

**THE IMPACT OF FOREIGN AID ON PUBLIC SPENDING
THE CASE OF ETHIOPIA**

BY

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ABSTRACT

This paper seeks to address the effect of foreign aid on public spending with particular reference to the case of aid fungibility in Ethiopia. In this paper, 4 developmental sector and 3 non-developmental sector were considered. Agriculture, construction, education and transport & communication were classified as developmental expenditure while, defense, general service and debt servicing were classified as non-developmental expenditure. For each developmental sector, GDP, sector specific aid and aid other than the sector specific aid variables are considered for explanatory variables and sector specific spending is considered as dependent variables.

The analysis was done using OLS estimation. In estimating the long run model, first, the time series characteristic of the data is tested using ADF test and found that all the variables in developmental and non-developmental models are integrated order of one. Then, the cointegration test was conducted and concluded that there is one cointegrating vector between developmental spending, sector-specific aid, other aid and GDP. It is also found that there is one cointegrating vector b/n non-developmental spending, foreign aid and GDP. The test of weak exogeneity indicate that all explanatory variables in developmental model are weakly exogenous. Before going to estimation, the following step is to test zero restriction on the coefficients of explanatory variables in which case, at least one of the explanatory variable coefficient is found to be significantly different from zero. In estimating the short run impact, ECM method was employed after knowing not only that there is one cointegrating vector between dependent and explanatory variables, but also the variables are integrated of order one $I(1)$. Hence, the estimated result in education and agriculture sectors were marked by non-fungibility in which case the sectoral aid impact on sectoral spending have crowding in effect. However, for transport & communication and construction sector, aid fungibility seems to exist which means that there is crowding out effect. In this case, the sectoral aid impact on the sectors spending is negative. For non developmental expenditure, aid is found to be significantly affecting debt servicing expenditure but insignificant for general service and defense expenditures.

1 Introduction

1.1 BACKGROUND

Foreign aid, which is post world war II phenomenon, has been an important structural feature in the international economy. Originally, it began in the late 1940's with the purpose on reconstructing the war-torn economy of Western Europe (Todaro 1989). However, through time developing countries increasingly received foreign aid from multilateral and bilateral sources, which had two objectives. The first objective was to promote long term growth and poverty reduction in developing countries. The second one was to promote short-term political and strategic interests of donor countries (WB 1998).

In the early days of development assistance, government was seen as the positive agent for change and development. Domestic capital markets in developing countries were thought to be non existent and incapable of growth. So, in many developing countries the first moment of independence created optimism about new government as agents of political, social, and economic change. Government-to-government aid was believed as the best way of promoting development in recipient country. Unfortunately, the optimisms of aid-financed government led projects were not as effective as expected and exacerbated by the gradual dismantling of central planned economies in the late 1980s. In contrast, the export boom and rapid development in East Asian economies, market based system became more popular and effective strategy for development (WB 1998).

Thus, following these differences in ideology for development process, the third view of both government and market-based system was initiated. The objective of this development

strategy is to implement growth enhancing market based policies (stable macro economic environment, trade liberalization and so on) and to ensure the provision of important public services that cannot be well and equitably supplied by private markets for instance, infrastructure services and provision of education (WB 1998). This strategy was initiated to control the failure of both market and government activities.

Noting the above development strategy, African economies have received large inflow of foreign aid after 1950s. In Africa, the share of Official Development Assistance (ODA) to GDP has significantly increased over the years. It drastically increased from 1.9 percent in 1960-61 period to 2.9 percent in 1970-71 and to 5 percent in 1983-84 and reached 9.6 percent in 1990-91 period (WB 1992). Finally, the share of foreign aid to GDP in the post reform period also increased to 18 percent during 2000-01 fiscal year.

World Resource Institute (1993) also explain ODA (Official Development Assistance), as extremely important to the economies of many developing countries in which, in some cases, it represents 20 percent of GNP (15 countries), 12 of them are from Africa. Despite these significant flows, the contributions of foreign aid to economic progress have not been effective.

Despite this fact, OECD countries in recent years have been struggling to control fiscal deficits and contain growth in government spending. Even though foreign aid is tiny fraction of their budgets, it has been one of the first items for the drastic reduction of expenditure. This is because all major donors reduced their aid relative to their GNP's between 1991 and 1997

partly due to the end of cold war, in which case the relative importance of the strategic aid had declined (WB 1998).

Following the end of the cold war period, in which strategic aid was no longer justified, it opened up a new possibility to make aid more effective at meeting the primary goal of long term growth and poverty reduction. Yet, given budget problems and rising capital flows, donors has been rethinking about the importance and value of foreign assistance. Especially, the donors has been increasingly concerned that aid development assistance for critical social and economic sectors is being used directly or indirectly to fund nonproductive expenditures including defense (WB 1998).

In Ethiopian case, an inflow of external loans and grants started around 1950's. During the third five-year plan period (1957-1973), 25 percent of the required total investment was covered by external public capital. During that period, what, Ethiopia has been receiving was not small. It was often argued that the direction of foreign aid was characterized by negligible long run objectives, in favor of infrastructure services compared to direct investment activities for agriculture and industry sectors. Similarly, during the post revolution period, 37 percent of the total annual campaign of 1979-83 was financed by foreign aid (Tolessa 2001).

1.2 STATEMENT OF THE PROBLEM.

One of the main channels through which foreign aid influences development outcomes is through its impact on the recipient country's public expenditures. This link between foreign aid and public expenditure is however, not straightforward, because some part aid is fungible. For instance, an aid recipient country could allocate earmarked aid to specific sector however,

the recipient country may reduce its own resource to sector receiving aid and transfer it to other sector budget (WB 1998). In other case, aid can be fungible when the intended earmarked aid to specific sector is transferred to other sectors.

Suppose that aid is given to build primary school for a specific developing country and if the recipient country would have undertaken anyway in the absence of donor financial support, then the consequence of aid is to release for the government to spend on other items. Thus, while the primary school may still get built, the aid is financing some other expenditure. In such a case, aid is said to be fungible.

This diversion of resource to other sectors that was supposed to be given for the specific sector i.e., aid fungibility, raises three issues. First, the question of what aid ultimately finances is interesting only if the preference of using the finance is different from what donors would like to serve. Second, when donor and recipient preference differ it is still not clear whether the presence of fungibility is good or bad. It is dependent on how the government allocated the resource to productive projects or consumption (WB 1998).

Third, if aid funds crowd out domestic resource from the activity, they may end up financing undesirable activities, at the margin. In such a case, the development impact of external assistance may be quite different from that perceived traditional measure of project success including economic rate of return (Devarjan et al 1998).

At this point, it is important to note that, if aid is not supporting productive investment in recipient countries then it must be financing either unproductive investment or consumption.

In this case, high proportion of aid, which goes to recurrent expenditure, is not be necessarily bad, since several components of such spending (e.g. on health, education) can have higher return than capital expenditure.

1.3 OBJECTIVES OF THE STUDY

Broadly speaking, the objective of the study is to analyze the impact of foreign aid on components of public expenditure by sectors.

Specifically, the paper objective is,

1. To determine whether or not aid fungibility exists in Ethiopia and to determine whether it varies across sectors.
2. To determine whether aid increases net expenditures (crowds in) in those sectors or substitutes (crowds out) for expenditure that the government would have undertaken without external assistance.
3. To examine whether foreign aid has any effect in stimulating expenditure in non-developmental activities namely defense, debt servicing and other general services expenditures.

1.4 SIGNIFICANCE OF THE STUDY.

In most previous similar studies on aid fungibility were conducted in cross-country basis. The study of foreign aid on a sectoral basis by cross country analysis doesn't allow us to clearly examine the sectoral impact of aid on sector's spending. In this respect, different countries have different result for the impact of aid on sectors spending. Hence, such work can usually be conducted in the context of country specific, to capture the different impact of earmarked aid on the sectors.

The literature of aid effectiveness on public spending contributed generally in the cross sectional analysis of Sub-Saharan Africa. However, in Ethiopian case, the number of studies done so far is limited in number and scope, in which further study still required. Hence, the result expected from this study could also be useful in improving policy design, institutional set up, implementation, monitoring and evaluation in the area of foreign aid allocation to public spending.

1.5 SCOPE OF THE STUDY, DATA SOURCE AND METHODOLOGY.

The paper uses sectoral aid, sectoral development spending and GDP time-series data from 1966/67-1998/99 fiscal years. The sectoral composition loans and external assistance from all sources, and other variables of non development public spending in total will also be used in Ethiopian case. These non development spending public sectors that aid is frequently given are agriculture, construction, education, and transport & communication which are classified as developmental category.

Data source.

Relevant data for the thesis will be collected from various issues of the International financial Statistics (IFS), Bulletin of National Bank of Ethiopia and unpublished documents of Ministry of Finance and MEDaC for aid and expenditures variables.

Methodology

To analyse the link between foreign aid and public spending Swaroop & Jha (1999) and Pack & Pack (1990) aid fungibility model is going to be adopted in this paper. The model that is used to analyse is derived from utility maximization of government choice for two public goods type which are used for consumption and investment purposes. The dependent variable

is classified as non developmental (consumption) and developmental (investment) spending. From the utility maximization of government choice, the model derives for explanatory variables for sector specific government spending are GDP (gross domestic product), sector specific aid and other aid which is given to other sector spending. In other words, the impact of earmarked sector specific aid on components of government spending is estimated for development spending model. To inquire whether foreign assistance funded non developmental activities i.e., general service spending, defence expenditure and debt servicing, the impact of foreign aid on these non developmental activities will also be examined. After the model is specified, stationarity test will be done on all time series variables to avoid possible spurious regression result by using ADF (Augmented Dickey Fuller) test. Most time series data are classified as non stationary and hence meaningful result can be drawn by undertaking cointegration test, i.e., if the non-stationary series have stable long run linear relationship, which is stationary, then we can estimate a sensible economic relationship among variables using Johansen Maximum likelihood procedure. This procedure also tests the significance of the explanatory variables and the long run adjustment of the model. All in all, the model equations are estimated by using OLS technique with the restriction that the model passes the stationarity, cointegration and the diagnostic tests for short run models.

1.5 LIMITATIONS

The model of aid fungibility assumed two types of expenditures, i.e., categorical aid which is allocated only to developmental expenditure and no categorical aid is allocated for non-developmental spending. However, the model assumption is strictly valid if these two types of expenditure separable in the government utility function. This may not be the case because

government may have some expectation regarding the total amount of aid they will receive. They may also have a perception to which the aid can be used in a fungible manner.

In other cases, it is assumed that all aid is allocated through government sector. However, in developing countries aid may have come through NGO's (Non governmental organizations) or other sources. Hence, the whole figure of aid may be understated.

2 Survey of the literature

2.1 THEORETICAL LITERATURE

Foreign aid is a transfer of concessional resources, usually from foreign government or international institution, to a government or non-governmental organization in a recipient

country. It may be provided for a variety of reasons, including diplomatic, commercial, cultural and developmental purposes. It is typically used to fund expenditures for the purpose of facilitating development in the receiving country. In most cases, aid has been used to finance discrete investment projects such as building of road, building of schools, providing training and education, family planning and so on. Resource flows to these projects is in the form of concessionary loans and grants which is known as Official Development Assistance¹ as quoted in Ali et al (1999). This definition of aid however, excludes some concessional flows, namely those of private voluntary agencies. It also excludes official flows of little or no concessionarity. Grants, soft loan, or credits for military purposes are also specifically excluded.

2.1.1 Foreign Aid History and its Current Debate.

The origin of the current aid package began in the 1940s with the aim to serve the economies of Western Europe. This aid package was the largest in the history and known as the 'Marshall Plan'² which helped these countries to rebuild their economies after the severe devastation of World War II. However, through time, the direction of the flow of foreign aid changed from these countries to less developed ones. The success story of development aid given to Western Europe in the 1940s and 1950s led many institutions to believe that similar transfer to developing countries would permit them a comparably similar transformation

¹ For a given aid to be specified as ODA ,it must fulfill three criteria. First, it has to be undertaken by official agencies. Second it has to have the promotion of economic development and welfare as its main objectives: lastly,it has to have a grant element of 25% or more. ODA also includes technical cooperation and assistance(Parkinson 1983).

² Marshal plan initiated after the war II for the reconstruction and recovery. The economies of Western Europe devastated by the war were among the largest aid package the world had witnessed.

(Krueger 1986). Consequently, developing countries continues to receive increasing amount of development aid from various bilateral and multilateral sources from time to time.

According to Krueger (1986), this transfer of financial resources had two intellectual underpinnings. The first was the Harrod-Domar model³, which extended the Keynesian emphasis on investment to include capacity-increasing effects. The second dimension was the emphasis given by economists to physical capital and the view that shortage of capital largely accounted for the poverty of developing countries.

As quoted in Ali et al (1999), Van der walle (1998) also note aid in the context of development paradigm, in which poor countries were viewed as being trapped in a low-income equilibrium and inability to generate investment by themselves to promote capital formation and rapid growth.

As aid in developing countries expanded, its impact on recipient countries become a central issue and the concept of '**aid dependence**' emerged. According to Ali et al (1999), aid dependence is a situation where governments of LDC's receive a large inflow of aid which result in higher expenditure level thereby, through the multiplier effect extend to the production sector of the recipient economy. This higher adjustment level of aid over a number of years is referred to as aid dependence.

³ It is also called two-gap model or financing requirement model, remain the current development practice in Africa and elsewhere. It is an a aid financed investment approach to development.

However, according to Lensink and White (1997), which is quoted in Ali et al (1999), aid dependency can be defined in the context of other objective to support a given program. The main objectives that have often been identified by donors have included promoting growth, reducing poverty, advancing female emancipation and/or gender equality, enhancing environmental sustainability and good governance. The other dimension of current aid debate deals with the impact of aid on investment and growth. Two major approaches could be distinguished in this respect: the aid-financed investment approach and the aid-induced policy reform approach.

The aid-financed investment approaches, widely known as growth models of the 1950's and 1960's, were collectively known as Harrod-Domar Models, the Two Gap Models, or the Financing Requirement Models. These approach postulate that growth is proportional to investment by a constant to the reciprocal of incremental-capital output ratio, i.e., the number of capital units required to produce an additional unit of output. The basic assumption is that there are short-to-medium run direct positive links between aid and investment, and between investment and growth.

The alternative approach that provides a better understanding of Africa's growth and developmental performance is to analyze economic policies that countries have pursued over the years in relation to the role of aid. According to Ali (1999), these policies are the ones, which affect economic growth through capital accumulation and capital efficiency. The idea here is to assess the extent to which governments implement enhancing reforms that can be

assisted by foreign aid to the environment of good or bad policy. A number of previous studies have come up with the conclusion that aid has supported good policies.

Thus, the first approach does not provide a key understanding of Africa's growth and development processes, because in many empirical findings, the theoretical link of aid, investment and growth doesn't hold as it was expected. Rather it is the difference in economic policies, which explains much of the differences in growth process. Therefore, the combination of private investments, good policies and foreign aid can be a tool for economic growth. However, defining good policies based on macroeconomic aspect may prove to be restrictive in the context of development objectives (Ali et al 1999).

There is also a new line of argument emerged from donor countries which sets some conditionality for recipient countries to be eligible for aid package. Based on Institute of Development Studies, IDS (2001) policy briefings, the promotion of "good government" has become an explicit objective of most aid donors during the early 1990's. Definition of what it means by "**good government**" varies among the societies of recipient countries, equity and a commitment to market-oriented economic policies. For most donors, the main ingredient for "**good government**" are democracy, respect for human right, a rule of law, efficiency, accountability⁴ and transparency⁵ in government and public administration. Disagreement among donors on the content of good government agenda means that the donors failed to give clear signal to recipients about what type of good policies do they wanted to see.

⁴ Accountability between partners is the responsibility for transferring resources to intended purpose.

⁵ Transparency implies information shared between partners, and accessible in the public domain.

The aims and approaches used to pursue good government policies is more or less the same that the donor imposed. But the different thing is that donors are putting more emphasis on using aid to promote good government. Moreover, due to the growing belief that “**bad government**” has undermined the developmental process in LDC’s, donors have started to put restriction. Some basis for such restriction include some on the basis of corruption record, poor control of public funds, lack of accountability, human right abuses and excessive military expenditure.

2.1.2 Nature of Aid in LDC’s

The Multilateral Development Bank⁶ generally provides project-oriented assistance to LDC’s. Government project oriented lending has a closed end matching structure, which means that donors and recipients share the total cost of particular investment but with a limit on the total amount of aid available. In other words, in order to receive the fixed amount of loan aid, the recipient may be required to reallocate a certain amount of its own funds in addition to requirements of how the funds should be utilized. The theoretical purpose for providing closed-end matching aid is to stimulate recipients to increase spending in the sector that receives the aid. On the other hand, categorical aid, which is aid for special purposes but without the cost sharing requirements, would be expected to have a smaller effect on recipient spending, since there is no inputs of local funds (Cashel-Cordo, 1990).

⁶ Multilateral development banks are multilateral institutions that are continental. Africa Development Bank, Asia Development Bank, European Bank for Reconstruction and Development, Inter-American Development group and World Bank group are the five institutions of Multilateral Development Institutions.

The International Monetary Fund (IMF), is the other multilateral source of financing for LDC's. Unlike the MDB, IMF loans generally are not tied to specific investment projects. Thus, an IMF loan doesn't require additional funds from the recipient's central government. The set of conditions on IMF loan, however, is in the form of policy changes required for the recipients. The policy changes may involve a significant restructuring of the public sector budget. IMF aid is also a form of closed end matching aid, since to receive fixed amount of loan aid, the recipient may be required reallocating on how the IMF fund should be used (Cashel-Cordo 1990).

