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The Budgetary Impact of Import Tax Reform in Ethiopia

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Abstract

Ethiopia is currently implementing a structural adjustment program. The program partly deals with reducing the overall fiscal deficit. Tariff reform is one aspect of the package of trade policy measures envisaged. Tariff reform aims at lowering the average tariff rate in order to cease discrimination against private sector imports and at rationalizing the protective system. However, since tariff reduction is undertaken during a period of structural adjustment, the potential loss of tax revenue from lowering tariff rates is an important issue which needs special consideration.

The major objectives of this study are to estimate the effect of changes in the import tax system on total tax revenue and on other key macroeconomic variables, and to forecast the future tax revenue due to a recent (1993) system change in the import taxation.

The main findings are that due to a recent tariff reduction, import tax and total tax revenue will decline in the future. This reduction in tax revenue, *ceteris paribus*, will in turn increase the overall fiscal deficit.

Revenue losses arising from tariff reduction must be compensated by other sources of tax revenue. In this case, the recommended measures to offset the loss are, moving the exempted items to lower tariff rates, broadening the domestic tax base (particularly introducing a single stage sales tax on goods previously exempted from domestic tax payment) and improving administrative capability to eliminate evasion.

CHAPTER 1

INTRODUCTION

1.1 Statement of the Problem

In less developed countries large fiscal and trade deficits and unsustainable debt burden have become the typical characteristics for the last decade and so. Ethiopia, as one of these countries, is suffering from different macroeconomic imbalances.

In Ethiopia, particularly during the past regime (1974-1991), the growth of the public economy was very high. In this period, many new ministries, institutes, corporations and departments were established which lead to a dramatic expansion of government expenditures . Total government expenditure was 21.7 per cent of GDP in 1975, rose to 25.9 per cent of GDP in 1981, reached 41.9 per cent in 1989 and declined to 32.1 in 1993. Total revenue was 19.7 per cent of GDP in 1981, reached the highest peak of 30.1 per cent in 1989 but declined to 20.5 per cent in 1993. On the revenue side there has been a marked decline in the rate of growth of tax revenues in recent years. The average annual rate of growth of real tax revenue declined from 7.52 per cent on average in 1961-1974 to 4.9 per cent on average in 1975-1991. The share of tax revenue to GDP declined from 15.35 per cent in 1981 to 13.2 per cent in 1991.¹

This shows that there was a wide difference between government expenditure and revenue. Overall fiscal deficit rose from 6.2 per cent of GDP in 1981 to 11.0 per cent and 11.6 per cent of GDP in 1992 and 1993 respectively. In the year 1991

" the total budgetary deficit was in excess of Birr 2 billion, about 60% of which was financed by borrowing from the banking system, with clearly inflationary consequences."¹

The external imbalance of the country has worsened over the last decade. This is more or less due to the wrong policy measures taken in this country. These measures include the use of over- valued currency, import taxes as a means to protect the domestic production of importables, and export duties as a means of encouraging non-traditional exports.³ The trade deficit increased by 21.9 per cent from 1277.4 millions of Birr in 1986 to 1558.3 in 1991.

The debt burden of Ethiopia was one of the highest. At the end of 1990 , the country's total external debt amounted Birr 6.3 billion. Debt service payments, which stood at Birr 427.1 million in 1985-86 , had reached Birr 676.4 million in 1988/89,⁴ and 898.2 in 1991/92. In the past 17 years, gross domestic savings were low, varying between 0.2 per cent and 7.5 per cent of GDP, as gross fixed capital formation and public consumption in terms of GDP generally rose and the resource gap widened. These imbalances represent serious macroeconomic problems of the country. The inflation rate during the 17 years ending 1990/91 averaged about 9 per cent. This low rate is partly explained by its prudent fiscal policy, but also by its income and price policies.⁵

The Transitional Government of Ethiopia (TGE) has set economic policy by emphasizes the need to revitalize the economy and create a conducive environment for development.

The government has begun implementation of comprehensive macroeconomic and structural reforms to introduce a market-based economy.⁶

According to the policy framework paper (1992/93-1994/95), with a view to strengthening the public finances, a project has been initiated with IMF assistance to rationalize the existing tax structure and increase revenue, broaden the tax base, improve equity, enhance efficiency, and ensure adequate incentives for investors. The improvement of the tax and customs system includes reducing the top marginal rate of income tax system, restructuring the sales tax to render it more uniform, rationalizing the various import levies and limiting erosion from exemptions and reforming the tax and customs administration. Some of these have already been implemented and others are to be implemented in future.

External policies will seek to remove cost-price distortions, encourage exports and efficient import substitution, liberalize imports, attract foreign investment, regularize relations with creditors, and the debt service ratio. To deal with Ethiopia's heavy external debt burden, external borrowing on nonconcessional terms will be limited. An effort will also be made to improve debt management by strengthening debt monitoring and analysis capability.⁷

The official exchange rate was devalued by 59% in foreign currency terms in 1992 and it was further devalued in 1994. To cease discrimination against private sector imports and rationalize the protective system, the tariff structure was

revised in 1993. To increase government revenue, it is designed to apply a tax reform which focuses on broadening tax base in the period 1992/93-1994/96.

By taking all these actual and planned reforms into consideration, it is important to be able to examine and project the effect of different policy measures. Reducing the fiscal deficit is one part of the structural adjustment program. But any recommendation to reduce the protection effect may have revenue implications which may be contradictory with the mentioned objective of reducing the fiscal deficit. This thesis tries to highlight the possible effects of policy measures undertaken.

1.2 Objective of the Study

The general objective of this thesis is to study the place of import taxes in the tax revenue system of the country and to examine the effects of changes in the import tax system on total tax revenue and other macroeconomic variables. Towards this end, the specific issues which the study attempts to address are:

1. to analyze the historical development of individual taxes systems in general (direct taxation, indirect taxation and foreign trade taxation) and import taxation in particular. This would help to see how tax structure change (rate, base and coverage) affects the revenue derived from it. Both the major

change in import composition and some changes in the rates of import duties are reflected in revenue from imports. The rate structure presumably has an impact on the allocation of resources and patterns of investment.

2. to determine the income elasticity of the import tax system as well as individual and overall tax systems (domestic consumption tax, corporate income tax and other direct taxes). Such investigation provides information on the potential of each tax system to raise revenue in the future, which is of considerable significance in formulating tax policy.

3. to estimate the effect of change in the import tax system on total tax revenue and on other key macroeconomic variables such as the fiscal deficit, balance of payments economic growth, etc.

4. to forecast the future tax revenue due to a recent 1993 system change in the import taxation.

5. to discuss different policy issues and recommendations proposed in different periods in order to answer the following questions:

- were the revenue effects of tariff reform anticipated and were complementary tax measures recommended to protect revenue?
- what are the specific tax components which are capable of offsetting the revenue loss due to a tariff reform?
- will the recommendation of introducing VAT and other

domestic consumption taxes be suitable in the Ethiopian case? and

- what future structure of tariff should be proposed?

1.3 Methodology of the Study

The study covers fiscal years for the period 1967/68 to 1992/1993. This period is chosen mainly because it is during this period that major reforms in import tax structure were made.

In this study, based on published information on the rate and base structure changes in different years, particularly the major changes in 1967, 1978 and a recent (1993) tariff reform, a detailed discussion of the facts of these structural changes will be made.

We will use Ehdaie's (1990) econometric model for estimating built-in elasticity and the impact on revenues and other macroeconomic variables of a discretionary import tax measure. His dynamic simultaneous- macroeconomic model of taxation captures the interaction between GDP, individual tax systems, and individual tax revenues and bases as well as examining various tax-related issues. As representative of each individual tax system, its "average effective tax rate net of endogenous (built-in) changes in the tax yield and base" (AETRN) is introduced in the model. Time series data on AETRN are automatically generated in the process of estimating the model parameters. To estimate efficient and consistent parameters of the model, a non-linear two stage least squares (N2SLS) estimation method is used. In the study, an attempt

has been made to select the suitable software from the available packages that are appropriate to our study. Datafit and pc-give are the known softwares to estimate parameters and make diagnostic tests of time series data. Both are used in estimation process.

1.4 Data sources, Limitations and Organization of the Study

Data for GDP and its components are collected from the Ministry of Planning and Economic Development. Data related to actual tax revenue are gathered from the Ministry of Finance. Information regarding changes in rates, bases and coverage, as well as on quantitatively restricted and exempted goods, are also collected from the Ministry of Finance, particularly from the Customs and Excise Tax Administration. Other statistical information such as value of imports and exports is collected from the Ministry of Trade. Some of the available data are presented according to the Gregorian Calendar. In this case, to keep all the data uniform in Ethiopian fiscal year, corrections are made by taking the bi-annual data.

The model which is going to be applied incorporates only interaction of individual tax systems (i.e., corporate income tax, domestic consumption tax, import tax and other direct taxes) and their bases. Due to the lack of data on their true bases, proxy bases as representative of each true bases are used. All estimation of parameters and their analysis are based on these variables.

The study is organized under six chapters. Chapter 1 is an introduction part. Chapter 2 looks into the historical development of Ethiopia's tax system. Chapter 3 deals with the theoretical development of the model. Here a brief discussion about the interaction of tax systems and their bases are made. Chapter 4 presents the empirical results and their interpretation. In chapter 5, tax revenue projection due to a discretionary system change of import taxation are made. Finally, the principal findings of the study and conclusions drawn from the analysis are provided in chapter 6.

1.5 Survey of the Literature

There is a significant volume of literature on tax revenue in general. In developing countries trade taxes, particularly import taxes, are a major source of revenue. Most of the reviews of the literature are presented in each appropriate chapter as an introduction. Some general reviews are undertaken below.

Changes in revenue from import duties are based on changes in rate, base, and compliance. By changes in base we mean changes in the flows of imports of the goods in question. Changes in rates mean changes in the assessment per-unit flows and changes in evasion by individuals or concerns or changes in the definitions that are dutiable.¹

Both of these changes are reflected in revenue from import duties. An increase in revenue that comes from an increase in the rate of duty without any change in underlying flows of

goods may fall on the real income of the importing sector that has its flow of goods regulated by physical controls, rather than on the final consumers of these goods. This is especially true for imported inputs. But if the imported goods are processed consumer goods, the burden may fall on consumers rather than on importers.

The taxation of imported goods depends on the nature of the goods themselves. Some of the goods are taxed at a higher rate if they are considered luxury goods. This may be to fulfil the objective of equity. Import duty relief is granted to some commodities as part of the policy of the government to promote the development of domestic industry. Apart from these, goods are imported duty free or at low rates, apparently either because they are considered necessities or they are not meant to be for commercial purposes.

In general, the economic cost of taxation increases with tax rates and is higher when the base is narrow, as is the case in most developing countries.⁹

According to the World Development Report 1988, recent reforms in developing countries such as Colombia, Indonesia, Jamaica and Malawi have rightly concentrated on expanding the base, thus avoiding higher tax rates and their adverse effects on incentives. The report suggests that to make the tax structure more transparent and to ease administration and enforcement, the reforms have also favoured fewer rates and fewer exemptions.¹⁰

Tax revenue as a share of GDP has increased during the past decade in many developing countries in response to the need for fiscal adjustment. Taxes on international trade, especially import taxes, are still the largest source of central government revenue in low income countries, particularly in sub-Saharan Africa. In industrial countries, however, income taxes are often the most important source of revenue.¹¹

For developing countries, dependence on trade taxes ranges from 4 per cent in Brazil to 58 per cent in the Gambia. Fiscal dependence on trade taxes is greatest in sub-saharan Africa, followed in order by Asia, the Middle East and North Africa, and Latin America and the Caribbean.¹²

Thomas and Nash state that high dependence on trade taxes in developing countries makes their fiscal balance vulnerable to changes in trade tax revenue induced by liberalization, and they suggest that "the key policy issues are how best to anticipate the effect of trade reform measures on fiscal balance and how to develop alternative, more efficient revenue measures."¹³

In developing countries, import taxation is also used for protection purposes. But in most cases the protection effect yield an efficiency loss, particularly distortions in relative prices which interfere with industrial specialization. Pack (1984) concludes that protection permits lower domestic scale and explains many of the differences in efficiency.¹⁴ Clague (1970) observe "a loss of positive relationship between

relative competitiveness and relative efficiency."¹⁵

Distortions in relative prices interfere with interindustry specialization as well as within the manufacturing sector itself. Intra-industry specialization and participation in the international division of the production process are also obstructed by barriers to imports and disincentive to exports.¹⁶

Moreover, in individual industries, the bias against exports and in favour of production for domestic use creates a divergence between social and private profitability. Such a divergence also results from distortions in inputs prices that affect the choice of input mix.¹⁷

The evidence about the effect of import restrictions shows a negative effect on growth and exports. According to Thomas and Nash (1991), a study undertaken on thirty two developing and five industrial economies found that both the levels and dispersion of effective protection rates for importable were strongly and negatively correlated with growth rates, correcting for the effect of the factors.¹⁸ Economies of scale are also forgone as a result of the bias in favour of production for domestic use and against exporting particular products.¹⁹

According to many researchers, [Lewis (1967), Greenaway and Sapsford (1987), Evans and Greenaway (1991)]²⁰, fiscal dependence on trade taxes, particularly import taxes is inversely related to economic development, which is proxied by

per capita income. Moreover, Burgess and Stern in their cross-country study concludes that those which use import duties heavily are predominantly small and poor open economies, with less developed domestic markets. Furthermore countries that make heavy use of import duties have poorly developed systems of domestic taxation of goods and services.¹¹

African countries, as stated above, clearly the characteristics associated with heavy dependence on trade taxes. Typically as well as having a relatively low level of income per capita, they are agriculturally based, relatively heavily dependent on primary products, and not highly urbanized. The country group which these characteristics describe most clearly is the sub-Sahara African economies. This may be why there is likely to be greatest sensitivity to Bank and IMF staff induced trade policy reform in sub-Saharan Africa.

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CHAPTER 2

Historical Development of the Tax System and Analysis of Tax Revenue Composition

In both developed and underdeveloped countries, the need for taxation, i.e. transferring resources from the private to the public sector, emanates from the need to finance the ever-expanding level of government expenditure, to restrict private spending that is wasteful, and to reduce gross inequalities of wealth.¹ But their needs sometimes differ as their economies differ. Taxation in a rich country is geared to cover what are considered socially desirable expenditures, and in the underdeveloped countries it is the income from taxation that is the main determinant of the level of government expenditure². Moreover, taxation, in most cases, is considered as a most important contributor in the process of capital formation. Since capital formation has a long period in human history, taxation also has a long history linked to it and in the context of public finance³.

According to Pankhurst, the history of taxation in Ethiopia started during the middle ages when land was subject to tax.⁴ Land taxation was closely tied to the vast hierarchy and land tenure system. A major function of taxation was to provide for this vast hierarchy of social classes⁵. Hence, peasants were the first liable to pay taxes in Ethiopian history. Because of the non-monetized economy of the country and also with a very fragmented administration system, all payments were made in kind. Pankhurst writes that "taxes on the land were traditionally paid in kind, that is, in grain,

honey, butter, cotton and livestock as well as in labour in the form of service"⁶.

The modern taxation system was introduced in Ethiopia by the Italian occupation government, which began to levy income tax at least by 1938⁷. Today, after a series of proclamations and amendments were made on different tax systems, the tax structure has greatly improved.

Taxation in Ethiopia is divided in three broad categories: direct taxes, indirect taxes and foreign trade taxes⁸. In the case of direct taxes, the burden directly falls on the person from whom the tax payment is legally demanded. According to Proclamation N^o 255 of 1967, income tax from employment, income from business, income from agriculture and land use and income from rent of land and building, under four schedules were grouped under direct taxes.⁹

In the case of indirect taxes, the legal tax payer can have the avenue to shift the burden to others through the price of domestic goods. In this category, according to Proclamation N^o 30 of 1942, excise taxes and transaction taxes on local products, turnover taxes and sales tax were grouped.¹⁰

The taxes from international trade have two components, import taxes and export taxes.

The above classification faces controversies mainly in two cases. First, there was burden shifting tendency by land lords towards poor peasants when they are requested to pay the land

use and agricultural income taxes. It was not direct payment. Secondly, since there are ways to shift the burden to others through prices in the case of import duties, a more logical grouping is that of grouping together import duties with sales tax on imported and domestically produced goods, all of which fall on consumption.

2.1. Direct Taxation

The 1943 law of direct taxation system first came into effect in 1944,¹¹ and before 1976 there were two major revisions, i.e., in 1963 and 1967. According to Proclamation No 255 of 1967, the detailed schedules of direct taxation are stated as follows.

Schedule A :- which applied to the taxation of incomes from employment,

Schedule B:- which applied to incomes from rent of land and buildings as well as from cropsharing arrangements between land owners and tenants,

Schedule C: which applied to the taxation of incomes from any trade, business, professional or vocational occupation, and

Schedule D: which applied to income from agricultural activity.

