

ADDIS ABABA UNIVERSITY
School of Graduate Studies

**Productivity of Government Spending and Test of Causality Between
Government Expenditure and Economic Growth**

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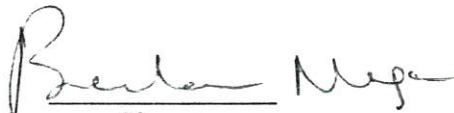


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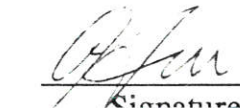
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ACKNOWLEDGMENT

I would like to thank my advisor Prof. Teshome Mulat whose advice has contributed to the betterment of this paper. Intellectually, my greatest indebtedness goes to my friend Ato Alemayehu Geda (PhD student) who has devoted his time in supplying the necessary materials and invaluable comments which really has improved the paper.

Thanks are due to my parents who financed me to complete my study as self-sponsored student. I should also like to express my thanks to Genet H/Mariam who typed the whole manuscript.

ACKNOWLEDGEMENT

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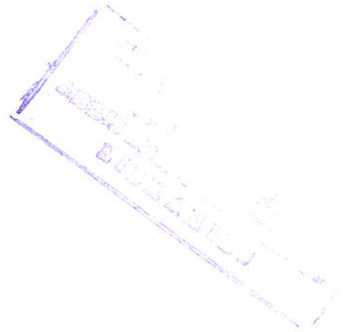
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Abstract

Government expenditure as one of major instrument of fiscal policy is now becoming the growing concern in almost all countries. Countries who follow the world bank sponsored structural adjustment program (SAP) need to revise their policy of public spending. Ethiopia, being one of them, is going in restructuring its public resources allocation. Thus policy makers need to know the productivity of public expenditure.

This paper deals with how public spending did behave for the last three to four decades and test the causal relation between the growing public expenditure and national income. Using Granger causality and Translog production function, the available Ethiopian data show the presence of instantaneous bidirectional causal relation between growth of real percapita income and government expenditure. The elasticity estimates of the translog production function show government expenditure on human resource development and capital expenditure have the greatest effect on economic growth. Hence, the new government of Ethiopia has to give due consideration to these sectors' development when it restructures the existing fiscal policy (expenditure restructuring).



CHAPTER I

I.INTRODUCTION

1.1 Statement of the Problem and Importance of the Study

The fact that the market mechanism alone can not perform all economic functions calls for Government intervention in the economy. Thus, public policy is needed to guide, correct and supplement the economy in certain desired ways.

Fiscal policy, which was traditionally concerned with the provision of services by government and the mobilization of resources needed for financing them, consists of the use of taxes, government spending and public debt operations. The role of fiscal policy in the long-run in developing countries is more positive, in that it is geared to the mobilization of revenue resources, to their allocation among competing priorities, and to ensuring that the broad direction of the movements in the economy are in conformity with national aspirations.

Out of the three major instruments of fiscal policy (namely, taxes, spending and borrowing) expenditure is now becoming the growing concern in almost all developing countries. As a general trend, in the past four or five decades, public expenditure in every country has increased rapidly and it was also diversified.

As a result of this growth and diversification, there is an increasing awareness in government circles of developing and developed countries alike of the need to bring public expenditure under better control.

Different governments may have different views about the proper size of public expenditure, but all have the same task of reconciling it with government revenue. As a related issue, the public administrators and politicians have all shown great concern about the need for effective machinery to ensure that services are provided economically and efficiently.

Conventionally, public expenditure expressed as a proportion of gross national product (GNP) is used to demonstrate the size and growth of public spending. "No hard and fast rules can be laid down regarding the desirable magnitude and rate of growth of public expenditure, as much depends on the institutional factors and the timing.¹ The increase in public expenditure over time can be measured using elasticity (i.e the percentage change of public expenditure with respect to a percentage change of gross domestic product (GDP)). In Ethiopia, as in the case of any other countries, public spending shows a continuous increment for the past thirty or forty years. "Before 1975 the ratio of government expenditure to GDP was less than 21.7% which was less than the average for the developing countries (22.4%) but in the post 1975 years this ratio markedly increased and by the year 1990 it reached 45.2%." ²

¹ Department of Technical Co-operation for development planning and control of public current expenditure lessons of country experience, United Nations, New York, 1987 (sales No.E.87 II.H.3)p.15

² Teshome Mulat, "Trends in government Finance, Ethiopian Journal of Economics, Vol.II No.1 April 1993 p.75

This growth in public expenditure is caused by political, economic and socio-demographic factors. The growth and distribution of public expenditure is the outcome of political decisions that can be attributed to the changing role of Government in fiscal policy. While in the past (pre 1974) the role of the Ethiopian government had been mostly limited to the allocation of resources and economic stabilization, the post 1974 Ethiopian government followed a "socialist" system of economic management where the role of the government goes beyond mere resource allocation and stabilization of economic activities. It was involved in productive and distributive activities. After the overthrow of the "derg" regime, the new government changed the centrally planned socialist economy into a market economy, and it also accepted the structural adjustment program (SAP) of the IMF and WB.

Once the government accepted this structural adjustment program, the main concern in public finance are:

- (a) Reforming revenue system- that is the economic cost of raising more revenue must be weighted against the cost of cutting public spending. Since as a rule more revenue and less spending will be needed.
- (b) Improving the allocation of public spending- government can promote both economic growth and equity by supplying the physical infrastructure needed for productive private investment and by providing social services to meet the basic needs, improve the productivity of labour and also strengthen public finance through reform of state-owned enterprises.

To accomplish such tasks policy makers need to peruse a research on how to raise and allocate public funds effectively. In line with this need, in this paper I will analyse how government spending was growing, what was the causative relation between government spending and National income and the effect of sectoral allocation of government expenditure on the productivity of the economy.

To explain the continuous increment in public spending we chose the following three models because of their simplicity and popularity.

Development models of public expenditure growth: Proponents of this model argue that the public sector has to provide social overheads such as roads, transportation systems, Sanitation systems, law and order, health and education and other investments in human capital. This public sector investment, it is argued, is necessary to gear the economy toward "take-off" and to a higher level of economic and social development.

Wagner's law- For Wagner the growth of public expenditure represents superior (or income elastic) wants for public good. Thus as real income in the economy rises (i.e. as real GNP increases) public expenditure on these services would rise more than proportionately, which would account for the rising ratio of government expenditure to GNP.

Peacock and Wiseman's model: Peacock and Wiseman formulated their analysis upon a political theory of public expenditure determination, namely governments like to spend more money, that citizens do not like to pay more taxes, and governments need to pay some attention to the wishes of their citizens. In normal times, therefore, public

expenditure would show a gradual upward trend as the economy grows. During period of social upheaval, however, this gradual upward trend in public expenditure would be disturbed. Social upheaval is usually associated with war, famine or some large scale social disasters.

Using the available time series data, first, the cause and effect relationship between public expenditure growth and national income are examined. Generally, past fiscal studies postulated that growth in public expenditure over time is caused by national income, while a few macroeconomic models tends to switch the causality in the relationship. "Although each line of enquiry has thrown interesting light on the phenomena, in neither case has the assumed causative process has been subjected to rigorous empirical pretesting. Purely a priori judgements for choosing between the two competing postulates are rendered difficult because of the possibility of feedback in macro relations which tend to obscure both the direction and the nature of causality."³

It is clear that knowledge of the true nature of the causative process will help to determine that if the causality were Wagnerian, public expenditure is relegated to a passive role, if it was keynesian on the other hand, it acquires the status of an important policy variable.

Second, government deficits in most developing countries and especially in countries like Ethiopia, which are introducing market reforms are expected to respond to this measures by reducing public spending. An understanding of the productivity of the

different compositions of public spending and of their implications for economic growth by policy makers is a key consideration in the development of adjustment strategy. Hence, the study will give some empirical support for the development strategy that argues for curtailment of public spending on unproductive activities and higher spending on productive ones.

Thus, this paper will attempt to answer these questions by examining empirically how the growth performance of Ethiopian economy was affected through time by the composition of public expenditures. It is hoped that the data will tell which components of public expenditure contributed to faster economic growth in the long-run. This can be used as a guide to policy making.

1.2. Hypotheses of the Study and It's Limitations

Overall economic growth is a necessary condition for long-term development; therefore, the incidence of public spending on the pace of growth is of fundamental importance. Thus, what has been the experience of Ethiopian during the past twenty to thirty years? What was the role of the state in the economy? And what should be done with the on going structural adjustment program? It is hypothesised that public spending causes an increase in GDP through increasing the productivity of private investment. The paper seeks to find some answers to the following set of questions.

- (a) To what extent does the pattern of growth in public spending and national income go hand in hand.
- (b) What has been the trend of government expenditure and the GDP.

- (c) What effect, if any, does public expenditure have on economic development?

Attempt is made to answer the above three questions using available data.

The study suffers from considering only the expenditure side without looking at the incidence of the revenue structure. It is believed that a more comprehensive approach would have resulted in more concrete conclusions. Even an analysis of the direct social incidence of public expenditure will not be covered here. Thus, though not exhaustive the study will be limited to the effect of government expenditure on economic growth.

1.3 Objectives of the Study

The objective of the study will be:

1. To analyze the trend of public expenditure growth in relation to the above three models (i.e Wagner's law, Development models of public expenditure growth and Peacock and Wiseman's model).
2. To test the nature and the direction of causality between public expenditure and National Income.
3. To estimate the productivity of public expenditure i.e, to show which composition of public spending affects economic growth.

1.4 Methodology and Data

To test the growth of public expenditure in Ethiopia, the above three models will be used along with the available data. Time series data obtained from MOPED and MF would be used to test causality between the growth of government expenditure and national income.

