1967/68	25.51%	29.33%	44.04%
1968/69	28.72%	28.66%	40.67%
1969/70	35.47%	29.90%	33.24%
1970/71	34.15%	33.35%	31.84%
1971/72	31.37%	30.28%	37.53%
1972/73	32.17%	32.95%	34.10%
1973/74	32.72%	43.34%	23.18%
1974/75	37.04%	48.62%	13.65%
1975/76	35.32%	39.78%	24.63%
1976/77	33.42%	34.67%	28.82%
1977/78	34.47%	32.60%	29.82%
1978/79	30.69%	34.67%	33.21%
1979/80	20.87%	46.43%	30.46%
1980/81	24.86%	42.30%	32.69%
1981/82	26.55%	38.92%	34.40%
1982/83	26.50%	40.45%	33.00%
1983/84	20.99%	33.61%	44.97%
1984/85	36.43%	34.36%	29.10%
1985/86	39.34%	26.88%	33.57%
1986/87	32.62%	24.28%	42.81%
1987/88	26.35%	26.29%	47.11%
1988/89	30.74%	29.58%	38.98%
1989/90	28.08%	33.15%	38.56%

1990/91	30.16%	23.68%	45.27%
1991/92	34.56%	28.61%	36.54%
1992/93	31.31%	33.66%	34.97%
1993/94	35.12%	33.42%	29.23%
1994/95	32.47%	34.17%	31.86%
1995/96	32.28%	31.46%	34.35%
1996/97	20.61%	39.62%	38.81%
1997/98	19.70%	42.85%	29.78%
1998/99	28.10%	29.91%	33.71%
1999/2000	30.32%	33.80%	33.50%

Source: National Bank Quarterly Bulletin

Appendix 8: The share and growth rate of imports

Period		Real growth				As ratio of GDP			Total
Ethiopian	Period G.C	Consumer	Intermediate	Capital	Imports	Consumer	Intermediate	Capital	Imports
1953	1960/61					5.05%	3.25%	3.63%	12.11%
1954	1961/62	5.11%	15.27%	24.84%	14.06%	5.11%	3.61%	4.37%	13.32%
1955	1962/63	-5.33%	-0.09%	18.84%	3.95%	4.66%	3.48%	5.00%	13.34%
1956	1963/64	-0.63%	7.17%	6.24%	3.96%	4.44%	3.57%	5.09%	13.29%
1957	1964/65	12.81%	12.88%	27.82%	18.40%	4.71%	3.79%	6.12%	14.80%
1958	1965/66	16.31%	15.37%	23.74%	19.08%	5.30%	4.23%	7.33%	17.06%
1959	1966/67	-6.99%	8.69%	-6.54%	-3.03%	4.74%	4.42%	6.59%	15.89%
1960	1967/68	-16.91%	2.44%	3.26%	-2.83%	3.81%	4.38%	6.58%	14.94%
1961	1968/69	19.22%	3.45%	-2.21%	5.88%	4.38%	4.37%	6.21%	15.26%
1962	1969/70	7.10%	-9.54%	-29.14%	-13.28%	4.54%	3.83%	4.25%	12.79%
1963	1970/71	27.18%	47.36%	26.57%	32.12%	5.56%	5.43%	5.19%	16.30%
1964	1971/72	-11.35%	-12.37%	13.76%	-3.50%	4.78%	4.62%	5.72%	15.25%
1965	1972/73	-25.04%	-20.47%	-33.59%	-26.90%	3.49%	3.58%	3.70%	10.85%
	Average	1.79%	5.85%	6.13%	3.99%	4.63%	4.11%	5.51%	14.42%
1966	1973/74	47.66%	90.98%	-1.33%	45.17%	5.04%	6.68%	3.57%	15.41%
1967	1974/75	-3.39%	-4.27%	-49.73%	-14.66%	4.82%	6.32%	1.78%	13.00%
1968	1975/76	-24.77%	-35.45%	42.30%	-21.11%	3.60%	4.05%	2.51%	10.19%
1969	1976/77	18.04%	8.72%	45.96%	24.73%	4.21%	4.36%	3.63%	12.58%
1970	1977/78	-5.79%	-14.11%	-5.46%	-8.64%	3.98%	3.77%	3.45%	11.56%
1971	1978/79	25.92%	50.39%	57.47%	41.43%	4.79%	5.41%	5.18%	15.60%
1972	1979/80	-31.99%	33.92%	-8.29%	-0.02%	3.11%	6.91%	4.53%	14.88%
1973	1980/81	-2.64%	-25.52%	-12.25%	-18.25%	2.99%	5.08%	3.93%	12.01%
1974	1981/82	22.76%	5.77%	20.96%	14.94%	3.67%	5.38%	4.75%	13.82%
1975	1982/83	-11.04%	-7.37%	-14.52%	-10.88%	2.97%	4.53%	3.69%	11.19%
1976	1983/84	35.70%	42.35%	133.53%	71.34%	4.29%	6.88%	9.20%	20.46%
1977	1984/85	37.62%	-18.94%	-48.70%	-20.71%	6.54%	6.17%	5.23%	17.96%
1978	1985/86	42.03%	2.88%	51.74%	31.53%	8.46%	5.78%	7.22%	21.50%
1979	1986/87	-30.84%	-24.65%	6.37%	-16.58%	5.13%	3.82%	6.73%	15.73%
1980	1987/88	-5.25%	27.06%	29.09%	17.31%	4.86%	4.85%	8.69%	18.46%
1981	1988/89	-44.95%	-46.93%	-60.96%	-52.83%	2.67%	2.57%	3.38%	8.68%