In contrast, bilateral sources provide aid on a country-to-country basis. Aid is provided through both grants and loans, which generally targeted toward specific sectors or purposes. The form of bilateral aid is categorical aid, in which aid is targeted but where there is little or no cost sharing arrangement with recipient countries.

The flow of this foreign aid (bilateral aid) from high- to low-income countries can be classified into three types. The first includes income transfers of a 'relief nature' such as emergency and distress relief (including drought-related food transfers, medical and refugee relief, and balance of payment crisis support). These transfers are generally temporary responses to unanticipated events or shocks to the economy. They can be perceived as an attempt by the donor community to help finance what is denoted in the permanent-income theory as transitory consumption. In addition, they can be viewed as an attempt to maintain a 'subsistence' level of consumption by absorbing the shocks to income entirely by changes in savings (Friedman 1957) as cited in Teressa (1997).

The second type of aid consists of income transfers for development purposes, such as project aid and technical assistance. The level and duration of these transfers are signaled by past and current commitments and may, therefore, be approximately anticipated by recipients. Contrary to the temporary nature of the relief transfers, development assistance is more systematic and permanent. However, the fungibles of these funds are somewhat limited because they are tied to specific projects or programmes (Teressa, 1997)

The third type of aid has little to do with accelerating economic growth. According to Kruger (1986), it is stressed that donors may wish to promote commercial interest, to support a friendly government in power, and to acquire good will now in the expectation that it will be politically valuable later. In some of these cases diplomatic realities may preclude using the donor's resources for developmental purposes. Hence, the objective of such type of aid have often been military or political factor, which may or may not be consistent with using the resources.

2.1.3 Fungibility

It is basically concerned with how an aid inflow affects government expenditure and financing patterns in the recipient country. Two distinct, but inter-related strands of the development literature have attempted to deal with the impact of aid flow on government expenditure and financing pattern, both having the concept of aid fungibility as a central issue. Fungibility can be defined in two contexts. Fungibility in the development/foreign aid context refers to the ability of an aid recipient to avoid donor-imposed restrictions and spend some amount of targeted aid on non-targeted aid programmes. This amount is defined as the fungible component of targeted aid (McGillivray & Morissey, 2000).

Fungibility in the public finance context refers to the recipient's ability to transform some portion of targeted aid into pure income or income-generating resources that can be spent effectively in any way the recipient chooses. Here, the "fungible component" refers to the pure income supplement. Some of it can be spent on the targeted good depending on whether this good is normal or inferior (Feyzioglu et al 1998).

The approach used to address fungibility can be divided into two. The first one is concerned with the fungibility of aid as regards government spending patterns, while the other one, so-called 'fiscal response' literature, adopts a more theoretical approach and attempts to analyze how aid impacts on various categories of expenditures and financing sources including the effect on taxes. (McGillivray and Morrissey 2000).

There are also important qualifications made by World Bank report (1998) for a given aid to be fungible. These qualifications can be summarized as below:

- Full fungibility does not mean that none of the aid is spent on civil goods (e.g. education).
- Fungibility is a problem when donors and recipients have different objectives (e.g. donors want all money spent in education but recipient want to spend some of the money in education and some in military).
- Fungibility requires that the amount of aid in target sector is less than the amount the recipient would have spent from its own resources.
- Fungibility is less likely when a) the amount of aid is large relative to the recipient's budget as in many aid dependent countries and b) the item to which the financing is tied is specific and a small fraction of the recipient's budget.

White et al (1998), further elaborates the definition of fungibility by distinguishing between aggregate and categorical fungibility. The former is where the aggregate category (say, imports or government expenditure) does not rise in a one-for-one manner with an aid flow whose intended purpose is to increase the aggregate figure. Categorical fungibility occurs if the inflow increases any expenditure item within the aggregate other than those intended by the donors.

McGuire (1978) has done a seminal work on modeling aid fungibility in his study on local government response to federal grant for education. His seminal work was adopted in Feyzioglu et al (1998) World Bank panel study on 14 developing countries. The different case of fungibility hypothesis stated in this paper is presented in figure 1 and explanation on the case is given as follows.

Suppose that a developing country government buys two public goods (defense and education), both normal (not inferior), in the market to provide to its citizens. The budget line B'B represents public spending choices that can be financed by domestic resources. Given the preferences of the recipient-country government, point A represents the optimal mix of the two goods, defense and education, in the absence of aid. Point A represents the preferred resources allocation. An amount F of earmarked foreign aid is given for G_2 . The donor agency and the recipient country are assumed to have different preferences regarding how aid should be spent. While the donor agency would like the aid funds to be spent on G_2 at the margin, for a variety of reasons, it is unable to monitor the intended pattern of public spending.

Given the pre-aid budget constraint, if the recipient country can treat a portion \varnothing ($0 \leq \varnothing \leq 1$) of the earmarked aid as if it were a pure revenue supplement. The following three cases define the degree of fungibility.

Case 1. Aid is fully fungible if $\varnothing = 1$ and the post-aid optimal mix of the two goods, chosen by the country is an interior solution. The latter requires that the country spend at least some of its own resources besides the aid in the targeted sector $\varnothing = 1$ implies that the budget constraint shifts outward by the full amount of aid with a kink from point A to E, (Feyzioglu et al 1998).

Case 2. Aid is fully non fungible if $\varnothing = 0$. In this case, the country is not able to manipulate its resources use and is forced by the donor agency to spend all the aid money in the targeted sector. Given the preference of the country, such move is sub-optimal, as shown by a move from point A to point D in the figure. For example, if the pre-aid composition of education and defense spending is known to be at point A, the recipient country could be required to spend in addition the aid resources, G, on education. The post aid composition of spending would then be at point D, and aid would be non-fungible at the margin (Feyzioglu et al 1998).

Case 3. Aid is partially fungible if $0 < \varnothing < 1$. In this case, the country's budget constraint shifts outward by the amount of fungible aid. A kink (line C'EA) in the new budget line B'C'C indicates that the education spending chosen by the country plus the non-fungible part of the aid has to be greater than (or equal to) the amount of aid. The country chooses an optimal point on its new budget line and adds non-fungible part of the aid to its educational spending. This case is given by a point that lies between E and D on the post-aid budget

line. Partial fungibles imply that the country is not able to transfer resources from education to defense as much as possible (Feyzioglu et al 1998).

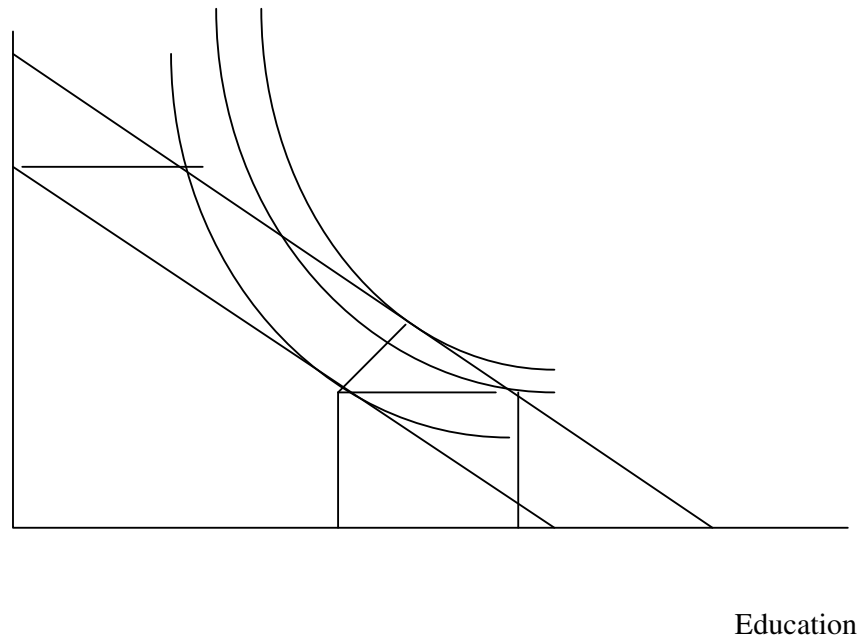


Figure 1. Impact of Aid on Country's Budgetary Allocations.

2.1.4 Government Spending and Foreign Aid.

The empirical literature on the effect of foreign aid is generally supported by Gramlich's theory. According to Gramelich (1969), an addition to resources through grants stimulates greater public expenditure than an additional dollar in local resources.

In other words, an increase in \$ 1 aid leads to more than a dollar increases in government spending. Thus, instead of providing tax relief by substituting for domestic mobilization, aid may increase taxation by "crowding in" government spending. This "Crowding in" is possible if aid helps government mobilize other resources through improved tax collection or better access to commercial funds or if aid relieves constraints that were limiting government

spending (WB 1998). In this case, aid can be fungible if the government uses the increased resource to finance spending, tax cuts or reduce fiscal deficit. Despite the above arguments, however, it is not generally evident that flypaper effect hold.

2.1.4.1 Impact of aid on consumption and investment.

In the absence of foreign aid, every economy faces a choice to consume now or in future, i.e. investment. The more investment undertaken by a given economy, the less it consumes now, in order to release more resources in future times. Hence, foreign aid, just like any other domestic resources, could be allocated for investment and/or for consumption (Weissenkopf 1972) as cited in Teressa (1997). In LDC, foreign aid can effectively transform into income-augmenting fund and thus purely fungible resources (Khiliji and Zampelli 1991, Pack and Pack 1993). This directly influences how these countries governments allocate foreign aid for the expansion of productive expenditures, expansion of consumption expenditures, tax reduction or other objectives of government policy (Mosley et al 1987). To grasp this interplay between capital formation and consumption spending requires an understanding of a country's response to price and income movements, plus some knowledge on the effective mechanism of foreign aid, and the responsiveness of aid donors to recipient country's needs, must be known (McGuire 1987; White 1992)

2.1.4.2 Aid and Development Spending to Sectors.

In practice, it is difficult to find the link between aid and development financing. In general, development financing is aimed at particular project or specific expenditures, such as investment in infrastructure or social services. Since many developing countries have weak data on how development expenditures and other spending like defense are allocated it is

difficult to split between development expenditure and aid. However, a general idea can be gained by examining the aid impact on various sectors of the economy in which aid is frequently given (WB 1998).

There are two ways of addressing sectoral fungibility i.e., if aid to a particular sector raises expenditure along that sector by comparison of cross sectional data and time-series analysis. The net effect of an aid dollar on spending in specific sector depends not only on the composition of the aid received, but also on how the government responds to aid flows (WB 1998).

In this case, the recipient government has several options to spend when they receive aid. They can increase spending or reduce taxes one to one to inflow of foreign aid. Another option can be the reduction of fiscal deficit and/or increase spending in non-developmental activities.

2.2 EMPIRICAL LITERATURE

The literature on the effectiveness of foreign aid is more concentrated on studies linking aid with macro economic variables such as economic growth, consumption, investment and taxation on one hand and outcome of poverty on the other hand. In most cases, the macroeconomic impact of foreign aid on less developed countries has attracted considerable attention in literature. A number of previous econometric studies have analyzed LDC's public sector fiscal behavior in the presence of aid flows. This includes seminal work of Heller (1975), McGuire (1987), Cashel-cordo and Craig (1991) and Gang and Khan (1991). These studies have used key macroeconomic variables such as, public investment, taxation and

various categories of recurrent consumption to examine the possibilities that aid reduces taxation effort and is substituted between public investment and public consumption, which is the case of “fungibility”. Despite its importance to policy, there have been few studies, which have analyzed the impact of foreign aid effectiveness on its sectoral allocation.

To the best of my knowledge, the fungibility of foreign aid among public expenditures categories such as agriculture, health, education, transport and communication and other sectors have not been fully analyzed in Ethiopian case. These phenomena or “fungibility”⁷ have been more closely examined by Pack and Pack (1990), Mosley et al (1987), Feyzioglu et al (1998), Boone (1994, 1996), Khilji and Zampelli (1991), Swaroop and Jha (1999) and Devarjan et al (1999).

The original study to examine the fiscal response to foreign aid comes from Heller (1975). His study used 11 African countries data from 1960 up to 1971, which includes the public investment, borrowing public consumption disaggregated into civil consumptions (government administration, public debt servicing security and diplomacy expenditure) and socio economic consumption. The dependent variables are categorized as grants and loans. The econometric result obtained by using two stage least square method indicate that the impact of foreign inflows on taxes is negative and the impact of foreign loan on borrowing is also negative but lower than that of effect of grant on taxes. Foreign loans, which lead to an increase in total expenditure and grants, are partially allocated to consumption budget.

⁷ Evidence of fungibility were acknowledged by many authors such as Heller (1975), Weisskopf(1972), Mosley(1980,1987)i.e. they implied that foreign aid have been used to increase consumption rather than investment.

One of the criticisms of Heller's model is failure to incorporate indirect positive impact of aid on taxes through its positive impact on output (Income). The indirect effect of aid on taxes is considered in the upcoming model of Mosley (1987) to reflect its full effect.

Mosley et al (1987) contrast results from estimating OLS regression with the result from estimating the simultaneous system of equation using three stage least squares method based on the data averaged over the period 1970-80 for 63 countries. Neither of the method yielded a statistically significant correlation between aid and growth suggest a possible linkage of aid to non-productive expenditure which in turn has a negative price effects to the private sector. . A distinguishing feature of the analytical framework used by the authors is the incorporation of indirect effect of aid on growth through two channels: the spending pattern of public sector (fungibility), and change in relative prices (hence influence private sector behaviors).

They recommended that donor's concentrate on aid on countries that meet certain criteria for high effectiveness of aid such as estimated rate of return; proportion of aid allocated to "non-productive" recurrent expenditure, and estimated impact of aid on the private sector.

Boone (1994) examines the impact of aid on consumption and investment by using 97 data form developing countries in which 36 of them belong to Africa. He used OLS regression method in which aid variable taken for the study has 25 percent grant component. An estimated aid determinants equation, which also includes aid/GDP, annual GDP, and per capita growth rates, showed aid to be strongly negatively correlated with income per capita and population. The empirical results also indicated that marginal propensity to consume wasn't significantly different from one, and that the marginal propensity to invest was not

significantly different from zero. That means the effect of a 1 unit increase in foreign aid stimulates consumption by nearly the same amount and it is ineffective to increase investment which is a capital expenditure.

However, these results Boone (1994) were based on a sub-sample, which excluded countries with aid/GDP ratios of 15 percent or higher, whose inclusion have yielded radically different results in other works. The marginal propensity to consume fell to 0.45 and the marginal propensity to invest rose to 0.35. The author attributes the difference in the results to non-fungibility of aid in small countries where one infrastructure project is equivalent to large fraction of GDP. Boone (1994) also examined the allocation of aid between government and private consumption and concluded that neither the government nor the private sector chose to invest on aid.

In his later study, Boone (1995) employs a public choice framework to examine the importance of political regime in recipients' countries to aid effectiveness. In the framework, he considered that politicians finance two activities, namely "productive" government spending and transfers to supporters using either distortionary taxes or aid. He also, stressed that aid may also be used to reduce the distortionary taxes. Three alternative political regimes were considered. The first one is an elitist regime whose optimal policy is to transfer aid resources to wealthy elites. The next one is an egalitarian regime whose optimal policy is to transfer aid resources to the poor and hence improve poverty indicator. The last one is a

laissez-faire⁸ regime whose optimal policy is to use the aid to lower distortionary taxes, and hence stimulate investment and growth.

Thus, Boone's (1995) empirical findings based on data for some 97 developing countries concluded three results. First, there was no significant impact of aid on tax proxies or on the measures of distortionary policy. Thus there was no support for the hypothesis that government uses aid to reduce distortion. Secondly, there was no significant impact of aid on basic indicators of poverty/human development (infant mortality, primary schooling and life expectancy), suggesting that aid does not benefit the poor. Thirdly, the marginal propensity to consume resources was not significantly different from one, and the marginal propensity to invest aid resources was not significantly different from zero. Boone (1996) attributes the lack of impact on poverty partly to the fact that aid doesn't introduce incentive to recipient countries for policies that would improve human development indicators.

Alemayehu (1996) examines the fiscal response to external assistance in Africa by using a time-series data from 21 countries with the time series data for the period 1971 up to 1990. His study is different from the others since it disaggregates taxes as indirect and direct in order to analyze their separate effect. The employed model is departed from the assumption of utility maximization. The result obtained by OLS regression of fiscal response model indicates that the impact of capital flows on taxes varies across the type of inflows, nature of taxes and by regions. Aid from bilateral sources has negative impact on direct taxes and it has significant impact on direct taxes. In the expenditure side, it is found that a capital inflow has strong positive impact on current government spending.

⁸ According to Bailey (1995), in Laissez-faire regime that is in pre-Keynesian neoclassical system, the market is the motivating factor to allocate resources efficiently rather than by the government.

However, in his analysis the data on capital inflows and current expenditure is obtained from different sources which might have certain discrepancy. The data for capital inflows is obtained from IMF publication and the expenditure data is obtained from GFS (Government Financial Statistics) in which government expenditure data is obtained from recipient country. There may be discrepancy in the foreign inflow data reported in IMF publication and recipient country financial tables. Also the fact that His study is different from the others in using standard econometric technique (stationarity and cointegration test) were used to analyze the fiscal response to external assistance, made this work different from the others.