The rate structure of schedule A, according to the 1967 proclamation, were less progressive than those of 1963, ranging between 2% to 25%. Most of the income groups were taxed at ad-

valorem rates. After 1974, the military government issued Proclamation N^o 77 of 1976 which was further amended by Proclamation N^o 144 of 1978. The 1978 proclamation, however, ushered in a major change in this category of tax. In particular, the rates were made marginal, thus eliminating the causes of regressivity in the old, 1967, law. The Transitional Government of Ethiopia (TGE) replaced amendment 1976 and 1978 by Proclamation N^o 30 of 1992. This new proclamation further increased the progressivity of the rate structure relative to the previous two amendments.

As far as schedule B is concerned, as mentioned earlier, it referred to the tax applied to incomes from rent of land and buildings as well as from cropsharing arrangements between land owners and tenants. This was essentially a tax on property income. It can be considered as a reflection of the social, economic and political system of the country. Two rate structures were postulated, one for bodies and the other for persons, at different rates. But after 1976, this source of income has dried up. This is due to the nationalization of urban and rural lands as well as extra dwellings. This nationalization of individual properties eliminated the source of income from these bases. The present tax on rent income is that of the 1992 special decree. In this special decree, income derived from rent of houses, buildings for office or manufacturing, materials and goods, etc. is subject to tax. The first Br 1200 of annual income is exempted while the tax rates on additional incomes are progressive.

The third, schedule C, covers taxes applied to income from any trade, business, profession or vocation, income from lumbering purposes; income from processing or transforming of agricultural products, income from other activities relating to agricultural forestry, breeding cattle or maintaining pasture land, and lastly income from any interest and from "all other sources not specifically mentioned." The 1967 proclamation was further amended by the 1978 proclamation and it was more progressive relative to the old one because of the elimination of the old regressive feature by introducing marginal rates in the new law. The system currently under operation is that of Special Decree № 18/1990. It marked a slight difference from that of 1978.

Schedule D refers to a tax on agricultural activities. The first legislative act establishing a land tax payable in cash was proclaimed by Proclamation № 8 in 1942. The introduction of agricultural income tax Proclamation № 255 of 1967 replaced the tax in lieu of tithe. It was further amended by Proclamation № 77 of 1978. The main difference between the period before and after 1976 is that in the latter period, the proclamation to nationalize rural lands, eliminated not only the former category of schedule D but also the taxes related to land ownership, i.e., land tax, education tax and health tax¹¹. Due to the nationalization of land, the revenue from this schedule became low.

2.2. Domestic Indirect Taxation

This is the area of taxation in Ethiopia which is characterized by a great multiplicity of taxes, with consequent great burden on the tax administration. The major components of these taxes are: excise taxes and transaction taxes on domestic products, turnover taxes and sales taxes.

A grouping of commodities with broad coverage was first introduced in 1943,¹³ but the law has undergone a number of changes. Most domestic indirect tax rates were specific. According to a report of UNDP, (1985), "as 58% of all domestic indirect taxes are based on specific rates, their elasticity is very low, 0.5 in 1980/81."¹⁴

Excise tax under this category is mainly designed to raise government revenue, and its base is locally produced goods. With limited industrialization, excise revenue comes from a few selected commodities. According to Proclamation No 162/1978, commodities liable to excise taxes were twelve in number. This law was amended by Proclamation No 68 of 1993. In this new law most of the specific rates were changed to ad-valorem ones. The rates of excise tax on domestic production and imports are the same; difference is only on the base on which they are applied (the detailed rates are given in Table 2).

Transaction tax had four components under the principal legislation of 1963,¹⁵ namely, transaction tax on goods locally manufactured, transaction tax on imports and exports, turnover tax, and transaction tax on construction work.

Accordingly, the responsibility for the collection of revenue from import-export transaction tax was transferred to the Customs and Excise Administration. Transaction tax on local products was subject to an ad-valorem rate, 7%, on domestically manufactured goods, except pharmaceutical items, which were charged at 5% . The tax charges were computed based on the gross amount received from sale by manufacturers of locally produced goods and disposed of by the manufacturer other than by sale.

The turnover ad-valorem tax rate, 2%, was levied on the sale of all goods in Ethiopia, irrespective of their origin, levied at each successive scale ("cascade tax") imposed on every sale at all stages of production and distribution.¹⁶ Sales of stamp duties constitute the least significant category of indirect taxes. They were applied to bills of exchange, bonds, leases, petitions, applications to government offices, etc.

In 1990, a new sales tax proclamation was issued by the government in order to consolidate the many and scattered indirect taxes, to make tax administration more simple and efficient, and to widen the coverage.¹⁷ In this case, all the previous proclamations and amendments were repealed by this sales tax law, i.e. transaction tax, turnover and stamp duties are now consolidated into a single tax system. Based on the producer's selling price, as regards goods produced locally and the service charge for services supplied, the tax rates were levied at 12% and 10% respectively. The law currently in operation issued by the Transitional Government of Ethiopia.¹⁸

According to this law, the sales tax shall be paid on goods sold locally at 12% ad-valorem rate and on services such as telecommunication, laundry, garage, etc; also contractors and tax payers whose daily sales income is between Birr 25-50 are taxed at 5% rate and others at 10%.

2.3. Foreign Trade Taxation

Foreign trade was the main source of tax revenue for the past two or three decades. This sector is also an important determinant of a country's degree of monetization, urbanization and industrialization.¹⁹

Similar to other developing countries, particularly sub-Saharan African countries, foreign trade taxation in Ethiopia has two components, namely import taxation and export taxation.

2.3.1. Import Taxation

Import taxation in Ethiopia has three components. These are customs duties, excise taxes on imports and transaction taxes on imports. The basis for import taxation is the c.i.f value of imports. The government uses import taxes to protect domestic production, to promote development of domestic industries, and to raise revenue.²⁰ The other justification for using import taxes is administrative feasibility. As stated by Burges and Skin, "... it is very significant with the least administrative cost particularly in poor countries with less developed markets and limited administrative capabilities,...

it represents a convenient handle for the raising of revenue but it is generally unattractive on efficiency grounds."¹¹

Customs Duties

The first proclamation on customs duties with detailed coverage of goods was issued in 1943 and came into force in April 1944.¹² Before this period, at about the time of the Italian invasion, customs duties were levied on some 70 categories of imports. At that time, the rates differed from commodity to commodity depending on the group of people they served and their end use. For instance, the tax was higher on luxuries, especially those consumed by the foreign community (such as cigarettes and cigars) than on necessities required mainly by the native population (such as khaki and abujadid).¹³ After 1944, a number of major amendments and changes in the rates of customs duties were made, of which the 1947, 1951, 1969 and the 1976 revisions are worthy of mention. The large number of items and the complex system of grouping them make it difficult to present the complete rate structure. We have tried to indicate the major changes of the tariff structure.

Customs duties were further amended by Legal Notice N^o 354 of 1969. The schedules and commodities were classified according to the Brussels Tariff Nomenclature (BTN) of the Customs Corporation Council and according to the Standard International Trade Classification (S.I.T.C., revised) of the United Nations Statistical Office, respectively. In the 1969 amendment 77 articles under the former law were deleted and replaced. In this law, the ranges were between 15% ad-valorem

rate on cotton - wool gauze, plain or mediated, and on some metal manufactures; and 75% ad-valorem rate on meat extracts, soups manufactured from meat and on other related items. Before this amendment, most of the items were taxed at specific rates. The main reform brought about by the 1969 amendment was that of changing specific rates to ad-valorem ones, but not for all imported items.

After the 1974 Ethiopian revolution, particularly in 1976,¹⁴ among different measures taken by the military government, customs duties reform was one of them. The classifications were also according to B.T.N and S.I.T.C.R. The schedules were broadened by covering 520 commodities (or groups of commodities) classified in 24 sections and 98 chapters. These schedules include both specific and ad-valorem duties. As can be seen from Table 1, the tariff rates vary from 5% on some goods considered necessities to a maximum of 125% on goods considered luxuries. In this proclamation, goods such as fertilizers, chemicals used in hospitals and similar institutions, goods imported by or for presentation to any religious body, goods for laboratory and scientific use, some spare parts of aircraft and railways, etc. were given duty free privilege.

Capital goods constitute the major import items in the Ethiopian import structure, particularly in the period 1986/87-1990/91. In this period, however, such imports as agricultural and industrial machinery, implements and parts thereof are exempted from paying customs duty. Although the exemption reduces government revenue, it was a deliberate policy by the

government intended to enhance economic development. This was an incentive provided by the tariff structure to overall development in general and industrialization in particular.

In the 1976 proclamation, the quota system (quantity restriction) started and importation of some goods was totally prohibited. The prohibited goods were liquors with high alcoholic contents, weapons, drugs, etc. while the quantitatively restricted goods included foodstuffs, general merchandise, building materials, stationery materials, investment goods, textiles and their components. The Ethiopian Import Export Corporation (ETHIMEX) had the sole right of importation of these goods. The quota system may be used to encourage domestic industries. But economic theory ranks the quota as an inferior protective instrument to the tariff in most circumstances. Where quota restrictions have been pervasive, the effect on the tax base may be very high, which in turn affects the tax revenue from imports.¹⁵ There was also a serious shortage of foreign exchange. The available foreign currency could not satisfy the importers' demand. This had a direct effect on the value of imported goods, which are the bases for import taxes. Moreover, restrictions on the issuance of import licenses were one of the causes for a limited number of importers. Since entering in this sector is narrowed by this policy, again this had a direct effect on both the value of imports and the revenue derived from them.

The 1979 amendment of regulation No 68 raised the tax rates on jewellery, ivory, bone, adornment and worked vegetable or minerals, carving materials and articles of these materials

from 100% to 200% . In 1990, the rate on vehicles was raised to a maximum of 230%, especially on vehicles with the maximum horse power, designed mainly to discourage luxury goods.

According to regulation № 3/1989, the importation of goods was permitted on Franco-Valuta basis to increase imports and the revenue from them. This was mainly designed to tackle the problem of foreign currency availability.

The Transitional Government of Ethiopia is trying to change the centrally planned economy in order to encourage growth and reduce poverty.¹⁶ Many measures have been taken. After the devaluation of the Birr in 1992, the tariff structure was revised in 1993. Customs Tariff Regulation № 122 of 1993 replaced regulation № 42/1976 and its subsequent amendments. This reform reduced the previous 230% maximum rate on some goods to a maximum of 80%. The new rates are given in Table 1, together with the 1976 rates for the sake of comparison, and all the rates are given as ranges because of the difficulty of computing their averages.

Under this tariff reform too, some exemptions are given to organizations, persons and public bodies. Diplomats and consulars, churches and related religious bodies, tourists, gifts and donations are still free from import duties but some others are subject to low tax rates .

The previously quantitatively restricted goods are now permitted entry and are liable to tariff rates. Importers can obtain import license relatively simply. In conjunction with

the adoption of an appropriate exchange rate, a comprehensive process of import liberalization commenced, with a view to rationalizing and reducing the rate of effective protection. Automatic, nondiscriminatory, and transparent licensing of importers was made effective in early 1992, except for items on a short negative list relating to security and health.¹⁷ Foreign exchange currency auctions have been instituted for importers, except on some goods for which foreign currency is not permitted. The importation of goods on Franco-Valuta basis is also permitted. This regulation (importation of goods on Franco-Valuta Basis, regulation N21/1991) is purposely designed to capture small importers whose currencies originate abroad. All imports on Franco-Valuta basis are subject to payment of regular customs duty.

The Ethiopian tariff system plays a dual role of revenue generation and domestic industry protection. Although it is difficult to differentiate between tariffs levied for revenue and protection purposes, on the average 75% of revenue from foreign trade taxes comes from these duties, and there is clear evidence that the tariff policy in the manufacturing sector plays a protective role. One of the criteria for identifying whether domestic industry is protected or not is to look into the amount and extent of taxes levied on similar imported and domestic products. The higher the taxes on imports in relation to domestic goods, the more protective the tariff.¹⁸ Another approach is to look into the types of goods the duty is levied on. Generally, if the duty levied on an item is only for revenue, the goods on which the duty is imposed should be those which are not produced locally.

Table 1

Statutory Tariff Rates

(in percentage)

section	Items by group	1976*	1993**
1	Live animals; animal products	10*-80**	5*-65**
2	vegetable products	15-100	5-80
3	Animal and vegetable fats and oils and their cleavage products prepared edible fats; animal and vegetable waxes	10-50	20-50
4	prepared food stuffs, Beverages, spirits and vinegar, tobacco	10-100	10-80
5	Mineral products	20	15
6	products of the chemical and all red industries	10-60	5-40
7	Artificial resins and plastic materials, cellulose esters and ethers, and Articles thereof, rubber, synthetic rubber, factice and articles thereof.	10-50	5-40
8	Haw bids and skins, leather, furskins harness; Travel goods, handbags and similar containers; Articles of out (other than silk-worm gut)	10-100	5-80
9	wood and articles of wood; wood charcoal; cork and articles of cork, manufactures of straw, of esparto and of other plaiting materials;	10-60	5-40
10	paper -making material; paper and paper board and articles thereof.	10-60	5-40
11	Textiles and textile articles	10-100	5-80
12	Foot wear, headgear, umbrellas, sunshades, whips, riding-crocs and parts thereof, prepared feathers and articles made therewith, artificial flowers, articles of human hair's tams	20-100	20-80
13	Articles of stone, of plastic, of cement, of Asbestos, of Mica and of similar materials; ceramic products glass and glass ware	10-100	5-80
14	pearls, precious and semi-precious stones, precious metals, rolled precious metals, and articles thereof, imitation jewellery, coin	75-100	50-80
15	Base metals and articles of metal base	10-50	5-30
16	Machinery and mechanical appliances, Electrical equipment, parts thereof.	10-50	5-80
17	vehicles, aircraft, and parts thereof; vessels and certain associated transport equipments	10-130	10-80
18	Optical, photographic, cinematographic, measuring, checking, precision, medical and surgical instruments and apparatus, clocks and watches, musical instruments, sound recordings and reproducers, television image and sound recorders and reproducers, magnetic parts thereof.	20-100	5-80
19	Arms and Ammunition; parts thereof	75	80
20	Miscellaneous manufactured articles	20-100	10-80
21	Works of art, collectors pieces and antiques	10	20

Source * Customs tariff regulation № 42/1976

** Customs tariff regulation №122/1993

Note + Minimum tariff rate in the group,

++ Maximum tariff rate in the group .

If the duty is levied on items which are similar to locally produced commodities, then the duty is protective.¹¹

According to a study made by the World Bank, (1985),¹² Ethiopia used high protection in order to promote domestic industries, but this had a negative response. Most industries were inefficient. Domestic resource costs were calculated for a sample of 19 public industries, and 14 industries were found to be inefficient. It was concluded that "if resources are not being allocated to highly valued uses, and/or if those resources are being utilized at less than full potential within that use, we would expect high cost of production, low quality of manufacturing goods and/or low economic benefits."

Excise Tax on Imports

Excise tax is payable in addition to other taxes and duties. Except those levied on tobacco and tobacco products, leather and plastic goods, all of the taxes were specific rates, particularly under amendment No 284 of 1971. The excise tax rates are similar for both local products and imports. A series of proclamations and amendments were made to improve this tax system in different periods. The amendments of 1978 changed some specific rates to ad-valorem rates without any change in their coverage.

The present reform is that of regulation No 122 of 1993. These rates are given in Table 2. Under this law, all excise tax rates are ad-valorem and this law widens the coverage from

the previous 12 items to 17 items by including luxury goods. These goods are radios, machines, video, television sets, passenger cars, etc.

Transaction Tax on Imports

Transaction tax on goods imported or exported is charged, levied and collected by the customs administration at the point of entry or exit of goods, and the general rules of assessment and collection applicable to customs duties also apply to the transaction tax. After its introduction in 1956, the law has undergone a number of changes. In 1967, in addition to customs duties, imported goods were in general liable to a transaction tax of 15% based on the value as assessed by customs.³¹ The transaction tax on imports was considered the most important tax in the past two decades, not only because the country's import trade was significant and continually increasing, but also because imports were taxed at the rate of 15% of this value, a rate which was much higher than those at which the other transaction taxes were levied.³²

Transaction tax rates on imported goods were increased in May 1979 to 18% on all imported goods excluding pharmaceutical items. In addition, all imported goods which were subject to transaction tax were also liable to a 1% municipality tax. These transaction tax rates were higher as compared to a 7% transaction tax imposed on domestic manufactured goods. Municipality tax was not payable on domestic production. Thus the high indirect taxes on imported goods were additional protection given to home industries.