1982	1989/90	44.73%	77.60%	56.74%	58.44%	3.71%	4.38%	5.09%	13.21%
1983	1990/91	15.99%	-22.85%	26.78%	8.01%	4.47%	3.51%	6.70%	14.81%
	Average	7.21%	7.75%	14.98%	8.29%	4.40%	5.02%	4.96%	14.50%
1984	1991/92	-28.58%	-24.70%	-49.69%	-37.67%	3.31%	2.74%	3.50%	9.58%
1985	1992/93	20.59%	56.63%	27.40%	33.12%	3.57%	3.83%	3.98%	11.39%
1986	1993/94	46.63%	29.78%	9.24%	30.71%	5.14%	4.89%	4.28%	14.64%
1987	1994/95	47.86%	63.52%	74.38%	59.95%	7.21%	7.59%	7.08%	22.22%
1988	1995/96	-7.38%	-14.24%	0.43%	-6.84%	6.04%	5.89%	6.43%	18.71%
1989	1996/97	-38.10%	22.08%	9.52%	-3.06%	3.55%	6.83%	6.69%	17.24%
1990	1997/98	24.39%	40.79%	-0.14%	30.16%	4.47%	9.73%	6.76%	22.71%
1991	1998/99	202.44%	47.98%	140.02%	112.01%	12.72%	13.54%	15.26%	45.28%
1992	1999/2000	-32.63%	-29.44%	-37.97%	-37.57%	8.13%	9.06%	8.98%	26.81%
	Average	26.14%	21.38%	19.24%	20.09%	6.02%	7.12%	7.00%	20.95%
	Overall	9.65%	10.14%	13.11%	9.52%	4.83%	5.20%	5.58%	15.89%

Appendix 9

SOLOW GROWTH MODEL

The Solow model introduced in 1957 focuses on four variables: output, capital, labor and an exogenous technology or the " effectiveness of labor (Romer, 2001). Using the Cobb-Douglas representation, the labor augmenting technical progress[21] can be written as:

$$Y_t=K^b(A_t\ Lt)^{1-b} \text{ ----------(1b)}$$

Where Y is output, K is capital and L is labor, A is level of technology, and $0<b<1$.