To test the fungibility hypotheses, Pack and Pack (1990), used three types of equations: non-developmental current expenditure, developmental expenditures and revenues for Indonesia during the period 1966-1986 across five sectors namely agriculture, industry, transport and tourism, social sectors and others. These types of equations were also used to allow the cross sectional error correlation implied by the relation of the dependant variables through the budget constraint. The coefficient estimates are then used to stimulate the effects of a rupiah increase in aid per capita, which is spread over the sectors in proportion to their average share in project aid during the 1966-1986 period of the study. They used a systems estimation procedure, in the case of seemingly unrelated regressions, SUR employed in Zeller (1962).

The result for Indonesia, as Pack and Pack (1990) put it, shows that a one rupiah increase in categorical aid apportioned according to average categorical aid values, stimulates an increase in total expenditure of 1.58 rupiah. Half of the increase is financed by an increase in revenue raised by Indonesia from its own sources and suggested that the other half increase may come

from a reduction in expenditures in the residual expenditure category namely to manpower and regional development.

The finding that aid increases revenue collection is not in line with the fiscal response literature that taxes fall as aid rises. Taxes are raised rather than reduced in response to inflow of aid and hence, the author concluded that, as Pack and Pack (1990) put it, foreign aid didn't displace development expenditure and it rather stimulates total public expenditure. Moreover, most categorical aid⁹ was spent on the purposes for which donors intended it. No diversion of aid to other categories of development expenditure occurred. They also found no support either for diversion of developmental aid to current expenditures or foreign aid leads to a reduction in domestic revenue-raising effort. However, Pack and Pack (1993), in the Dominic Republic case study, find that, foreign aid is characterized by fungibility consisting of major shifts from developmental expenditures to deficit reduction, debt service and reduction in tax-efforts.

The value of R^2 reported on the Pack & Pack (1990) study is 0.99, which may show a higher probability that the estimate regression is spurious. The time series property of the data and the diagnostic tests are not incorporated to the model. Moreover, to capture the full range of aid fungibility, they didn't estimated the impact of foreign aid on non developmental expenditure by disaggregating into various types such as defense spending, debt servicing and other types of general expenditures.

Devarjan et al (1999), focused on Sub-Saharan Africa with the largest GDP share of aid. He used a panel data which has annual observation on 18 Sub-Saharan African countries from

⁹ The categorical aid includes agricultural aid, industrial & mining aid, transport & tourism aid, education & health aid and aid other than these sectors.

1971-1995 by using two stage least square method. Ethiopia was also included in the analysis to examine the impact of sector specific concessional loan on sectoral spending. In this study, fungibility of concessional loan intended for particular sector in Africa has different outcomes. According to them, aid given to energy and transport & telecommunication sectors leads to some increase in public spending in those sectors, but the increase is not one to one. However, aid to education sector has an almost one-to-one effect on the sector's spending in Africa. They also indicated that in partial fungible sectors, governments pull more out of aid resources than they do out of their own at the margin. All in all, aid to Africa is partially fungible which means that government do not spend all sectoral aid in that sector, nor do they use such aid for budgetary support.

Feyzioglu et al (1998) estimated the impact of concessional lending to sectoral aid allocation based on the data from 14 developing countries during 1971-90 by using OLS regression method. Net annual ODA, sectoral aid net of disbursement of concessional loans were both taken as dependent variable expressed in terms of share in GDP. It was found that a \$ 1 in aid increases government spending by \$1. In contrast, a \$1 in concessional loans increases government spending by more than \$1. Their findings can be categorized into four attributes. First, concessional loans to transport and communication sector are not fully fungible. Concessional loans to energy sector are partially fungible. However, for agriculture and education sector it is slightly fungible. Secondly, almost 30% of ODA goes to government capital expenditure and about 70% to recurrent expenditure. Thirdly, about 20 percent of ODA goes to public investment. Lastly, there was no evidence that ODA's impact on public investment crowds out private investment.

Feyzioglu et al (1998) also found no significant impact of aid on infant mortality in regressions of the latter on aggregate ODA. The authors also report results indicating that concessional loans, mostly from multilateral financial agencies, were most simulative to both government expenditure and public investment.

In this study, for analysis of sectoral fungibility they use concessional loans as an explanatory variable. However, it would have been more sound if the aid variable includes both external assistance and concessional loan. Since, concessional loans are more binding in their allocation to sectors and the interpretation of fungibility across sectors would be understated.

Swaroop et al (1999) however, uses Indian data to examine the fiscal effects of foreign aid from 1970-1995 by using OLS techniques. They disaggregated expenditure into non-developmental and developmental for agricultural, irrigation, energy, transport and manufacturing sectors. They model two dimensions of foreign aid fungibility at a federal level and inter-governmental (state) level. Their empirical findings suggests that the central government convert most foreign funds including those earmarked for state governments into fungible monies and spend on activities that would have been undertaken anyway.

In all the sectors, the coefficients of sectoral aid variables found to be statistically insignificant which lacks an explanatory power to explain the difference of fungibility across sectors. The R^2 is also too low ranging from 0.08 up to 0.54.

The fungibility hypothesis, which has been tested by use of econometric method in a number of studies reviewed in the previous part. However, results are far from consistent. Feyzioglu et

al (1998) finds high fungibility of aid to agriculture, education and health, partially fungible in energy sector and non-fungible in transport and communication sector. In another study, Devarjan et al (1999) employed similar methodology but finds that aid to education is non-fungible and partial fungible in transport and communication and energy sectors. The result obtained from different studies indicates mixed result even if the sample countries differ. A more careful reading of empirical evidence reveals that degree of fungibility differs between sectors and countries with the lack of empirically supported explanations.

In all the literature discussed above, have methodological shortcomings. That is no adequate attention is paid to the lag structure for both dependent and independent variables. Moreover, data on loan are inadequate as an indicator of aid in general [loan data is used in Feyzioglu et al (1998) and Devarjan et al (1999)]. In most empirical literatures, diagnostic tests are also not reported. Most data seems to be taken as stationary variables in which no clear indication of this test presented on the papers.

In addition, data collected from mixed sources may not be justifiable. A problem that several of these studies have confronted the fact that data on aid is collected from donor agencies while data on public expenditures is collected from recipient countries expenditures. Regardless of fungibility issue, it is known that how much grant donors claimed to have provided from the OECD's international development table and it is known that how much the recipient government receives aid as a budgetary revenue record from IFS (international Financial statistics). It is expected to have one to one relation from the two sources. However, IMF (1998) made detailed case studies in some countries and finds that OECD flows and the respective inflow to the country budgetary revenue considerably differs. For example,

Feyzioglu et al (1998) and Devarjan et al (1999) used different sources. Selection of countries also may lead to sample bias.

Finally, an attempt was made to examine the impact of foreign aid and trade in Ethiopia by Teressa (1997) at macro sectoral and micro levels. At the macro level, attempts were made to assess foreign aid and trade impact on government consumption, gross domestic investment, aggregate import and GDP net of exports. The empirical study showed that foreign aid and its components, i.e., foreign aid and bilateral loan have been among the most important factor positively influencing Ethiopia's domestic saving. Teressa (1997) also stressed that bilateral and multilateral aid had significant effect on government consumption, while export have negatively influenced current government consumption. He concluded that foreign loans and bilateral aid have been the major sources to finance imported capital goods and also to consumer goods.

At sectoral level, as Teressa (1997) puts it, the impact of foreign aid and trade measured by the impact of one of their proxies, namely imported mineral fertilizers, had significant positive influences on farm households, cereal production, productivity and employment. The finding suggests that, through making modern farm inputs available to farm households, foreign aid contributed to increased food production and improving productivity.

Teressa (1997), analysis is different from the other study in which he chooses the best models for macro, sectoral and micro equation on the basis of their statistical (beside economic and econometric) performance. The prime interest in his model however was to estimate the impact of foreign aid and trade on import, export, domestic investment, saving and

government consumption which is strictly different from this paper objective of estimating the impact of aid on government spending on sectoral level. In Teresa (1997), sectoral level analysis only considered agricultural sector in which the analysis made inquiry by examining the effect of foreign aid on agricultural export. Moreover, the aid variable data used for sectoral analysis is only the aggregate one. However, to analysis fungibility across sectors earmarked sector specific data is needed for the study.

3. Foreign aid and Government Spending In Ethiopia

3.1 OVERALL TREND OF GDP

Ethiopia is one of the poorest countries in terms of current GDP per capita which is estimated at 256.49 Birr in 1999/2000. The latest UNDP Human Development Index also ranks Ethiopia in position 172 out of 174 countries. The lowest rank is partly attributed to rigid macroeconomic policies, recurrent drought & civil war, in which case it took away huge amount of domestic resources to those incidences.

The agriculture sector, which account for 50 percent of GDP, registered annual growth of 14.5 percent during 1963/64-1998/99 period. Especially in 1994/95 and 1995/96 agricultural outputs was estimated to have grown by 34.0 percent and 14.6 percent respectively. In this respect, favorable climatic condition, peace and stability have contributed to the sound performance of the sector. In addition, policy changes that have been taken place in the agriculture sector particularly in the area of pricing and marketing of inputs and outputs coupled with research and extension programmes have also contributed to expansion of agricultural output (Solomon et al 1999).

In contrast, the real growth rate of industry was 13.9 percent during 1963/64-1998/99 fiscal year. In later period, its growth rate reached a maximum of 8.5 percent. Most of the sector progress comes from the expansion manufacturing and small-scale industries. According to Solomon et al (1999), the expansion of agricultural output is due to the availability of foreign exchange and imported goods.

Table 3.1 Sectoral composition of GDP

Period	Agriculture	Industry	Services
1966-1974	64.78	10.18	25.03
1975-1991	55.60	11.43	32.96
1992-2000	55.31	11.37	33.30

Source: Computed from MEDaC various years statistical table.

The sectoral composition of GDP shows that agriculture still maintains the dominant position over the three eras. The share of industrial sector to the total GDP was 10.18 percent in the Imperial period, which is slightly less than 11.43, and 11.37 percent in Derg and post reform regime implying that the change in percentage share in industrial sector is relatively slower. In the distribution service sector, its share was the highest in the Derg regime but only slightly to the post reform share of 14.15 percent. Hence, in all these cases, sectoral compositions of GDP have not shown much change in the share of output composition over 30 years.

3.2 COMPOSITION OF GOVERNMENT SPENDING

The real total expenditure of Ethiopia was 734.3 million birr in 1970/71 fiscal year but then reached to 1,356.9 million birr in 1974/75. It increased, on the average, at the rate of 40.5 percent per annum. Similarly, in the Derg regime, the trend of government spending from 1974/75 up to 1990/91 shows that real public expenditure increased from 1440.09 million birr in 1975/76 to 2766.11 million birr in 1990/91, which shows 76.8 percent increase per annum on the average. When it comes to the post-reform period, the real government expenditure

was 2,130.71 million in 1991/92 and then sharply increased to 4,622 million birr in 1998/99 at the rate of 79.6 per annum on the average.

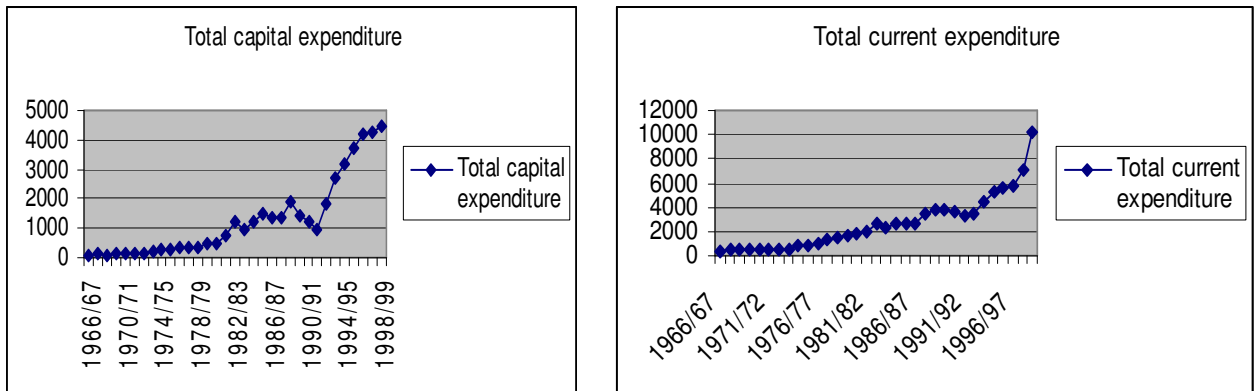


Figure 3.1 Trends in capital and recurrent expenditure over time

The rise in the recurrent/capital expenditure ratio was observed in the 1970s from 28.79 percent to reach 38.24 percent in the 1980s on the average. This sharp rise in capital/recurrent expenditure ratio is mainly due to the rise in the government share of total investment. The socialist management of the Derg regime privatized many institutions in which, recurrent expenditure increased dramatically. Moreover, outlay for revolutionary developmental campaign had contributed much of the increase in recurrent/capital expenditure ratio which continued up to the beginning of the post reform period.

The relative share of capital expenditure to the total spending in the post reform period jumped from 25.01 percent in 1991/92 to 30.45 percent in 1996/97. However, the share of recurrent expenditure to GDP was about 9 percent during the Imperial era and increased sharply to 18.3 percent in the Derg regime, by reaching its maximum in 1987/88 fiscal year due to the growth of the public sector economy. Then, it sharply decreased to 16.99 percent in the post reform period as the system of administration decentralized in to regional level. The

relative share of capital expenditure to GDP has not shown a significant change, especially after the peak level of 11.8 percent in 1988/89 fiscal year. In terms of percent, the capital share to GDP in the 1970s was 3.47 on the average, and then increased to 8.95 in the 1980s and lastly decreased to 8.16 in the 1990s.

3.2.1 Recurrent Expenditure

Recurrent spending consists of expenditure items, which are recurring in the process of delivering government economic and social services. Wages and salaries, operation and maintenance, pension and price subsidies, and debt servicing are among the major components of recurrent expenditure.

The allocation of recurrent expenditure by functional classification reveals that annually about 43.14 percent of recurrent expenditure was channeled to general services. The share of general services further increased to 54.11 percent in the Derg regime and then decreased to 37.75 percent during the post-reform period. The real amount of government expenditure fell to 658.09 million birr in the post reform period from 764.57 million birr in the Derg regime. In contrast, economic service share during the Imperial period has been better when it is compared to the other regimes. It falls to 6.35 percent during the Derg regime by shifting its share to general services and other categories. In the post reform period, allocation of fund basically concentrated on economic and social sectors to increase their respective service share by 2.05 and 3.07 percent.

Table 3.2 recurrent expenditure by functional classification

Average real terms Expenditure categories	Period (Percent Share)		
	1966-1974	1975-91	1992-2000
General Services	328.81(43.14)	998.56(54.11)	1006.04(39.75)
Defense	142.73	764.57	658.09
Others*	150.60	163.64	221.07
Economic services	76.33(11.25)	111.36(6.35)	205.28(9.30)
Agriculture	21.57	47.49	128.25
Industry	3.40	10.70	13.82
Transport& comm.	11.34	3.09	9.10
Construction	31.23	40.04	41.57
Social services	165.81(22.42)	349.43(20.98)	529.04(24.05)
Education	114.33	222.05	336.57
Health	35.58	69.88	114.69
Others	31.79(23.19)	170.34(18.56)	341.62(24.86)
Pension	14.60	60.60	81.44
Debt servicing	17.28	68.73	204.72

Source Computed from Ministry of Finance.

Others* includes organization of the state, judiciary, public order and security etc...

3.2.2 Capital Expenditure

Capital expenditure is broadly defined as an outlay to development projects to enhance the capacity of the economy for the production of goods and the provision of economic and social services. Such outlays include spending on land development, construction of power plants, building, dams' roads and other construction, and purchase of machineries and equipments. It also includes payment for project study and design management supervision, and direct labor cost. However, some expenditures of capital nature that are treated in recurrent budget as some recurrent outlays, also appear in the capital budget (MEDaC 1998).

Capital expenditure is categorized into three groups: economic development, social development, and general development. Economic development includes productive activities and infrastructural facilities such as agriculture, industry, mining and energy, transport and communication etc. Social development includes education, public health and social welfare, while general development includes compensation payments as its component.

The lion share of capital expenditure has been allocated to economic development followed by expenditure to social development in all the regimes. The average share of economic development to capital expenditure was 75.6 percent in 1970s and then increased to 82.9 percent in 1980s and declined to 72.97 percent in the 1990s.

In contrast, the share of social development which was only 8.2 percent of total expenditure in 1970s increased to 9.8 percent and 17.4 percent in the 1980s and 1990s respectively. The high growth rate of social development expenditure was mainly due to permanent increase of education spending in the post-reform period. During the Imperial period, the nominal

education spending was 19.2 million birr in 1966/67 and then piled up to 33.36 million birr 1974/75 but there was no significant rise in education spending during the post reform in which it stayed 31.3 million birr.

Table 3.2.2 Sectoral distribution of capital expenditure (in percent)

Categories	Average Real terms(percentage Share)		
	1966-1974	1975-1991	1992-2000
Economic Development	144.21(78.64)	642.92(86.87)	793.03(74.33)
Agriculture	37.16	208.70	134.32
Industry	15.27	86.27	81.55
Transport & comm.	47.49	84.70	186.31
Construction	17.31	46.87	74.86
Social Development	36.43(18.56)	70.20(11.76)	223.90(17.35)
Education	19.91	27.65	111.39
Heath	14.26	20.00	51.72
General Development	3.76(2.53)	7.91(0.89)	64.25(4.49)

Source Computed from Ministry of Finance

The Sectoral distribution of capital expenditure in the Imperial era indicates that expenditures for social development have got more share than the other regimes. It was in the imperial era that many public hospitals and schools were constructed to have highest share of social sector spending out of total spending.