Table 2

Excise Tax Rates

No	Items by Group	Rate by %
1	Any type of sugar excluding molasses	50
2	Drinks	
	- soft drinks	80
	-Mineral water	50
	-Alcohol drinks	
	-All types of Beer and Stout	150
	-All types of wine	50
	-Other alcoholic drinks	75
3	All types of pure alcohol	200
4	Denatured alcohol	50
5	Tobacco and Tobacco products	
	-Tobacco leaf	20
	-cigarettes, cigar cigarillos, pipe tobacco etc	50
6	Salt	50
7	Fuel super benzine, regular benzine petrol	30
8	Perfumes	100
9	Leather	
	All types of tanned or dressed leather	20
	All types of fur skin, tanned or dressed	50
10	Textile	
	-Textile fabrics, nylon, silk etc.	10
	Textile of any type partly or wholly cotton	10
11	Various types of personal adornment of any origin	50
12	Dish washing machines of a kind for domestic use	80
13	Washing machines of any kind used for domestic use	30
14	Video Decks , Television or video cameras	30
15	Television broadcast receivers whether or not combined with gramophone radio, or sound receivers and reproducers	10
16	Motor passenger cars, Station wagons	
	-upto 1300 c.c.	20
	-from 1301 c.c. to 1800 c.c.	50
	-above 1800 c.c.	100
17	Landrovers, Jeeps and other four wheel drives	20

Source: Customs Tariff Regulation No 122/1993

The sales tax was introduced in 1990, as discussed earlier, to replace transaction and municipality taxes, which were in force prior to this amendment. The basis of computation of sales tax, as far as sales tax on imports is concerned, is the price on which the customs duty is assessed for goods imported and the rate of this tax was 24% ad-valorem rate.

The sales tax system currently used is issued in 1993. According to this new law, the basis of computation of the sales tax in respect of goods imported is cost insurance and freight (c.i.f) plus customs duty and the excise tax paid, as the case may be, and the sales tax shall be paid on goods imported at 12% tax rate except for imported goods like live animals, meat and its components, fish, milk, etc which are liable at 5% rate .

2.3.2 Export Taxation

In developing countries export taxes are widely used because they provide a useful and administratively easy device for taxing income of producers, especially agricultural producers, whose income is usually difficult or impossible to tax. Secondly, they help to mop up windfall profits in times of rising export prices; and they also provide a useful anti-inflationary device.

In Ethiopia, the bulk of the export duties revenue is obtained from those on coffee exports, and to a smaller extent

from those on hides and skins exports. Apart from export duties proper, all exported goods were subject to a 2% transaction tax. In addition to these, coffee exports are liable to cess tax and surtax. A surtax was also levied on sugar and cotton seeds on their FOB price.

Today, in order to encourage exporters and to increase participation in the world market, all export taxes levied on goods other than coffee have been eliminated. Coffee taxation has been retained as a source of government revenue from some of the increased profit which accrues to the exporters as a result of increase in prices for the goods in the world market.³³

2.4 Analysis of Tax Structure and Revenue Composition.

In this section an attempt will be made to examine the revenue structure of taxation in Ethiopia. A study of this nature would indicate the direction in which the government has been attempting to increase tax revenue, and the effort made in devising tax policy in an attempt to strengthen the revenue base. The information which helps to analyze the mentioned effect is given in Table 3.

As can be seen from Table 3, on the total tax revenue side, there has been a significant amount of growth over the time period mentioned. Its ratio to GDP increased from 8.2 % in 1967 to 19.6 % in 1987, and declined to 13.2 % in 1992. The

average ratio is 13.5 %, which is less relative to other developing countries such as Kenya, 19.9, Togo, 24.9 and Zambia 23.2 percent.³⁴ The 1978 tax reform marked a significant increase in total tax ratio until the declining ratio emerged in 1989. The period, after 1989 represented the last years of the Derge, and there were some parts of the country out of government control. Even for some parts under government control, there were administrative constraints to collect taxes properly. Tax evasion was also very high.

The revenues from direct taxes were relatively insignificant before 1978. The reasons for the low contribution of direct taxes, as discussed earlier, were at first, its restricted coverage particularly in the 1960's when agricultural income taxation was not included. Secondly, even after the introduction of the above direct tax component, low standard of living, a large non-monetized sector, inaccurate records, ineffective administration, contributed to the little share of direct taxes in total tax revenue.³⁵ After 1978, in fact, there are tendencies to shift from foreign trade taxes to direct taxes, and these can be seen from the table.

The period under review marked a low share of indirect domestic taxes. Interestingly enough, their relative importance in the revenue system has been subject to only slight variation. In fact before 1975, their contribution rank was second following foreign trade taxes. But after that year, it became the least and after 1983 it started rising again. The reason for the low proportion of indirect domestic taxation is the limited size of the manufacturing sector (which is its

Table 3 Tax Structure and Revenue Composition (1967-1992)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Tax Revenue (% of GDP)	8.2	8.1	8.3	8.6	9.1	9.6	9.6	10.6	10.2	12.5	12.9	14.2
Tax Structure (% of tax revenue)												
- Direct taxes	24.4	29.4	27.8	30.2	31.0	29.3	28.3	29.9	28.4	24.4	24.0	27.5
- Indirect taxes	32.9	31.9	31.1	31.4	33.7	31.2	31.3	32.9	28.4	21.2	19.9	23.5
- Foreign trade taxes	42.6	38.6	41.1	38.5	35.3	39.6	40.4	37.1	43.2	54.4	56.1	49.0
Import taxes (% of foreign trade taxes)	80.6	81.1	73.7	76.8	79.2	73.1	76.6	80.5	67.5	53.0	46.6	59.4
Export taxes	19.2	18.9	26.3	23.2	20.8	26.9	23.4	19.5	32.5	47.0	53.4	40.6
Customs duties *	57.5	55.2	51.0	53.1	52.5	46.7	46.2	49.6	44.9	35.3	32.1	37.7
**	71.2	68.0	69.2	69.2	66.3	63.8	60.4	61.6	66.6	66.7	68.9	63.4

cont'd Table 3

1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
15.2	15.6	15.9	15.9	17.6	16.9	17.2	18.4	19.6	19.1	17.4	15.5	11.9	13.2
29.3	35.9	39.3	38.8	37.9	41.0	40.8	43.3	43.7	44.8	42.8	38.9	39.6	33.2
28.8	28.5	27.6	28.4	28.6	31.8	29.5	29.8	31.1	33.1	35.0	35.9	32.9	33.3
41.9	35.6	33.1	32.8	33.4	27.8	29.6	26.9	25.2	22.1	22.2	25.1	27.4	33.4
45.4	61.2	59.9	60.1	55.5	62.9	52.7	72.7	74.9	68.7	89.6	94.7	97.8	96.0
54.6	38.8	40.1	39.9	44.5	37.1	47.3	27.3	25.1	31.3	10.4	5.3	2.2	4.0
*25.4	34.5	32.8	34.2	32.5	36.9	30.9	40.9	40.3	38.1	50.9	52.4	54.4	48.1
**55.8	56.4	54.7	56.9	58.7	58.7	58.7	56.2	53.8	55.5	56.9	55.3	55.6	50.0

Source: Computed from data obtained from the Ministry of Planning and Economic Development (MPED) and the Ministry of Finance.

* Share of customs duties in foreign trade taxes,

** Share of customs duties in import taxes.

base) and the great multiplicity of taxes, with a consequent great burden on the tax administration. The World Bank recommendation of tax system reform focuses on how to use the potential of domestic resource as the source of taxation to increase fiscal revenue rather than depending on foreign trade taxes, which are vulnerable to exogenous changes and other uncertainties.³⁶

Ethiopia displays many of the features common to developing countries. The revenue structure, as in other developing countries is characterized by the dominance of foreign trade taxes, which provide about 41 % on average of total government revenues.

Evans and Greenaway tried to answer the question, "what has fashioned this pattern of the heavy dependence on trade taxes in developing countries?" Their answer is not efficiency and equity but least administrative cost. According to them the cost/yield ratio associated with trade taxes is likely to be very much lower than the cost/yield ratio associated with domestic income tax or production taxes.³⁷ World Development Report 1988 also estimated the administrative costs of trade taxes at one per cent to three per cent of revenue collected. In contrast, for value added taxes the figure was five percent and for income taxes as high as ten percent.³⁸ Thus, although the economic cost of trade taxes generally exceeds those of income taxes and VATs, administrative costs are much lower. This may be why it is a crucial consideration for low income developing countries.

Table 4 Trade taxes and income per capita (1988)

Country	TT ^a /GR(%)	GNP ^b	MT/TT ^c
Rwanda	53.52	233	54
Sierra Leone	47.80	320	74
Mauritius	44.76	976	85
Sudan	44.60	436	76
Ethiopia	40.54	132	74
France	0.04	10684	100
Germany	0.02	11398	100
Netherlands	0.01	10508	100

^a- Trade taxes as a percentage of total government revenue

^b- GNP Per capita of mid-year population in US 1980 market prices

^c- Share of total trade tax accounted by import taxes,

Source:- Evans and Greenaway, Fiscal dependence on trade taxes and trade policy reform, 1991, p-100 & 101.

The high dependence on foreign trade taxes in Ethiopia can be seen from Table 3. Particularly between 1967 and 1977, about half of total tax revenue was from this sector. But after 1978, the share declined due to the imposition of high tariff rates and the introduction of the quota system. The table further demonstrates the relative importance of import taxation in foreign trade taxes. About 78 percent on average is contributed by import taxation. In fact the contribution of export tax was higher in the period 1975-1985 than 1967-1974. But it was declining during 1985 and reached 2.2 and 4.0 percent in 1991 and 1992. Its low share is due to the low export values and the existence of smuggling of coffee, which is the main source of export tax revenue. The low export values, basically due to a fluctuation and deterioration in the prices of primary exports

in the world market, creates a loss in import capacity, which is the base for import taxation. These changes are reverberated in the fiscal system through the tax revenue they produce."

The share of import taxes, as we have said, was high between the period 1967 and 1974, about 78 percent on average of foreign trade taxes. But after 1974, a declining trend was registered. This is mainly due to a highly restrictive system of imports, such as high tariff rate, quota system, lack of foreign currency, etc.

Another salient feature of the revenue composition is that not only does import taxation dominate foreign trade taxes but it is also dominated by customs duties. About 40 percent on average of import trade taxes and 60 percent on average marked by customs duties. As can be seen from the table, as far as foreign trade taxes and their components are concerned, there was no consistent trend throughout the period.

The critical issues with which this thesis deals are how discretionary changes (a change in base, rate and compliance) play a role in bringing the desired result, how an individual (overall) tax system responds to discretionary tax measures applied on one tax system, and what the effects are on total government revenue and on different macroeconomic variables due to a one tax system change, in our case (import taxation system change). With this aim, the theoretical development of the model is presented in the next chapter.

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CHAPTER 3

Estimation Method of Tax Elasticity and the Revenue Impact of Changes in the Import Tax System

In developing countries, the degree of response of tax revenue to changes in income is considered to be a vital ingredient in the criteria for a tax system. This tax system response is measured by built-in elasticity (hereafter elasticity)¹ and tax buoyancy, the former measuring the automatic response of revenue to income changes (i.e revenue increase, excluding the effects of discretionary changes), and the latter measuring the total response of tax revenue to changes in income.²

In this study, to estimate the impact on revenue of discretionary import tax measures and to evaluate the macroeconomic impact of this tax reform programme and also to examine various tax related economic issues, it is important to estimate built-in tax elasticity.

As stated above, estimating built-in elasticity requires separating discretionary tax measures from the historical time series data (HTSTD). There have been a lot of studies made by many researchers, the only difference in applying the built-in elasticity method being the type of technique applied to remove or separate discretionary effects from the historical data .

One such technique, for instance, is that of Charles Mansfield,³ a method he applied to Paraguay. He used a proportional adjustment method, which was first developed by

A.R Prest in 1962.⁴ Similarly, Mohammed Khans,⁵ in the context of Pakistan, used a dummy variable method to eliminate the effect of discretionary tax measures from tax yield. Another recent study is by F.P Mtatitikolo⁶ on Tanzania. He used a constant rate structure (CRS) technique to separate the effects of discretionary options in measuring tax elasticity.

These methods have been applied in Ethiopia by Wogenie Yirko⁷ and Teame Ghirmay⁸ to evaluate the tax system of the country. The former study used the proportional adjustment method whereas the latter used both the proportional adjustment and dummy variable methods. For almost the same period of study, they obtained elasticities of the tax system of Ethiopia, 1.14 (elastic) in the first case and 0.96 (inelastic) in the second.

According to Ehdaie,⁹ a complete adjustment of HTSTD to discretionary tax changes is impossible by means of any of the three major adjustment methods, i.e., proportional adjustment (PA), constant rate structure (CRS) and dummy variable (DV) techniques. First, these methods, particularly the PA method, assume a change in an individual system not to affect its own and other individual tax bases endogenously. This is a strong assumption which is not supported theoretically. This is because, through price and income mechanisms, a change in one tax system can affect other tax systems and bases. The CRS incorporates only discretionary tax changes resulting from changes in statutory tax rates and ignores tax changes that emerge from changes in administrative efficiency and in tax base. The main limitation of the Dummy variable method is that

of insufficient observation since in practice discretionary changes in taxation are frequently made. The method can work only if sufficiently large numbers of observations are available for each structure, which is difficult in developing countries.

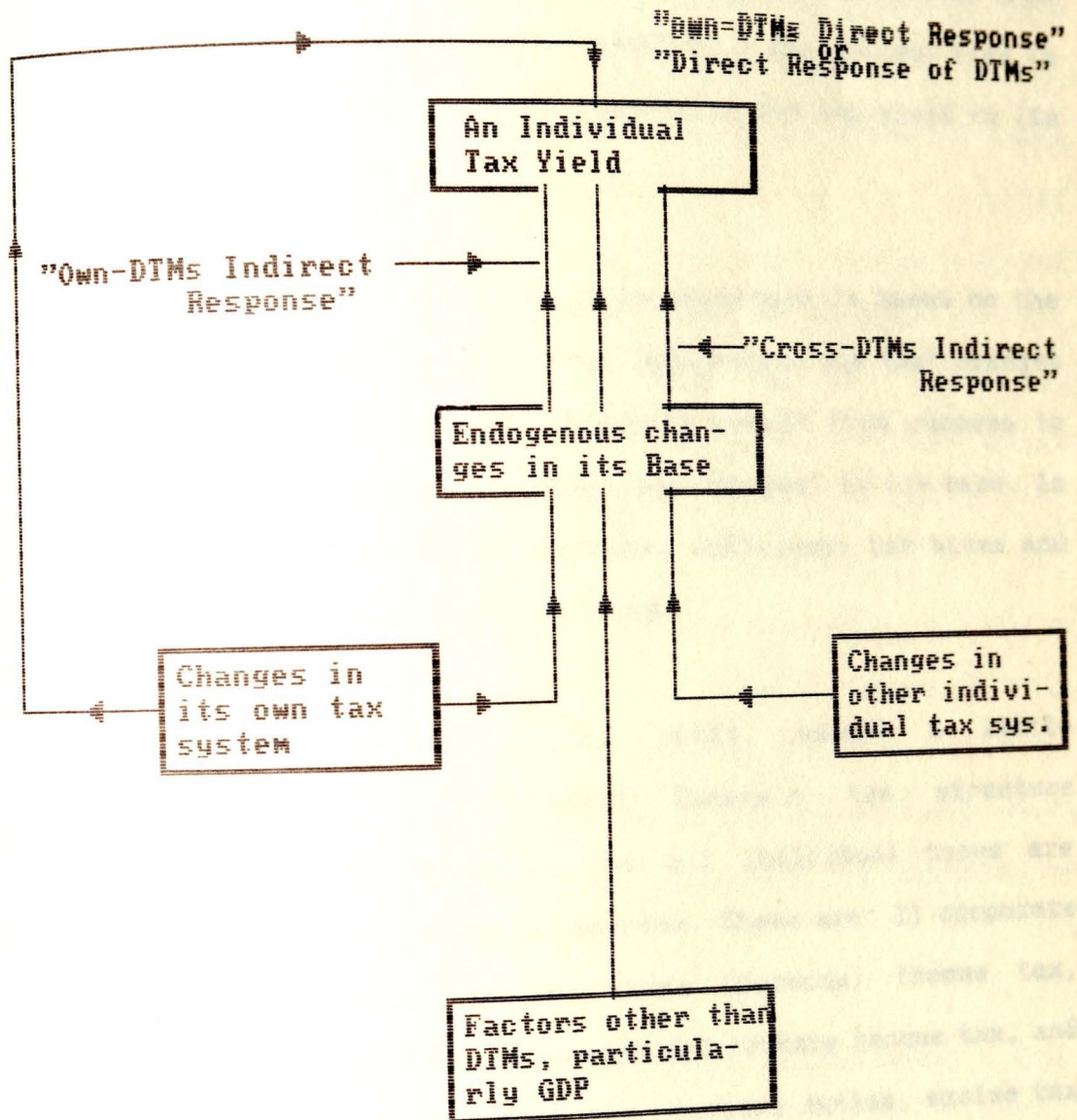
In addition to these, all the existing estimation methods of tax elasticity suffer from a specification bias, which is mainly due to the lack of an observable quantitative variable capable of reflecting all changes in an individual (domestic consumption taxes, import taxes, corporate income taxes, other direct taxes) and overall tax system ¹⁰.

His argument is based on the information presented in figure 1. It is apparent from this figure that an individual tax revenue directly responds to changes in its own tax system ("own DTM direct response") and to endogenous changes in its base. The base is endogenously influenced ,

- i) by changes in its own and other individual tax systems through price mechanism, investment, savings and/or income channels,
- ii) by factors other than DTMs, particularly variation in GDP,

Therefore, the tax revenue indirectly responds to changes in its ("own-DTM indirect response") and other individual tax systems ("cross-DTM indirect response") through their impacts on its base.