In order to identify the pattern and direction of causality, the Granger causality test will be applied. Accordingly if we denote public expenditure by X and Per capita National Income by Y , the two models to be tested can be written as:

$$Y_t = b_0 + a_0 X_t + \sum_{j=1}^m a_j X_{t-j} + \sum_{i=1}^n b_i Y_{t-i} + U_t \quad (1)$$

and

$$X_t = c_0 + d_0 Y_t + \sum_i c_i X_{t-i} + \sum_j d_j Y_{t-j} + V_t \quad (2)$$

Where U_t and V_t are mutually uncorrelated white noise series such that $Eutut^1 = Evtvt^1 = 0$ for all t and t^1 ($t \neq t^1$).

The past socialist regime in Ethiopia was actively engaged in the management of the public economy. Increase in government expenditure is seen as an engine for economic growth. [If this is to hold true, model (1) will be accepted].

$H_0 = a_j = 0$ for all j 's $j(j=0,1,\dots,m)$ against the alternative hypothesis that

$H_1 = a_j \neq 0$ for at least some j 's. By so doing the model would identify the pattern

of causality.

To estimate the productivity of government spending on sectoral basis, I will use the solow-type growth model which postulate that a country's output can be represented by a well-behaved aggregate production relationship of the following form:

$$Q = f(K, t) \text{ -----(3)}$$

Where: Q = aggregate output

K = vector of different types of inputs used in the production process

t = time and is supposed to capture technological change.

Most empirical test work approximate (3) by a cobb-Douglas type of technology.⁴

In order to account for the inflexibility of Cobb-Douglas production function and at the same time take into account the fact that factors of production may be substitutes or complements with one another, relation (3) is approximated by the following translog specification:

$\ln Q = \alpha_0 + \sum \alpha_i \ln k_i + (1/2) \sum \sum \alpha_{ij} \ln k_i \ln k_j + \tau t + u_t$, ----(4) Where U_t is an error term assumed to possess all classical properties, while $\alpha_0, \alpha_i, \alpha_{ij}$ and τ denote parameters to be estimated, with $\alpha_{ij} = \alpha_{ji}$. Differentiation of (4) with respect to input i gives the marginal product of input i , which expressed in elasticity form defines the output elasticity

⁴

See S. Devarajan, V. Swaroop and H. Zow, 1993, what do governments Buy? World Bank working paper no.1992, Washington, D.C pp.4-5

with respect to input i.

$$\xi_i = \frac{(\delta \ln Q)}{\delta \ln k_i} = \alpha_i \sum \alpha_{ij} \ln k_i \quad (5)$$

The ξ_i defined above is a unit free measurement of the relative contribution of capital input i to the overall output and its interpretation is straightforward. That shows how much the output is going to change if the use of input i changes by one percentage unit. (See appendix 1.1)

Disaggregated government spending figures at the central government level is required to examine the full impact of public expenditure on economic growth of Ethiopia. The Ethiopian government budgetary expenditure is allocated centrally by the central government thus the data collected from Ministry of Finance, National Planning and Economic Development, National Bank of Ethiopia...will be used.

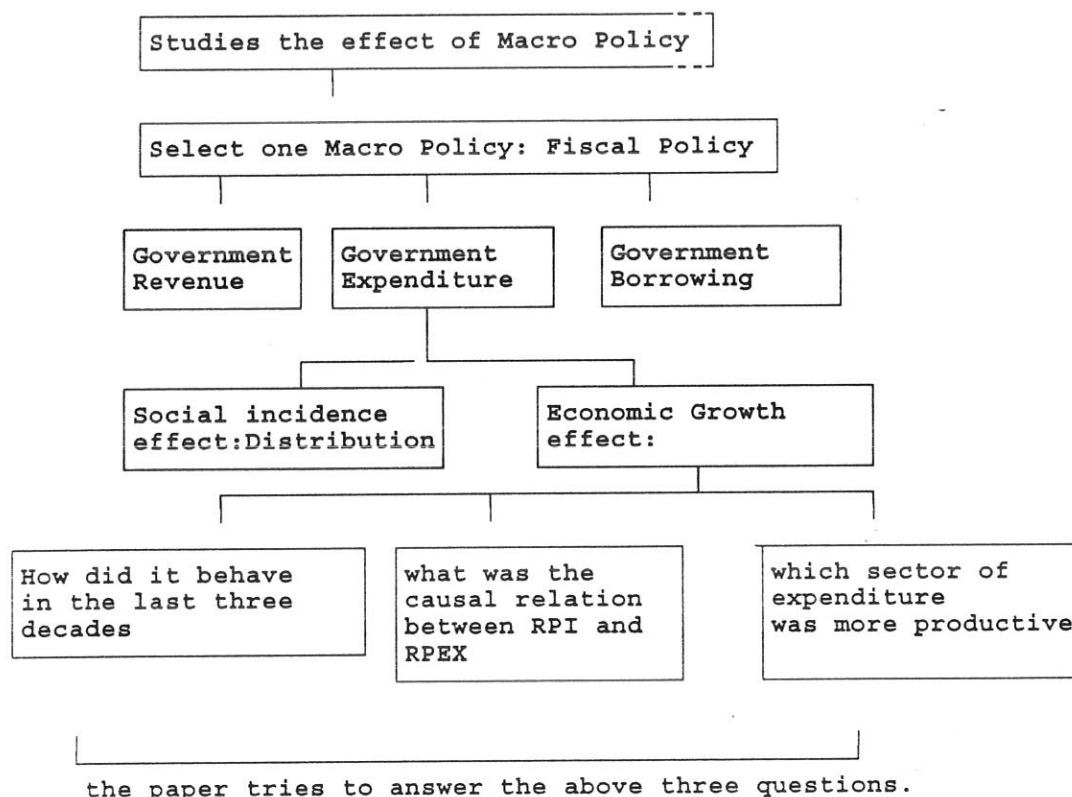
1.5 Organization of the Study

The remaining part of the study is organized in the following way: the second chapter reviews the theoretical and empirical evidences of previous studies on the Ethiopian government expenditure. The assessment of previous studies consist of those carried by different scholars on Ethiopian government expenditure and other similar studies on developing and developed countries. Chapter three presents the growth of public expenditure in Ethiopia in the past three decades. Chapter four deals with quantitative analysis of the causality hypothesis between growth of public spending and



GDP. Granger (1987) causality test will be applied. C1
the complementarity and competitiveness of public expen
private capital Investment. This section further analyses (ba
complementarity of public expenditure) the productivity of govern
sectoral allocation. Finally, concluding remarks and policy implicat.
discussed in chapter six. [see diagram below for summary].

Diagrammatical Explanation of the analytical framework.



CHAPTER II

II LITERATURE REVIEW

Government expenditure was studied by Teshome (1993), Eshetu (1994), Wogeine (1994), e.t.c. A study by Teshome (1993) on the growth of government spending in Ethiopia concludes that the expenditure of Ethiopian government behaves like that of peacock and Wiseman's postulation. Other studies also examined the different economic implications of the growing government spending focusing on its functional, sectoral and also regional classifications Wogeine (1994). However none of them dealt with these issues using Econometric model to test the causal relation between government expenditure and national income growth or the productivity of the sectoral allocation of Ethiopian government spending. Nonetheless, such studies have been done in other developing countries.

The theoretical explanation of the causative relation between government spending and national income growth goes back to the 1890s, when Wagner stated that public expenditure is a behavioral variable similar to private consumption expenditure and must increase as the economy develops. Adolph Wagner, a member of the "historical school" suggested in 1880's that the transition from an agricultural to an industrial society would lead to increased political pressure for social progress. Such progress would be attained through a massive expansion of social services by the state.

On the other hand, other Scholars like Keynes, have treated public expenditure as an exogenous policy instrument in which government can use them as appropriate macroeconomic policy instrument.

Keynesian Macroeconomics views government action as a central means of receiving the demand constraint. The logic is: If output is constrained by a lack of demand, and if exhortations to spend more fall on deaf ears, the government at least can be looked to for the means of providing a stimulus to aggregate effective demand. In the first place it can increase its own demand for output by raising government spending. Second by reducing taxes, or by making credit cheap, it can enhance private sector growth.

The outcome of world war II made the world economy to be in a state of less than full employment while the capacity to produce were there. It was why the Keynesian concept enjoyed almost a general acceptance and a considerable popularity in the contemporary economic writings from mid-forties to mid-seventies.

But to apply such theory for developing counties like Ethiopia one has to be cautious. Thus, the attitude of government policy makers towards the economic functions of the state and to the scope and forms of state economic intervention on the one hand, and the role of private business and of the market, on the other hand, should focus on the extent to which the state may intervene in direct economic management. At present the growth of the Ethiopian economy is constrained by effective demand, hence, macroeconomic disequilibrium result if one purely apply the Keynesian discipline.

Apart from these two arguments other scholars argued that a priori judgement for choosing between the two competing possibility are rendered difficult because of the possibility of feedback or absence of any causative relation in macro variables.

Therefore, one can say that the causal relation between government spending and economic growth is not obvious. Although some studies are based on the idea that government size has a causal influence on economic growth, the converse is certainly possible.

A study, on the test of causality between government spending and national income growth, by Singe and Sahni (1984) based on the data for India (1950-1981) suggested that while at the disaggregate level the causal process is rather diverse, it is essentially "feed back" type at the aggregate level. It neither confirms the Wagnerian (Income $\rightarrow$ Public expenditure) nor the keynesian (public expenditure $\rightarrow$ National income) view. Thus they conclude that public expenditure and national income be treated as jointly dependant variables in studies both in public finance and Macro econometric models and that any study purporting to analyses the growth of public expenditure (aggregate or by functional) and its role in the economy must necessarily discern the underlying causative process before carrying out an empirical investigation.