In the Derg regime, the share of economic development was the greatest of all the regimes. This was mainly because of government involvement to directly productive activities such as statistics and manufacturing of public enterprises in which case, the government spent large

sum of money in establishing and expanding the activities of publicly owned enterprises. According to Teshome (1993), largest share of capital expenditure may be seen as productive allocation but when it comes to Ethiopian case, crowding out of private investment through credit rationing, capital limit, licensing can be more explanatory factors to the increased participation of government in capital projects.

In the post-reform period, the share of social development to total capital expenditure shows an improvement increasing from 11.76 percent to 17.35 percent since much of the priority is given to the expansion of health and education sector spending.

3.2.3. Financing Capital Expenditure

Table 3.2.3 Source of capital expenditure Finance.

Period	Real average(Percentage Share)		
	Central Treasury	External Loan	External assistance
1967-1974	86.77(55.72)	53.52(32.93)	16.25(11.35)
1975-1991	366.51(55.53)	208.41(31.49)	83.91(12.98)
1992-1999	697.53(64.49)	298.86(26.65)	95.45(8.86)

Source: Computed from Ministry of Finance statistical table

The relative share of government sources of capital finance shown above indicated that there have been little changes in the relative importance of government sources of capital finance during the Imperial and Derg regime. This way of financing capital expenditure in the previous two eras seems to be highly depend on external finance, which is compared to 35

percent share in post reform regime. However, in the post-reform period, the relative share of central treasury to the total capital expenditure finance significantly increased to 64.49 percent from 55.53 percent and 55.72 percent during the Derg and Imperial regime respectively. The significant increase in the central treasury share might be due to the inclusion of counterpart fund to domestic sources of finance.

Counter part fund is actually a combination of assistance and loan obtained from different sources, channeled through the National Bank of Ethiopia (NBE). The NBE distributes the hard currency to importers based on the foreign exchange auction rate and collects Ethiopian birr and, after retaining the service charges, channels the rest to the Ministry of Finance, which uses the money to cover government expenditure (Solomon et al 1999). Thus, capital finance dependency on external sources fell to 35.51 percent in the current regime compared to 44.28 percent and 44.47 percent in the Imperial and Derg regime respectively.

3.3 TRENDS AND COMPOSITION OF EXTERNAL ASSISTANCE.

Ethiopia, as in many development countries, has been using foreign aid to complement domestic resources of the country. The inflow of foreign assistance, which was 18.84 percent of government expenditure, reached a maximum of 19.15 percent in the severe drought of 1984/85 period. In contrast, the external loan reached its first peak in 1980/81 period which amounted 494.8 million birr in nominal terms, significantly increased to 748.85 million birr in 1988/89 and then reaching its ever maximum of 1799.4 million birr in 1993/94 fiscal period.

As a share of GDP, foreign assistance and external loan contributed to total of 4.18 percent in 1966/67 and then decreased continually to 1.7 percent in 1973/74 but continually increased in the post reform period.

Table 3.3.1 sectoral aid composition

Period	Real Average(percent share)				
	Agriculture Aid	Transport Comm Aid	Construction Aid	Education Aid	Min En Aid
1966-1974	14.94 (24.13)	2.49 (4.47)	11.98 (19.9)	5.19 (9.02)	1.59 (5.35)
1975-1991	77.11 (13.71)	35.19 (3.80)	47.25 (8.64)	28.55 (3.70)	149.90 (1.77)
1992-2000	63.52 (1.36)	312.20 (4.98)	378.93 (5.79)	156.66 (2.75)	363.95 (6.14)

Source: Computed from Ministry of Finance.

The average real agriculture foreign aid trend in the Imperial period reached its highest level in 1971/72 period to 27.75 million birr which was well beyond its average level of 14.94 million birr. The volume of aid to agriculture was characterized by variety of activities such as agriculture training and research, fishing, coffee development, live stock and technical assistance (Tadesse 1994). Thus, aid to agriculture was also scattered in different activities in the Derg regime. The real amount of agriculture aid during the Derg regime reached its peak level of 108.7 million Birr in 1984/85 fiscal year mainly due to the severe drought in which external assistance has been given in the form of food aid. In the other year of the Derg regime, aid to agriculture was important to the development of minimum package program which was intended to influence as many poor peasants as possible with agricultural advices and necessary inputs (SIDA 1984) as cited in Tadesse (1994).

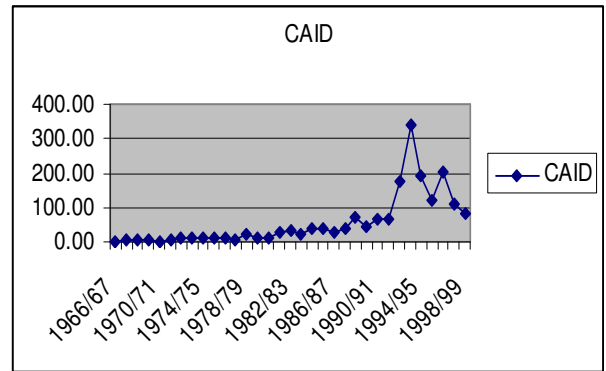
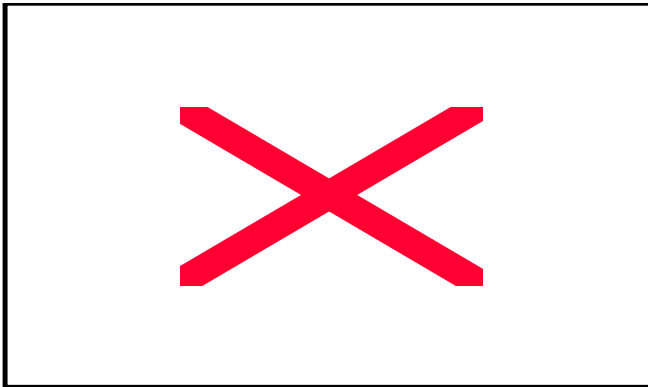


Figure 3.3 Trends in Agriculture (AAID) and Education (EAID) aid.

In contrast, the average real amount of education aid follows an increasing trend throughout the three different eras. In imperial regime its peak level was 12.13 million birr in which its sectoral aid mainly given to development of higher institution and to administrative & advisory service for Ministry of Education (Tadesse 1994). During this regime, the average level of aid rose to 47.25 million birr from 5.89 million birr in the previous regime. Extensive educational campaign in the late 1970's was undertaken by the government in which this assistance has been used to complement government budget. However, its peak level was in 1988/89 reaching 72.8 million birr compared to the lowest level of 6.49 million birr in 1977/78. It then, continues to increase in the post reform period, which is up to 340.84 million in 1993/94 fiscal period.

During the imperial period, transport and communication sector aid reached its first peak level in 1970/71 fiscal year amounting 7.68 million birr which has largely been given in the form of loans together with credits from non concessionary sources for communication development and airline network (Tadesse 1994). During the Derg period, transport and communication aid reached its highest peak level of 160.65 million birr in 1988/89 compared

to its average its ever peak level of 35.19 million birr, as a result of infrastructure and development priorities in post reform period transport and communication sector which received 312.20 million birr on the average.

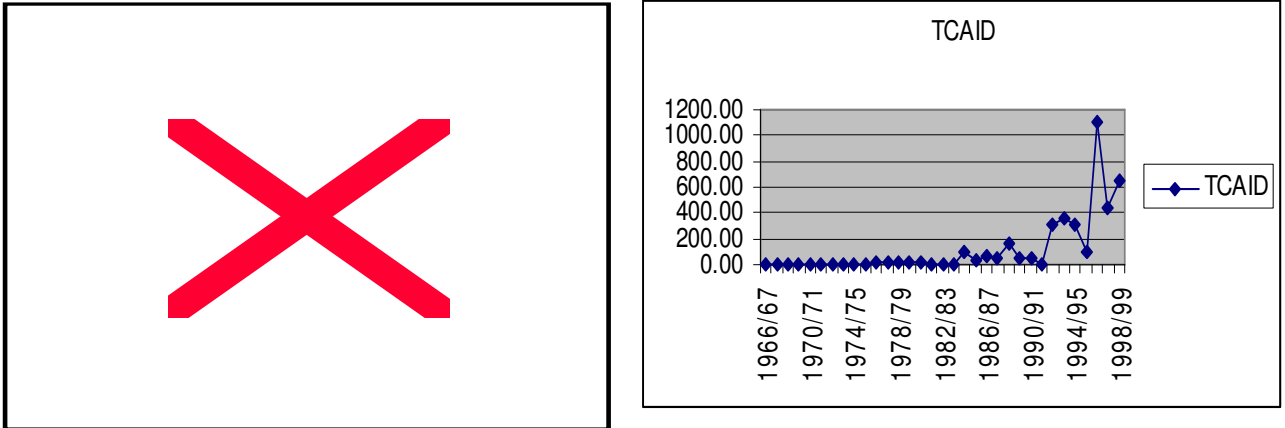


Figure 3.3 Trends in Construction (CAID) and Transport and Communication (TCAID) aid.

In other sectors such as industry, assistance given has been small in the in the imperial era which was left mainly to foreign investor. However, during the Derg regime assistance to industry were scattered in the establishment and support of different cement factories and textile industries (Tadesse 1994).

Aid to the mining & energy sector was 1.40 million birr on average in the Imperial era in which most of the assistance was given for the purpose of infrastructure and social development. However, this sector received impressively higher amount of aid during the Derg regime which was 141.26 million birr on average, and then to its maximum of 431.44

million birr in the 1988/89, the overall magnitude of the sectoral aid also continues to increase in post reform period.

4. Model specification and Methodology

4.1 MODEL SPECIFICATION

The model to be used in this study has been employed in a number of studies namely McGuire (1978) Pack & Pack (1990,1993), Swaroop & Jha (1999). The paper has built its model on the same principle employed in previous studies to estimate the impact of foreign aid on public spending on cross country and also country specific basis. More specifically, Swaroop & Jha (1999) and Pack & Pack (1993) aid fungibility model, which is going to be used, are discussed in this section.

Consider an economy with a central government and a number of sectors, which spends its total resources on a single private good C_p and two public goods G_1 and G_2 at both central and sectoral levels. Spending on these goods can be characterized as non-development (consumption type) G_1 and development (investment type) G_2 at both central and sectoral levels.

In addition to its own resources, the country receives earmarked assistance towards the purchase of good G_2 from the donor countries. The earmarked assistance and funds earmarked for sectoral aid programs, however, goes through the central government. Hence, funds received for sectoral projects by the central government are expected to be passed on to the respective sectors.

Let's suppose that the central government buys two public goods-non-development (G_1) and development (G_2)-at prices P_1 and P_2 , respectively, and provides them to all of its citizens. In addition, it transfers to sector s $\{s=1,2,\dots,S\}$ an amount $p_2G_2^s$ is earmarked for the purchase of G_2 . This constitutes the total spending of the central government. In making these resource allocation decisions, it takes the prices, P_1 and P_2 , as given (Feyzioglu et al 1998).

Earmarked for development spending, let a^c and, a^s be the amounts of foreign aid given to the central government and the s^{th} sector, respectively.

The central government can make foreign aid fungible by treating a portion φ^c ($0 \leq \varphi^c \leq 1$) of a^c as its own revenue supplement and spend the remaining proportion accordingly. Similarly, the central government can treat a portion φ^s ($0 < \varphi^s < 1$) of a^s as fungible by making adjustments to the amount of earmarked transfer it gives to sectors for the development good. Thus, the central government finances its total purchases by the fungible portion of foreign aid as well as its own domestically generated revenue, R (Swaroop et al 1999). The budget constraint faced by the central government can be written as

$$p_1 G_1 + p_2 G_2 + \sum_{s=1}^s p_2 G_2^s = R + \varphi^c a^c + \sum_{s=1}^s \varphi^s a^s \dots\dots\dots(1)$$

The left-hand side of equation (1) is total spending of the central government. Except for revenue component, the right-hand side of equation (1) represents the total fungible funds of the central government. The non-fungible portions of aid, $(1-\varphi^c) a^c$ and $\sum (1-\varphi^s) a^s$, do not augment government's discretionary resources, but are used to purchase G_2 . While G_2 , which is purchased from the non-fungible part of aid, increases overall utility, it does not affect the marginal choices of the central government.

The central government chooses G_1 , G_2 and G_2^s to maximize the social welfare, subject to its budget constraint of equation (1), can be given by

$$W = W (U^1, U^2, \dots, U^s) \dots\dots\dots(2)$$

Where U^s is the utility of the representative agent in sector s .

W is the social welfare function.

The utility, U^s , is defined on the single private good, C_p^s , two categories of central (national) public goods and the two public goods (g_1^s and g_2^s) provided by sector s .

$$U^s = U^s (C_p^s, G_1, G_2, g_1^s, g_2^s, G_2^s) \dots \dots \dots (3)$$

In choosing G_1 , G_2 and G_2^s , the central government takes R , g_1^s and g_2^s as given. Maximization of the social welfare function, $W(.)$ subject to the budget constraint yields the first-order conditions, which, with simple manipulation, can be written as:

$$U^s_{G_1} = \left(\frac{P_1}{P_2} \right) U^s_{G_2} \dots \dots \dots (4)$$

$$U^m_{G_2m} = \left(\frac{a^n}{a^s} \right) U^n_{G_2^n} \quad \forall m, n \in \Sigma S, \dots \dots \dots (5)$$

Where $a^s (= \Delta W / \Delta U^s) > 0$ and $\sum_{s=1}^s a^s = 1$.

a^s is the weight of sectors utility in the social welfare function.

Condition (4) implies that in determining the choice of G_1 and G_2 , the marginal rate of substitution between the two public goods must be the same as the economic rate of substitution (given by the price ratios). On the other hand, condition (5) indicates that the change in social welfare due to the change in the utility of representative agent that results from a unit increase in centrally provided assistance towards the purchase of G_2 , is the same across sectors (Swaroop et al 1999).

Considering the resource allocation choice, the model assumes that the fiscal effects of foreign aid, if any, are restricted to changes in the composition of the government's

expenditure program but there are no level effects, i.e., aid has no impact on R (Swaroop et al 1999).

The utility model outlined above can be used to derive equations to estimate the fiscal impact of foreign aid on public spending. In this case, the difficulty may arise from the unavailability of data and the specification of utility function. Information is available on non-development and development spending (i.e., on p_1G_1 and p_2G_2 in our model), but not separately on prices and quantities. Thus, data constraints require that the demand equations for the development and non-development goods derived from the fungibility model be transformed and estimated as expenditure equations.

By specifying the functional form of the utility equation, equation (1), (4) and (5) can be solved to obtain the demand equation for G_1 , G_2 and G_2^s . With most functional forms of utility function (e.g., a constant elasticity of substitution form), the associated demand equations are non-linear in both parameters and variables, and/or the key parameters of interest- φ^c and φ^s are not identifiable. However, Stone-Geary (Stone 1954) utility functional form, yields estimable linear expenditure functions with identifiable parameters. We take this functional form for our empirical analysis. The results will not be sensitive to the specification of the utility function so long as it leads to linear demand functions (Swaroop et al 1999)

Appendix A provides the linear expenditure functions derived from maximizing the Stone-Geary specification of the utility function given in equation (3), subject to the budget constraint in equation (1).

In modeling the effect of aid on the central government's optimal mix of spending R, the domestically generated revenue, has been taken as fixed. We now allow the possibility that foreign aid could have revenue effects too. Let R be a linear function of the country's gross domestic product (GDP) and foreign aid (a), (Swaroop 1999). It then can be written as

$$R = \mu_0 + \mu_1 \text{GDP} + \mu_2 a \quad \text{Where } a = a^c + \sum_{s=1}^s a^s \dots\dots\dots(6)$$

Using time series data, the linear expenditure functions (derived in Appendix A) can be estimated along with equation (6) to examine the fiscal effects of foreign aid in aggregate system.

The following equation (7)-in a simplified and estimable form-is derived from equations (A3) and (A4) described in Appendix A. Similarly, equation (8) is a variant of equation (A5).

$$G_{c,t} = \pi_{c,0} + \pi_{c,1} \text{GDP}_t + \pi_{c,2} \text{Aid}_t + V_{c,t} \dots\dots\dots(7)$$

$$F^d_{t,s} = \omega_0 + \omega_1 g^d_{t-1,s} + \omega_2 \text{Aid}_{t,s} + \omega_3 \left(\sum_{j \neq s}^s [g^d_{t-1,j} + F^d_{t,j}] \right) + \omega_4 \sum_{j \neq s}^s \text{Aid}_{t,s} + e_{t,s} \dots\dots\dots(8)$$

Where

- G_t^c = Categories of central government's expenditure at time t;
- GDP_t = Gross domestic product;
- Aid_t = Total foreign aid;
- $\text{Aid}_{t,s}$ = Central assistance passed on to s^{th} sector on account of foreign aid;
- $F^d_{t,s}$ = Central government transfers (net of assistance on account of foreign aid) to

Sector s for development purposes;

$g_{t,s}^d$ = Development spending of s^{th} sector financed from its own sources;

V & η = White noise error terms for the two sets of equations.