The model assumes that the initial levels of capital, labor, and knowledge are taken as given. Labor and knowledge grow at constant rates:

$$dL/dt=nL(t) \text{ ----------(2b)}$$

$$dA/dt=gA(t) \text{ ----------(3b)}$$

Where n and g are exogenous parameters and d/d_t denotes a derivative with respect to time. Equation (2b) and (3b) imply that the growth rate of labor and technology is constant and equal to n and g respectively. The growth rate of a variable equals the rate of change of its natural log[22]. Applying this to (2b) and (3b), gives

$$LnL(t)=[\ln(0)]+nt \text{----------(4b)}$$

Where t is time.

$$LnA(t)=[\ln A(0)]+gt \text{----------(5b)}$$

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[21] Under Cobb-Douglas specification labor augmenting, capital augmenting and Hicks neutral technologies are the same (Romer, 2001).

[22] $\frac{D\ln(x)}{dt}=(\frac{d\ln x(t)}{dx(t)})(\frac{dx(t)}{dt})$

Where L(0) and A(0) are the values of L and A at time 0. Rearranging (4b) and (5b), we get these results

$L(t)=L(0)e^{nt}$----------(6b)

$A(t)=A(0)e^{gt}$----------(7b)

The capital accumulation equation is represented as follows

$dK_t/dt=sY-cK_t$----------(8b)

Where s is the fraction of output devoted to investment and considered as exogenous, and c is the rate of depreciation of physical capital.

Finally, defining output and the stock of capital per unit of effective labor as y=Y/AL and k=K/AL, respectively. Taking logs and differentiating of k=K/AL gives

$$\frac{dk/dt}{k}=\frac{dK/dt}{K}-\frac{dA/dt}{A}-\frac{dL/dt}{L}$$ ----------(9b)

Combining equation (2b), (3b), (8b) and (9b) gives

$$\frac{dk/dt}{k}=\frac{sY}{K}-c-n-g$$ ----------(10b)

Dividing Y and K by AL in equation (10ba) and rearranging this gives the capital accumulation equation

$dk_t/d_t=sy-(n+g+c)k_t$----------(11b)

$$=\frac{dx(t)/dt}{x(t)}$$

Where c is the constant rate of depreciation. The term n+g+c is now the effective depreciation rate for k_t. Rearranging equation (2a) in terms of output per effective worker gives

$y=k^b$----------(12b)

Substituting equation (12b) in to equation (11b) gives

$dk_t/d_t=sk^b-(n+g+c)k_t$----------(13b)

At the steady state growth rate of k_t is zero, as investment equals the amount of depreciation. Solving for the steady state value k^*_t in equation (14a) gives

$k^*=(s/n+g+c)^{1/(1-b)}$----------(14b)

Substituting this in to (12b) gives

$$y=\left(\left(\frac{s}{n+g+d}\right)^{b/(1-b)}\right)$$ ----------(15b)

Rewriting equation (15b) in terms of output per worker gives

$$Y/L=A(t)\left(\left(\frac{s}{n+g+d}\right)^{b/(1-b)}\right)$$----------(16b)

Equation 14b, therefore, shows that the steady state capital-effective labor ratio is related positively to the rate of saving and negatively to the rate of population growth and the rate of depreciation.

Taking logs of equation (16b), and substituting equation (5b) in to this equation gives the steady state income per capita as:

$Ln(Y_t/L_t)=lnAo+gt+b/(1-b)lns-b/(1-b)ln(n+g+c)$----------(18a)

Substitute lnA_t with lnA_o+gt since technology grows at constant rate.

The interpretation of this is that the level of percapita output is determined by growth of technology, investment rate and population growth rate. According to Solow, the sustained growth rate of per capita output overtime is dependent on technological changes. Policy changes can affect growth only temporarily just until a new steady-state level is reached.

The weakness of this model is that it assumes the production function is constant returns to scale in its two factors, capital and effective labor; inputs other than capital, labor and knowledge, are relatively unimportant and that the rate of growth of these factors are constant (Romer, 2001). It also does not mention the measure of technology.