Figure 1: Decomposition of Response of a Tax Yield to Discretionary Tax Measures.



" Indirect Response to DTMs= Sum of own and cross-DTMs Indirect Responses.

Source: Jaber Ehdaie, An Econometric Method for Estimating the Tax Elasticity and the Impact of Discretionary Tax Measures, World Bank Working Paper, WPS 334, P.6

3.1 Theoretical Development of the model¹¹

According to Ehdaie, "tax elasticity" is defined to measure the percentage increase in tax revenue resulting from endogenous changes in its base caused by a one percent rise in GDP. It is the product of elasticities of the tax yield to its base and the base to GDP.¹¹

The model which is going to be developed is based on the information in Figure 1. The core information are that changes in an individual tax revenue directly result from changes in its own tax system and/or "endogenous changes" in its base. In other words, individual tax systems, individual tax bases and yields and GDP are all interrelated.

For the purpose of our study, except a little modification, it is followed Ehdaie's tax structure classification. According to him all individual taxes are classified into five major categories. These are: 1) corporate income tax, 2) other direct taxes (personal income tax, agricultural income tax, dividends and lottery income tax, and rural land use tax), 3) import tax (customs duties, excise tax on imports, transaction tax on imports), 4) export tax and 5) taxes on domestic consumption (excise and transaction taxes on domestic products, turnover tax and stamp duties).

As we have said, to estimate the elasticities of each individual tax system, it require regressing two different relationships, i.e., each individual tax system to their bases and these bases to GDP. The problem here is that of finding the

true bases of each individual tax system. This is the problem in most developing countries.

By taking the data availability and tax structure into consideration, as in most studies on sub-Saharan Africa countries applied, the proxy variables for potential tax bases are selected. These are: private consumption (X_d), imports (X_m), exports (X_x), value added in the non-agricultural sector (X_c) and Gross Domestic Product (X_o) as proxies for the potential bases of domestic consumption tax (T_d), import tax (T_m), export tax (T_x), corporate income tax (T_c) and other direct taxes (T_o), respectively.¹³

To estimate the elasticities of each individual tax system and to determine the dynamic response of these taxes and their bases due to a change in one tax system, it is important to examine each relationship separately. For this reason, this model is disaggregated into three blocks and are discussed as follows.

3.1.1 Individual Tax Revenue Equations Block

As far as this section is concerned, it is possible to formulate a single model as representative of all individual tax system. As point out earlier, an individual tax revenue assessed by tax inspectors is directly affected by changes in its own tax system and its base. To separate out the direct revenue impact of these two factors, each individual tax revenue assessed by tax inspectors (T_i') is considered to be a function of two proxy variables, one of its potential tax base

(X_i) and another as representative of its own tax system (r_i) . The relationships between these two explanatory variables, X_i and r_i , and the dependent variable, T_i' , are assumed to be positive. The equation can have the form

$$\log(T_i')_t = \dot{Y}_{i0} + \dot{Y}_{i1} \log(X_i) + \dot{Y}_{i2}(r_i)_t + e_{it} \quad (1)$$

where

$i = d$, tax on domestic transactions,

$= m$, tax on imports,

$= x$, tax on exports,

$= c$, corporate income tax,

$= o$, other direct taxes

e_i = disturbance terms as representative of other explanatory variables excluded in the model.

It is clear that in the above equation, the tax revenue is the assessed one by tax inspectors but not actual. There is discrepancy between them. Adjustment is needed to come to actual one. Ehdaie's tries to adjust this by saying

tax inspectors will adjust the actual tax yields towards their assessed level. This adjustment process is not, however, completed instantaneously. Using the partial adjustment method, it is assumed that the tax inspectors adjust actual individual tax revenues, $(T_i)_t$, toward their assessed level, $(T_i')_t$, by adding a fraction of the difference between the assessed tax yield, $(T_i')_t$, and the actual tax revenue of the previous period, $(T_i)_{t-1}$, to the actual tax revenue collected in the previous period, $(T_i)_{t-1}$. This adjustment mechanism is written in its log-linear form as follows:

$$\Delta \log(T_i)_t = \delta_i [\log(T_i')_t - \log(T_i)_{t-1}] \quad (2)$$

where δ_i denotes the coefficient of adjustment of i^{th} individual tax yield, and $1 > \delta_i > 0$. The average time lag of the adjustment of the i^{th} individual tax revenue is $(1 - \delta_i)/\delta_i$, measuring the average period of time needed by tax inspectors to complete inspection of tax files related do to the i^{th} individual tax.¹⁴

Now it is possible to change the assessed tax revenue to actual one by substituting the adjustment mechanism, (2), in the former equation, (1). This process entered in equation (1) the lag of dependent variable (lag of tax revenue) as an independent variable. The actual individual tax with its explanatory variables can be written as

$$\log(T_i)_t = \alpha_1 \dot{Y}_{1t} + \alpha_2 \dot{Y}_{2t} \log(X_i)_t + (1 - \alpha_1) \log(T_i)_{t-1} + \alpha_3 \dot{Y}_{3t}(r_i)_t + U_{it} \quad (3)$$

where $U_{it} = \alpha_4 e_{it}$, stochastic term.

The time series data for T_i , X_i and $(T_i)_{t-1}$ can be easily obtained. For individual tax bases the proxy bases specified earlier can be used. The main problem is that the definitions of r_i as representative of the i^{th} individual tax system and their time series data.

According to Ehdaie, "it has been the lack of an observable quantitative variable as representative of an individual (or overall) tax system in public finance which has complicated the issue of estimating individual and overall tax elasticities"¹⁵ as discussed at the beginning of this chapter.

To deal with this problem, he derived a formula for r_i which will be processed in terms of the parameters and observable variables included in the model proposed to be developed. The formula is written as follows: (for step by step derivation see Appendix 3)

$$(r_i)_t = \frac{(T_i)_t / (1 + \alpha_1 \dot{Y}_{1t} + \alpha_2 \dot{Y}_{2t})}{(X_i)_t / (1 + g_i)_t} = \frac{[(R_i)_t (1 + g_i)_t]}{(1 + \alpha_1 \dot{Y}_{1t} + \alpha_2 \dot{Y}_{2t})} \quad (4)$$

where

T_i = individual tax revenue,

X_i = individual proxy bases,

$\phi_i \psi_{i1}$ = the coefficient of X_i ,

g_i = percentage endogenous changes in X_i during
the first year through the t^{th} year of the
period under review,

$(R_i)_t = (T_i)/X_i)_t$ = average effective individual tax
rate.

The equation with estimable parameters for individual tax
yields can be obtained by substituting (4) in (3) and written
as

$$\log(T_i) = \phi_i \psi_{i0} + \phi_i \psi_{i1} \log(X_i) + (1 - \phi_i) \log(T_i)_{t-1} + \phi_i \psi_{i2} (R_i) [(1 + g_i)] + \phi_i \epsilon_{it} \\ \dots \dots \dots (3')$$

where

ϕ_i = coefficient of adjustment,

ψ_{i1} = long-run elasticity of T_i with respect to X_i ,

$\phi_i \psi_{i1}$ = short-run elasticity of T_i with respect to X_i ,

$\phi_i \psi_{i2}$ = percentage changes in T_i due to one percentage
point increase in r_i (own-DTM direct
response) in the short run,

ψ_{i2} = percentage change in T_i due to one percentage
point increase in r_i (own-DTM direct
response) in the long run.

The parameters of equation (3)' can be estimated by means
of a non-linear econometric estimation method. Time series data
on r_i 's to deal with various tax related economic issues are

obtained after estimating the parameters of equation (3)' and by substituting these parameters in equation (4).

Once the problem of r_i s as observable proxy variables representing individual tax systems is solved by the above formula, the next section, the development of individual tax base equations, is straight-forward.

3.1.2 Individual Tax Base Equations Block

In this section, as the previous one, there is not a single-economic channel through which changes in individual tax systems affect individual tax bases. Because there are different proxy bases which makes it difficult to develop a single- functional form. Due to this, each individual tax base equation will be discussed separately.

Domestic Consumption Tax Base Function

Private consumption (X_d), as a proxy for the potential base of tax on domestic transactions, is considered to be a function of disposable income (Y_d). This is due to the fact that from macroeconomic theory point of view, the level of consumption is mainly dependent on the amount of income received net of taxes, i.e., disposable income.

As discussed earlier, a one tax system change affects indirectly the bases of other tax system through price

mechanism. By entering Y_d as an explanatory variable in this function, the impact of the DTMs related to direct taxes (changes in r_c and r_o) on X_d is explicitly taken into account.

To take into account the indirect effect of import tax system and own tax system of domestic consumption tax on private consumption, another explanatory variable, (r_i/r_d) , is entered into the domestic consumption tax base function.

The relationships of explanatory variables, Y_d and r_i/r_d , with dependent variable, X_d , are assumed to be positively related. The equation can be written as

$$\ln(X_d)_t = \bar{\alpha}_{d0} + \bar{\alpha}_{d1} \ln(Y_d)_t + \bar{\alpha}_{d2} (r_i/r_d)_t + v_{dt} \quad (5)$$

where

X_d = nominal private consumption at factor cost,

Y_d = $GDP - T_c - T_o$, nominal disposable,

$\bar{\alpha}_{d1} > 0$, elasticity of X_d with respect to Y_d ,

$\bar{\alpha}_{d2} > 0$, percentage change in X_d due to one unit increase in (r_i/r_d) ,

v_{dt} = disturbance terms as representative of excluded explanatory variable.

By substituting equation (4) in (5), the domestic consumption tax base function with estimable parameters is derived, that is

$$\ln(X_d) = \bar{\alpha}_{d0} + \bar{\alpha}_{d1} \ln(Y_d) + \bar{\alpha}_{d2} \left\{ R_d \left[\frac{(1+g_i)}{(1+\bar{Y}_d g_i)} \right] + v_{dt} \right\} \quad (5)'$$

$$R_d \left[\frac{(1+g_i)}{(1+\bar{Y}_d g_i)} \right]$$

Import Tax Base Function

As discussed in chapter 2, the base of import tax is the value of imported goods. This base, i.e., value of import, is considered to be a function of nominal GDP at factor cost. In this base function to capture the effect of a change in import tax, domestic consumption tax and corporate income tax system, another explanatory variables, (r_1/r_4) and r_c , are entered in this function. Their relationship to value of imports X_1 , are assumed to have GDP positively related, r_1/r_4 negatively related and r_c positively related. This equation is given as

$$\ln(X_1)_t = \bar{\alpha}_{10} + \bar{\alpha}_{11} \ln(\text{GDP})_t + \bar{\alpha}_{12} (r_1/r_4)_t + \bar{\alpha}_{13} (r_c)_t + v_{1t} \quad (6)$$

where

X_1 = nominal values of imports net of T_1 ,

GDP = nominal Gross Domestic Product at factor cost,

$\bar{\alpha}_{11} > 0$, elasticity of X_1 with respect to GDP,

$\bar{\alpha}_{12} < 0$, percentage changes in X_1 due to one percentage point increase in (r_1/r_4) ,

$\bar{\alpha}_{13} > 0$, percentage changes in X_1 due to a one percentage point increase in r_c ,

v_{1t} = disturbance terms as representative of other sources of variation in X_1 resulting from the factors excluded from the model.

As usual by substituting (4) for r_1 , r_4 and r_c in (6), it is possible to get import tax base function with estimable parameters, that is

$$\ln(X_1)_t = \bar{\alpha}_{10} + \bar{\alpha}_{11} \ln(\text{GDP})_t + \bar{\alpha}_{12} \left\{ R_1 \left[\frac{(1+g_1)}{(1+\bar{y}_{11}g_1)} \right] + \bar{\alpha}_{13} R_4 \left[\frac{(1+g_4)}{(1+\bar{y}_{41}g_4)} \right] + v_{1t} \right\} \quad (6)'$$

Corporate Income Tax Base Function

The proxy base of corporate income tax, i.e., value added in the non-agricultural sector, affected by corporate income tax system (r_c) and the variations in GDP through investment channels. Ehdaie says,

any change in the corporate income tax (say, a decrease in r_c) will affect (raise) the after-tax marginal rate of return to capital in this sector which will influence (enhance) the level of investment in the non-agricultural sector resulting in a change (an increase) in X_1 . Variations in GDP can also affect investment through the acceleration principle which, in turn, influences value added in the non-agricultural sector; that is, an increase (or a decrease) in GDP raises (or reduces) aggregate demand, including demand for goods and services produced in the non-agricultural sector. As a result, investment in this sector rises (or falls), resulting in an increase (or decrease) in X_1 .¹⁶

Another explanatory variable r_1/r_d is entered into corporate income tax base function to take into account the indirect impact of a change in import tax and domestic consumption tax system through price mechanism.

The relationships of these explanatory variables, r_c , GDP, and r_1/r_d with value added in the non-agricultural sector are assumed to be negative in the case of r_c , positive in the case of GDP but the sign is ambiguous in the case of r_1/r_d . According to Ehdaie,

the sign of the coefficient of this variable (∂_{11}) will depend on the sizes of the estimates of ∂_{11} and ∂_{12} , and the shares of X_d and X_1 in GDP as well as on the structure of the import tax system and imports., however, the ambiguity on the sign of ∂_{11} can be easily overcome by disaggregating import taxes into two major categories of imports, in other words, imports of consumption goods and other imports.¹⁷

The equation of corporate income tax base function is assumed to have the following functional form:

$$\ln(X_c)_t = \bar{\alpha}_{c0} + \bar{\alpha}_{c1} \ln(\text{GDP})_t + \bar{\alpha}_{c2}(r_c)_t + \bar{\alpha}_{c3}(r_1/r_4)_t + v_{ct} \quad (7)$$

where

X_c = nominal value added in the non-agriculture sector
net of corporate income tax at factor cost,

v_{ct} = disturbance terms as representative of other
sources of variation of X_c resulting from the
factors excluded from the model,

$\bar{\alpha}_{c1} > 0$, elasticity of X_c with respect to GDP, and

$\bar{\alpha}_{c2} < 0$, percentage change in X_c due to one percentage
point change in r_c .

By substituting (4) in (7) as before, the corporate income tax base function with estimable parameters is obtained. It is represented by (7)'.

$$\ln(X_c)_t = \bar{\alpha}_{c0} + \bar{\alpha}_{c1} \ln(\text{GDP})_t + \bar{\alpha}_{c2} [R_c(1+g_c) + \bar{\alpha}_{c3} \{R_1[(1+g_1)/(1+\bar{y}_1g_1)] + v_{ct} \\ (1+\bar{y}_1g_c)\}]_t + R_4[(1+g_4)/(1+\bar{y}_4g_4)]_t \quad (7)'$$

Export tax base function

The model developed for export tax base function is refers to that, the proxy base of export tax, nominal value of exports net of export taxes, is considered to be a function of the weighted average of GDP of importer countries (GDPw). Our primary objective is to estimate individual and overall tax elasticities with respect to GDP of the home country and secondly to estimate the direct and indirect response of

individual taxes due to a change in one tax system. In this case the export tax revenue and base function are excluded from the entire model.

To sum up and to make clear the discussions made so far, equation (3) is a single equation as representative for all individual tax revenue functions and equation (5), (6), and (7) perform the individual tax base function block of the model. Estimates of their parameters are obtained by estimating the parameters of equation (3)', (5)', (6)' and (7)' by means of a non-linear simultaneous-equation econometric estimation method.

3.1.3 Identities Block

This block is refers to the functional relationship of identities with their related variables. These identities are disposable income and tax revenue net of export taxes.

Disposable income is the difference between GDP and direct taxes. Its linear relationship can be written as

$$(Y_d)_t = (GDP)_t - (T_c)_t - (T_o)_t \quad (8)$$

These the above variables appear in logarithmic form in the equations developed above. In this case for reasons of convenience, it can be also transformed to log-linear form. It is given as follows

$$\ln(Y_d)_t = \bar{U}_0 + \bar{U}_1 \ln(GDP)_t + \bar{U}_2 \ln(T_c)_t + \bar{U}_3 \ln(T_o)_t \quad (9)$$

$$\text{where } \bar{U}_1 > 0,$$

$$\bar{U}_2 < 0,$$

$$\bar{U}_3 < 0.$$

The above priory assumptions indicate that except the coefficient of GDP, both the component of direct taxes have a negative sign. This is due to our definition of disposable income.

The total tax revenue excluding export taxes is simply the sum of the other individual tax yields, that is, in its linear form,

$$(T)_t = (T_c)_t + (T_o)_t + (T_d)_t + (T_m)_t \quad (10)$$

This equation also for reason of convenience, can be converted into the following log-linear form, which allows a direct estimate to be made of the automatic response of the overall tax system to variation in GDP. Since the total tax revenue is the sum of all individual tax yields, the coefficients of these individual tax yield should be positive. This equation in log-linear form can be written as

$$\ln(T)_t = \phi_0 + \phi_c \ln(T_c)_t + \phi_o \ln(T_o)_t + \phi_d \ln(T_d)_t + \phi_m \ln(T_m)_t \quad (11)$$

where

$$\phi_i > 0, \text{ and } i=c,o,d,m.$$

The identity equations which are in log-linear form, (9) and (11) are deterministic functions whose parameters can be estimated either by using the mean value of time series data on the variables included in them or by the OLS estimation method.