To test the displacement and fungibility hypotheses, Pack and Pack (1990) distinguished between developmental and non-developmental expenditures. They stated the model as follows.

$$ND_{i,t} = f(GDP_t, AID_t) \dots\dots\dots \text{Non developmental expenditure equation} \dots\dots\dots (9)$$

$$D_{i,t} = f(GDP_t, AID_{t,i}, OAID_{i,t}, TIME) \text{ Developmental expenditure equation} \dots (10)$$

Where

$D_{i,t}$ = Developmental expenditure at time t to sector i .

$ND_{i,t}$ = Non Developmental expenditure at time t to sector i .

$AID_{i,t}$ = Aid earmarked for sector i at time t .

$OAID_{i,t}$ = All other categorical aid to sectors other than i .

Time = Trend

GDP = Gross Domestic Product

Therefore, Pack and Pack (1990) incorporate important variable $OAID_{i,t}$ to analyze aid fungibility in a more clear manner. Hence, Equation (9) and (10) are the basis of estimating the effect of sectoral aid on sectoral government spending.

The above model can be disaggregated to

$$1. AGGS = B_0 + B_{11}AAID_t + B_{21}OAAID_t + B_{31}GDP_t \dots\dots\dots (11)$$

Where:

$$B_{11} \& B_{31} > 0, B_{21}=?.$$

AGGS = Agricultural spending.

AAID_t = Agricultural Aid

OAAID_t = Aid other than agricultural aid

Agricultural spending is expected to be positively related with GDP and its sector aid variable. However, in the analysis of fungibility the sign of the OTHER aid variables is not pre-determined a priori. The same holds for all other developmental sectors.

$$2. COGS = B_{02} + B_{12}CAID_t + B_{22}OCAID_t + B_{32}GDP_t \dots \dots \dots (12)$$

Where

$$B_{12} \& B_{32} > 0, B_{22}=?.$$

COGS = Construction spending

AAID_t = Construction Aid

OAAID_t = Aid other than construction aid

$$3. EDGS = B_{03} + B_{13}EAID_t + B_{23}OEAID_t + B_{33}GDP_t \dots \dots \dots (13)$$

Where

$$B_{13} \& B_{33} > 0, B_{23}=?$$

EDGS = Educational spending

AAID_t = Educational Aid

OAAID_t = Aid other than educational aid

$$4. TCGS = B_{04} + B_{14}TCAID_t + B_{24}OTCAID_t + B_{34}GDP_t \dots \dots \dots (14)$$

Where

$$B_{14} \& B_{34} > 0, B_{24}=?$$

TCGS_t = Transport and communication spending

TCAID_t = Transport and communication Aid

OTCAID_t = Aid other than transport and communication aid

For Non developmental sector.

$$5. DFGS = B_{05} + B_{15}AID_t + B_{25}GDP_t \dots \dots \dots (15)$$

Where

$$B_{25} > 0, B_{15} = ?.$$

DFGS = Defense spending

AID_t = Total foreign aid

$$6. DSGS = B_{06} + B_{16}AID_t + B_{26}GDP_t \dots \dots \dots (16)$$

Where

$$B_{26} > 0, B_{16} = ?$$

DSGS = Debt servicing

$$7. GSGS = B_{07} + B_{17}AID_t + B_{27}GDP_t \dots \dots \dots (17)$$

Where

$$B_{27} > 0, B_{17} = ?.$$

GSGS = General service spending

Note that, all the variables are in logarithmic form.

In an empirical application of the model presented above, first, the impact of earmarked foreign assistance to Ethiopia on its sectoral components of government spending is estimated i.e. from equation (11) to equation (14). Then, to inquire whether such assistance has funded specific non-development spending categories (e.g., defense, debt servicing, general administrative services), the link between foreign aid and the various non-development spending activities of the central government will also be examined i.e. from equation (15) to equation (17)

At national and sectoral levels of government, total expenditure is divided into two broad groups: development and non-development expenditures, with developmental expenditure having components of capital and recurrent categories. The development expenditure classification is done on account of economic and social services. In this case, expenditure on agriculture, construction, education and transport & communication sectors are classified as developmental categories. In other case, expenditure on defense, general service and debt servicing are categorized as non-developmental expenditures.

The sectoral developmental expenditure data is calculated from the addition of its sector central treasury and sector specific spending for recurrent use. In contrast, the non-developmental expenditure which includes general services¹⁰, defense expenditure; debt servicing are only recurrent spending of central government. The AID and OAID categorical aid variables are the addition of both earmarked loan and earmarked external assistance to their respective sectors.

To estimate the impact of foreign aid on central government's development and non-development spending annual time-series data from 1966/67 through 1998/99 will be used. Note that, the choice of the time period is based on data availability for all the relevant variables in the analysis.

4.2. METHODOLOGY

¹⁰ General Service categories include outlay for internal order and justice, security, organization of the states and others.

The standard estimation and hypothesis testing in economic theory assumed that all variables, in particular regression, are stationary¹¹. If variables entering into the estimation are non-stationary, then the result obtained using Ordinary Least Square (OLS) technique would be spurious in the sense that variables would seem to have promising diagnostic test result just because they have common trend over time rather than actual causation (Harris 1995). However, most macro-economic variables are non-stationary over time. For non-stationary series, which is the case for most econometric time series, there is a possibility to estimate by differencing these non-stationary variables in case where the differences are stationary. There can also be a case where, non-stationary variables are stationary with their linear combination to conclude that there is cointegration¹² (long run relationship) between the variables involved.

Estimation of the cointegrating relationship to be undertaken requires that all the time series variables in the model to be integrated of order one $I(1)$ ¹³. So, the next step after recognizing the order of integration of the variables as $I(1)$ or above, is to test whether the variables in question can cointegrate or not.

There are two common methods for testing co integration and estimating the relationship among cointegrated variables namely the Engle-Granger (1987) Two Step Procedure and Johansen's (1988) maximum likelihood method.

¹¹ A given variable is said to be stationary if it has a zero or at least constant mean, constant variance over time and if the covariance between two observations to depend only on the gap between two points but not the actual time the covariance considered (Gujarati 1995).

¹² When two variables are cointegrated, it suggests that even though both processes are non-stationary, there is some long run equilibrium relationship linking both series so that the relationship is stationary.

According to Harris (1995), the Engle-Granger two-step procedure was found to have a number of shortcomings. Because, it assumes that the long run linear combination (the cointegrated vector), of I (1) estimated by OLS is unique which may not always be the case. It also treats the variables on the right hand side of a given equation to be exogenous which may not be true for some cases. Therefore, the Engle Granger single equation method is said to be weak for testing cointegration among variables.

Hence, the method selected for estimation of long-run relationship between non-developmental expenditure & external assistance and between developmental expenditure & earmarked aid, uses the Johansen (1988) maximum likelihood method.

4.2.1 Johansen Maximum likelihood Procedure

Vector Autoregressive (VAR) is one form of multivariate modeling where no variable in the system assured to be exogenous before the estimation. This procedure is used to test and estimate the cointegration in a multivariate setting.

To formulate general unrestricted vector autoregressive model, each non-lagged variables in the model is regressed on all other variables lagged a certain number of time period. Hence, given the variables AGGS, OAAID, GDP and AAID in equation (11) section 4.1, it is possible to represent these variables by vector X_t that is shown in the following equations.

$$X_t = C_1X_{t-1} + C_2X_{t-2} + \dots + C_kX_{t-k} + \lambda D_t + \mu_t + e_t \dots\dots\dots(4.2a)$$

Where X_t is an (n x 1) matrix, which is a vector of non-stationary variables

C_t is an (n x n) matrix of parameter.

¹³ If non stationary series y_t becomes stationary after being differenced 1 time, then it is said to be integrated order of 1,I

D_t is a vector of dummies

μ_t is vector of deterministic components such as deterministic time trends¹⁴ & constant

e_t white noise error term

The VAR system under equation (4.2b) can be in its equivalent error correction form as

$$\begin{aligned} \Delta X_t &= \rho_1 \Delta X_{t-1} + \dots + \rho_{k-1} \Delta X_{t-i} + \Pi X_{t-k} + \lambda D_t + \mu_t + e_t \dots \dots \dots (4.2b) \\ &= \Pi X_{t-k} + \sum_{i=1}^{k-1} \rho_i \Delta X_{t-i} + \lambda D_t + e_t \end{aligned}$$

The estimate ρ_1 represents short run adjustments while Π contains long run information to changes in X_t . D_t represents vector of dummies, intercept and predetermined exogenous variables.

The Johansen approach seeks to determine the rank of Π , which gives the number of independent cointegrating vectors. Since there are n variables which constitute the vector X_t , the rank can be at most equal to n . If that is the case, i.e $r=n$, it implies that every variable is stationary $I(0)$ therefore, no error correction formula is required. In other case where there is a reduced rank, that is, if r is less than n , it is possible to represent Π as $\alpha\beta'$ where β' is $(n \times r)$ vector of long run parameters and the $(n \times r)$ α matrix represents speed of adjustments to equilibrium. Hence, ΠX_{t-k} in equation (4.2b) is equivalent to $\alpha\beta' X_{t-k}$ and $\beta' X_{t-k}$ represents up to $(n-1)$ cointegrating vectors which ensure the convergence of the vector X_t to their long run steady state equilibrium (Harris 1995).

(1).

¹⁴ Deterministic trends are trends which exhibit systematic variation that are completely predictable if we know the coefficient of time (Maddala et al 1999).

In the Johansen procedure, the first task is to determine the number of cointegrating vectors and to get the resulting estimates of α and β . In this case, two other scenarios can be noted to determine the existence of long run relationship between variables. In the first case, if the rank r of a matrix is 0, then there is no cointegration since Π ($n \times n$) is a null matrix. Therefore, there is no long run relationship between variables. In the second case, when there is a reduced rank i.e., $r \leq n-1$ cointegrating vectors in β , the rank of matrix ΠX_{t-k} should be stationary to have longrun relationship (Harris 1995).

Johansen's approach, however, like any other methodologies, have some shortcomings. Firstly, in case where more than one cointegrating vectors are identified, there is no clear cut criteria that the methodology offers for selecting a specific vector that represents long run relationships. Secondly, the number of cointegrating vector identified under this approach is too sensitive to the number of lags and type of deterministic trend included in the VAR model.

4.2.2 Tests for unit roots

The first step for Johansen procedure is to determine the order of integration of non-stationary variables. A series is said to be integrated of order d if it becomes stationary after differencing d times, which is denoted as $I(d)$.

Establishing the order of integration between sectoral aid, sectoral government spending and GDP is the first move that enables us to determine the next step of estimation. If all the variables under the study are found to be stationary, then the application of standard method is

possible. However most macro time series data have not been stationary over time. So, the alternative is to difference the variable till they become stationary and run regression on their differences.

The most commonly used test for order of integration is the DF (Dickey Fuller) and ADF (Augmented Dickey Fuller) tests. The Dickey Fuller approach states the null hypothesis as the series is non-stationary, against the alternative of stationarity. Based on DF test, the series Y_t becomes stationary if the absolute value of δ in the equation (I) is less than 1. It will not be stationary when the absolute value of δ is greater than or equal to 1.

$$Y_t = \delta Y_{t-1} + e_t \dots \dots \dots (I)$$

$$\Delta Y_t = \rho Y_{t-1} + e_t \dots \dots \dots (II)$$

The above equation can be transformed to equation (II) to make it more sensible for econometric hypothesis testing. Hence equation (I) is subtracted by Y_{t-1} to generate equation indicated in (II). In this case, $\rho = 1 - \delta$. The Dickey Fuller test then states the null hypothesis, as ρ is statistically equal to zero against the alternative of $\rho < 0$. Rejection of $\rho = 0$ in favor of the alternative $\rho < 0$ indicates that Y_t is integrated of order zero. But, if the null $\rho = 0$ not rejected, then the process is not stationary and one needs to test for higher order of integration.

However, if the error term in the above equation is not white noise i.e. doesn't have a zero mean and constant variance, the DF test will not be valid. This is the major weakness of DF test. In other words, the disturbance term e_t is assumed to be independently and identically distributed (*IID*). If this assumption is incorrect, then the limiting distributions and critical

values obtained by DF test cannot hold. The augmented Dickey Fuller (ADF) test, however, takes care of this problem by including the lagged left hand side variables as additional explanatory variables to approximate the autocorrelation. The ADF test procedure is identical to the standard DF test procedure (Harris 1995). It is constructed within a regression model of the form presented as follows.

$$\Delta y_t = \delta_1 y_{t-1} + \sum \beta_1 \Delta y_{t-1} + e_t \dots \dots \dots \text{(III)}$$

$$\Delta y_t = \delta_0 + \delta_1 y_{t-1} + \sum \beta_1 \Delta y_{t-1} + e_t \dots \dots \dots \text{(IV)}$$

$$\Delta y_t = \delta_0 + \delta_1 y_{t-1} + \sum \beta_1 \Delta y_{t-1} + \alpha_t + e_t \dots \dots \dots \text{(V)}$$

Testing for unit root equation (III) assumes that the data generating system of Y_t is a simple first order autoregressive process¹⁵ with zero mean and no trend. Since the process is not known whether it has a trend or not, equation (V) has to be estimated by adding trend term α_t and a constant term δ_0 . While, equation (IV) adds only constant term δ_0 (Harris 1995).

Therefore, if $\delta_1=0$, the y_t sequence contains a unit root. So, after estimating the above three equations by OLS, the resulting t-statistics are compared with the critical values given by the ADF table. If the t-statistics computed is less than the critical value, then the series can be said non-stationary (Enders 1995).

Although DF and ADF unit root tests are widely known and used in the literature, however, there are other unit root tests which can substitute those widely used stationary tests i.e.,

¹⁵ Autoregressive process is a process where the variable y_t is regressed on its own past value and error terms e_t which has a random process with mean zero and variance σ^2 .

Phillips-Peron (PP) and Sargen-Bhargava Variance ratio tests can be representative examples other than ADF and DF tests (Maddala et al 1999).

Phillips-Peron test has serious “size distortion” problem in finite sample size when the data generating process has a predominance of negative autocorrelation in first difference (De Jong et al 1992) as quoted in Maddala et al (1999). This has often been taken to suggest that the Phillips-Peron test may be less reliable than the ADF tests where there is pre-dominance of negative correlation in first difference (Maddala et al 1999).

Moreover, ADF and Phillips-Peron tests have been suffering from the problem of “size, distortion and lack of power of unit root tests” (Maddala et al 1999). They argued that the ADF and Phillips-Peron tests display size distribution in the presence of negatively correlated moving average error with Phillips-Peron test having a low power of 0.10 against the trend stationary alternatives. In contrast, the ADF test has the power of approaching 0.33 and thus likely to be more useful in practice. They suggested for the need to develop high-powered tests (Maddala et al 1999).

In this paper, as discussed above, stationarity test is undertaken by ADF because it is better than DF and Phillips-Peron test and it is widely practiced in most literature. Moreover, ADF test can be easily accessible in various econometrics softwares such as PCGIVE and PCFIML than the others.

5. Estimation results.

5.1 TIME SERIES CHARACTERISTICS OF THE DATA

The first step in analyzing time series data is to check the order of integration of the variables under consideration, which can be determined by undertaking ADF test for unit roots. The cointegration analysis and the associated error correction modeling are among the next step and recent solution to the problem of estimating relationship to the variables that have unit roots. Estimation of cointegrating relationship requires that all time series variables in the model to be integrated order of one. The most commonly used test for order of integration is the ADF (Augmented Dickey Fuller) test.

In the ADF test procedure, the null hypothesis of unit root to the variables in their natural log is tested against the alternative of stationarity. If the null hypothesis is not rejected, then the variables are differenced once again to check for stationarity. In this case, the null hypothesis of unit root in which variables are in first differenced form tested against the alternative of stationarity. If the null hypothesis is rejected then the series is stationary in first difference and it is $I(1)$. The general guideline in the ADF test is that if the absolute value of t-ratio is less than the absolute value of relevant ADF critical value we reject the null hypothesis.

The fact that actual data generating process is not known before estimation, the test of determining the order of integration for sectoral expenditure, sectoral aid and GDP variables is conducted by first including both constant and trend terms then by considering constant term only and finally without taking constant and trend terms in the ADF test.

The value of the ADF test statistics for all time series variables included in the estimation process is presented in table 5.1.1 and 5.1.2.

Table 5.1.1 Result of ADF tests for expenditure Categories

	Variables in their natural log			Variables in first difference log		
	With out Cons&trend	With constant	With cons & trend	With out Cons&trend	With constant	With cons & trend
AGS	1.14	-1.92	-1.18	-3.33**	-4.04**	-4.94**
TCGS	0.23	-1.12	-2.14	-3.85**	-4.06**	-4.21*
EDGS	-2.13*	0.01	-1.94	-2.37*	-2.77*	-2.87
CGS	1.21	-1.14	-2.53	-3.13**	-3.26*	-3.69*
GGS	2.94	1.4	-1.22	-2.18*	-3.79**	-4.16*
DFS	2.09	0.16	-2.47	-2.07*	-3.92**	-4.08*
GSGS	2.94	1.40	-1.22	-1.54	-3.10*	-3.54
GDP	3.89	1.08	-0.87	-4.17**	-4.55**	-4.69**

The sample period is from 1966/67 up to 1998/99.

The superscript * and ** denotes the rejection of the null hypothesis at 5% and 1% respectively based on ADF critical value.