Appendix 10 Real value of the variables

Year	y_t	m_t	L_t	Kap_t	Int_t	$(Pm/p)_t$	R_t	F_t	Pm	p
1960/61	5125	621	10.93	186	167	0.65	364	507	36.8	0.56
1961/62	5317	708	11.13	232	192	0.64	402	619	36.3	0.56
1962/63	5520	736	11.12	276	192	0.65	469	946	36.8	0.57
1963/64	5759	765	11.38	293	206	0.62	550	1016	36.8	0.59
1964/65	6121	906	11.65	375	232	0.61	592	1182	37.2	0.61
1965/66	6326	1079	11.94	464	268	0.59	516	1301	37.7	0.64
1966/67	6583	1046	12.25	434	291	0.57	455	1246	36.6	0.65
1967/68	6803	1017	12.57	448	298	0.58	459	1230	38.4	0.67
1968/69	7053	1076	12.91	438	308	0.57	466	1345	38.6	0.68
1969/70	7295	933	13.25	310	279	0.60	413	1193	43.1	0.72
1970/71	7568	1233	13.31	393	411	0.50	513	1424	36.9	0.73
1971/72	7805	1190	13.66	447	360	0.55	467	1543	39.3	0.71
1972/73	8016	870	14.02	297	287	0.69	675	1588	50.2	0.73
1973/74	8195	1263	14.39	293	547	0.53	1221	2170	41.4	0.78
1974/75	8287	1078	14.77	147	524	0.81	952	1390	62.5	0.78
1975/76	8343	850	15.16	209	338	0.97	778	85	79.9	0.82
1976/77	8429	1060	15.57	306	368	0.75	930	1336	70.2	0.93
1977/78	8381	969	15.64	289	316	0.83	441	675	82.4	0.99
1978/79	8783	1370	16.07	455	475	0.89	241	1307	93.9	1.06
1979/80	9209	1370	16.51	417	636	0.93	227	1457	100.0	1.07
1980/81	9325	1120	16.97	366	474	1.14	87	1169	123.6	1.08
1981/82	9315	1287	17.45	443	501	1.12	188	1534	127.9	1.14
1982/83	10254	1147	17.94	379	464	1.33	128	1196	152.4	1.15
1983/84	9608	1966	18.45	884	661	0.92	213	1785	105.2	1.14
1984/85	8677	1559	18.97	454	536	0.76	274	1844	113.6	1.50
1985/86	9536	2050	19.51	688	551	0.76	576	2651	107.9	1.42
1986/87	10875	1710	20.10	732	415	0.99	425	1922	130.8	1.32
1987/88	10869	2006	20.74	945	527	0.82	211	1989	113.4	1.38
1988/89	10906	946	21.44	369	280	1.54	76	1125	223.0	1.44
1989/90	11350	1499	22.20	578	497	0.82	34	1425	121.7	1.48
1990/91	10938	1620	23.03	733	384	0.75	134	1946	131.5	1.75
1991/92	10535	1009	23.30	369	289	0.91	193	1104	179.4	1.97
1992/93	11799	1344	24.11	470	452	1.19	498	1655	269.3	2.26
1993/94	11999	1756	23.45	513	587	1.14	1183	3024	269.9	2.36
1994/95	12644	2809	24.15	895	960	0.87	1672	4124	233.0	2.68
1995/96	13987	2617	24.87	899	823	1.06	1981	3782	288.7	2.71
1996/97	14714	2537	25.62	985	1005	1.19	1183	2508	335.5	2.82
1997/98	14543	3302	25.69	983	1415	0.92	1098	2601	282.8	3.08
1998/99	15461	7001	26.34	2360	2094	0.53	2147	8442	167.2	3.15
1999/00	16302	4370	27.00	1464	1477	0.82	1116	5334	261.7	3.19

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