Structural Form of the Model

Table 5

$$\begin{aligned}
\log(T_d)_t &= \alpha_d \bar{Y}_{d0} + \alpha_d \bar{Y}_{d1} \log(X_d)_t + (1 - \alpha_d) \log(T_d)_{t-1} + \alpha_d \bar{Y}_{d2}(r_d)_t + u_{dt}, \\
\log(T_m)_t &= \alpha_m \bar{Y}_{m0} + \alpha_m \bar{Y}_{m1} \log(X_m)_t + (1 - \alpha_m) \log(T_m)_{t-1} + \alpha_m \bar{Y}_{m2}(r_m)_t + u_{mt}, \\
\log(T_c)_t &= \alpha_c \bar{Y}_{c0} + \alpha_c \bar{Y}_{c1} \log(X_c)_t + (1 - \alpha_c) \log(T_c)_{t-1} + \alpha_c \bar{Y}_{c2}(r_c)_t + u_{ct}, \\
\log(T_o)_t &= \alpha_o \bar{Y}_{o0} + \alpha_o \bar{Y}_{o1} \log(X_o)_t + (1 - \alpha_o) \log(T_o)_{t-1} + \alpha_o \bar{Y}_{o2}(r_o)_t + u_{ot}, \\
\ln(X_d)_t &= \bar{\alpha}_{d0} + \bar{\alpha}_{d1} \ln(Y_d)_t + \bar{\alpha}_{d2}(r_m/r_d)_t + v_{dt}, \\
\ln(X_m)_t &= \bar{\alpha}_{m0} + \bar{\alpha}_{m1} \ln(\text{GDP})_t + \bar{\alpha}_{m2}(r_m/r_d)_t + \bar{\alpha}_{m3}(r_c)_t + v_{mt}, \\
\ln(X_c)_t &= \bar{\alpha}_{c0} + \bar{\alpha}_{c1} \ln(\text{GDP})_t + \bar{\alpha}_{c2}(r_c)_t + \bar{\alpha}_{c3}(r_m/r_d)_t + v_{ct}, \\
\ln(T)_t &= \bar{\phi}_0 + \bar{\phi}_d \ln(T_d)_t + \bar{\phi}_m \ln(T_m)_t + \bar{\phi}_c \ln(T_c)_t + \bar{\phi}_o \ln(T_o)_t, \\
\ln(Y_d)_t &= \bar{U}_0 + \bar{U}_1 \ln(\text{GDP})_t + \bar{U}_2 \ln(T_c)_t + \bar{U}_3 \ln(T_o)_t, \\
(r_m/r_d) &= \theta_0 + \theta_1(r_m)_t + \theta_2(r_d)_t.
\end{aligned}$$

where

Td=Tax on domestic transaction	(endogenous variable)
Tm=Import tax	(endogenous variable)
Tc=Corporate income tax	(endogenous variable)
To=Other direct tax	(endogenous variable)
Xd=Private consumption	(endogenous variable)
Xm=Imports	(endogenous variable)
Xc=Value added in the non-agricultural sector	(endogenous variable)
Xo=Gross Domestic Product	(exogenous variable)
r_i =The i^{th} individual realized tax rate for $i=d,m,c,o$.	(exogenous variable)
Yd=Disposable income	(endogenous variable)
T=Total tax revenue net of export taxes	(endogenous variable)

3.2. Entire Model and its Dynamic Multipliers

At this stage it is clear that the developed model, equations (3)...for $i=c,d,m,o$, (5), (6), (7), (9) and (11) provide the structural form of the model. This structural form of the model with their variables distinguished with their character either endogenous or exogenous is given in Table 5. By using a non-linear estimation method, efficient and consistent estimates of their parameters are obtained. The equations with estimable parameters are (3)', (5), (7)', (9) and (11) (See Appendix 4).

As discussed earlier, the variable r_i entered into equations as representative of own tax system. It is this impact which plays a crucial role because the own tax system change covers every direct change in rate, base and compliance. These changes are common in most less developed countries. To simplify the derivation of the revenue impact of changes in each individual tax system from the estimated parameters of the model, the study uses, what Ehdaie used, "... the generated time series data on r_i s to linearize (r_i/r_d) in order to keep the entire model in semi-log linear form."¹⁸ According to him, its linear form is obtained by expanding it around the mean values of r_i s using Taylor's series, which gives,

$$(r_i/r_d) = \theta_0 + \theta_1(r_i) + \theta_2(r_d) \quad \text{Appendix 5, the eq. (12)}$$

where $\theta_0 = (r_i/r_d) > 0$,

$\theta_1 = (1/r_i) > 0$, and

$\theta_2 = [r_i/(r_d)^2] < 0$.

As in the case of identities, equation (12) is a deterministic equation whose parameters can be estimated using either the mean value of the generated time series data on r_s or the OLS estimation technique.

3.2.1. Short Run and Long Run Individual and Overall Tax Elasticities

The model developed is disaggregated into three blocks. Out of which the two are individual tax revenue equations and individual tax base functions. As Ehdaie defined the concept of tax elasticity, it is the product of the coefficients of the tax yield to its base and the base to GDP. Moreover, this partitioning provide information concerning the reason for high or low elasticity in terms of the component elasticities. If the rate structure is progressive and the statistical results suggest a low tax-to-base elasticity, it implies either that the composition of base is shifting towards less highly- taxed categories or that the administration is weak.¹⁹ Information is also provided regarding which bases are heavily taxed and which are lightly taxed.

By using a non-linear two stage least square (N2SLS) method, (it is a simultaneous equation system, with ten endogenous, five exogenous and four predetermined endogenous variables, for more detail, see Appendix 5), the short run and long run individual and overall tax elasticities in terms of the parameters included in the model can be obtained. The formula which helps to calculate these elasticities is given in Table 6.

Short Run and Long Run Individual and Overall

Tax Elasticity in terms of the Parameters

Included in the Model

Table 6

Tax Yields	Tax Elasticities
A. Short Run	
Total Tax (T)	$\dot{C}_1 \dot{Y}_{s1} \dot{\theta}_{s1} + \dot{C}_4 \dot{Y}_{d1} \dot{\theta}_{d1} [0_1 + \dot{Y}_{e1} \dot{\theta}_{e1} (0_1 + 0_3 \dot{Y}_{s1})] + \dot{C}_2 \dot{Y}_{e1} + \dot{C}_3 \dot{Y}_{s1}$
- Import Tax (Tm)	$\dot{Y}_{s1} \dot{\theta}_{s1}$
-Consumption Tax (Td)	$\dot{Y}_{d1} \dot{\theta}_{d1} (0_1 + \dot{Y}_{e1} \dot{\theta}_{e1} (0_1 + 0_3 \dot{Y}_{s1}))$
-Corporate Income Tax (Tc)	$\dot{Y}_{e1} \dot{\theta}_{e1}$
-Other Direct Tax (To)	$\dot{Y}_{s1}$
B. Long Run	
Total Tax (T)	$\dot{C}_1 \dot{Y}_{s1} \dot{\theta}_{s1} / 1 - \dot{Y}_{s1} + \dot{C}_4 \dot{Y}_{d1} \dot{\theta}_{d1} [0_1 + \dot{Y}_{e1} \dot{\theta}_{e1} / 1 - \dot{Y}_{s1} + 0_3 \dot{Y}_{s1} / 1 - \dot{Y}_{s1}] + \dot{C}_2 \dot{Y}_{e1} \dot{\theta}_{e1} / 1 - \dot{Y}_{s1} + \dot{C}_3 \dot{Y}_{s1} / 1 - \dot{Y}_{s1}$
-Import Tax (Tm)	$\dot{Y}_{s1} \dot{\theta}_{s1} / 1 - \dot{Y}_{s1}$
-Consumption Tax (Td)	$\dot{Y}_{d1} \dot{\theta}_{d1} / 1 - \dot{Y}_{s1} * [0_1 + \dot{Y}_{e1} \dot{\theta}_{e1} / 1 - \dot{Y}_{s1} + 0_3 \dot{Y}_{s1} / 1 - \dot{Y}_{s1}]$
-Corporate income Tax (Tc)	$\dot{Y}_{e1} \dot{\theta}_{e1} / 1 - \dot{Y}_{s1}$
-Other Direct Tax (To)	$\dot{Y}_{s1} / 1 - \dot{Y}_{s1}$

3.2.2. Direct and Indirect Responses of Individual and Overall Tax Revenues to Changes in the Import Tax System

In this section the need for building this model is to predict how a change in one variable is likely affect other variables over time. It is particularly related to policy measures, i.e., exogenous variables. According to Pindyck and Rubinfeld,

..., one might construct a macroeconometric model, for example, to determine how changes in government expenditure, the money supply, or some other exogenous policy variable will affect future values of the GNP and its components, prices, employment, etc. One might construct a microeconomic model of some industry to forecast the future impact on market equilibrium of changes in personal income (or other demand-determining exogenous variables), changes in export demand, or (if the industry is the regulated one) changes in the government regulatory policy.²⁰

According to them, to evaluate the impact of exogenous variable change no other variables, deriving multipliers will be necessarily.

In this study calculations are made to determine how changes in the import tax system affect individual and overall tax revenues and individual tax bases and also how it uses to evaluate the impact on other macroeconomic variables. The formula which helps for the calculation of direct and indirect responses is given in Table 7 (for detail information, see Appendix 5)

Direct and Indirect Responses of Individual and Overall Tax
Revenues to Changes in the Import Tax System

Table 7

Type of Tax	percentage changes in Tax Yields due to $\Delta r_1 = 1$
A. Short Run Response	
Total Tax	
-Direct Response	$\dot{C}_1 \dot{Y}_{11}$
- Indirect Response	$\dot{C}_1 \dot{Y}_{11} \ddot{O}_{11} \theta_1 + \dot{C}_4 \dot{Y}_{41} \theta_1 (\ddot{O}_{41} + \ddot{O}_{41} \dot{U}_1 \dot{Y}_{c1} \ddot{O}_{c1})$ $+ \dot{C}_c \dot{Y}_{c1} \ddot{O}_{c1} \theta_1$
-Import tax	
-Direct Response	$\dot{Y}_{11}$
-Indirect Response	$\dot{Y}_{11} \ddot{O}_{11} \theta_1$
-Consumption Tax	
-Indirect Response	$\dot{Y}_{41} \theta_1 (\ddot{O}_{41} + \ddot{O}_{41} \dot{U}_1 \dot{Y}_{c1} \ddot{O}_{c1})$
-Corporate income tax	
-Indirect response	$\dot{Y}_{c1} \ddot{O}_{c1} \theta_1$
B. Long Run Response	
Total Tax	
-Direct response	$\dot{C}_1 (\dot{Y}_{11}) / (1 - \dot{Y}_{11})$
-Indirect Response	$[\dot{C}_4 \dot{Y}_{41} \theta_1 / 1 - \dot{Y}_{41}] + [\ddot{O}_{41} + \dot{Y}_{c1} \ddot{O}_{c1} \ddot{O}_{41} \dot{U}_1 / 1 - \dot{Y}_{c1}]$ $+ \dot{C}_1 \dot{Y}_{11} \ddot{O}_{11} / 1 - \dot{Y}_{11} + \dot{C}_c \dot{Y}_{c1} \ddot{O}_{c1} \theta_1 / 1 - \dot{Y}_{c1}$
-Import Tax	
-Direct Response	$(\dot{Y}_{11}) / 1 - \dot{Y}_{11}$
-Indirect Response	$(\dot{Y}_{11} \ddot{O}_{11} \theta_1) / (1 - \dot{Y}_{11})$
-Consumption Tax	
-Indirect Response	$\dot{Y}_{41} \theta_1 / 1 - \dot{Y}_{41} * [\ddot{O}_{41} + \dot{Y}_{c1} \ddot{O}_{c1} \ddot{O}_{41} \dot{U}_1 / 1 - \dot{Y}_{c1}]$
-Corporate Income Tax	
-Indirect Response	$(\dot{Y}_{c1} \ddot{O}_{c1} \theta_1) / (1 - \dot{Y}_{c1})$

3.2.3. Impact of Changes in Import Tax System on key Macroeconomic Variables

To evaluate the impact of change in the import tax system, first efficient and consistent estimates of the parameters for the model computed by means of equation (3)'.

According to Ehdaie the reduced/final form of the model can be used as an empirical framework to evaluate the short run/long run macroeconomic impacts of a tax reform program and to forecast a government's revenues from various sources of taxation. To do so he added,

Time series data on g_s can be easily obtained based on its definition. Using this data and estimates of ϕ_s and $\dot{y}_s$, time series data on r_s are generated by means of equation (4). The generated time series data on r_s can be used independently to explore the impact of changes in import tax system on key macroeconomic variables such as economic growth, inflation, budget deficit, saving, investment and international balance of payment.¹¹

References

- ¹ In many studies, instead of the term "Buoyancy" some authors prefer the term elasticity. In this paper the term elasticity unless otherwise specified, is used throughout to mean built-in income elasticity.
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- ¹⁰ Ibid p.11
- ¹¹ In this section, the theoretical development of the model, particularly different individual tax revenues and bases and identity equations are taken from the study by Jaber Ehdaie, op-cit, p.17-44.
- ¹² Ibid, p.16.
- ¹³ Ibid, p.19, and also See, World Development Report, 1988, p.8-14.
- ¹⁴ Jaber Ehdaie, op-cit, p.18.
- ¹⁵ Ibid, p.19.
- ¹⁶ Ibid, p.28-29.
- ¹⁷ Ibid, p.30.
- ¹⁸ Ibid, p.37.
- ¹⁹ Teame Ghirmay, op-cit, p.98.
- ²⁰ Robert S.Pindyck and Daniel L. Rubinfeld, Econometric Models and Economic Forecasts, International Student Edition, 1986, p.391.
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CHAPTER 4

Application of the Model

The model discussed in chapter three is used to estimate efficient and consistent parameters of the model by means of simultaneous-equation econometric techniques. In this study, these estimated parameters are used, first to estimate the built-in elasticity of the Ethiopian tax system, second to evaluate the macroeconomic impacts of a change in the import tax system, third to deal with various tax-related issues and finally to forecast the effect of a change in the import tax system on future government tax revenue.

4.1 Estimation Method and Empirical Results

The model developed is econometrically applied to the time series data which cover the period running from 1967/68 to 1991/92 Ethiopian fiscal year in order to accomplish our objectives. These data and their corresponding sources are supplied in Appendix I and II.

In every econometric model application, there are many problems which make the estimators biased, inconsistent and inefficient based on the nature of the data. But the possibility of these three failures occurring at once is very rare. Multicollinearity, heteroscedasticity and serial correlation are the major problems.¹ Multicollinearity refers to a situation where the variables dealt with are subject to two or more relations.² The presence of multicollinearity is common but the question is how strong these interrelationships have to be to cause a problem. Thus, with multicollinearity,

the problem is not one of existence or nonexistence but of how serious or problematical it is.³ Fortunately, this economic application has no series multicollinearity problem which is a feature of the sample. Even with the relationships of individual tax system and proxy bases, it is a simultaneity issue which can be easily overcome by expanding the single-equation econometric model. Heteroscedasticity refers to the violation of the assumption that "residuals have a common variance".⁴ This is a problem that is encountered more often in cross-section data than in time-series data. The consequences of heteroscedasticity are twofold:⁵ the estimates of the regression parameters are unbiased but inefficient, and the estimates of the variances are biased. An assumption which is, "residuals U_i are mutually independent", will not always be valid, particularly in time-series data. In time-series data the successive residuals tend to be highly correlated and this correlation is known as serial correlation or autocorrelation.⁶ The explanation often given for the existence of serial correlation in the residuals is that the residuals comprise a number of omitted variables which are themselves serially correlated. In time-series data we often find that the residuals are serially correlated.

In this case because of using time series data, as we have said, there is the possibility of the presence of serial correlation in the model going to be applied. If this is ignored, the estimate of the parameters will be⁷

- a) inconsistent, which mean that conducting any kind of test related to these parameters will be unreliable, and

- b) biased, that is, parameters of such an equation will be over-estimated (or under-estimated) if the coefficient of the serial correlation is positive (or negative).

In models with serially correlated residuals the solution to the serial-correlation bias problem is to estimate the complete model by non-linear regression procedures⁸. For this reason, all the behavioral equations are estimated using two-stage least squares (N2SLS), but for those equations which do not contain a lagged dependent variable, the three equations of individual tax base, a correction for first-order serial correlation is also used. In order to obtain consistent estimates of both the equation coefficients and the serial correlation coefficient, a procedure is devised to combine these estimation techniques, i.e., two stage least square and first order-serial correlation technique.⁹ This procedure involves an iterative process in which a first estimate of the serial-correlation coefficient "p" is obtained, two-stage least squares is performed on the equation in its generalized difference form a new estimate of "p" is obtained, two-stage least squares is again performed.¹⁰ By involving these procedures both together, the efficient and consistent estimates of parameters of the model are obtained.