ADF critical value for 5% and 1% significance level: Without constant & trend -1.9 and -2.6 respectively

With constant -2.9 and -3.6

With constant & trend -3.5 and -4.3

Table 5.1.2 Result of ADF tests for foreign aid Categories

	Variables in their natural log			Variables in first difference.		
	Without Cons&trend	With constant	With cons & trend	With out Cons&trend	With constant	With cons & trend

AAID	0.99	0.66	-0.88	-2.97**	-3.23*	-4.25*
TCAID	-0.42	-2.88	-5.08**	-5.20**	-5.66**	-5.59*
EDAID	1.43	-1.12	-2.43	-3.84*	-4.43**	-4.40**
CSAID	2.54	-1.14	-2.53	-3.09	-4.00*	-4.09*
OAID	1.22	0.85	-1.71	-3.44	-3.78*	-3.89*
OCAID	2.60	-1.60	-1.17	-2.07	-3.92*	-4.08*
OTCAID	3.05	-0.33	-2.39	-1.96*	-4.32*	-4.23*
OEAID	2.86	-1.16	-2.08	-2.89*	-5.07**	-5.11*
EXTAS	-1.6	-0.04	-4.97**	-3.13**	-4.41**	-3.98*
LOAN	3.2	-0.88	-3.06	-2.67**	-4.32**	-3.31

The sample period is from 1966/67 up to 1998/99.

The superscript * and ** denotes the rejection of the null hypothesis at 5% and 1% respectively based on ADF critical value.

ADF critical value for 5% and 1% significance level: Without constant & trend -1.9 and -2.6 respectively

With constant -2.9 and -3.6

With constant & trend -3.5 and -4.3

Where EXTAS - External Assistance LOAN- External loan.

AGGS - Agricultural Government Spending

TCGS - Transport & Communication Government Spending

EDGS - Education Government Spending

COGS - Construction Government Spending

DFGS - Defense Government Spending

GSGS - General Service Government Spending

DSGS - Debt Servicing Government Spending

OAAID - Aid other than agriculture aid.

OEAID - Aid other than Education Aid

OTCAID - Aid other than Transport & Communication Aid

OCAID - Aid other than Construction Aid

AGAID - Agriculture Aid TCAID - Transport & Communication Aid

EDAID - Education Aid, COAID - Construction Aid

From the table 5.1.1 of expenditure category variables, the ADF test statistics shows that the null hypothesis of a unit root cannot be rejected when the variables are in their natural log when constant and trend element included in the ADF test. This is because the t-ratio absolute value of the variables are less than the ADF critical value for “without trend and constant”

column. However, when constant and trend terms are not included in the ADF test, the null hypothesis is not rejected for all variable except EDGS variable.

For aid category variables, in table 5.1.2 however, TCAID and EXTAS variables are I (0) when trend and constant are included in the ADF test, since the t-ratio for these variables are greater than its ADF critical value. In contrast, when only constant term is included in the ADF test, all the aid category variables are I (0) indicating that the t-ratio of these variables are less than its ADF critical value.

When expenditure and aid categories variables are in their first difference form, the null hypothesis of unit root is rejected, in the case of only constant included in the ADF test. This is indicated by the value ADF t-ratio for all expenditure and aid variables in table 5.1.1 and 5.1.2 to the column of “with constant” which is greater than its ADF critical value. Hence, we can conclude that all the expenditure variables are integrated of order one I (1).

5.2 TESTS FOR COINTEGRATION AND LONG-RUN RELATIONSHIPS

An important property of I (1) variables is that there can be linear combinations of these variables that are I (0). If this is so, then these variables are said to be cointegrated (Maddala et al 1999). To test the presence of cointegration, the null hypothesis of no cointegration between variables of sectoral aid, sectoral government spending is tested against the alternative hypothesis that there is at least one cointegration vector between variables. This cointegration test will be undertaken for different components of development and non-development spending models.

To determine the lag length an initial choice of lag 2 has been given to all the variables under estimation. With the exception of transport and communication model, all the other sectoral models are found to be determined with the lag length of 1 (the result of lag length determination is shown in Appendix b). Since the results obtained from lag length determination are to be used for long run economic interpretation, a VAR process of order one VAR (1) is selected for number of cointegration test result produced under table 5.2.1 and 5.2.7. The determination of appropriate lag also gives a residual, which is white noise.

Johansen (1988) identified two methods to determine the number of cointegrating vectors in the long run model. The Lambda max test formulates the null hypothesis by verifying the existence of r cointegrating vector against the alternative $r+1$. The other one is the Lambda trace test formulates the null hypothesis i.e., there are number of distinct cointegrating vector less than or equal to r against the alternative that there are r or more cointegrating vectors.

With this test, the decision to reject or not to reject the null hypothesis is made by comparing the computed maximum trace eigenvalues (λ max and λ trace) with given critical values shown in each last columns of table 5.2.1 up to table 5.2.7. If the computed value of the test statistics (given by the column of test statistic in each of the above tables) is greater than the critical values, the null hypothesis is rejected. So, based on λ max test, the null hypothesis of “no cointegrating vector” i.e. $r=0$ is rejected at 5% significance level.

The following tables (5.2.1-5.2.7) show the result of cointegration test for both models of developmental & non- developmental government spending.

Test results for the number of cointegration vectors

For Developmental Expenditure

Table 5.2.1 Construction sector.

Ho Null hypothesis	H ₁ Alternative hypothesis	Test statistic λ max.	95% critical value
r=0	r=1	35.27*	31.5
r<1	r=2	17.95	25.5
r<2	r=3	12.65	19
r<3	r=4	4.931	12.3

Table 5.2.2 Agriculture sector.

Ho Null hypothesis	H ₁ Alternative hypothesis	Test statistic λ max.	95%critical value
r=0	r=1	39.79*	31.5
r<1	r=2	13.73	25.5
r<2	r=3	9.29	19
r<3	r=4	4.81	12.3

Table 5.2.3 Transport and communication sector

Ho Null hypothesis	H ₁ Alternative hypothesis	Test statistic λ max.	95% critical value
r=0	r=1	36.06*	31.5
r<1	r=2	18.8	25.5
r<2	r=3	8.36	19
r<3	r=4	2.83	12.3

Table 5.2.4 Education sector

Ho Null hypothesis	H ₁ Alternative hypothesis	Test statistic λ max.	95% critical value
r=0	r=1	43.82*	31.5
r<1	r=2	17.34	25.5
r<2	r=3	13.04	19
r<3	r=4	11.71	12.3

For Non - Development Expenditure

Table 5.2.5 Defense Expenditure

Ho Null hypothesis	H ₁ Alternative hypothesis	Test statistic λ max.	95% critical value
r=0	r=1	43.45*	42.4
r<1	r=2	15.05	25.3
r<2	r=3	3.756	12.3

Table 5.2.6 Debt servicing expenditure

Ho Null hypothesis	H ₁ Alternative hypothesis	Test statistic λ trace	95% critical value
r=0	$r \geq 1$	44.36*	42.4
r<1	$r \geq 2$	19.59	25.3
r<2	$r \geq 3$	4.95	12.3

Table 5.2.7 General Service

Ho Null hypothesis	H ₁ Alternative hypothesis	Test statistic λ max.	95%critical value
R=0	$r \geq 1$	43.42*	42.4
R<1	$r \geq 2$	12.77	25.3
R<2	$r \geq 3$	2.302	12.3

Note r denotes the number of cointegrating vectors. ** Denotes rejection at 1 %level of significance *

Denotes rejection at 5% level of significance. Constant term is included which is unrestricted

Based on the above results on sectoral cointegration analysis tables, which use λ max test for all development sectors model and defense expenditure model, concluded that there is only

one cointegrating vector among the variables of sectoral government spending, GDP and sectoral aid. Hence, the test rejects the null hypothesis that there is no cointegration among the variables under consideration at 5% significance level. Therefore, we can conclude that there exists a long run relationship between sectoral aid, sectoral expenditure and GDP. For non-developmental sectors (to debt servicing and general service), which uses λ trace test, rejects the null hypothesis of no cointegrating vectors. So, there is at least one cointegrating vector. When a single cointegrating vector is obtained, there is only one linear combination of the variables, which is represented by the first β matrices in row and the standard alpha coefficient is represented by the first column of alpha matrices. The standardized β -coefficient matrices and the standardized α -coefficient matrices for all developmental and developmental sectors are expressed in Appendix C. In this case, the cointegrating vectors estimated by the Johansen's method provides the reduced form of long-run relationship. Since the equations expressed below are specified in logarithmic form, the coefficients indicate reduced form of long run elasticities. Hence, the reduced form long-run relationship for each sector equations are expressed as follows,

1. $COGS_t = 1.71 CSAID_t - 0.56OCAID_t - 3.7GDP_t$
2. $AGGS_t = 1.23 AAID_t + 0.12 OAAID_t + 1.4124GDP_t$
3. $EDGS_t = 0.63 EAID_t + 0.32 OEAID_t + 3.08 GDP_t$
4. $TCGS_t = 0.65TCAID_t - 4.28 OTCAID_t - 2.36 GDP_t$
5. $DFGS_t = -7.11GDP_t - 1.98AID_t$
6. $DSGS_t = 0.99GDP_t + 1.01AID_t$
7. $GSGS_t = -4.27GDP_t - 0.05AID_t$

But, the reduced form of long run relationship may not coincide with the structural relationship. Therefore, to obtain economically valid structural relationship, we have to impose and test zero restrictions on the standardized α and β coefficients which enable us to modify the cointegrating relationship with respect to its results (Harris 1995).

The next stage is to test whether the long run system adjusts toward equilibrium by using alpha (α) coefficient.

Standardized α (adjustment) coefficients

For developmental expenditure Table 5.2.8

	Agriculture Spending	Construction Spending	Education Spending	Transport and comm. spending
α coefficient	-0.65	-0.06	-0.40	-0.53

For non developmental expenditure Table 5.2.9

	Defense Expenditure	Debt servicing Expenditure	General service Expenditures
α coefficient	-0.07	-0.10	-0.09

Based on table 5.2.8 and 5.2.9 we can say something about the speed of adjustment in the long run. Table 5.2.8 and 5.2.9 report α coefficient that measures the rate of feedback effect of the disequilibrium in cointegrating relation to the variable in the VAR. If the α -coefficient is negative and large in magnitude, then it means that disequilibrium will fade away in the long run. For developmental expenditures, it is shown in the table 5.2.8 that the system adjust towards long run equilibrium, which has a negative sign as theoretically expected. It means that 65%, 6%, 40% and 53% of disturbances are adjusted toward long run steady state to agriculture, construction, education and transport & communication sectors spending respectively. The long run steady state path is also true for non-developmental model in which

7%, 10 % and 9 % of disturbance is adjusted for defense, debt servicing and general service expenditures respectively.

In order to know the validity of these results, there is theoretically determined restrictions which is tested on the cointegrating vectors. This is done by imposing a zero restriction on β -coefficient (indicated in each first row of the following tables) to determine whether the explanatory variables¹⁶ in the model are weakly exogenous or endogenous, by using the likelihood ratio tests (LR)¹⁷ statistics that has χ^2 distribution with one degree of freedom. In this case, the null hypothesis states that the variables taken as explanatory variable are weakly exogenous against the alternative of endogenous. Here, the guideline to determine the endogeneity or exogeneity of the explanatory variables can be known by P-value (last row on each of the following tables), which indicates the probability of not rejecting the null hypothesis. If the P-value is greater than 0.05, then the null hypothesis of weak exogeneity cannot be rejected at 5 % significance level.

Test for Zero restriction on β -coefficient

Table 5.2.1.1 Construction sector

	CAID	OCAID	GDP
β -coefficient	0.5210	0.1625	-0.0259
Lr test χ^2	2.1912	1.1831	1.1002
P- value	0.1389	0.2767	0.2942

Table 5.2.1.2 Agriculture sector

¹⁶ The explanatory variables in each developmental sectors consist of sector specific aid, aid other than the sector specific and GDP variables.

¹⁷ The LR-test statistic used for restrictions is given by $-2\log(Q) = T \sum \log(1 - \lambda_i^*) / (1 - \lambda_i)$ where, $Q = (\text{Restricted maximum likelihood}) / (\text{Unrestricted maximum likelihood})$, $T =$ number of observations, $r =$ rank, and λ_i^* & λ_i are eigenvalues for unrestricted and restricted model respectively (Harris 1995)

	AAID	OAAID	GDP
β -coefficient	0.4603	0.034	-0.0182
Lr test x^2	2.5434	0.1328	1.1654
P-value	0.1108	0.7155	0.2804

Table 5.2.1.3 Transport and communication sector

	TCAID	OTCAID	GDP
β -coefficient	0.706	-0.052	-0.001
Lr-Tests x^2	3.2321	2.2676	2.7836
P-value	0.0722	0.1321	0.0952

Table 5.2.1.4 Education sector

	EDAID	OEAID	GDP
β -coefficient	0.318	-0.047	-0.013
Lr-Tests x^2	3.7658	0.4451	1.3647
P-value	0.0523	0.5046	0.2427

For non developmental expenditure

Table 5.2.1.5 General Service

	AID	GDP
β - coefficient	-0.58	0.185
Lr-Tests X^2	0.4325	12.049
P-value	0.5108	(0.005)*

Table 5.2.1.6 Defense

	AID	GDP
β - coefficient	-0.004	0.441
Lr-Tests X^2	4.4841	0.3846
P-value	(0.0342)*	0.5351

Table 5.2.1.7 Debt servicing

	AID	GDP
β- coefficient	0.851	-0.023
Lr-Tests X^2	3.5948	2.941
P-value	0.0508	0.0864

**Denotes rejection at 1% significance level

* Denotes rejection at 5 % significance level

For developmental spending model, the above test for zero restriction of β-coefficient shows that the sector specific aid and GDP in all developmental sectors are weakly exogenous to each of sectoral spending. This is indicated by the P-value which is greater than 0.05 for all the sectors of developmental spending. In this case, the importance of testing weak exogeneity is that, if all the variables in the cointegrating vectors are not weakly exogenous, then it is not valid to move to a single equation approach when estimating the short run model. However, for non-developmental sectors, foreign aid found to be endogenous to defense expenditure.

The next procedure is to test zero restriction for long run parameter. The Johansen method which produces consistent estimator of the long-run parameters, uses the likelihood ratio (LR) statistics to test zero restrictions of the parameters. In this case, Johansen (1988) has shown that the limit distribution of estimator has the property of classical linear regression assumptions and hence the likelihood ratio test statistics for testing hypothesis of zero restriction on the parameters are asymptotically distributed as x^2 variable (Harris 1995) .

In this case, the long run coefficients of the variables in each sector should be tested for “significance” to determine which variables are uniquely constituting the cointegrating vectors. Again, a zero restriction is imposed on each coefficients and the result for LR test

statistics is summarized from table 5.2.2.1 up to table 5.2.2.7. So, in this test, the null hypothesis states that the explanatory variables are insignificant to affect the dependent variable against the alternative hypothesis, which expresses the explanatory variables significance toward explaining the variation of the dependent variable. In this case, if all these coefficients are not statistically different from zero the identified cointegrating vector won't have any relevance to explain the variable in economic terms. Note that, all the time series variables are presented in logarithmic form to express their own elasticities.

Test for zero restrictions on the long run parameter

Developmental expenditure

Table 5.2.2.1 Construction sector.

	COGS	COAID	OCAID	GDP
B-coefficient	1.00	-1.71	0.56	3.73
LR Test (X^2)	7.0871	5.8614	2.4205	3.6574
P value	(0.0078)*	(0.0155)*	0.1198	0.0558

Table 5.2.2.2 Agriculture sector

	AGGS	AGAID	OAAID	GDP
B-coefficient	1.00	-1.2354	-0.1205	-1.4124
LR Test (X^2)	7.5318	2.5332	0.1637	4.3220
P value	(0.0061)*	0.1115	0.6863	(0.0376)*

Table 5.2.2.3 Education sector

	EDGS	EDAID	OEAID	GDP
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B-coefficient	1.00	0.63	-0.32	3.08
LR Test (X^2)	11.595	3.9864	2.4205	0.642
P value	(0.007)*	(0.0459)*	0.3571	0.4227

Table 5.2.2.4 Transport and communication sector.

	TCGS	TCAID	OTCAID	GDP
B-coefficient	1.00	-0.654	4.283	2.3691
LR Test (X^2)	14.038	5.6261	10.643	0.1377
P value	(0.0002)*	(0.177)*	(0.0011)*	0.7106

Table 5.2.2.5 Defense spending

	DFGS	AID	GDP
B-coefficient	1.00	7.11	1.98
LR Test (X^2)	7.0871	5.8614	2.4205
P value	(0.0078)*	(0.0155)*	0.1198

Table 5.2.2.6 General Service.

	GSGS	AID	GDP
B-coefficient	1.00	-0.05	-4.27
LR Test (X^2)	9.004	1.846	15.845
P value	(0.0026)*	0.174	(0.001)*

Table 5.2.2.7 Debt Servicing.

	DSGS	AID	GDP
B-coefficient	1.00	1.0151	0.99
LR Test (X^2)	4.4201	6.4172	0.1080
P value	(0.0395)*	(0.0113)*	0.7424

The first set of restriction test tells us whether the individual elasticities are significantly different from zero. Using the likelihood ratio test statistics (LR), the zero restriction is rejected for all elasticities in all equations. The zero restriction test shows that all the elasticities are not equal to zero. In this case, at least one of the explanatory variables coefficient is significant (at 5%) from zero which is indicated by the magnitude of p-value greater than 0.05. In the above tables from 5.2.2.1 up to 5.2.2.7, construction aid (COAID), transport & communication aid (TCAID) and education aid (EDAID) are significant to affect their respective sectoral spending while GDP only significantly affecting agricultural spending (AGGS) in the long run. Aid other than transport and communication (OTCAID) aid, also significantly affects its sector spending. However, other explanatory variables in the developmental sector are insignificant. For non-developmental model, foreign aid significantly affects general service and defense expenditure. Moreover, GDP only significantly affects debt servicing but the rest explanatory variables for non-developmental expenditures are found to be insignificant.