Most theoretical and empirical works on the growth of government expenditure, question themselves what will be the effect of the expansion of government spending on aggregate economic growth?

As Olson (1984) points out, the ideological debate over the relationship between increased government spending and economic growth provides little evidence to resolve the issue; there does not seem to be a strong relationship between government ideology and economic performance due, perhaps, to the absence of a clear relationship between

ideology and government size. Moreover, economic theory does not provide a fully developed methodology that incorporates government spending in standard growth models. Economic theory, however, identifies two principal channel theory according to which government activities may influence economic performance.

First, government spending, particularly investment may provide goods that enter directly into private sector production, such as education and infrastructure. Government spending also may indirectly influence the efficiency of private sector allocation of inputs. (In the literature this is sometimes referred to as the crowding-in effect).

Government spending to correct market failures, guarantees of property rights and the enforcement of contracts, and provision of essential public goods will have a positive effect. If public capital formation and private capital formation are truly complementary, government projects may stimulate entrepreneurs and enhance private investment and growth.

While by the same token government regulation may impose excessive burdens on the private sector. High taxes or heavy borrowing to finance government spending may distort private incentives. In addition if the financing of government investment project bids up interest rates (real interest rate in the Ethiopian case) private investment may be crowded out, slowing growth.

Since all these effects are likely to operate, the direction of the net effect which Ram (1986) calls an "externality effects", is an empirical issue.

The "second channel" is the efficiency of government as a producer, as distinct from a provider of goods and services. The issue here is the relative efficiency of government, as opposed to private production. The argument here is if productivity in the government sector is lower than in the private sector, a larger government presence in the economy will be associated with weaker aggregate performance. This is what happened in Ethiopia in the era of the "derg". Conversely, efficient government sectors, where relative factor productivities are high, will enhance aggregate output. These differences in productivity may arise both from differences in the nature of goods produced in the two sectors and from the inefficient management of government relative to private operations.

Previous studies suggested a strong link between productivity growth and government policies in all developing countries, (World Bank 1991) a link confirmed by the studies of individual countries in East Asia.

From the ongoing experience we can see that successful economies include not only those with low government expenditure-to-GDP ratios (Korea, Taiwan) but some with relatively high ratios such as Botswana, Malaysia (Lindauer and Velenchik 1992). Thus, more attention be devoted not to how much government spends but to what governments actually do with their resources since it is believed that many governments are not allocating their limited resources efficiently or effectively. Too much is being spent in the wrong areas and too little is being left for the critical tasks that only governments can perform. Misallocation is occurring both within and between capital and recurrent spending.

Several studies have also done on the sectoral allocation of government finance. A study by Baffes and Shah (1993) on the productivity of public spending shows reshaping public spending priorities in favour of human resource development and away from military spending would positively stimulate world economic renewals.

Baffes and Shah examined the composition of public spending and its implication for economic growth. They used a translog production function by treating gross domestic product as the output and labour, private capital, and several types of public sector capital stocks as the inputs, using time series data for 24 countries for the year 1965-84.

The model (see appendix 2.1) performs quite satisfactorily with the appropriate statistical tests. The result shows that the production function of all but four countries exhibited increasing returns to scale. The highest output elasticity⁵ was for public spending on human resource development capital followed by private capital and labour. Output elasticity of public expenditure on infrastructural capital was found to be relatively small, with the exception of Latin American countries where it exhibited relatively high values. Military capital had negative output elasticity in slightly more than half of the cases considered. While estimating the productivity of government spending the model also shows the scale elasticities on the average goes approximately with countries GDP. (i.e the higher per capita GDP is consistent with higher elasticities). On the other hand Deverajan, Swaroop and Zoo argued that:

5

The output elasticities with respect to inputs are unit free measures of the marginal products which are expected to be positive in order for the production function to be a well behaving one.



" The traditional views that public capital spending strengthens economic growth and current spending does not are not borne out by experience in developing countries. In fact, the only category of public spending associated with higher economic growth is current spending although spending on preventive care and "other education" has some positive effects."⁶

In their article *What Do Governments Buy?* Devarajan, Swaroop and Zoo developed a simple analytical framework that shows how the composition of public spending affects economic growth. Their empirical analysis uses annual data on 69 countries from 1970 through 1990 to examine the link between components of government expenditure and economic growth.

Based on their model (see Devarajan, et al 1993) they found that an increase in the share of current spending has positive and statistically significant effects on growth. Otherwise, the news is mainly negative.

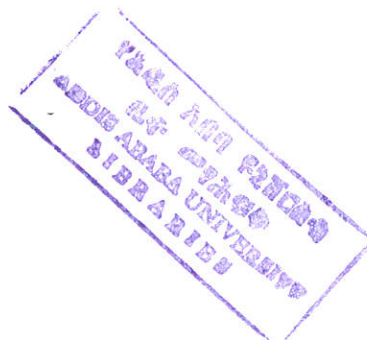
While in other studies, Barro (1990) based on data of 98 countries finds that an increase in resources devoted to non-productive⁷ government consumption is associated with lower percapita growth.

Thus, from the above different theoretical and empirical studies it is difficult to conclude which type of government spending is more productive. Therefore, the next

⁶ Shantaganan Devarajan, V.Swaroop and H.Zoo, 1993, "What Do governments Buy?" World Bank (February 1992) pp.1

⁷ On the categorization of public spending as productive and non-productive, there appears some disagreement. Some Scholars, Kormendi and Meguire (1985), Grier and Tullock (1987), Summers and Heston (1988) classify defense and education as government consumption and hence unproductive. Barro (1990) models them as productive. He considers spending on public education as investing in human capital. Similarly, defense spending helps protect property rights which increases the probability than an investor will receive a positive marginal product of capital.

section will treat those arguments based on the available time series data of Ethiopia. But one has to be careful on the qualifications surrounding the empirical study. Due to the quality of data in LDC's and also the limiting assumptions of the models all results should be interpreted with great caution.



CHAPTER III

III Public Expenditure and Economic Growth in Ethiopia

3.1 Development of Aggregate Expenditure in Ethiopia

In the early years (before 1974/75) the government of Ethiopia was reflecting traditional liberal notions of limited state involvement in the economy. Economic activities were overwhelmingly private, with government largely limited to providing a congenial framework for its regulation and expansion. Public command of economic resource in these early years was low, and the prevailing economic policy was conservative.

The nominal public expenditure of Ethiopia which was 213.1 million birr in 1960/61 reaches 1048.8 million birr in 1974/75. It increased on the average at a rate of 12.46 percent per annum. In this era (the era of the king) current expenditure increase at a rate of 11.5 percent while capital expenditure increased at a rate of 19.6 percent. The trend of government spending from 1974/75 till -1990/91 (the era of the Derg) shows the nominal public expenditure increase from 777.7 million birr in 1973/74 to 4913 million birr in 1990/91 which is 11.07 percent increase per annum on the average.

The major share of public expenditure growth was accounted by recurrent expenditure⁸ of which defence expenditure contributed more than 40 percent .

8

The Ethiopian government (ministry of Fiance) classified the Central government recurrent expenditure (including external assistance) as: General services; General government, National defence, internal order and Justice and others) Economic services (Agriculture, industry, mining and Energy, Trade and Tourism, Transport and commination and construction); Social services (Education and training, culture and sport public health, labour and social welfare, R.R.C and Housing and Community services); Transfers (Person payment, Debt servicing: internal and external with interest, subsidies and others)

On the other hand the capital⁹ budget has however, grown at a rate of 16 percent per annum in the 1973/74-1990/91 period compared with 10.7 percent per annum for the recurrent budget.

TABLE 3.1

GROWTH OF NOMINAL GOVERNMENT EXPENDITURE IN ETHIOPIA

(IN MILLION BIRR)

YEAR	CUR.EXP.	CAP.EXP.	TOT.EXP.
1942 1949/50	72.9	13.5	86.2
1952 1959/60	136.9	20.9	157.6
1962 1959/60	478.9	106.3	585.0
1972 1978/79	1694.7	505.1	2137.9
1982 1989/90	3929.1	1440.1	5369.2

SOURCE: CALCULATED FROM MINISTRY OF FINANCE ANNUAL REPORT

Table 3.1 shows the growth of total public expenditure on recurrent and capital expenditure classification. If one disaggregated such figure on functional base defence expenditure increased at a rate of 5.27 percent from 1960/61 to 1974/75 and at a rate of 20.3 percent from 1974/75 to 1990/91.

⁹

Capital expenditure (including external assistance) is classified as economic development (Agriculture and land settlement, mining and Energy, Industry, Transport, Communication and Contraction, Water resource, commerce and tourism and Financial Agencies) social development (education, culture sport, public health and others) and public Buildings.

Human resource development expenditure increased at the rate of 10 percent from 1960/61 till 1974/75 and at a rate of 8.6 percent from 1974/75 till 1990/91.

The growth of real total government expenditure¹⁰ also shows how government involvement in the economy grows as time goes. These can be seen from the following table (Table 3.2) and Figure (Figure 1).

TABLE 3.2

GROWTH OF REAL GOVERNMENT EXPENDITURE IN ETHIOPIA

(IN MILLION BIRR)

YEAR Ethiopian Calendar	REAL CUR.EXP.	REAL CAP.EXP.	REAL TOT.EXP.	
1942	A	A	A	
1952	A	A	A	
1962	1322.1	156.1	859.0	
1972	1727.5	514.9	2179.3	
1982	2857.5	1047.3	3904.9	

SOURCES: MINISTRY OF FINANCE ANNUAL REPORT

A=DATA FOR GDP DEFLATOR IS NOT AVAILABLE

¹⁰

Nominal figures are deflated using GDP deflator.