This estimation technique cannot be applied to individual tax revenue equations, even if serial correlation is present, because the estimate of "p" would be inconsistent for those equations which contain a lagged dependent variable.¹¹ In fact it could be argued that it is not desirable to include a lagged dependent variable as a lagged explanatory variable. But

there is also an argument that including it sometimes provides the best means of imposing a lagged distribution on the equation, and this benefit may outweigh the associated statistical problems.¹² These equations are, therefore, estimated using two-stage least squares without applying a serial-correlation correction system. Based on the above discussion, the hypothesis of zero autocorrelation in individual tax yield equation is not therefore rejected.

As can be seen from Table 8, "Econometric model of taxation in Ethiopia, by means of N2SLS estimation method", all the estimated parameters are with expected signs and plausible sizes. They are significantly different from zero at more than 95% probability level except for those of r_{1s} in import tax revenue equation, in domestic consumption and corporate income tax base function, and the adjustment coefficient of domestic consumption tax. The coefficients of determination and mean-sum of squares of errors presented in this table indicate the goodness-of-fit of the entire estimated model.

The three equations in the identities block, since they are deterministic functions, unlike the seven stochastic equations, are estimated by using ordinary least square (OLS) estimation method and they have expected signs and sizes.

Time series data on g_{1s} could easily be obtained based on its definition. Using these data and estimates of δ_i and $\dot{y}_{1s}$ from Table 8, time series data on r_{1s} are generated by means of equation 4 in chapter 3. These data are presented in Table 10.

Econometric Model of Taxation in Ethiopia

Table 8

(N2SLS Estimation Results)

Equation included in the Model'

Stochastic Equations

$\ln(T_1)_t = -2.079 + 0.907 \ln(X_1)_t + 0.067 \ln(T_1)_{t-1} + 0.037(r_1)_t$
 (-12.2) (13.8) (0.94) (15.15)
 $R^2=0.98$ $MSE=0.03$ $F(8,16)=118.68$

$\ln(T_4)_t = -5.518 + 1.179 \ln(X_4)_t + 0.005 \ln(T_4)_{t-1} + 0.207(r_4)_t$
 (-10.21) (11.52) (0.06) (12.23)
 $R^2=0.99$ $MSE=0.04$ $F(8,16)=282.44$

$\ln(T_c)_t = -2.194 + 0.515 \ln(X_c)_t + 0.015 \ln(T_c)_{t-1} + 0.124(r_c)_t$
 (-0.95) (1.28) (1.52) (3.20)
 $R^2=0.99$ $MSE=0.1$ $F(7,17)=207.74$

$\ln(T_o)_t = -4.828 + 0.979 \ln(X_o)_t + 0.051 \ln(T_o)_{t-1} + 0.467(r_o)_t$
 (-1.12) (1.82) (0.51) (9.92)
 $R^2=0.99$ $MSE=0.02$ $F(4,19)=2151.2$

$\ln(X_1)_t = -2.187 + 1.043 \ln(GDP)_t - 0.058(r_1/r_4)_t + 0.074(r_c)_t$
 (-3.32) (9.08) (-4.05) (9.08)
 $R^2=0.96$ $MSE=0.13$ $F(3,20)=165.82$

$\ln(X_4)_t = 0.657 + 0.898 \ln(Y_4)_t + 0.005(r_1/r_4)_t$
 (0.24) (2.72) (1.26)
 $R^2=0.99$ $MSE=0.04$ $F(3,20)=510.27$

$\ln(x_c)_t = 5.023 + 0.307 \ln(GDP)_t - 0.04(r_c)_t - 0.028(r_1/r_4)_t$
 (0.44) 0.22 (-0.70) (-1.35)
 $R^2=0.99$ $MSE=0.05$ $F(4,18)=304.54$

Identities

$\ln(T)_t = 1.487 + 0.247 \ln(T_1)_t + 0.34 \ln(T_4)_t + 0.209 \ln(T_c)_t + 0.189 \ln(T_o)_t$
 $R^2=0.99$ $MSE=0.015$

$\ln(Y_4)_t = -1.308 + 1.186 \ln(GDP)_t - 0.039 \ln(T_c)_t - 0.027 \ln(T_o)_t$
 $R^2=0.99$ $MSE=0.006$

$(r_1/r_4)_t = 2.79 + 0.281(r_1)_t - 0.624(r_4)_t$
 $R^2=0.94$ $MSE=0.82$

* MSE=Mean Squares errors, . r_i s are in percentage form, Within the parentheses are "t" statistics.

The short run and long run elasticities of individual tax yields and bases and overall tax revenue with respect to GDP, the direct and indirect responses of each individual tax yield to the changes in its own and other individual tax systems are simply obtained by substituting the estimated parameters into the formulas presented in chapter 2. The results are presented in Tables 9 and 11 respectively. To be more specific, in these tables, each of these models are solved as ordinary and difference equations systems in order to estimate the short run and long run impacts of changes in exogenous variables, $\ln(\text{GDP})$ and r_{is} , on endogenous ones, individual tax yields and bases and total tax revenue. The results obtained shows the response of each of the tax yields and bases to changes in GDP, i.e., built-in elasticity ($\hat{\Delta}\text{GDP}=1\%$) and to changes in import tax system ($\hat{\Delta}r_i=1$).

4.2 Interpretation of the Empirical results.

The foregoing section was concerned with the estimation method and empirical results. In this section we deal with the analysis of the results over the period of our study. As can be seen from Table 8, the first four equations are referred to as individual tax revenue equations, the next three stochastic equations as individual tax base equations and the last three equations are known as identities. By means of non-linear two stage least square method, consistent and efficient parameters are obtained. These results and their interpretations are summarized as follows.

All individual tax revenue functions have significant sizes with their own proxy bases. These are 0.91, 1.18, 0.52, and 0.98 for import taxes with imports, domestic consumption taxes with private consumption, corporate income taxes with value added in the non-agricultural sectors, and other direct taxes with GDP, respectively. This means that due to a 1% change in their proxy bases, each individual taxes responds by 0.91%, 1.18%, 0.52% and 0.98%, respectively.

The tax bases to GDP changes also have plausible sizes, 1.04 for imports with GDP, 0.89 for private consumption with disposable income and 0.31 for value added in the non-agricultural sector with GDP. A 1% change in GDP causes imports and private consumption to change by 1.04% and 0.89%, respectively whereas value added in the non-agricultural sector changes by only 0.31%. This implies that the growth rate of the manufacturing sector with respect to GDP is very low.

All the coefficients of the lagged dependent variables in tax revenue equations are below 0.1, which indicates that the adjustment of the long term effect occurs very fast. According to Pindyck and Rubinfeld, if the coefficients are greater than 0.9, the adjustment of the long-term effect occurs only slowly.¹³

As stated earlier, r_{jt} s represent an individual own tax systems change, which means own discretionary tax measures, either in rates or bases. All the coefficients of r_{jt} s in stochastic equations have expected signs and significant sizes except r_1/r_4 in the domestic consumption taxes and corporate

income taxes base equation. The estimated coefficient of r_{is} in each equation shows that discretionary tax measures have had a significant impact on both individual tax revenues and bases. Moreover, it indicates that taxation has been an effective instrument in mobilizing resources from the private to the public sector.

From Table 9, one can observe that the tax system in Ethiopia is inelastic with respect to GDP, whose long run coefficient is below 1 (i.e 0.89). This indicates that major discretionary changes were needed to raise the ratio of tax proceeds to GDP. Import taxes, domestic consumption taxes and other direct taxes are elastic, 1.01, 1.23, and 1.03, respectively. But the unique result here is that corporate income tax is very inelastic, about 0.2 with respect to GDP. This is due to the low growth rate of the manufacturing sector in Ethiopia.

Once again, in Table 9, the elasticity coefficient of imports is 1.04, which means more than the proportional change. This makes clear that Ethiopia is heavily dependent on imports for consumption and/or its investment needs. This may be the cause for an elastic coefficient of import taxes with respect to GDP.

From the generated time series data on r_{is} in Table 10, it can be observed that Ethiopia is highly dependent on import taxation as a source of government revenue. The data under import taxes column fluctuate highly. This indicates that continuous regulation and amendments were made in the country for different objectives. These have a direct effect on

Short Run and Long Run Individual and Overall Tax
Table 9 Elasticities

Tax Yields and bases'	Tax elasticities due to $\Delta \ln(\text{GDP})=1\%$
<u>A: Short Run</u>	
$\Delta \ln(T)$	0.86
$\Delta \ln(T_s)$	0.946
$\Delta \ln(T_d)$	1.221
$\Delta \ln(T_c)$	0.158
$\Delta \ln(T_o)$	0.979
$\Delta \ln(X_s)$	1.043
$\Delta \ln(X_d)$	0.898
$\Delta \ln(X_c)$	0.307
<u>B: Long Run:</u>	
$\Delta \ln(T)$	0.89
$\Delta \ln(T_s)$	1.014
$\Delta \ln(T_d)$	1.227
$\Delta \ln(T_c)$	0.166
$\Delta \ln(T_o)$	1.033
$\Delta \ln(x_s)$	1.043
$\Delta \ln(X_d)$	0.898
$\Delta \ln(X_c)$	0.307

* Base elasticities are simply taken from the regression results.

government tax revenue. This is why Thomas and Nash stated that, "... high dependence on trade taxes in developing countries makes their fiscal balance vulnerable to changes in trade tax system."¹⁴

The direct and indirect impact of the change in import tax system on own tax yield, overall tax revenue, and on other individual tax yields and bases can be seen from Table 11.

Based on the results for the period examined, the direct impact of a one percentage point increase in import tax system, (r_1), increases own tax revenue and total tax revenue by 3.75% and 0.93%, respectively. In other words, this means that the direct impact on own tax and total tax revenue is positively related with the change in import tax system.

The indirect impact represents the effects through their bases. A one percentage point increase in import tax system decreases its own base by 1.6% and value added in the non-agricultural sector by 0.79% but increases private consumption by 0.15%. Through these channels, it decreases its own tax revenue by 1.43% and corporate income tax by 0.14% while it increases domestic consumption tax by 0.19%. The net reduction in overall tax revenue is equal to 0.39%. Here the interesting results are the impact on value added in the non-agricultural sector and on the corresponding corporate income taxes. From point of view demand theory, for instance, an increase in the tariff rates, through price mechanism, will have a positive relation with both value added in the non-agricultural sector and the revenue derived from it, i.e., corporate income tax. In

Generated time Series Data On r₁₅

Table 10

(in percentage)

* EFY Year	Import tax	Domestic Consumption tax	Corporate income tax	Other direct taxes
1967/68	27.79	3.51	—	2.12
1968/69	25.04	3.24	—	2.48
1969/70	28.00	3.12	1.61	1.60
1970/71	26.81	3.14	1.81	1.74
1971/72	25.79	3.63	1.86	1.69
1972/73	33.39	3.67	1.83	1.85
1973/74	34.00	3.54	1.89	1.66
1974/75	27.33	3.93	2.38	1.79
1975/76	26.51	3.30	2.38	1.55
1976/77	32.92	2.81	2.84	1.48
1977/78	36.32	2.75	2.94	1.61
1978/79	19.49	3.54	2.77	2.34
1979/80	18.92	4.55	3.49	2.39
1980/81	20.91	4.76	5.25	2.47
1981/82	17.32	4.78	6.18	2.45
1982/83	17.55	4.90	5.97	2.38
1983/84	16.61	5.51	6.46	2.61
1984/85	16.83	5.74	6.57	2.52
1985/86	13.26	5.42	6.87	2.48
1986/87	18.89	5.93	7.83	2.59
1987/88	19.25	7.01	8.35	2.68
1988/89	16.44	7.31	8.27	2.75
1989/90	23.52	7.39	6.70	2.68
1990/91	25.75	5.66	5.69	2.26
1991/92	35.60	3.73	4.78	1.62
1992/93	35.06	4.45	3.63	1.83

*Ethiopian Fiscal Year

this case, from our results one can judge that the price mechanism has not worked or that it was inefficient in the period under review.

The reduced/final form of the model (Tables 10 and 11) can be used as an empirical framework to evaluate the macroeconomic impact of a tax reform program and to forecast government revenue from various sources of taxation. However, this requires converting the proposed DTMs to r_i s or vice versa. The illustration below is on how to convert a tariff reduction to r_i s in the Ethiopian case.

As we have noted earlier, the Transitional Government of Ethiopia reduced statutory tariff rates (STR) from a maximum of 230% on some goods to a maximum of 80% in order to rationalize protection and to enhance efficiency. According to the projection made by Ministry of Finance, one-third of the reduction in tariff rates is expected to be compensate due to the inclusion of exempted and restricted goods being subject to customs duties. Thus the net reduction is equal to 100%.

The questions are, how much of this reduction in STR will decrease/increase import tax revenue and total tax revenue? And what will be the macroeconomic impact of this discretionary tax measures? Answering these questions requires quantitative knowledge on the impact of a one percentage point increase in tariff rates on both its corresponding and other individual tax yields and bases. Providing such information, first of all, requires converting a one percentage point increase/decrease in tariff rate to r_i .

Direct and Indirect Responses of Individual and Overall Tax
Tax Revenues to Changes in the Import Tax System

Table 11

Tax Revenues and Bases	Percentage Changes in Tax Yields and bases due to $\hat{a}r_1 = \%$
<u>A: Short Run Impacts</u>	
$\hat{a}ln(T)$	-0.0039 (0.0093)
$\hat{a}ln(T_s)$	-0.0143 (0.0375)
$\hat{a}ln(T_d)$	0.0019
$\hat{a}ln(T_c)$	-0.0041
$\hat{a}ln(T_o)$	0.000
$\hat{a}ln(X_s)$	-0.0163
$\hat{a}ln(X_d)$	0.0015
$\hat{a}ln(X_c)$	-0.0079
<u>B: Long Run Impacts</u>	
$\hat{a}ln(T)$	-0.0041 (0.0094)
$\hat{a}ln(T_s)$	-0.0159 (0.0401)
$\hat{a}ln(T_d)$	0.0019
$\hat{a}ln(T_c)$	-0.0043
$\hat{a}ln(T_o)$	0.000
$\hat{a}ln(X_s)$	-0.0163
$\hat{a}ln(X_d)$	0.0015
$\hat{a}ln(X_c)$	-0.0079

* With the parentheses is the direct response of tax revenue to the DTMs.

In Ethiopia the higher tariff rates were imposed on luxury goods such as vehicles. The rates on vehicles were about 100% in 1976, rose to 130% in 1984 and further increased to 230% in 1990. The amount increased in the latter period is equal to 100% (230%-130%). This situation is opposite to the recent tariff reforms. Given this change and time series data on r_1 , in Table 10, the amount of increase in r_1 due to a one percentage point increase in tariff rate is calculated as follows.

As a result of increasing tariff rate from 130% in 1984 to 230% in 1990, r_1 rose from 16.61 to 25.75 in these years. (see Table 10)

Given a 100% increase in rate, r_1 went up by 0.091 percentage points due to a one percent increase in tariff rates. In this case to make a one percentage point change in r_1 equivalent to 100% tariff rate change, we multiply 0.091 by its reciprocal (to hold $\Delta r_1 = 1$). The product of this 0.091 reciprocal, which is equal to 10.9, with individual tax yield and base in Table 11, will give the direct and indirect impacts due to a 100% tariff rate change. The results are given in Table 12 and they are interpreted as follows.

The direct impact due to a 100% tariff rate reduction is that import tax yields and overall tax revenue will be reduced by 40.9% and 10.4%, respectively. These reductions in revenue, *ceteris paribus*, may result in an increase in the overall deficit, which may in turn cause inflationary consequences. Kamin and Rosenbaum (1985) argue that "...tariff

reduction reduces government revenue and increases imports which in turn increases both the budget deficit and the balance of payments deficit."¹⁵

The indirect impact is that imports will increase by 18.1%. Through this effect, import tax and overall tax revenue will increase by 15.9% and 4.3%, respectively. One can easily observe that there is still a net loss, on import tax and overall tax revenues, by 25% and 6.1%.

The Calculated Possible Impacts Due to
a Tariff Rate Change

Table 12

Tax revenues and bases	Short run impacts	Long run impacts
	$\hat{a}_r=1$	$\hat{a}_r=1$
$\hat{a}ln(T)$	-0.043 (0.104)	-0.046 (0.104)
$\hat{a}ln(T_i)$	-0.159 (0.409)	-0.177 (0.446)
$\hat{a}ln(T_d)$	0.0211	0.0211
$\hat{a}ln(T_c)$	-0.0456	-0.478
$\hat{a}ln(T_o)$	0.000	0.000
$\hat{a}ln(X_i)$	-0.181	-0.181
$\hat{a}ln(X_d)$	0.0167	0.0167
$\hat{a}ln(X_c)$	-0.088	-0.088

Another indirect impact is that domestic consumption tax will decrease by 2.1% whereas corporate income tax will increase by 4.7%. Finally, value added in the non-agricultural sector will increase by 18.2% and private consumption will fall by 1.67%.