Interpretation of the long run model

Based on this model of aid fungibility, positive and significant coefficient on AID_t variables indicates that sector specific aid for use of sector i , has a significant impact on expenditure category i . A positive coefficient on $OAID_t$ indicates a diversion of aid toward that sector. Real GDP is also expected to increase with the increase in sectoral expenditure variables.

The long run model result indicate that, sectoral aid has positive stimulating effect on its sector spending in all developmental sectors. Especially in the construction sector,

construction aid has positive significant impact on its spending. The estimate also support that a 1% increase in construction aid leads to a 1.71% increase in construction spending. This result is in line with the Gramelich (1969) theory, which postulates that, a 1% increase in foreign aid stimulates more than 1% increase in public spending. Its reason can be that aid to this sector has matching requirement. It is a case where an aid recipient country has to finance a significant part of the project from its own resources to receive foreign assistance in which case, sector specific expenditure is expected to increase more than its sectoral aid. In Ethiopia, matching requirement is also evident in transport & communication and construction sectors which is meant for undertaking capital project. In this case, the fund composed from domestic resources and external assistance is widely used for road construction. The other explanatory variable, GDP has insignificant negative effect on construction spending with unexpected sign.

Aid other than agriculture aid (OAID), also has positive impact on its spending. Feyzioglu et al (1998) panel data study also finds similar result on this variable. In this case too, Gramelich (1969) theory holds in which a 1% increase in agricultural aid stimulates a 1.23% increase in agricultural spending. Thus, foreign aid seems to have a crowding in effect on domestic resource outlay for agriculture sector. The other variable, GDP also has positive impact on agriculture spending sector as expected.

For transport & communication sector, its sectoral aid has a positive impact on sector's spending but, it is less than one to one i.e., a 1% increase in transport and communication aid leads to 0.65 increase on its sectoral spending. Pack & Pack (1990), Devarjan et al (1999) and Feyzioglu et al (1998) also found similar results. However, aid other than transport &

communication aid (OTCAID), has negative impact on the sector's spending in which case, outlay for transport and communication is not complemented by its sector aid.

Similarly, education sector aid has positive impact on its spending but it does not support the Gramelich (1969) theory as 1% increase in aid don't stimulate for more than 1 % increase in education aid. In this case, 1% increase in aid leads to 0.63 increases in education spending. In other case, aid other than education aid (OE Aid), has a positive impact on education spending which indicates that there is re-direction of sectoral aid among developmental expenditure categories. The other explanatory variable, GDP also has an expected sign in which the same result is obtained from Devarjan et al (1999) panel data analysis on aid fungibility.

To examine whether foreign aid assists other non-developmental activities, the effect of foreign aid on defense, debt servicing and general service expenditures are examined. For debt servicing, foreign aid has a positive impact, which isn't similar to the findings of Swaroop et al (1999), for India. Swaroop et al (1999) indicates that there is no such link between debt servicing and foreign aid. But for the defense and general service expenditures, it has a negative impact. GDP has a negative impact on defense spending and general services, which reveals that defensive expenditure has an adverse impact on the expansion of output. In contrast, GDP has positive impact on debt servicing which indicate that, part of the increase in country's income is allocated to debt servicing.

5.3 SHORT RUN MODEL.

First differencing and regressing using OLS potentially throw away valuable information about the long run relationship which economic theory postulates. Therefore, ECM (Error Correction Model) method is employed to integrate short run dynamics with long run equilibrium and to obtain information on equilibrium relationship within a stationary and statistically consistent model. However, the ECM model operates under the condition that the variables are integrated of order one and also with one cointegrating vector.

The procedure adopted for estimation of the short run model is Hendry's general to specific method. In this method, all the independent and dependent variables with reasonable lag are included in the estimation. Then, the insignificant explanatory variables are continuously dropped until a parsimonious model with few explanatory variables remains. Some of the variables in parsimonious model may have significant impact and economic meaning to the system.

The issue of weak exogeneity of the explanatory variables is important in estimating the Error Correction model. If all the dependent variables are exogenous, we can directly estimate with the single equation otherwise, if one of the independent variable is endogenous, Engle-Granger causality test must be undertaken in order to check whether the independent variables really granger causes the dependent variable.

Granger causality test involves using F-statistic to determine whether the lagged information of one variable x has any statistically significant role in explaining y with its lag. If the lagged value of x 's makes no statistically significant contribution to explain y with its lag, then it is said that "x doesn't granger cause y". Similarly, if lagged value of y makes no statistical contribution to the explanation of x with its lags then, y doesn't granger cause x .

For non-developmental expenditure equation, foreign aid found to be endogenous to the defense expenditure equation. However, when Engle-Granger test undertaken it is concluded that these variables can be taken as weakly exogenous i.e., Granger causality test for foreign aid to defense spending, fails to reject the null hypothesis that aid doesn't granger cause defense spending. Therefore, we can conduct OLS estimation procedure in the short run models.

The estimation result from OLS estimation from the general error correction representation of each sector spending can be shown in the following equations. These equations are short run models where both the differenced dependent and explanatory variables are regressed with their lag of two or three.

The equation form of the short run model is as follows

$$1. \Delta D_{i,t} = C + \Delta D_{i,t-1} + \Delta AID_{i,t} + \Delta OAID_{i,t} + \Delta GDP_t + ECM_{t-1} \dots \dots \dots (1)$$

Where

$\Delta D_{i,t}$ = First difference of development expenditure for sector i at time t.

$\Delta D_{i,t-1}$ = lagged first difference of development expenditure for sector i at time t-1.

$\Delta AID_{i,t}$ = First difference of foreign aid earmarked for sector i at time t.

$\Delta OAID_{i,t}$ = First difference of foreign aid to sectors other than sector i at time t.

ΔGDP_t = First difference of Gross Domestic Product at time t.

ECM_{t-1} = Error Correction term

$$2.\Delta\text{ND}_t = C + \Delta\text{ND}_{t-1} + \Delta\text{AID}_t + \Delta\text{GDP}_t + \text{ECM}_{t-1} \dots \dots \dots (2)$$

Where

ΔND_t = First difference of non-development expenditure at time t.

ΔND_{t-1} = Lagged first difference of non-development expenditure at time t.

$\Delta\text{AID}_{i,t}$ = First difference of total foreign aid at time t.

Note that all the variables expressed in equation (1) and (2) are transformed to logarithmic Function.

The following tables show the reduced form of short run model for both non-developmental and developmental expenditures.

Table 5.3.1 short run Regression result for developmental sector

Spending/Aid	Agricultural Spending	Construction Spending	Education Spending	Transport and communication Spending
Sector Spending at lag 0			-0.21 (-0.96)	-0.64 (-4.2)
At lag 1	0.30 (-1,76)			
Lag 2				
Lag 3				
GDP _t	3.31 (2.07)			
At lag 1				
At lag 2			4.85 (2.42)	
At lag 3		-1.98 (-1.27)		
AAID _{t-1}	0.46			

	(2.46)			
CAID _{t-3}		-0.32 (-2.4)		
EAID _t			0.36 (2.12)	
TCAID _{t-1}				-0.29 (-1.85)
OAAID _{t-1}	0.70 (2.33)			
OCAID _{t-2}		-0.67 (-2.02)		
OEAIID			0.58 (1.69)	
OTCAID _{t-1}				-3.67 (2.58)
Ecm _{t-1}	-0.36 (-1.15)	-0.34 (-0.871)	-0.43 (-1.133)	-0.09 (0.35)
Constant	-0.02 (0.02)	0.28 (2.5)	0.05 (0.45)	-3.29 (-2.93)
Diagnostic				
AR 1-2	2.27(0.14)	1.68(0.20)	0.53(0.76)	0.13(0.71)
Normality	3.5(0.16)	6.66(0.03)*	1.5(0.26)	0.27(0.87)
X _i ²	0.37(0.93)	1.85(0.14)	2.47(0.3)	0.84(0.62)
Reset	0.08(0.77)	0.009(0.99)	0.26(0.76)	4.39(0.04)*

Table 5.3.2 short run Regression result for non- developmental sector

	General service Expenditure	Defense Expenditure	Debt Servicing Expenditure
Sector spending Lag 1	0.67 (1.38)	1.155 (3.021)	0.311 (1.590)
AID	0.04 (1.58)		0.24 (2.29)
AID _{t-1}		0.124 (1.433)	
GDP			2.22 (1.59)
GDP _{t-1}		1.658 (1.351)	
GDP _{t-2}	0.57 (1.26)		
Constant	0.01 (0.23)	-0.09 (-0.85)	-0.05 (-0.50)
ECM _{t-1}	-0.46 (-1.12)	-1.24 (-2.66)	-0.42 (-1.07)
Diagnostic test			

AR 1-2	0.175(0.840)	0.155(0.856)	1.137(0.338)
Normality	4.105(0.128)	7.05(0.05)*	4.673(0.096)
X _i ²	0.764(0.638)	0.550(0.801)	0.408(0.898)
RESET	0.193(0.664)	2.754(0.110)	1.124(0.299)

Interpretation of the short run model

In the short run model of development spending, several inferences can be made concerning the effects of foreign aid from the estimated coefficients. As implied in the previous section (5.2), the negative coefficients of sectoral aid on the sector spending and the negative coefficients of aid other than sector-specific aid, indicate diversion of aid away from the specific sector. Negative coefficients of explanatory variables may arise when there is a diversion of categorical aid from developmental investment towards debt servicing, defense expenditure and to other general service expenditures.

Hence, to analyze this issue of fungibility, it is necessary to estimate how the aid given for a specific sector has influenced it and each of the other categories. Moreover, the extent of fungibility is estimated by assuming a 1 birr change in total aid, proportionally allocated among categories according to their mean values. Each category of aid is increased by its average fraction of total aid, which is given by,

$$D_i^* = X_{1,i}^* (A_i/A_t) + X_{2,i}^* (OA_i/A_t)$$

Where D_i^* is the change in expenditure categories associated with a one birr change in total foreign aid, allocated proportionally to each aid category, and X_1^* and X_2^* are the average changes in expenditure associated with a one birr change in sector specific aid and other aid categories and they are the estimated coefficients of the short run models for sector specific aid and other aid respectively.

Therefore a calculated change in an expenditure category greater than the change in categorical aid indicates a diversion of aid toward that expenditure. Positive sign of sector specific aid and other aid categories indicate that aid stimulates increase in expenditure toward the sector under study i.e., aid increasing more than its expenditure indicates diversion of spending away from a particular sector.

By taking the average values of A_i , OA_i and A_t from the data set we can say something about the elastic response of sectoral government spending as a result of a change in foreign aid category.

Agriculture sector

$$D_i^* = X_{1,i} * (AAID_i / AID_t) + X_{2,i} * (OAAID_i / AID_t)$$

$$0.47 = 0.46 * (3.77 / 11.33) + 0.70 * (5.21 / 11.33)$$

Hence, the elastic response for a change in 1 birr of foreign aid stimulates 0.47 cents increase in agriculture spending. However, it is the last period of agriculture aid and other aid that affect agriculture spending significantly. Both aid variables significantly affect spending in the short run, which is supported by t-test value of 2.46 and 2.3 for agriculture aid (AAID) and aid other than agriculture aid (OAAID) respectively. Thus, the agriculture sector is dependent on external assistance and also other kinds of grant which seems to come from the other sectors. Although insignificant, Swaroop et al (1999) also finds the same positive impact of both aid variables on agriculture spending. Moreover, in Pack and Pack (1990) study, the elastic response for a change in 1 birr of foreign aid stimulates 0.09 cents increase in agriculture spending. The other variable, GDP also has expected sign and significance level of 2.46. It means that part of the increase in country's income is spent on funding agriculture spending. In addition, last fiscal year expenditure has a deteriorating effect on the current

expenditure in the short run which is insignificant. The error correction term which measures the speed of adjustment to equilibrium is negative but insignificant. Therefore, there is no long run adjustment mechanism in the agriculture sector model.

Construction sector.

In this sector, the result is directly the opposite of what has been found in the agriculture sector. Both aid variables in the construction model are significant but, they have negative impact on construction spending. According to the definition of fungibility, the negative significance of sector specific aid and other aid indicate diversion of foreign aid away from the intended sector. So, in this case the definition of fungibility clearly holds. Moreover, to analyze the extent of fungibility we can also calculate the total effect of aid by using the above formula.

$$D_i^* = X_{1,i}^* (CAID_t / AID_t) + X_{2,i}^* (OCAAID_t / AID_t)$$

$$-0.43 = -0.32(3.87/11.33) - 0.67(5.59/11.33)$$

Hence, the elastic response to a 1 birr increase in construction aid reduces construction spending by 0.43 cents. However, the negative significant effect (t value -2.4) of construction aid to its spending mainly from the lagged effect. GDP also has unexpected insignificant negative impact on construction spending in the short run which means that the effect of an increase in the past period income has deteriorating impact on the current construction spending. Hence, aid effect on this sector spending doesn't support Gramelich (1969) theory and it has different result from Swaroop et al (1999) study for India case. Since the ECM term

is so insignificant, the construction sector model has no long run relationship between its variables.

Education sector.

For this sector short run model, the impact of aid variables have both positive effect on education spending. What makes education aid different from agriculture aid is that, it has an immediate significant impact on its sectors spending. Therefore it has crowding in effect on education spending. Aid other than education aid (OEAIID), however, has insignificance level of 1.69 but it is positive indicating that there is no diversion of aid to other aid categories in the short run. The extent of aid variables effect on education spending can be calculated as follows.

$$Di^* = X_{1,i} * (EAID_i / AID_t) + X_{2,i} * (OEAIID_i / AID_t)$$

$$0.39 = 0.36(3.15/11.33) + 0.58(5.71/11.33)$$

In this sector, the elastic response for a change in 1 birr of foreign aid stimulates 0.39 cents rise in education spending. The model reveals that foreign aid to education almost has an immediate impact on its spending which is indicated by the current 2.12 significance level of education aid. Therefore, it has crowding in effect on education spending. However, GDP has unexpected significant negative sign with lagged period of 2 which means that positive income level adversely affects current education spending. The ECM here, is also insignificant (-1.13) in which case, education sector model has no adjustment mechanism toward long run equilibrium.

Transport and Communication sector.

This sector is characterized by negative significant impact of aid other than transport and communication aid (OTCAID) to the sector spending. This sector aid although insignificant, it adversely affects transport & communication spending which means that the fungibility case also holds here in addition to the construction sector. The extent of fungibility can also be seen from the following calculations.

$$D_i^* = X_{1,i} * (TCAID_i / AID_t) + X_{2,i} * (OTCAID_i / AID_t)$$
$$-1.85 = -0.29(2.59/11.33) - 3.67(5.72/11.33)$$

The short run result for transport and communication sector indicates the case of fungibility. It is even more pronounced than the construction sector by the fact that, not only transport and communication aid (TCAID) adversely affects its sectoral spending but also, diverts the allocated budget away from the sector. That is, the elastic response to a change of one birr in aid value of both transport and communication aid (TCAID) and aid other than transport and communication aid (OTCAID) induce the sector to reduce its expenditure by the change of 2.07 birr. Similar result is also obtained in Swaroop et al (1999) study for India case. However, GDP impact on this sector spending is insignificant. Although, the ECM term has expected sign, it is insignificant and hence difficult to conclude that the model adjusts to long run equilibrium.

For non developmental expenditures

The short run models for non-developmental expenditures reveal that foreign aid has positive impact on defense and general service expenditures but it is insignificant. It indicates that

there is a possibility that aid funded the outlay for general services and defense but it is not a clear cut conclusion because other unstated non developmental activities may have got benefit from the foreign aid. It is also possible that within developmental category, aid is spent to complement for recurrent use. The ECM coefficients in all non-developmental sectors have got expected negative sign but we cannot verify the existence of long run relationship between foreign aid, GDP and non developmental spending.

The diagnostic test proved that there is absence of residual autocorrelation (AR), functional misspecification (RESET) and normality tests show that the residuals could still be approximated by normal distribution except in the defense expenditure which shows a negative but greater than one coefficient.

CONCLUSIONS AND POLICY IMPLICATIONS

This paper has attempted to empirically examine the relationship between foreign aid and public spending in Ethiopia. Using a model of aid fungibility, derived from utility maximization framework by Swaroop et al (1999), it is possible to examine the impact of foreign aid to public spending on a sectoral basis. For the empirical analysis, annual time series data from 1966/67 to 1998/99 fiscal year is selected on the basis of availability of all relevant variables. The sectors considered in the study are agriculture, construction, education and transport & communication which are classified as developmental sector. Moreover, the

impact of foreign aid on non-developmental spending such as outlay for general services, defense, and debt servicing also examined to inquire whether aid funded these activities.

By considering latest development in time series econometrics analysis, this paper discusses both short and long run impact of foreign aid by using Johansen Maximum Likelihood test which determines the long run relationship and dynamic structure of the aid fungibility model. In formulating the model for developmental expenditure, sector specific aid, other aid and GDP are considered as explanatory variables while sector specific spending is considered as dependent variable. However, before estimation the time series characteristics of data have been tested by using Augmented Dickey Fuller (ADF) test and found that all the variables are integrated order of one, when only constant term is added to the ADF test. The Cointegration test undertaken by using Johansen method, found that sectoral aid, sectoral expenditure, and GDP have only one cointegrating vector.