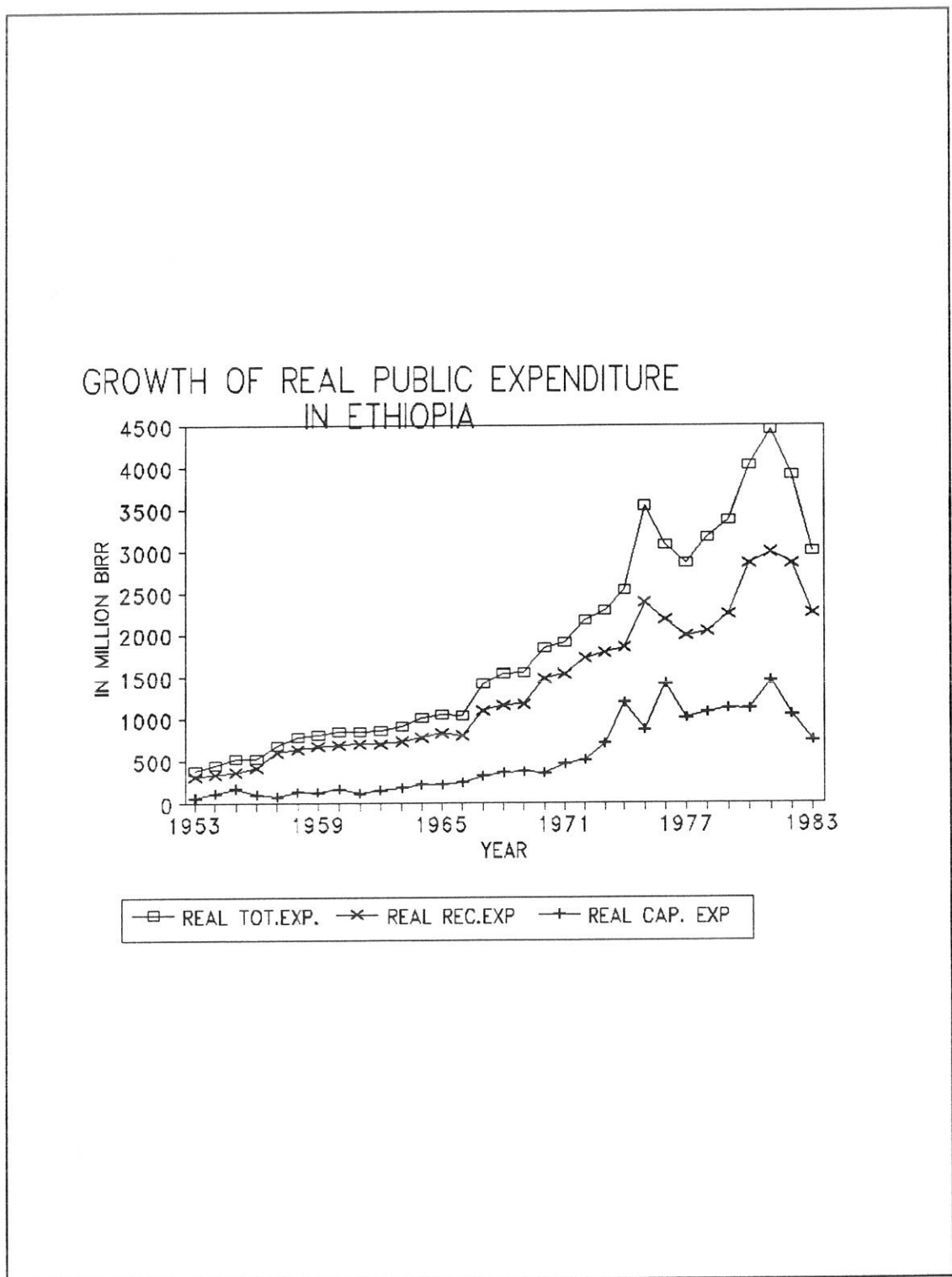


Figure 1

The major consequence of such trend (growth in public expenditure) due attention whether these trend in government spending used for productive expenditure or not?

3.2 Growth of Public Expenditure and Gross Domestic Product (GDP)

The general growth of public expenditure has increased from 8.6 percent of GDP in 1960/61 to 13.9 percent in 1973/74 and 36% in 1990/91. The anatomy of this expenditure growth is of some interest, both from the macro economic point of view and for an understanding of the efficiency of the use of resources in the economy (see table 3.3).

TABLE 3.3 GROWTH OF GDP AND EXPENDITURE IN ETHIOPIA

(IN MILLION BIRR)

YEAR Ethiopian Calender	GDP AT CUR.PRICE	TOT.EXP.	EXP. AS A % OF GDP	
1942	0	86.2	0	
1952	0	157.6	0	
1962	4482.8	585.0	13.0	
1972	8540.7	2137.9	25.0	
1982	12430.2	5369.2	43.2	

SOURCES: CALCULATED FROM MINISTRY OF FINANCE AND MOPED ANNUAL REPORT

0=DATA FOR GDP IS NOT AVAILABLE

The Ethiopian government between 1967-1983 (1973/74-1990/91) was following the Marxist-Leninist mode of economic management. Economic policy was aimed at the total nationalization and collectivisation of the basic means of production,(for an implementation of a centralised planning and a management system run by the state

administration). There was state monopoly in almost all economic activities. Thus, the growing public expenditures went to financing different government projects which were inefficient, and to "defend the mother land". Therefore, in the era of the "Derg" one can say growing public expenditure was unproductive and that is why the economic effectiveness of the socialist state has been sharply criticised.

The sustained public expenditure growth which caused wide fiscal deficit recognized by the present government of Ethiopia as one of the short comings of economic performance and had decided to adjust the framework of economic institutions and policies so as to accelerate growth and to arrest the decline in percapita income.

Various past studies attributed the deepening of fiscal deficit of Ethiopia to the previous government's (Derg) fiscal policy which discouraged the private sector and undermined its confidence. Others also argue that even investment expenditures were not sufficiently productive: It mere exhibited excess capacities and there have been serious delays in the construction of new projects.

Thus, the new government of Ethiopia which accepted the Structural Adjustment Program (SAP) as a policy to improve the deepening fiscal deficit has to reformulate new policy. To do so one of the alterative policies is to curtail the growing expenditure. Once the curtailment of expenditure is recognized the next step is to determine from which sector of the economy expenditure should be cut and to which sector expenditure should be increased so as to improve performance of the Ethiopian economy. The next chapters will deal with such problems

CHAPTER IV

IV. Test of Causality between growth of RPI and RPEX

As one can easily observe from previous chapter (chapter III) it is difficult simply to argue that the relationship between the growth of Real Percapita Income (RPI) and Real Percapita Expenditures (RPEX) follow either Wagnerian or Keynesian proposition. Thus, in this chapter the paper will test the above hypotheses empirically using the Granger causality test.

4.1 Data and Estimation

The present analysis has been carried out at the aggregate level using the Ethiopian data for the period 1960/61-1990/91. In both cases (RPI and RPEX) I have used annual data since GDP is estimated annually and public expenditure is hardly sensitive to seasonal fluctuations. The data used here have been drawn from various official and unofficial publications of the Government of Ethiopia. The Data for GDP are collected from the Ministry of Planning and Economic Development (MOPED) while government expenditure data is collected from Ministry of Finance¹¹ (MF).

Most economic time series data have a problem of autocorrelation (the correlation between the error terms arising in time series data, that is, the error term at time period t is correlated with error term $U_t + j$ or U_{t-j}). They are conveniently classified as either

¹¹ The official data on public expenditures were not available in constant price for the sample period. However, since movement in most price deflators are generally synchronous, I have attempted to capture the effect of price changes by using the implicit Gross Domestic Product (GDP) deflator. I recognize that the deflator used here is only the second-best.

belonging to the DSP (difference-stationary process) class or TSP (trend-stationary process) class.¹²

Thus, the appropriate procedure for trend elimination (whether to use differences or regressions on time) will depend on this classification. Yet, most economic time series, however, are of the DSP type and, hence, estimation in first differences is appropriate.¹³

Therefore, the first step in analyzing time series data is checking the order of integration of the variables under consideration which can be determined by:

(A) Dickey-Fuller (DF) $\Rightarrow$ the DF test is based on the regression:

$$\Delta Y_t = \mu + \beta \Delta Y_{t-1} + \epsilon_t, \text{ when } \Delta Y_t \text{ denotes the variable of interest and } \Delta$$

denotes the difference operator; μ and β denotes the variable to be estimated. The null hypothesis H_0 is: Y_t is not $I(0)$. H_0 is rejected if the estimate of β is negative and significantly different from zero.

(B) Augmented Dickey-Fuller (ADF) $\Rightarrow$ The ADF test is based on

$$\Delta Y_t = \mu + \beta Y_{t-1} + \sum_{i=1}^{\tau} \alpha_i \Delta Y_{t-i} + e_t,$$

Where τ is selected so that e_t is white noise; μ , β and α_i denote parameters to be estimated as before. Again H_0 is rejected if β is negative and significantly different from zero.