It is important at this stage to recall some related results obtained by others. According to David Greenaway, based on his cross-country study, dependence on trade taxes is not desirable. He concluded that economic development has an inverse relationship with fiscal dependence on trade taxes. He further concluded that

... separation of total trade taxes into import taxes and export taxes suggests that both are inversely related to economic development. The relationship is stronger and more conclusive in the case of the former, however. It seems reasonable to conclude therefore that the relationship between total trade taxes and development is dominated by the presence of import taxes."¹⁶

Furthermore, Burgess and Stern conclude that " those countries which use import duties heavily are predominantly small and poor open economies with less developed markets. The domestic tax users, on the other hand, tend to be large, for richer countries with diversified economies."¹⁷

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CHAPTER 5

Tax Revenue Projection

The implementations of macroeconomic policies and structural adjustment programs are a recent phenomenon in Ethiopia. The structural adjustment programs use fiscal deficit reduction, i.e., reduction of excess government expenditure over revenue. But other reform, in our case, a tariff reform may have revenue implications. Projections need to be made about the effect of tariff reduction on future tax revenue in order to recommend an alternative means to offset the revenue loss. In the following section an attempt is made to make the five-year tax revenue forecasts based on the current base and the new tariff system.

5.1 Methods and Results of Projection

A widely used method for tax revenue projection is to estimate the tax revenue buoyancy with respect to some postulated determinants from observations in the past and calculate future revenue from the assumed levels of these determinants using the buoyancy.¹ However, the projection based on buoyancy involves the assumption that all discretionary changes which occurred during the historical period taken would be replicated and would have the same effect over the period to be forecast. This, of course, is an unacceptable assumption for forecasting purpose because it is illogical to keep all exogenous variables constant in the future.

Another common procedure followed in forecasting involves the estimation of the income-elasticity of total tax revenue and making forecasts for tax revenue as a whole.¹ Such an approach, however, does not take into account the possibility of different patterns of the economy in the future. This is also unacceptable and not appropriate for our study. In this study the dynamic responses/multipliers, which are developed and estimated in the preceding two chapters, are used for forecasting purpose.

As we have said earlier, the reduced/final form of the model can be used as an empirical framework to forecast a government's revenue. It can be seen in the preceding chapter (chapter 4) that validations of the model are checked whether the estimated coefficients are statistically significant with the proper sign. The goodness-of-fit of the model can also be observed from the coefficients of determination and mean-sum of squares of errors. We want to use our model to make statements about the dynamic response, i.e., the response over time of macroeconomic variables to changes in a particular variable. According to Pindyck and Rubinfeld, "one way to quantify these statements is to calculate and examine the multipliers associated with the model's exogenous variables."¹ These, the calculated multipliers, will help as a main instrument to forecast tax revenue for a given variable change. For our purpose, the multiplier coefficients are calculated for an exogenous variable change, i.e., tariff rate change, which is given in Table 12. By taking these multiplier coefficients, the forecasting process is straight forward. The process is as follows.

The revenue projections cover the period from 1993/94 to 1997/98. Fiscal year 1992/93 is taken as the base year for both import tax and total tax revenues. This year is the most recent year for which firm data are available. The forecasts are made by a step-by-step procedure. The procedure is repeated for all subsequent years and the forecast of a particular year is built on the forecast of the preceding year. This step-by-step forecasting procedure has the following formula:⁴

$$R_{t+1} = R_0 [1 + b(dB/B_0)]$$

where

R_{t+1} = the forecast value of the tax revenue,

R_0 = the level of tax revenue in the preceding year,

$b(dB/B_0)$ = in this study it represents the multiplier coefficients but in the other "b" is the elasticity coefficient and dB/B_0 is the projected proportionate rate of growth of the tax base in the first year.

The crucial assumption here is that the multiplier coefficients are constant and the same for all years under projection. The revenue projections are made under two cases:

Case 1 :- refers to the direct impact of tariff reduction on the own tax and total tax revenue based on their calculated multipliers,

Case 2:- refers to the indirect impact, i.e., the impact of tariff reduction on the value of imports, and through this channel its effect on import tax and total tax revenue.

The details of these two cases and the projected results are presented as follows.

According to the calculated results in Table 12, the direct impact of a tariff reduction is that import tax yields and overall tax revenue will be reduced by 40.9% and 10.4%, respectively. By taking fiscal year 1992/93 as a base year, revenue forecasting is made for the future five years, and the results are given in Table 13.

Projection of the Direct Impact of Tariff

Reduction on Revenue

Table 13

(in millions of Birr)

Tax revenue	1993/94	1994/95	1995/96	1996/97	1997/98
Import tax revenue	411.23	242.63	143.15	84.46	49.86
Total tax revenue	1921.77	1729.59	1556.63	1410.97	1269.88

The indirect impact of a tariff reduction is that due to this reduction the value of imports will be increased by 18.1%. This change (increase) in value of imports will in turn increase import tax yields by 15.9% and total tax revenue by 4.3%. Based on this calculation, the revenue forecasts are given in Table 14.

Projection of the Indirect Impact of Tariff
Reduction on Revenue

Table 14

(in millions of Birr)

Tax revenue	1993/94	1994/95	1995/96	1996/97	1997/98
Import tax revenue	808.52	937.40	1087.38	1261.36	1463.18
Total tax revenue	2220.71	2309.54	2401.92	2497.90	2597.82

5.2 Devaluation and its Relation to the Value of
Imports and Import Taxes

According to many studies, [Dornbuch and Helmers (1988), Edwards (1989), Bonnie, Campbell and Loxeley (1989)]¹, devaluation is a raising of the exchange rate amounted to currency depreciation. The need for devaluation is mainly to tackle the problem of overvaluation of domestic currency and its effect on macroeconomic variables. The basic problem of an overvalued exchange rate is that, like any price distortion, it exerts an adverse impact on economic efficiency and growth.¹

One argument about devaluation is that it improve the trade balance. It seeks to encourage production of exports and import substitutes (tradables) by shifting resources from non-tradables, such as services and home goods. It also promotes exports by depressing domestic consumption of exportables, which is known as expenditure switching.¹ In addition to expenditure switching, devaluation impacts on the balance of

payments through capital flows. It attracts capital inflows and conversely discourages capital outflow.⁸

In contrary, there is an argument against devaluation. According to Bonnie, Campbell and Loxeley,

.... it would not improve the balance of payments, and it would generate inflation thereby causing political tension over income shares and erosion of the budget balance. Furthermore, a devaluation would not succeed in reducing the real exchange rate to some target level, because the inflation it generated would lead rapidly to an appreciation of the real rate, requiring in turn further devaluation and causing, therefore, a never-ending spiral of devaluation-inflation- further devaluation.⁹

It is argued that devaluation, foreign trade (exports and imports), tariff, taxes and charges particularly related to this sector, all are closely interrelated. Comparison between nominal exchange rate and real exchange rate provides an indication of the extent of devaluation that would be required. Disparities among nominal, effective and real exchange rates underline the importance of relating an intended devaluation of an official exchange rate with the existing effective and real exchange rates.¹⁰ If tariffs, taxes and charges on exports and imports are kept unaltered, an adjustment of the official exchange rate would not reduce the relative gap between nominal and effective exchange rate.¹¹ Reduction of this gap requires lowering tariffs, taxes, etc on foreign trade.

Similarly, as far as the effect of devaluation on foreign trade is concerned, when a currency is devalued, the domestic prices of traded goods increase automatically. This means that for the same world prices of traded goods, exporters

receive and importers pay more local currency.¹¹ Due to this it has a clear consequence of encouraging exporters and discouraging importers. The increase in domestic currency prices of exports and imports, flow from the fact that devaluation increases the value of foreign currency measured in units of local currency. As a result of a relatively high cost of imports due to devaluation, imported goods may decline and it would provide or facilitate for greater import substitution. This in turn may reduce tax revenue from imports.

Seen as a whole, devaluation, foreign trade and different taxes related to this trade are greatly linked to each other. As far as this study is concerned, incorporating devaluation could be significant. But due to the present continuous devaluation made in the country (within two months it was devalued three times, 5.13, 5.58 and 5.66 Birr for 1 US dollar), this makes it difficult to determine the present and future impact of devaluation.

5.3 Policy Implications of Tax Revenue

Projection

From the revenue projections made earlier, two important conclusions can be drawn. The first one is that, as can be observed from Table 13, due to a tariff rate reduction, the revenue loss in total tax is greater than the loss in its own tax revenue, i.e., import tax revenue. For instance, the revenue loss in import tax is that, it will be declined from Birr 411.23 million in 1993/94 to Birr 242.63 million in 1994/95. This means the loss is by 168.6 million. But the total tax

revenue loss is that it will be reduced from Birr 1921.77 million in 1993/94 to Birr 1729.59 million in 1994/95. The loss is equal to 192.18 million which is relatively high with that of the loss in import tax revenue, 168.6. It is from the fact that because of a tariff reduction, other individual tax components contribute to further loss in total tax revenue. As we have said earlier, (chapter 4), as tariff is reduced, it indirectly reduces domestic consumption taxes and increases corporate income tax revenue. It may be this reduction in domestic consumption tax that may contribute to further loss in total tax revenue.

The case of Table 14 is a bit unique. The indirect impact of a tariff reduction, which means the impact through its effect on imports, increases import tax revenue by a relatively great amount than an increase in total tax revenue. In general the crucial point to conclude is that, it is very important to take into account the interaction of each individual tax system and their bases to design a certain tax reform.

The second point is that, as can be seen from the projection tables (Table 13 and 14), a tariff reduction reduces import tax and total tax revenue by the amount projected on one path, and it increases import tax revenue and total tax revenue indirectly through its effect on imports on the other. Here there are two different directions. But the important point is that, due to a tariff reduction, there is a net loss of 25% and 6.1% for import tax and total tax revenue, respectively. Thus it is an important point to see this effect, i.e., revenue reduction with the present need of reducing fiscal deficit.

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- ¹ See R.W Bahl, "Alternative Methods for Tax Revenue Forecasting in Developing Countries: A Conceptual Analysis", IMF Occassional Paper, DM/83, 1972, p.3.
- ² Artus Kauko K., "Tax Revenue Forecasting: A Methodological Study with Application to Turkey", Studies in Domestic Finance, IBRD, No.5, 1974, p.7.
- ³ Robert S. Pindyck and Daniel L. Robinfield, Econometric Models and Economic Forecasts, International student edition, 2nd edition, Forg & Sons Ltd, 1986, p.360.
- ⁴ This formula is taken from the study by Roy, Bahl, op-cit, p.15. See this study for different methods of projection and also Artus Kaukok, op-cit, p.29.
- ⁵ See Dornbuch and Helmers, The Open Economy: Tools for Policy Makers in Developing Countries, EDI Series in Economic Development, Oxford University Press, 1988, p.108. See Sebastian Edwards, Real Exchange Rates, Devaluation and Adjutement, The MIT Press, 1989, p.254. See Bonnie, K. Campbell and John Loxeley, Structural Adjustment in Africa, The Macmillan Press Ltd, 1989, p.10.
- ⁶ Eshetu Chole, "The Dismal Economy: Current Issues of Economic Reform and Development in Ethiopia", Ethiopian Journal of Economics, vol-ii, No.1, 1993, p.55.
- ⁷ Dornbuch and Helmers, op-cit, p.118.
- ⁸ Ibid, p.120.
- ⁹ Bonnie, K. Campbell and John Loxeley, op-cit, p.17.
- ¹⁰ Prime Minister's Office, Prospectives on Devaluation in Ethiopia, The Transitional Government of Ethiopia, Addis Ababa, 1992, p.7.
- ¹¹ Ibid, p.8.
- ¹² Eshetu Chole, op-cit, p.57.

CHAPTER 6

Summary and Conclusions

Ethiopia displays many of the features common to developing countries. As in most developing countries, the tax revenue structure is characterized by the dominance of foreign trade taxes, particularly import taxes. In the period from 1967 to 1977, about half of total tax revenue was from taxes on foreign trade, out of which the share of import taxes was about 78% on average (see Table 3). But after 1978, the share declined due to a highly restrictive system of imports, such as high tariff rates, a quota system, lack of foreign currency, a restrictive import licensing system, etc. In 1990, 1991 and 1992, the share of import taxes in foreign trade taxes was 94.7%, 97.8% and 96.0%, respectively. This indicates that the contribution of export taxes was insignificant. This was due to a declining trend of export values, basically due to a fluctuation and deterioration in the prices of primary exports (particularly coffee) in the world market and also the existence of smuggling of coffee which is the main source of export tax revenue.

Import taxation, in addition to its revenue contribution, was used to protect domestic industries and to promote equity in consumption. The protection objective, as we have discussed earlier, yields an efficiency loss, particularly distortions in relative prices, which interfere with industrial specialization.

Nowadays Ethiopia is implementing a structural adjustment program, following the recommendations made by IMF and the World Bank.

Tariff reforms are one aspect of the package of trade policy reform supported by World Bank adjustment lending. Tariff reforms aim to rationalize the tariff code, reduce the dispersion of rates, and lower the average tariff rate in order to cease discrimination against private sector imports and rationalize the protective system. However, since many tariff reforms are undertaken during periods of stabilization and fiscal austerity, the potential loss of tax revenues from lowering and unifying tariff rates is an important issue which needs special consideration.

In Ethiopia, the tariff structure was revised in 1993. This reform reduced the 230% maximum rate on some goods to a maximum of 80%. With overall fiscal deficit amounting to 11.0% and 11.6% of GDP in 1992 and 1993, respectively, revenue losses arising from tariff reductions must be forestalled. The tradeoff between moves toward open trade and fiscal imperatives is thus frequently central to policy reform. In this case it is important to evaluate the macroeconomic impact of a tariff reform and to project its impact on future government tax revenue.

The model developed uses to estimate the short run and long run elasticities of individual tax yields with respect to GDP. More importantly, the application of the model helps to evaluate the critical issues, which are the possible direct and

indirect impact of tariff reform on key macroeconomic variables. The major findings emerging from the analysis of the preceding chapters may now be brought together as follows.

First, the tax system in Ethiopia has been found inelastic with respect to GDP, whose longrun coefficient is below 1 (i.e., 0.89). Import taxes, domestic consumption taxes and other direct taxes are elastic, 1.01, 1.23, and 1.03, respectively, while corporate income tax is very inelastic, about 0.2 with respect to GDP. This is due to the low growth rate of the manufacturing sector in Ethiopia.

The elasticity coefficient of imports is 1.04, which means more than proportional change, whereas value added in the non-agricultural sector and private consumption are inelastic, 0.31 and 0.89, respectively. The elastic coefficient of imports indicate that Ethiopia is heavily dependent on imports for consumption and/or its investment needs. This may be the cause for an elastic coefficient of import taxes with respect to GDP.

With respect to the direct impact of the change (reduction) in tariff rate, as calculated in Table 12, it has been found that import tax yields will be reduced by 40.9% and overall tax revenue by 10.4%. These reductions in revenue, ceteris paribus, may result in an increase in the overall fiscal deficit, which may in turn cause inflationary consequences. Again, the revenue loss due to a tariff reduction, through its effect on the external current account, ceteris paribus, will in turn increase the balance of payments deficit. This is because national investment will exceed

national saving due to a loss in revenue. This means it is equal to current account deficit. Thus the revenue loss will increase the balance of payment deficit indirectly. Since it is argued that the revenue loss affects national saving, in this case it will have a clear direct effect on economic growth, particularly as far as the contribution of the government in different sectors of the economy is concerned.

The indirect impact is that imports will increase by 18.1%. Through this effect, import tax and overall tax revenue will increase by 15.9% and 4.3%, respectively. One can easily observe that there will still be a net loss. Due to an increase in the value of imports, the trade balance will be affected, and this has an indirect contribution to a further balance of payments deficit.

Another macroeconomic impact due to tariff reduction is that revenue from domestic consumption tax will decrease while revenue from corporate income tax will increase. Finally, value added in the non-agricultural sector will raise and private consumption will fall.

In general, due to a tariff reduction, a massive revenue loss will emerge and this will directly affect other macroeconomic variables such as the overall fiscal deficit, inflation, the balance of payments and economic growth.

A tariff reduction designed to encourage outward-oriented development will work only if alternative sources can be found to replenish revenue lost in the cause of reducing protection.

Tariff reform can be aborted or leads to further distortions if complementary macroeconomic policies, specifically tax reforms, are absent. Integrated reform of tariffs with taxes would seem to be the answer.

It is important at this stage to highlight some points that can offset the revenue loss due to a tariff reduction.

The impact of tariff reduction on tax revenue needs to carefully assess the exemption status of imports. As reported earlier, only about 45% of the value of imported goods has been subject to the tax in the past. Even under a new tariff code, there are still many exempted goods. Exemptions either for specific type of goods, for specific importers, to some extent are important but otherwise if their coverage are wide, then are endemic in tariff systems. Direct evidence on the amount of tariff revenue lost to exemption is difficult to come by. The revenue implications of large changes in rates can be offset by modest changes elsewhere in the system of exemptions. The benefit of eliminating exemptions is primarily transparency. At this critical time when there is a need to offset the revenue loss due to tariff reduction, moving those exempted items to lower rates would actually increase revenue. The numerous exemptions should be eliminated.