¹² See G.S. Maddala, (1992) pp.259

¹³ Ibid

Once the stationarity of the data is checked by either DF or ADF the next step is to see whether the variables of interest are all say $I(1)$.¹⁴ [which is the case as it will be shown in the next section]. To test for cointegration using Engle and Granger (1987) approach we regress one variable on the other and then test whether the estimated residual is $I(0)$. In other words estimating $\Delta Y_t - \beta \Delta X_t = e_t$ and then test for stationarity of e_t . If e_t is $I(0)$ it implies ΔY_t and ΔX_t are cointegrated (have long-run relationship).

The second step here is to see whether there exists causality between expenditures and GDP growth. As (Granger, 1986) put it if the variables being considered are cointegrated, there exists causality in at least one direction. To test the above hypotheses empirically the Granger Causality test model will be:

$$Y_t = b_o + a_o X_t + \sum_{aj} X_{t-j} + \sum_{bi} Y_{t-i} + U_t \quad (4.1)$$

and

$$X_t = c_o + d_o Y_t + \sum_{ci} X_{t-i} + \sum_{dj} Y_{t-j} + V_t \quad (4.2)$$

Where b_o , a_o , c_o , d_o , a_j , b_i , c_i and d_j denotes parameters to be estimated. U_t and V_t are assumed to be mutually uncorrelated white noise processes.

If $a_o = 0$ and $d_o = 0$ and some a_i 's and c_j 's have non-zero values, (4-1 and 4-2) implies a simple causal relation with feedback (i.e simple bidirectional causality).

If $a_o \neq 0$ and $d_o \neq 0$ and some a_i, b_i , c_i and d_j 's have non zero values, then (4-1 and 4-2) implies instantaneous bidirectional causality.

¹⁴

A time series Y_t is said to be integrated of order 1 or $I(1)$ if ΔY_t is a stationary time series.



Finally, unidirectional causality implies if the above relations hold for one equation only. Usually such causal relationships can be detected with conventional statistical tests.

The estimation of Granger causality (Granger 1987) is not without shortcomings. It is well known in the literatures that in the bivariate system, causality testing considers only the relationship between two variables. It may ignore some important information which could be the linkage variable of the two studied variables. Hence, the results of causal influences obtained from the bivariate system may be misleading, specially if the estimated results show no causality.

In order to capture some information which we may exclude in the bivariate system, one has to extend the model to trivariate system, where the third variable will be considered as the link variable of the two studied variables.

Before going to empirical estimation I tested the time series data of Ethiopian Real Gross Domestic Product (RGDP) and Real total expenditure (RTEX) which may have a structural break in some of the years. Between 1953(1960/61) and 1983(1990/91) the Ethiopian government went through a major economic policy reform. This is the time when the Ethiopian government Economic policy direction changes from the imperial era (when government involvement into the economy were passive) to the "socialist economy" in 1966(1973/74). I tested this period if there has been any changes in the trend because of this event. The dummy variable which I introduce to test whether there is a structural break in the trend of both RGDP and RTEX shows significance which implies the presence of strong structural change in the time series data (See appendix 4). But as

Adam (1993) says "while the regression models we used are asymptotically consistent, the test used are however shown to exhibit extremely low power when applied to the type of data sets and structural breaks typically encountered in African Macroeconomics."¹⁵ Thus every one has to be cautious in the interpretation of such results.

4.2 Empirical Estimation and Results

The DF and ADF which used to test for the stationarity of the data are presented in table 4-1a and 4-1b for both of the time series data: RPI (Real per capita Income) and RPEX (Real per capita Expenditure) are non stationary since as it is expected from most time series data they fail to pass either of the DF and ADF test. But both data become stationary at their first difference hence are I(1). See table 4.2a and 4-2b.

TABLE 4-1a

Unit root tests for variable RPI

statistic	sample	observations	without trend	with trend
DF	(1961/62- (1994/95) 1954 - 1987	34	-1.8366(-2.9499)	-1.8515(-3.5468)
ADF(1)	(1962/63)- (1994/95) 1955 - 1987	33	-2.2420(-2.9528)	-2.1962(-3.5514)

95% critical values in brackets.

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Christopher Adam (1993) "Testing for regime shifts in short- sample African Macroeconomic Data: A survey of Montecarlo Evidence, Institute of Economics and statistics, university of Oxford, England. pp.17

TABLE 4-1b

Unit root tests for variable RPEX

statistic	sample	observati ons	without trend	with trend
DF	(1961/62)- (1994/95) 1954 -1987	34	-1.6278(-2.9499)	-.78476(-3.5468)
ADF(1)	(1962/63)- (1994/95) 1955- 1987	33	-1.6458(-2.9528)	-.90958(-3.5514)

95% critical values in brackets.

TABLE 4-2a

Unit root tests for variable DRPI

statistic	sample	observa tions	without trend	with trend
DF	(1961/62)- (1994/95) 1954 -1987	34	-10.3771(-2.9499)	-9.4770(-3.5468)
ADF(1)	(1962/63)- (1996/95) 1955 - 1987	33	-3.0701(-2.9528)	-2.7053(-3.5514)

95% critical values in brackets.

TABLE 4-2b

Unit root tests for variable DRPEX

statistic	sample	observati ons	without trend	with trend
DF	(1961/62)- (1994/95) 1954 - 1987	33	-5.0693 (-2.9528)	-5.3042 (-3.5514)
ADF(1)	(1962/63)- (1996/95) 1955 - 1987	32	-3.5997 (-2.9558)	-3.8951 (-3.5562)

95% critical values in brackets.

For the cointegration of the two variables the estimated $DRPI_t - \beta DRPEX_t$
 $= e_t$ ¹⁶ unit root test shows e_t to be $I(0)$ which implies the existence of long-run
relationship between DRPI and DRPEX. See table 4-3

TABLE 4-3

Unit root tests for residuals

Based on OLS regression of DRPI on CON D2 DRPEX D1 34 observations used for estimation from 1954 to 1987			
statistic	sample	observations	value
DF	1955 - 1987	33	-6.7505 (-4.4454)
ADF(1)	1956- 1987	32	-4.8155 (-4.4568)

95% critical values in brackets when available.

D_2 = Dummy variable for the changing economic policy of government in 1973/74

D_1 = Dummy variable for the 1984/85 drought of Ethiopia.

Causality

Since there is structural break in the year 1973/74, I introduce dummy variable to capture such effect. OLS is used to estimate the causal relation between DRPI (Detrended Real Per Capital Income) and DRPEX (Detrended Real Per Capita Expenditure) with their lag's. The result of the models are summarized as follows:¹⁷

¹⁶ For the regression of $DRPI_t - \beta DRPEX_t = e_t$ see appendix 4-1

¹⁷ For the details of the estimation see appendix 4-1 & 4-2

Estimation of causality between DLRPI and DLRPEX for the period 1960/61-1990/91 is reported in Table 4.4 and 4.5.

TABLE 4-4

Ordinary Least Squares Estimation

Dependent variable is DLRPI 26 observations used for estimation from 1958 to 1983			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
CON	-.057985	.010005	-5.7955[.000]
DLRPEX	.17851	.038871	4.5923[.000]
DLRPEX(-1)	.16729	.050718	3.2984[.005]
DLRPEX(-2)	.11272	.063263	1.7818[.095]
DLRPEX(-4)	.099889	.055577	1.7973[.095]
DLRPI(-1)	.60098	.10417	5.7693[.000]
DLRPI(-2)	.58343	.11210	5.2046[.000]
DLRPI(-3)	.44205	.092629	4.7722[.000]
DLRPI(-4)	.25224	.082997	3.0391[.008]
D1	.085506	.013959	6.1256[.000]
D2	-.23708	.028663	-8.2715[.000]
R-Squared	.94836	F-statistic F(10	27.5469[.000]
R-Bar-Squared	.91393	,15)	

TABLE 4-5

Ordinary Least Squares Estimation

Dependent variable is DLRPEX 26 observations used for estimation from 1958 to 1983			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
CON	.21312	.048465	4.3973[.000]
DLRPI	3.0165	.71902	4.1953[.001]
DLRPEX(-1)	.67340	.24344	2.7662[.014]
DLRPEX(-2)	.56717	.26279	2.1583[.046]
DLRPI(-1)	2.2306	.57213	3.8988[.001]
DLRPI(-2)	2.3203	.59218	3.9183[.001]
DLRPI(-3)	1.3456	.49017	2.7451[.014]
DLRPI(-4)	.58821	.40239	1.4618[.163]
D1	.30271	.081929	3.6947[.002]
D2	-.64161	.21325	-3.0087[.008]
R-Squared	.63676	F-statistic F(9,16)	3.1164[.020]
R-Bar-Squared	.43243		

From table 4-4 and 4-5 we can see that the causal relation between the two considered variables is instantaneous bidirectional.

Thus, the test of Granger causality implies the present and past expenditure of government and also lag's RPI affect the present RPI and the reverse is also true. Therefore the time series data of Ethiopia empirically support both the Wagnerian and the Keynesian hypotheses about the causal relationship between government expenditure and Economic growth. (see appendix 4-1 and 4-2)

However, based on the statistical significance one can say the growth of real per capita income was more explained by the growth of total expenditure than the reverse even if the overall test shows simultaneity of the two causalities. The next chapter treat productivity of public expenditure based on the strong impact of model 4.1 while leaving the simultaneity problem for further research.

CHAPTER V

V.Productivity of Public Expenditure

This chapter is concerned with the impact of government spending on productivity growth. The direct and indirect influence of government expenditure on the growth of productivity in the private sector of the economy will be dealt. A sound decomposition of government expenditure into various functional categories has been done to assess their relative contributions to productivity.

5.1 Government Spending and Private Investment

The importance of private investment to the growth and development strategy of Ethiopia in the transition to the free market economy is emerging with the growing agreement on the desirability of increasing the private sector's share in total capital formation through increased reliance on market forces and incentives. Thus, the key to sustained recovery in Ethiopia is the revival of private investment. This revival requires a coordinated set of credible policies. One of these policies is fiscal policy (public expenditure restructuring).

Hence, the vital questions to be answered are: to what extent does public spending complement private investment (crowding-in) and to what extent does it crowd out. How does the size of the fiscal deficit and alternative ways of financing it affect private investment? How do these options affect the real interest rate, credit allocation and the real exchange rate and thereby private investment. Such issues should be dealt with as the

new Ethiopian government (after 1990/91) restructures its expenditure policies.

Economic theory and empirical findings also show the relationship between fiscal policy (public expenditure) and private investment could either be characterized by complementarity or competitiveness (substitutability).

Once the Ethiopian government accepted the structural adjustment programme (so as to follow free market economy, in which expansion of private sector investment should be the main source for economic growth), public spending resources has to be shifted to those areas which are complementary to private sector investment.

5.2 Government Spending and Productivity

Aschauer (1989) advances the idea that on neoclassical grounds, expansions of public investment spending should have a larger stimulative impact on private output than equal-sized increases in public consumption expenditures. Specifically, public investment, it is argued, induces an increase in the rate of return to private capital and, thereby, stimulates private investment expenditure and productivity.¹⁸

However, many development economists, especially those of the "structuralist school" argue under certain circumstances a higher government consumption expenditure is also associated with fast growth.

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Aschauer, David A., 1989, Is public expenditure productive? *Journal of monetary economics* NO.23 pp.177-200.

Economic theory does not give a clear prediction about which of the two (i.e government consumption expenditure or government investment expenditure) has a strong impact on the growth of output. From an income accounting perspective, a higher government consumption expenditure would come at the expense of either investment in conventional capital or private consumption. If government consumption spending increases at the expenses of investment this would tend to diminish the growth rate of GDP. However, a substantial portion of government "consumption expenditures" are in fact investment in the broader sense, especially education and health care. Thus, a higher government consumption expenditure does not necessarily reduce capital formation even if it is at the expense of conventional investment. The implications are not clear if government consumption expenditures increase at the expense of private consumption.

Clearly such conflicting points of view can be justified through empirical research.

5.3 The Transmission Mechanism of Public Expenditure and Economic Growth.

Even if economic theory and empirical findings do not strongly agree on the degree of government involvement in the economy, the role of state intervention in the economic activities as complement to private investment is justified. The correlation matrix's¹⁹ of

¹⁹ The correlation between two variables X and Y is: Correlation $r_{xy} = \frac{S_{xy}}{S_x S_y}$ where,

Standard deviation: $S_x = \left[\frac{\sum_i (x_i - \bar{x})^2}{n-1} \right]^{1/2}$

and Covariance: $S_{xy} = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{n-1}$

table 5.1-5.3 shows the correlation between GDP growth, government investment expenditure and private investment.

TABLE 5-1

Estimated Correlation Matrix of GDP G_I and P_I (1953 1983)

	GDP	G_I	P_I
GDP	1.00000	.60005	-.13762
G_I		1.00000	-.31109
P_I			1.0000

Where G_I = Government Investment Expenditure

P_I = Private investment expenditure

TABLE 5-2

Estimated Correlation Matrix of GDP G_I P_I (1953 1967)

	GDP	G_I	P_I
GDP	1.0000	.85410	.65119
G_I		1.0000	.22860
P_I			1.0000

TABLE 5-3

Estimated Correlation Matrix of GDP G_1 P_1 (1967-1983)

	GDP	G_1	P_1
GDP	1.0000	.77453	-.37717
G_1		1.0000	-.63772
P_1			1.0000

Where G_1 Government investment
 P_1 = Private Investment

Table (5-1) Estimated correlation matrix of GDP, G_1 P_1 from 1953-1983 (1960/61-1990/91) shows the presence of negative correlation between growth of government expenditure and private investment. But Table (5-2), Estimated correlation matrix of GDP, G_1 and P_1 from 1953-1967 (1960/61-1973/74) shows positive correlation between the growth of public spending and private investment. The above two outcomes are substantiated by table (5-3). Estimated correlation matrix of GDP, G_1 and P_1 from 1967-1983 (1973/74-1990/91) which shows the presence of strong negative relation between the two variables.

Thus, these relationships are the outcome of the economic policies which were followed in Ethiopia for the past three to four decades. The negative correlation between government spending and private investment growth in Ethiopia from the year 1973/74-1990/91 is not surprising for those who know what was the economic policy of Ethiopia.



The present government of Ethiopia (from 1990/91) who follows free market economy encourage private investment so as to gain fastest growth rate of GDP. The direction of restructuring public expenditure to increase GDP would also facilitate private investment. Hence, by measuring productivity of public expenditure, we hope to shed some light on the expected positive correlation between government spending and private investment.

5.4 Model Specification

The framework we developed for the study of the relationship between government spending and the growth of percapita real GDP did not allow the inclusion of many factors affecting that relationship. Unfortunately there is no any accepted theory to shed light on the determinants of the growth of per capita real GDP and therefore, there is no generally accepted set of variables to include in the study.

Ideally this section should have discussed the relationship between total government impact and a comprehensive measure of economic welfare. But as I have mentioned early (section 1.2), given the importance of government influence in the economy, per capita real output is used as a measure of economic welfare and restructuring of government spending as a fiscal policy instrument.

The analysis is based on the estimation of parameters in a translog production function. Recently developed econometric techniques for dealing with non stationary time series data are used in the estimation.

5.5 The Variables to be estimated

The description of the variables used in the analysis is as follows:

RPI:[Y] Gross Domestic Product is obtained from the Ministry of Planning and Economic Development (MOPED) and is deflated by the GDP deflator and divided by population in order to express it in per capita terms.

Labour:[L] Since the aggregate data on man hours worked were not available, the proxy for this variable is the number of active labour force adjusted by the unemployment rate.²⁰

Capital:[K] Series for this variable were constructed from the MOPED data.

Government Human Resource development spending: [H] Recurrent Expenditure on education and training and public health from the Ethiopian Ministry of Finance annual report is constructed.

Government Defence Expenditure:- [D] Series were constructed from the Ministry of Finance Annual Report.

Government Capital expenditure:- Data obtained from the ministry of Finance Annual Report.

The selection of these three policy variables are based on their share of total expenditure and importance as a policy variable.

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The data for active labour force and unemployment rate is compiled from CSA



Two translog Production Functions will be estimated one based on the proportion of sectoral expenditure to total expenditure (Model 1) and the second one on sectoral expenditures (Model 2).

The translog production function is:

$$\ln y = k_0 + k_1 \ln L + k_2 \ln K + k_3 \ln D + k_4 \ln H + k_5 \ln C + (1/2) \sum \sum \alpha_{ij} \ln k_i \ln k_j + \tau t + e \quad (5-1)$$

Where $\ln$ = natural logarithm

Before estimation of the models stationarity of the data is checked using both Dicky-fuller and Augmented Dickey fuller test of the Micro-Fit3 package. The results are summarized in the following tables.

Table 5.4

Unit root tests for variable LMYP*

statistic	sample	observati ons	without trend	with trend
DF	1954 1983 1961/62 1990/91	30	6.8082 (-2.9627)	-.095849 (-3.5671)
ADF(1)	1955 1983 1962/63 1990/91	29	3.4080 (-2.9665)	-.25665 (-3.5731)

95% critical values in brackets.

* LMYP = the natural logarithm of Mid-year population

Table 5.5

Unit root tests for variable LRGCF*

Statistic	Sample	Observations	Without trend	with trend
DF	1954 1983 1961/62 1990/91	30	-1.9493 (-2.9627)	-1.6008 (-3.5671)
ADF(1)	1955 1983 1962/63 1990/91	29	-1.8846 (-2.9665)	-1.7927 (-3.5731)

95% critical values in brackets.

* LRGCF = The natural logarithm of Real Gross capital formation

Table 5.6

Unit root tests for variable LRDEX*

statistic	sample	observations	without trend	with trend
DF	1954 1983	30	-1.0484 (-2.9627)	-1.6297 (-3.5671)
ADF(1)	1955 1983	29	-1.1568 (-2.9665)	-2.2715 (-3.5731)

95% critical values in brackets.

* LRDEX = The natural logarithm of Real Defence Expenditure

Table 5.7

Unit root tests for variable LRHRDEX*

statistic	sample	observations	without trend	with trend
DF	1954 1983	30	-2.2874 (-2.9627)	-2.1804 (-3.5671)
ADF(1)	1955 1983	29	-2.6970 (-2.9665)	-4.0363 (-3.5731)

95% critical values in brackets.

* LRHRDEX = The natural logarithm of Real Human Resource Development expenditure

Table 5.8

Unit root tests for variable LRCEX*

Statistic	sample	observati ons	without trend	with trend
DF	1954 1983	30	-1.5996 (-2.9627)	-2.8346 (-3.5671)
ADF(1)	1955 1983	29	-1.0586 (-2.9665)	-3.1386 (-3.5731)

95% critical values in brackets.

* LRCEX = The natural logarithm of Real Capital Expenditure.

Since all of the variables are non-stationary, their first difference is checked and all become stationary. (See tables below)

Table 5.9

Unit root tests for variable DLMYP*

statistic	sample	observati ons	without trend	with trend
DF	1956 1983	28	-7.9386 (-2.9706)	-7.7968 (-3.5796)
ADF(1)	1957 1983	27	-5.9629 (-2.9750)	-5.8318 (-3.5867)

95% critical values in brackets.