The evidence cited earlier shows that domestic consumption taxes have proved to be the most elastic and productive revenue source in Ethiopia. One of the World Bank's recommendations to offset the revenue loss due to a tariff reduction is to introduce VAT or other domestic taxes such as a sales tax. But

this recommendation seems to have an adverse effect in Ethiopia's case because domestic consumption taxation in this country is widely employed, as indicated by its elasticity coefficient. In this case applying this recommendation will not be desirable. What recommended as a means here is that not to impose additional burden on consumers by introducing VAT, but trying to eliminate administrative constraints related to the domestic tax system and trying to expand the domestic tax base, such as introducing a single-stage sales tax on goods previously exempted from domestic tax payment, depending on revenue requirements.

The corporate income tax is inelastic. Even though it is common for most developing countries, the amount is very low in Ethiopia. There is a general reform to encourage the base of this tax system, i.e., investment, nowadays in Ethiopia. If the reform will be effective, i.e., investment will grow rapidly in future, corporate income taxation will be used as an important source of government revenue. In this case, in the long run corporate income tax will be one of tax components capable of offsetting the revenue loss due to a tariff reduction.

As far as the future tariff structure is concerned, the tariff reform of Ethiopia is ambiguous. It does not follow the standard reduction system which can be seen in the literature on international trade, i.e., concertina method which collapses the structure by reducing the top rate at each step of the transition to the next-highest level, while leaving other rates the same and the radial method which reduces all

tariff rates to a fraction of their previous levels (Dornbuch and Helmers, 1988). In fact there is no strict rule to follow. Every method has its merits and demerits, particularly from the point of view of social welfare. A uniform tariff rate is one of the systems recommended by the World Bank. A uniform tariff rate raises consumer prices by an equal proportion over world prices. This system contradicts with the objective of promoting equity in consumption. Where there is a wide gap in income distribution and variation in consumption patterns across different households, this system will favour the upper income group. It is not recommended for Ethiopia at this early stage. In this case differentiation is needed in rate structure in order to keep the objectives of equity in consumption until other macroeconomic policies facilitate preconditions for these objectives.

The extent of differentiation in the rate structure must be chosen in the light of international experience and the country's administrative capabilities.

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Appendix I

Individual and Total Tax Revenue

(in millions of Birr)

Year	Total Tax	Import Tax	Export Tax	Tax on Domestic Transaction	Corporate Income Tax	Other Direct Tax
1968	315.5	108.5	25.8	104.1	NA	77.1
1969	332.1	104.1	24.2	106.0	NA	97.8
1970	371.8	112.6	40.1	115.7	31.7	71.7
1971	407.1	120.3	36.3	127.7	39.5	83.3
1972	433.2	121.1	31.9	145.8	43.6	90.8
1973	483.8	139.9	51.5	150.8	47.4	94.2
1974	537.1	166.3	50.8	168.2	55.3	96.5
1975	589.8	176.3	42.6	194.1	74.3	102.5
1976	613.3	178.8	86.2	174.0	76.5	97.8
1977	855.8	246.7	218.7	181.4	98.3	110.7
1978	938.9	244.5	281.8	186.8	104.1	121.7
1979	1146.5	333.7	228.3	268.9	117.4	198.2
1980	1298.2	247.2	297.1	373.6	161.5	218.8
1981	1361.8	296.7	188.3	387.3	256.8	232.7
1982	1436.4	284.7	190.4	396.2	326.2	239.9
1983	1558.0	306.8	203.8	443.1	344.7	259.6
1984	1731.5	321.2	257.9	495.5	384.5	275.4
1985	1677.5	293.0	172.8	523.7	416.5	271.5
1986	1876.3	293.2	262.9	554.2	467.9	298.1
1987	2092.4	408.5	153.7	623.9	582.1	324.2
1988	2317.8	437.9	147.1	720.4	662.1	350.3
1989	2371.0	360.2	164.4	784.5	683.9	378.1
1990	2159.1	430.6	49.8	759.4	553.4	371.1
1991	2114.0	503.0	28.3	758.7	477.8	346.2
1992	1591.0	425.4	9.3	540.0	380.4	251.2
1993	2135.3	697.0	18.7	711.2	376.8	331.6

Source: Ministry of Finance
 NA. Data not available
 * Ethiopian Fiscal Year

Appendix II

Individual and Total Tax Proxy Bases

(in millions of Birr)

Year'	GDPmp	Import	Export	Private Consumption	Value Added in the Non-Agri.
1968	3858.0	390.3	252.7	2990.0	1590.7
1969	4085.4	415.7	266.0	3217.4	1707.9
1970	4482.8	402.1	298.1	3541.3	1845.8
1971	4733.3	448.7	305.9	3804.9	2004.1
1972	4768.1	469.6	314.4	3744.4	2130.6
1973	5030.4	418.9	384.1	3821.8	2297.8
1974	5577.3	489.1	502.4	4269.9	2535.6
1975	5551.0	645.1	556.2	4405.4	2679.8
1976	5995.8	674.5	478.3	4678.3	2753.9
1977	6854.5	749.5	580.5	5514.9	2937.5
1978	7252.9	673.1	688.0	5865.8	3006.5
1979	8071.3	1198.8	615.7	6483.4	3508.7
1980	8540.7	1306.6	864.3	6880.8	3788.7
1981	8720.7	1418.9	879.1	6851.3	4007.9
1982	8997.8	1643.6	805.1	7009.8	4268.8
1983	9759.4	1748.3	836.2	7370.8	4670.4
1984	9835.5	1933.9	832.7	7431.0	4814.6
1985	9923.5	1740.5	862.8	7529.4	5065.4
1986	10905.6	2211.4	699.2	8375.9	5446.3
1987	11398.9	2162.9	961.3	8623.2	5865.4
1988	11850.9	2274.5	765.6	8421.1	6264.2
1989	12413.5	2191.2	871.7	8654.5	6527.2
1990	12430.2	1831.1	935.0	8416.2	6520.1
1991	13669.8	1953.2	613.8	10709.7	6542.2
1992	13384.5	1194.9	390.4	11582.4	6191.4
1993	16126.8	1987.8	503.9	12625.6	8078.6

Source: Ministry of Planning and Economic Development and
National Bank of Ethiopia

* Ethiopian Fiscal Year

Appendix III

Entire Model with Estimable Parameters

$$\begin{aligned}
 \ln(T_d)_t &= \phi_{d0} + \phi_{d1} \ln(X_d)_t + (1 - \phi_{d1}) \ln(T_d)_{t-1} + \phi_{d2} [R_d (1 + q_d) / (1 + \psi_{d1} q_d)] + \epsilon_{dt} \\
 \ln(T_c)_t &= \phi_{c0} + \phi_{c1} \ln(X_c)_t + (1 - \phi_{c1}) \ln(T_c)_{t-1} + \phi_{c2} [R_c (1 + q_c) / (1 + \psi_{c1} q_c)] + \epsilon_{ct} \\
 \ln(T_s)_t &= \phi_{s0} + \phi_{s1} \ln(X_s)_t + (1 - \phi_{s1}) \ln(T_s)_{t-1} + \phi_{s2} [R_s (1 + q_s) / (1 + \psi_{s1} q_s)] + \epsilon_{st} \\
 \ln(X_d)_t &= \theta_{d0} + \theta_{d1} \ln(Y_d)_t + \theta_{d2} [R_d (1 + q_d) / (1 + \psi_{d1} q_d)] + v_{dt} \\
 &\quad R_d [(1 + q_d) / (1 + \psi_{d1} q_d)] \\
 \ln(X_c)_t &= \theta_{c0} + \theta_{c1} \ln(GDP)_t + \theta_{c2} [R_c (1 + q_c) / (1 + \psi_{c1} q_c)] + \theta_{c3} [R_c (1 + q_c) / (1 + \psi_{c1} q_c)] + v_{ct} \\
 &\quad R_c [(1 + q_c) / (1 + \psi_{c1} q_c)] \quad (1 + \psi_{c1} q_c) \\
 \ln(X_s)_t &= \theta_{s0} + \theta_{s1} \ln(GDP)_t + \theta_{s2} [R_s (1 + q_s) / (1 + \psi_{s1} q_s)] + \theta_{s3} [R_s (1 + q_s) / (1 + \psi_{s1} q_s)] + v_{st} \\
 &\quad 1 + \psi_{s1} q_s \quad R_s [(1 + q_s) / (1 + \psi_{s1} q_s)] \\
 \ln(T)_t &= \phi_0 + \phi_1 \ln(T_d)_t + \phi_2 \ln(T_c)_t + \phi_3 \ln(T_s)_t \\
 \ln(Y_d)_t &= \theta_0 + \theta_1 \ln(GDP)_t + \theta_2 \ln(T_c)_t + \theta_3 \ln(T_s)_t \\
 g(i) &= \ln(X_i)_t + \ln(X_i)_t \\
 &\quad \text{for } i = d, m, c, o.
 \end{aligned}$$

Appendix IV

To deal with this gap, r_i is defined as follows

$$(r_i) = [A_i / X_i']$$

where

$(A_i)^t$ = the i^{th} individual tax yield at time "t" net of the changes caused by endogenous changes in its base during the first year through the t^{th} year of the period under review, and

$(x_i')^t$ = the i^{th} individual tax base at time "t" net of endogenous changes during the first year through the t^{th} year of the period under review.

It is revealed from this definition that the value of r_i in a given year, say "t", represents the average effective tax rate of the i^{th} individual tax in that year in the absence of endogenous changes in its base and in its tax yield during the first through the t^{th} year of the period under review. Therefore, r_i directly reflects all changes in the i^{th} individual tax system.

The main problem is that r_i is not an observable variable because time series data on X_i' and A_i are not available. In this case another formula is needed.

The study uses the formula derived for each of these variables and, hence, for r_i in terms of the observable variables and parameters included in the model, whose substitution in equation (3), in chapter 3, generates an individual tax equation with estimable parameters. The derivation of the formula is as follows.

Let g_{it} denote percentage "endogenous" changes in the i^{th} individual tax base during the first year through the t^{th} year of the period under review. Using g_{it} , the i^{th} individual tax base (X_i) is decomposed into row separable parts in terms of its two major sources of variation mentioned above, that is,

$$(X_i)_t = (X_i')_t (1+g_{it}) \quad (5)$$

(X_i') is that part of $(X_i)_t$ which is exogenously affected by changes in its potential tax base made by fiscal authorities and $(1+g_{it})$ is that part of $(X_i)_t$ which is influenced by the factors resulting in endogenous changes in $(X_i)_t$.

By solving equation (5), the following formula is obtained for X_i'

$$(X_i')_t = (X_i)_t / (1+g_{it}) \quad (6)$$

According to the definition of r_i , its coefficient in equation (3) (see chapter 3), $\delta_i \dot{Y}_{it}$ measures the direct response of the i^{th} individual tax to DTMs (own-DTM direct response), and the coefficient of X_i , $\delta_i \dot{Y}_{it}$, measures its response to the endogenous changes in its base (elasticity of T_i with respect to X_i). Using $\delta_i \dot{Y}_{it}$, each individual tax yield can be decomposed into two separable parts in terms of its two major sources of variation. These are changes in its own tax system and endogenous changes in its tax base, presented as follows

$$(T_i)_t = (A_i)_t (1 + \delta_i \dot{Y}_{it} g_{it}) \quad (7)$$

where

$\delta_i \dot{Y}_{it} g_{it}$ = the percentage change in the i^{th} individual tax yield during the first year through the t^{th} year of the period under review which result from g_{it} percent endogenous changes in its base taken place throughout the same period.

A_i is that part of T_i which is directly affected by changes in the i^{th} , which is the only source of variation.

By solving equation (7), the following formula is derived for A_i .

$$(A_i)_t = [(T_i)_t / (1 + \delta_i \dot{Y}_{i1} g_{it})] \quad (8)$$

Now by substituting (6) and (8) in (4) (see chapter 3), the following formula for r_i ,

$$(T_i)_t / (1 + \delta_i \dot{Y}_{i1} g_{it}) = [(R_i)_t (1 + g_{it})] \quad (9)$$

$$(r_i) = (X_i)_t / (1 + g_{it}) \quad (1 + \delta_i \dot{Y}_{i1} g_{it})$$

where $(R_i)_t = (T_i)/X_i$ = average effective individual tax rate.

Appendix V

The structural form of the model with estimated parameters will include ten equations... equation (3) for $i=d, c, o, m$ and (10), (11), (12), (14), (16) and (17)... and ten endogenous, five exogenous, and four predetermined endogenous variables. It is a simultaneous equation system which can be written in the following form using matrix notation.

$$A + B(Y)_t + C(Y)_{t-1} + D(X)_{t=0} \quad (18)$$

Where

$A=10 \times 10$ matrix of constant terms,

$B=10 \times 10$ matrix of coefficients of dependent variables

$C=10 \times 10$ matrix of coefficients of lagged dependent variables,

$D=10 \times 5$ matrix of coefficients of exogenous variables,

$Y_t = 10 \times 1$ column vector of endogenous variables, and

$X_t = 5 \times 1$ column vector of exogenous variables.

By treating predetermined lagged dependent variables as exogenous ones, the model is an ordinary equation system; by solving it, the reduced form of the model is obtained, that is

$$Y_t = -B^{-1}A - B^{-1}C(Y)_{t-1} - B^{-1}D(X)_t \quad (19)$$

Using a non-linear two stage least square (N2SLS) method, the short run and long run individual and overall tax elasticities in terms of the parameters included in the model can be obtained.

In equation (19), each of the endogenous variables is a function of all the exogenous variables included in the model... these are $\ln(GDP)_t$, $\ln(T_i)_{t-1}$ and r_{ij} s. The ij^{th} element of $[-B^{-1}D]$ measures the instantaneous impact of a unit change in the j^{th} exogenous variable on the i^{th} endogenous variable (impact multipliers).

For instance, the i^{th} individual tax yield equation in its reduced form will be:

$$\ln(T_i)_t = q_{i0} + q_{i1}\ln(GDP)_t + \alpha q_{i11}\ln(T_i)_{t-1} + \alpha q_{i1j}(r_j)_t \quad (20)$$

where

$$j = m, d, c, o$$

q_{i1} = short-run elasticity of the T_i with respect to GDP,

q_{i1j} = percentage changes in T_i due to a one percentage

point in r_j , for $i \neq j$, it measures the short run impact of changes in the j^{th} individual tax system on the i^{th} individual tax revenue (cross -DTM indirect response), and, for $i=j$, it measures the short run overall impact of a one percentage point increase in r_i on its corresponding tax yield (sum of the own-DTM direct and indirect responses). Its short run own-DTM direct response is measured by the coefficient of r_i in equation (3), in chapter 3, in other words, $\dot{y}_{ii}$; therefore, its short run own-DTM indirect is simply measured by $q_{i(i)} - \dot{y}_{ii}$.

By treating lagged dependent variables as endogenous ones, the structural form of the model is a system of difference equations; by solving it, the final form of the model is

$$Y_t = [I + B^{-1}C]^{-1} [-B^{-1}A] + [I + B^{-1}C]^{-1} [-B^{-1}D] (X)_t \quad (21)$$

Where

$I = 10 \times 10$ unit matrix

In this equation, each of the endogenous variables is a function of all the exogenous variables included in the model... these are $\ln(\text{GDP})$ and r_j s. The ij^{th} of $\{[I + B^{-1}c]^{-1} [-B^{-1}d]\}$ measures the total impact of a unit change in the j^{th} endogenous variable (total multipliers).

For instance, the i^{th} individual tax yield equation in its form will be:

$$\ln(T_i)_t = w_{i0} + w_{i1} \ln(\text{GDP})_t + \sum w_{ij} (r_j)_t \quad (22)$$

for $j = m, d, c, o$

where

w_{i1} = long-run elasticity of T_i with respect to GDP, and

w_{ij} = the long-run response of T_i to one percentage point change in r_j

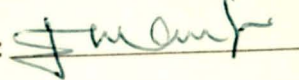
The elements of $[-B^{-1}]$ in equation (20) related to the coefficients of $\ln(\text{GDP})$, and the elements of $\{[I+B^{-1}C]^{-1} [-B^{-1}D]\}$ in equation 22 which are related to the coefficient of $\ln(\text{GDP})$, measure the short-run and long-run individual and overall tax elasticities.

Similarly the elements of $[-B^{-1}D]$ related to the coefficients of r_j s, and $\{[I+B^{-1}C]^{-1} [-B^{-1}D]\}$ related to the coefficients of r_j s measures the short-run and long-run direct and indirect responses of tax revenues to DTMs.

DECLARATION

I, the undersigned, declare that this is my work and that all sources of materials used for the thesis have been duly acknowledged.

Name : Messfin Midekssa

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Place : Addis Ababa

Date of submission : June 24, 1994.