* DLMYP = I(1) of LMYP

Table 5.10 Unit root tests for variable DLRGCF*

statistic	sample	observati ons	without trend	with trend
DF	1955 1983	29	-4.4485 (-2.9665)	-4.5231 (-3.5731)
ADF(1)	1956 1983	28	-2.9925 (-2.9706)	-3.0612 (-3.5796)

95% critical values in brackets.

* DLRGCF = I(1) of LRGCF

Table 5.11

Unit root tests for variable DLRDEX*

statistic	sample	observatio ns	without trend	with trend
DF	1955 1983	29	-3.7933 (-2.9665)	-3.7384 (-3.5731)
ADF(1)	1956 1983	28	-3.2213 (-2.9706)	-3.1490 (-3.5796)

95% critical values in brackets.

DLRDEX=I(1)of LRDEX

Table 5-12

Unit root tests for variable DLRHRDEX*

statistic	sample	observatio ns	without trend	with trend
DF	1955 1983	29	-3.6259 (-2.9665)	-4.0272 (-3.5731)
ADF(1)	1956 1983	28	-3.2500 (-2.9706)	-3.6359 (-3.5796)

95% critical values in brackets.

* DLRHRDEX = I(1) of LRHRDEX

Table 5-13

Unit root tests for variable DLRCEX*

statistic	sample	observations	without trend	with trend
DF	1955 1983	29	-5.7143 (-2.9665)	-5.6584 (-3.5731)
ADF(1)	1956 1983	28	-5.9570 (-2.9706)	-5.8375 (-3.5796)

95% critical values in brackets.

* DLRCEX = I(1) LRCEX

We introduce two dummy variable D_1 and D_2 to capture the effect of policy transformation from the king Haile Selassie era to the "socialist economy" in 1973/74 and the great Draught of Ethiopia in 1984/85.

5.6 Estimation Results

The estimated results of the Translog Production Function is:

Table 5-14

Translog Production Function Parameter Estimates

INPUT	MODEL1	MODEL2
CON	0.158(2.9)	0.904(1.06)
$\ln(k_1)$	-0.576(-1.76)	-0.876(-1.70)
$\ln(k_2)$	-0.978(-1.9)	-0.243(-1.16)
$\ln(k_3)$	-0.694(-0.34)	0.131(1.78)
$\ln(k_4)$	-0.853(-0.8)	-0.437(-3.0)
$\ln(k_5)$	0.238(1.10)	-0.390(-1.6)
$1/2[\ln(k_1)\ln(k_1)]$	1.238(2.1)	3.803(2.35)
$\ln(k_1)\ln(k_2)$	0.273(1.215)	-4.311(-0.69)

INPUT	MODEL1	MODEL2
$\ln(k_1)\ln(k_3)$	0.456(0.511)	-1.06(-2.395)
$\ln(k_1)\ln(k_4)$	0.978(2.444)	1.935(1.928)
$\ln(k_1)\ln(k_5)$	1.01(2.559)	1.89(2.984)
$1/2[\ln(k_2)\ln(k_2)]$	0.598(2.353)	-3.858(-0.773)
$\ln(k_2)\ln(k_3)$	-2.849(-0.22)	0.331(2.873)
$\ln(k_2)\ln(k_4)$	-0.537(-1.362)	0.523(1.28)
$\ln(k_2)\ln(k_5)$	-0.572(-2.629)	-1.483(-0.978)
$1/2[\ln(k_3)\ln(k_3)]$	-1.198(-2.575)	-0.679(-0.678)
$\ln(k_3)\ln(k_4)$	-1.322(-2.61)	1.19(2.901)
$\ln(k_3)\ln(k_5)$	-1.389(-0.144)	-1.09(-1.26)
$1/2[\ln(k_4)\ln(k_4)]$	-0.13(-0.141)	0.478(0.551)
$\ln(k_4)\ln(k_5)$	0.308(0.465)	0.101(0.13)
$1/2[\ln(k_5)\ln(k_5)]$	0.609(0.261)	0.57(0.554)
D1	-0.018(-1.42)	-.057(-1.55)
D2	-0.117(-1.47)	-0.379(-1.91)
T	0.004(1.747)	0.005(1.029)
R ²	0.55	0.53
F-value	12.6	6.4
OBS	29	29

NOTES: The numbers in parentheses denote t-statistics. K_i denotes the i^{th} input: 1 = labour; 2 = Capital; 3 = defence expenditure; 4 = Human resource expenditure; 5 = Government capital expenditure. Both models contain intercept term "CON" and time trend dummies T. The two seasonal dummies D1 and D2 denote the policy change effect in 1973/74 and the great drought of Ethiopia in 1984/85. OBS denotes the number of observation. R^2 is the adjusted R^2 .

The estimated $R^2 = 0.55$ and 0.53 for each model and the F-statistic 12.6 and 6.4 shows the two models explain the parameters well. The Diagnostic tests also show the absence of any problem in the estimation.

Using equation (5) of page 15 the elasticities are summerised in table 5-15.

Table 5-15

Summery of the Translog Production Function Results

INPUT	MODEL1 [Elasticities]	MODEL2 [Elasticities]	Significance (5%)
K_1	0.12	0.15	Yes
K_2	0.28	0.17	Yes
K_3	0.06	0.01	No
K_4	0.38	0.46	Yes
K_5	0.28	0.30	Yes

NOTES: The measures of elasticities have been calculated at means of each observation. Having in mind the limitation of the theory behind the variables chosen for this study, and due to weaknesses in the quality and also availability of data the economic meaning of the estimated parameters are as follows:

From table 5.14 and 5-15 we can see that the three policy variables have the expected sign and pass the overall statistical test (F-test). Only k_3 (Government expenditure on defence) fails to pass the t-test at 5% significance.

Thus, the elasticity of output with respect to human resource development shows government involvement into the economy on such activities has a positive impact on the growth of the economy. The second important variable k_5 (government capital expenditure

)has also significant effect on economic growth. k_3 (government expenditure on defence)has negligible effect.

CHAPTER VI

Conclusion and Policy Implication

The purpose of this paper was to see the behaviour of public spending in Ethiopia, its causal relation with growth of per capita income and measuring the productivity of the composition of public expenditure.

Recurrent expenditure accounts for more than 75% of total expenditure while capital expenditure is around 25%, the latter attains its peak value in 1988/89 at 36.89% of total expenditure. The major component (for the time considered) of the recurrent expenditure was defence which accounted more than 40% of total recurrent expenditure. On the other hand, 89% of the total capital expenditure went for infrastructure development.

Testing for the causal relation between growth of per capita income and government spending we found the existence of instantaneous bidirectional causal relation. Both the Wagnerian and Keynesian hypotheses are supported by the results of the models. Thus, policy makers may pay attention to the causal relations of public expenditure variables and economic growth.

After determining the causal relations between the two variables, the paper investigated the productivity of government spending based on its sectoral allocation. The results show that government expenditure on human resource development is more productive than the rest of the variables considered. The second important variable is government capital expenditure which is supposed to serve as a complement to private

capital investment. The third policy variable which was estimated was defence expenditure and had negligible effect on the growth of per capita income.

The higher output elasticity with respect to human resource development and capital expenditure, and the insignificant output elasticity of military expenditure suggest that it may be necessary to reshape public expenditure priorities in favour of human resource development and capital expenditure and away from military spending. As economic growth is a long-run objective it is expected that only through a sustained application of policy will it be possible to attain the desired goal of development.

Looking at the trend of government expenditures, defence expenditure decreased by more than 50% (from 1990/91-1994/95) and government spending on human resource development and capital expenditure increased by more than 92% and 85% respectively. (The figures for the year 1992/93-1994/95 are calculated from the preliminary (unpublished) report of the Ethiopian Ministry of Finance).

The results of this study fully support the present government's effort to restructure public expenditure. Lastly the presence of a simultaneity causal relation between public expenditure and GDP growth suggests further research.



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ABBREVIATIONS USED IN THE THESIS

RPI	Real percapita income
RPEX	Real percapita expenditure
DRPI	Detrended real percapita income
DRPEX	Detrended real percapita expenditure
MYP	Mid-year population
LMYP	Log mid-year population
RGCF	Real Gross capital formation
LRGCF	Log-real gross capital formation
RDEX	Real defence expenditure
LRDEX	Log-real defence expenditure
RHRDEX	Real human resource development expenditure
LRHRDEX	Log-real human resource development expenditure
RCEX	Real capital expenditure
LRCEX	Log-real capital expenditure
DLMYP	Detrended log-real mid-year population
DLRGCF	Detrended log-real gross capital formation
DLRDEX	Detrended log-real defence expenditure
DLRHRDEX	Detrended log-real human resource development expenditure
DLRCEX	Detrended log-real capital expenditure
GNP	Gross national product
IMF	International Monetary Fund
WB	World Bank

MF	Ministry of Finance
RGDP	Real gross domestic Product
RTEX	Real total expenditure
DLRPI	Detrended log-real percapita income
DLRPEX	Detrended log-real percapita expenditure
CSA	Central Statistics Authority
CES	Constant elasticity of substitution
DRGDP	Detrended real gross domestic product

Appendix 1.1

Translog Production Function

In the area of models of producer behaviour, the classical paper by Arrow (1961) called in to question the inherent restrictions of the Cobb-Douglas model that all elasticities of factor substitution are equal to one. Since then researchers have developed numerous flexible functions that allow substitution to be unrestricted (i.e not even constant) and one of them is the Transcendental logarithmic or translog, production function. This function is the most frequently used flexible function in empirical work. It was developed as a means of approximating the CES production function by Kmenta (1967) and was introduced formally in a series of papers by Berndt, Christianson, Jorgenson, and Lav, including Berndt and Christianson (1972) and Christianson et al (1973)

The translog production function was approximated by:

$$\ln Y = \beta_0 + \sum_m \left(\frac{\delta \ln Y}{\delta \ln K_m} \right) \ln K_m + \frac{1}{2} \sum_m \sum_n \left(\frac{\delta^2 \ln Y}{\delta \ln K_m \delta \ln K_n} \right) \ln K_m \ln K_n$$

Identifying these derivatives as coefficients the translog production function becomes:

$$\ln Y = \beta_0 + \beta_1 \ln K_1 + \dots + \beta_m \ln K_m + \frac{\delta_{11} (\ln K_1)^2}{2} + \delta_{12} \ln K_1 \ln K_2 + \dots + \frac{\delta_{22} (\ln K_2)^2}{2}$$

If δ_{mn} equals zero, it reduces to the Cobb-Douglas function (with constant elasticity of substitution).

In this model the output shares are given by

$$\delta \ln \frac{Y}{\delta \ln K_1} = \beta_i + \sum \delta_{ij} \ln K_i$$

If one insert the coefficient estimates and the mean values for $\ln K_i$'s (not the logs of the mean) that will be the result of the elasticity. The estimated standard error for this linear combination of the least squares estimates is computed as the square root of:

Est. var $[\beta_i + \sum \delta_{ij} K_i]$ which most of the time reasonably close to the earlier usual

estimate (In the usual cobb-Douglas production function)

To test the hypothesis that there is statistically significant difference between the translog production function and the usual cobb-Douglas production function one has to use F statistic.

Appendix 2-1

The model they use is (Devarajan et al, 1993)

$$\ln Q = \delta_0 + \sum \delta_i \ln K_i + \left(\frac{1}{2}\right) \sum_{i=1}^n \sum_{j=1}^n \delta_{ij} \ln K_i \ln K_j + y_t + U_t$$

As a measure of output they have taken per capita Gross Domestic product (GDP). They have considered five types of capital stocks. These include labour, private capital, infrastructure capital, human resource development capital and military capital, and again divided by the population in order to come up with the per capita figures for inputs.

They used ordinary least squares in order to estimate the above translog specification by pooling the data on region and income level as:

- (1) AFRICA: Egypt, Kenya, Tanzania and Zimbabwe
- (2) ASIA: Indonesia, India, Pakistan, Korea, Sri Lanka, Malaysia, Philippines, and Thailand.
- (3) EMENA: Greece, Iran, Israel, Portugal, and Turkey
- (4) LAT: Bolivia, Colombia, Mexico, and Venezuela
- (5) OECD: Canada, Japan, U.S.A and Germany

As I mentioned in the body of the paper the estimated parameters are consistent with the above model specification. Most of the coefficients are significant at the 5% level of significance and with the exception of the LAT region, which had an adjusted R^2 of 0.97, all other adjusted R^2 's were 0.99. At the same time, all F-statistics were significant at the 1% level of significance.

Appendix 4

Ordinary Least Squares Estimation

```

*****
Dependent variable is  DRPI
30 observations used for estimation from 1954 to 1983
*****
Repressor      Coefficient      Standard Error      T-Ratio[Prob]
CON            -1.4505            .48954              -2.9630[.006]
DRPEX          .022117            .0009036            24.4753[.000]
D1             -3.8732            .59331              -6.5281[.000]
D2             -3.3315            2.7383              -1.2166[.235]
*****
R-Squared      .98729  F-statistic  F( 3, 26) 673.1816[.000]
R-Bar-Squared  .98582  S.E. of Regression  1.5852
Residual Sum of Squares  65.3336  Mean of Dependent Variable  -.84678
S.D. of Dependent Variable  13.3133  Maximum of Log-likelihood  -54.2428
DW-statistic   1.4476
*****

```

Diagnostic Tests

```

*****
*   Test Statistics   *   LM Version   *   F Version   *
*****
*   *               *               *               *
* A:Serial Correlation *CHI-SQ( 1)=  1.7532[.185]*F( 1, 25)=  1.5517[.224]*
*   *               *               *               *
* B:Functional Form   *CHI-SQ( 1)=  .75175[.386]*F( 1, 25)=  .64256[.430]*
*   *               *               *               *
* C:Normality         *CHI-SQ( 2)=  1.8665[.393]*   Not applicable   *
*   *               *               *               *
* D:Heteroscedasticity *CHI-SQ( 1)=  .40873[.523]*F( 1, 28)=  .38675[.539]*
*****

```

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

Ordinary Least Squares Estimation

Dependent variable is DRPEX

30 observations used for estimation from 1954 to 1983

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
CON	72.7667	20.6021	3.5320[.002]
DRPI	43.3336	1.7705	24.4753[.000]
D1	165.9576	27.5847	6.0163[.000]
D2	43.2127	124.3229	.34758[.731]

R-Squared	.98562	F-statistic F(3, 26)	594.1628[.000]
R-Bar-Squared	.98396	S.E. of Regression	70.1669
Residual Sum of Squares	128008.3	Mean of Dependent Variable	131.5559
S.D. of Dependent Variable	554.1039	Maximum of Log-likelihood	-167.9480
DW-statistic	1.2873		

Diagnostic Tests

* Test Statistics *	LM Version	* F Version *
* A:Serial Correlation	*CHI-SQ(1)= 2.7930[.095]*	F(1, 25)= 2.5664[.122]*
* B:Functional Form	*CHI-SQ(1)= .028404[.866]*	F(1, 25)= .023692[.879]*
* C:Normality	*CHI-SQ(2)= .60474[.739]*	Not applicable *
* D:Heteroscedasticity	*CHI-SQ(1)= .30072[.583]*	F(1, 28)= .28352[.599]*

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values



Appendix 4-1

Ordinary Least Squares Estimation

Dependent variable is DLRPI

26 observations used for estimation from 1958 to 1983

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
CON	.23252	.048396	4.8044[.000]
DLRPEX	3.2736	.71284	4.5923[.000]
DLRPEX(-1)	-.60561	.23861	-2.5381[.023]
DLRPEX(-2)	-.60424	.25414	-2.3776[.031]
DLRPEX(-4)	-.36832	.24454	-1.5062[.153]
DLRPI(-1)	2.2488	.55084	4.0824[.001]
DLRPI(-2)	2.1552	.58046	3.7129[.002]
DLRPI(-3)	1.5369	.48863	3.1454[.007]
DLRPI(-4)	.76996	.40569	1.8979[.077]
D1	-.30702	.078914	-3.8906[.001]
D2	.74466	.21637	3.4416[.004]

R-Squared	.68448	F-statistic F(10, 15)	3.2540[.020]
R-Bar-Squared	.47413	S.E. of Regression	.091634
Residual Sum of Squares	.12595	Mean of Dependent Variable	.030002
S.D. of Dependent Variable	.12636	Maximum of Log-likelihood	32.3971
DW-statistic	1.6184		

Diagnostic Tests

* Test Statistics *	LM Version	F Version	*
* A:Serial Correlation	*CHI-SQ(1)= 1.6095[.205]*F(1, 14)= .92383[.353]*		
* B:Functional Form	*CHI-SQ(1)= .047822[.827]*F(1, 14)= .025798[.875]*		
* C:Normality	*CHI-SQ(2)= 1.5384[.463]*	Not applicable	*
* D:Heteroscedasticity	*CHI-SQ(1)= .044560[.833]*F(1, 24)= .041203[.841]*		

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

Appendix 4-2

Ordinary Least Squares Estimation

Dependent variable is DLRPEX

26 observations used for estimation from 1958 to 1983

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
CON	.21312	.048465	4.3973[.000]
DLRPI	3.0165	.71902	4.1953[.001]
DLRPEX(-1)	-.67340	.24344	-2.7662[.014]
DLRPEX(-2)	-.56717	.26279	-2.1583[.046]
DLRPI(-1)	2.2306	.57213	3.8988[.001]
DLRPI(-2)	2.3203	.59218	3.9183[.001]
DLRPI(-3)	1.3456	.49017	2.7451[.014]
DLRPI(-4)	.58821	.40239	1.4618[.163]
D1	-.30271	.081929	-3.6947[.002]
D2	.64161	.21325	3.0087[.008]

R-Squared	.63676	F-statistic F(9, 16)	3.1164[.023]
R-Bar-Squared	.43243	S.E. of Regression	.095197
Residual Sum of Squares	.14500	Mean of Dependent Variable	.030002
S.D. of Dependent Variable	.12636	Maximum of Log-likelihood	30.5662
DW-statistic	1.6435		

Diagnostic Tests

* Test Statistics *	LM Version	* F Version *
* A:Serial Correlation	*CHI-SQ(1)= 1.4552[.228]*F(1, 15)= .88931[.361]*	
* B:Functional Form	*CHI-SQ(1)= 1.0480[.306]*F(1, 15)= .63003[.440]*	
* C:Normality	*CHI-SQ(2)= 2.0239[.364]*	Not applicable *
* D:Heteroscedasticity	*CHI-SQ(1)= .034846[.852]*F(1, 24)= .032209[.859]*	

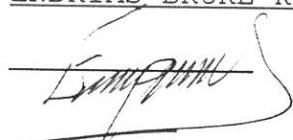
A:Lagrange multiplier test of residual serial correlation
 B:Ramsey's RESET test using the square of the fitted values
 C:Based on a test of skewness and kurtosis of residuals
 D:Based on the regression of squared residuals on squared fitted values

DECLARATION

This thesis is my original work, has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

NAME ENDRIAS BRUKE KIFLE

SIGNATURE


22/6-86