The regression results show that earmarked foreign aid given to agriculture and education have stimulated spending on the respective sectors by lesser amount than the increase in sector specific aid for the case of short run. Moreover, aid other than agriculture and education aid, also have positive impact on agriculture and education spending respectively, indicating that no diversion of aid observed on these sectors. The other variable, GDP also has expected positive significant sign to these sectors indicating that part of the increase in country's income is spent to agriculture and education sectors. Moreover, the long run estimated results also support the finding that sector specific aid, other aid and GDP have positive impact on spending in agriculture and education sectors which is also obtained in the short run.

However, earmarked foreign aid given to construction and transport and communication, have negative impact on their respective sectoral spending in the short run which is more exacerbated by the negative effect of aid other than construction and transport & communication aid. This is the case of fungibility where aid from any other sources have negative effect on their spending. However, in the long run, construction and transport & communication aid have positive impact on construction spending and transport & communication spending respectively. Hence, the result is mixed for both sectors when the long and short run cases are taken into account.

To examine whether foreign aid assist other non-developmental activities, the effect of foreign aid on defense, debt servicing and general service expenditures was also examined. It is found that foreign aid has positive impact in all non-developmental expenditures i.e. defense spending, debt servicing and general service expenditures. Also, in the long run, foreign aid has positive impact except for debt servicing which has a negative impact. For defense and general service, foreign aid has a positive impact in the long run, which is similar to the findings of Swaroop et al (1999) for India case. In this case, there is a possibility that foreign aid fund non-developmental activities indicated by its positive significant coefficient, although other unstated non-developmental activities may have got the benefits of foreign aid.

Therefore, fungibility in some case exists, which means that donors finance may not be spent for intended purpose. It implies that even when aid is earmarked for a specific sector or activity, there is no guarantee that government spending for that purpose will increase by the full amount of aid. Hence, linking aid to overall public expenditure program that provides

adequate resources to crucial sector, may be better way of transferring resources to developing countries like Ethiopia. The results also indicate that aid to particular sector does have an influence on the composition of public spending, so that sector aid programs have determinant role to play in development assistance. Moreover, redirection of sector specific aid among developmental expenditure categories may greatly benefit some sectors and adversely affect other sectors spending. It is even more undesirable if the redirection of aid fall into non developmental categories. Therefore, effective way of monitoring purpose-oriented aid is more needed to make sectoral spending efficient.

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Appendix A

With the Stone-Geary specification, equation (3) of the fungibility model of Section 4.1 can be written as

$$U^s = (C_p^s - \gamma_{cp})^{BC_p} \cdot (G_2 - \gamma_{G1})^{BG_1} \cdot (G_2 - \gamma_{G2})^{BG_2} \cdot (g_1^s - \gamma_{g1})^{Bg_1} \cdot (g_2^s + G_2^s - \gamma_{g2})^{Bg_2} \dots (A1)$$

γ 's are the subsistence quantities which indicates the minimum requirement for public goods to be available so their magnitude have to be positive. For Stone-Geary utility form BC_p, BG_1, BG_2, Bg_1 and Bg_2 are parameters which becomes coefficient when the above utility function changed into logarithmic form. Their summation have to be equal to 1 to satisfy the Stone-Geary utility form. A restriction imposed by this functional form is that all choice variables of the central government G_1, G_2 and G_2^s are independent of each other at the margin and the only link they have is through the budget constraint. Thus, While Stone-Geary functional form gives us an estimable linear expenditure system,

Maximization of U^s subject to the budget constraint

$$P_1 G_1 + P_2 G_2 + \sum_{s=1}^S p_2 G_2^s = R + \varphi^c a^c + \sum_{s=1}^S \varphi^s a^s \dots (A2)$$

yields the following estimable linear expenditure equations:

(i) Expenditure on G_1 :

$$P_1 G_1 = p_1 \gamma_{G1} + B_{G1} \varphi^c a^c + B_{G1} [R + \sum_{s=1}^S (\varphi^s a^s - P_2 G_2^s) - \sum_{s=1}^S P_j \gamma_{Gj}] \dots (A3)$$

$$\text{Where } B_{G1} = B_{G1} / (B_{G1} + B_{G2})$$

(ii) Expenditure on G_2 :

$$P_2 G_2 = P_2 \gamma_{G_2} + (1 - \phi^c + B G_2 \phi^c) a^c + B G_2 [R + \sum_{s=1}^S (\phi^s a^s - P_2 G_2^s) - \sum P_j \gamma_{G_j}] \dots \dots \dots (A4)$$

Where $\hat{G}_2 = G_2 +$ amount of G_2 purchased for the non-fungible part of a^c .

(iii) Expenditure on G_2^s :

$$P_2 \hat{G}_2^s = -P_2 (g_2^s - \gamma g_2^s) + (1 - \phi^s) a^s + \frac{\delta_2^s}{1 - \delta_2^s} \sum_{j \neq s}^S [P_2 (g_2^j + G_2^j - \gamma g_2^j) - (1 - \phi^j) a^j],$$

Where $\delta_2^s = (a^s b_{g_2^s}) / \sum_{j=1}^S a^j b_{g_2^j}$ and $\dots \dots \dots (A5)$

$\hat{G}_2^s = G_2^s +$ amount of G_2^s purchased from the non-fungible part of a^s .

APPENDIX B

Agriculture sector

Lag Length	AGGS	AAID	OAAID	GDP
1	1.196(0.344)	3.447(0.028)*	2.747(0.058)	6.596(0.001)*
2	2.652(0.632)	0.288(0.8815)	0.232(0.0939)	1.45(0.4102)

At lag 1

AGGS 1.79(0.161)

AAID 11.5(0.0689)

OAAID 5.01(0.004)**

GDP 11.5(0.000)*

Test of system reduction based on F-test 0.9786 (0.4910)

Construction sector

Lag Length	COGS	CAID	OCAID	GDP
1	4.752(0.008)**	0.337(0.0498)	2.747(0.058)	3.722(0.0224)*
2	0.604(0.6608)	2.3874(0.0894)	1.5182(0.2389)	1.0516(0.4086)

At lag 1

COGS 6.86(0.001)*

CAID 0.475(0.7535)

OCAID 2.71(0.056)

GDP 21.86(0.006)*

Test of system reduction based on F-test 1.7246(0.0691)

Education sector

Lag Length	EDGS	EAID	OEAID	GDP
1	3.182(0.0384)*	0.713(0.5937)	1.199(0.3487)	3.892(0.0194)*
2	1.370(0.2831)	0.702(0.5954)	1.851(0.162)	1.672(0.199)

At lag 1

EDGS 8.633(0.008)**

EAID 1.271(0.3110)

OEAID 13.35(0.000)**

GDP 3.713(0.0186)*

Test of system reduction based on F-test 1.4821(0.1403)

Transport and Communication sector

Lag Length	TCGS	TCAID	OTCAID	GDP
1	2.546(0.0732)	1.1811(0.1687)	3.518(0.026)*	7.062(0.0012)**
2	0.962(0.4506)	2.705(0.0614)	2.494(0.0755)	1.672(0.0141)

At lag 1

TCGS 1.809(0.6141)
TCAID 1.284(0.3348)
OCAID 12.76(0.000)**
GDP 6.780(0.000)**

Test of system reduction based on F-test 2.2329(0.0135)*

Construction sector

Lag Length	COGS	CAID	OCAID	GDP
1	4.752(0.008)**	0.337(0.0498)	2.747(0.058)	3.722(0.0224)*
2	0.604(0.6608)	2.3874(0.0894)	1.5182(0.2389)	1.0516(0.4086)

At lag 1

COGS 6.86(0.001)*
CAID 0.475(0.7535)
OCAID 2.71(0.056)
GDP 21.86(0.006)*

Test of system reduction based on F-test 1.7246(0.0691)

General Service

Lag Length	GSGS	AID	OCAID
1	12.7(0.000)**	4.08(0.001)**	3.15(0.04)*
2	0.47(0.704)	0.93(0.441)	1.652(0.206)

At lag 1

GSGS 9.55(0.000)*

AID 7.61(0.0016)*

GDP 2.35(0.097)

Test of system reduction based on F-test 1.213(0.1121)

Defense spending

Lag Length	GSGS	AID	OCAID
1	8.932(0.000)**	6.03(0.001)**	3.75(0.025)*
2	0.89(0.2458)	0.053(0.983)	0.692(0.567)

At lag 1

DSGS 14.65(0.000)**

AID 13.43(0.000)**

GDP 9.45(0.0027)**

Test of system reduction based on F-test 0.604(0.7878)

Debt servicing

Lag Length	GSGS	AID	OCAID
1	1.1969(0.3340)	6.18(0.0026)**	6.46(0.0033)*
2	0.89(0.2458)	0.053(0.983)	0.69(0.213)

At lag 1

DFGS 6.07(0.003)**

AID 10.43(0.001)**

GDP 12.14(0.07)*

Test of system reduction based on F-test 1.213(0.1121)

APPENDIX C

1. Education Sector

Standardized α -coefficient matrix.

EDGS	-0.4074	0.0273	-0.0154	-0.4845
EDAID	-0.3128	-0.1755	-0.2827	1.7116
OEAID	-0.0447	-0.1899	-0.2628	-0.6990
GDP	-0.0131	-0.0204	0.0676	-0.0421

Standardized beta coefficient matrix

EDGS	EAID	OEAID	GDP
1.0000	0.6300	-0.3263	3.0833
-1.9034	1.0000	1.7419	14.4700
0.1946	0.1234	1.0000	-0.2628
-0.0146	-0.2394	0.3097	1.0000

2. Agricultural sector.

Standardized α -coefficient matrix

AGGS	-0.6522	-0.2922	0.1317	-0.0579
AAID	0.4603	0.1471	0.2731	-0.1042
OAAID	0.0344	-1.8055	-0.0854	-0.0377
GDP	-0.0182	-0.3369	0.01786	0.0033

Standardized beta coefficient matrix

AGGS	GDP	OAAID	AAID
1.0000	-1.4124	-0.1205	-1.2354
-0.0404	1.0000	0.2110	-0.0036
-0.3135	-7.5903	1.0000	-0.7601
-0.1387	0.9961	0.0388	1.0000

3. Transport and communication sector.

Standardized α -coefficient matrix

TCGS	-0.5388	-0.2837	-0.3210	3.6976
TCAID	0.7068	-0.7667	-0.4121	1.1032
OTCAID	-0.0528	-0.0921	-0.0519	-0.0879
GDP	-0.0012	-0.0042	-0.0657	0.0219

Standardized beta coefficient matrix

TCGS	TCAID	OTCAID	GDP
1.0000	-0.6545	4.2831	2.3691
0.5283	1.0000	2.8323	-2.1814
-0.0831	-0.1201	1.0000	7.6419
-0.0256	-0.0442	0.1903	1.0000

4. Construction sector.

Standardized α -coefficient matrix

COGS	-0.4032	-0.0790	-0.2410	0.5366
COAID	0.5210	-0.2529	0.4700	-0.3906
OCAID	0.1625	-0.0817	-0.3207	0.5260
GDP	-0.0259	-0.0161	-0.0236	-0.1224

Standardized beta coefficient matrix

COGS	CAID	OCAID	GDP
1.0000	-1.7121	0.5612	3.7616
-0.0969	1.0000	0.9478	15.486
-0.4255	-0.4160	1.0000	5.6404
-0.0256	-0.0505	-0.3837	1.0000

5. Defense Expenditure

Standardized α -coefficient matrix

DFGS	-0.0791	-0.0523	0.3268
GDP	0.4410	-0.1155	0.3360
AID	-0.0048	-0.0176	0.0263

Standardized beta coefficient matrix

DFGS	AID	GDP
1.0000	7.1123	1.9802
-1.3040	1.0000	27.895
-0.4155	-0.0263	1.0000

6. Debt Servicing

Standardized α -coefficient matrix

DSGS	-0.1027	-1.8429	-0.0123
AID	-0.8517	-0.6529	-0.0392
GDP	0.0238	-0.0751	0.0543

Standardized beta coefficient matrix

DSGS	GDP	AID
1.0000	0.9917	1.0151
0.2798	1.0000	-0.1867
-2.7187	9.6292	1.0000

7. General Service.

Standardized α -coefficient matrix

GSGS	-0.0914	-1.0828	-0.5650
AID	-0.5806	-0.1326	-0.0392
GDP	0.1853	0.2550	-0.0785

Standardized beta coefficient matrix

DSGS	GDP	AID
1.0000	-0.0534	-3.3478
0.2798	1.0000	2.8720
-6.2131	0.5415	1.0000

i For Development Expenditure

1 Construction sector

$$\begin{aligned} \Delta CGS_t = & -0.26\Delta CGS_{t-1} - 0.35\Delta CGS_{t-2} + 0.12\Delta CGS_{t-3} - 0.04\Delta GDP_t - 2.46 \Delta GDP_{t-1} \\ & (-0.9) \quad (-1.0) \quad (0.47) \quad (-0.20) \quad (-0.9) \\ & + 0.82 \Delta GDP_{t-2} - 5.51 \Delta GDP_{t-3} - 0.04\Delta CSAID_t + 0.01\Delta CSAID_{t-1} \\ & (0.33) \quad (-2.14) \quad (-0.21) \quad (0.04) \\ & - 0.04\Delta CSAID_{t-2} - 0.41\Delta CSAID_{t-3} + 0.05\Delta OCAID_t + 0.37\Delta OCAID_{t-1} \\ & (-0.16) \quad (-1.88) \quad (0.03) \quad (0.81) \\ & - 0.86 \Delta OCAID_{t-2} - 0.88 \Delta OCAID_{t-3} - 0.15ECM_{t-1} \\ & (-1.76) \quad (-1.58) \quad (-0.28) \end{aligned}$$

2. Agricultural sector

$$\begin{aligned} \Delta AGGS_t = & -0.06 - 0.23 \Delta AGGS_{t-1} - 0.16 \Delta AGGS_{t-2} + 0.06 \Delta AGGS_{t-3} - 0.11 \Delta AGGS_t \\ & (-0.32) \quad (-0.5) \quad (-0.45) \quad (0.22) \quad (-0.20) \\ & + 0.94\Delta OAID_{t-1} - 0.11 \Delta OAID_{t-2} - 0.17 \Delta OAID_{t-3} + 0.16 \Delta AAID_t \\ & (2.03) \quad (-0.21) \quad (-0.30) \quad (-0.52) \\ & + 0.57 \Delta AAID_{t-1} + 0.25\Delta AAID_{t-2} + 0.35\Delta AAID_{t-3} + 5.4\Delta GDP_t \\ & (1.51) \quad (0.52) \quad (0.80) \quad (1.6) \\ & - 2.73\Delta GDP_{t-1} + 2.77\Delta GDP_{t-2} + -2.62 \Delta GDP_{t-3} + 0.99da - 0.25ECM_{t-1} \\ & (-0.68) \quad (0.93) \quad (-0.82) \quad (2.27) \quad (-0.40) \end{aligned}$$

3 Education Sector

$$\begin{aligned} \Delta EGS_t = & 0.06 - 0.36\Delta EGS_{t-1} - 0.07 \Delta EGS_{t-2} + 0.63\Delta EAID_{t-1} \\ & (0.2) \quad (-1.2) \quad (-0.3) \quad (2.4) \\ & 0.30 \Delta EAID_{t-1} + 0.36\Delta EAID_{t-2} + 0.16 \Delta EAID_{t-3} + 0.02\Delta OEAIID_{t-1} \\ & (1.2) \quad (1.2) \quad (0.3) \quad (0.05) \\ & - 0.06 \Delta OEAIID_{t-2} - 0.13\Delta GDP_t - 2.5\Delta GDP_{t-1} - 4.04\Delta GDP_{t-2} - 0.21ECM_{t-1} \\ & (0.3) \quad (0.04) \quad (-0.9) \quad (-1.2) \quad (-0.4) \end{aligned}$$

4. Transport and communication sector

$$\Delta TCGS_t = -0.8\Delta TCGS_{t-1} - 0.60 \Delta TCGS_{t-2} - 0.28\Delta TCGS_{t-3}$$

$$\begin{aligned}
& (2.9) \qquad \qquad \qquad (-1.8) \qquad \qquad \qquad (-1.2) \\
& -0.18 \Delta \text{TC AID}_{t-3} + 2.55 \Delta \text{OTCAID}_t + 7.16 \Delta \text{OTCAID}_{t-1} \\
& (-0.67) \qquad \qquad \qquad (1.06) \qquad \qquad \qquad (2.8)
\end{aligned}$$

$$\begin{aligned}
& +0.6 \Delta \text{OTCAID}_{t-2} + 3.06 \Delta \text{OTCAID}_{t-3} + 6.8 \Delta \text{GDP}_t \\
& (1.1) \qquad \qquad \qquad (0.93) \qquad \qquad \qquad (2.5)
\end{aligned}$$

$$\begin{aligned}
& + 0.99 \Delta \text{GDP}_{t-1} + 4.2 \Delta \text{GDP}_{t-2} - 3.48 \Delta \text{GDP}_{t-3} - 0.22 \text{ECM}_{t-1} \\
& (12.2) \qquad \qquad (0.66) \qquad \qquad (-0.32) \qquad \qquad (0.57)
\end{aligned}$$

ii For non -Development Expenditure

5. General Service Expenditure

$$\begin{aligned}
\Delta \text{GSGS}_t = & -0.003 + 0.64 \Delta \text{GSGS}_{t-1} - 0.11 \Delta \text{GSGS}_{t-2} \\
& (0.04) \qquad (1.2) \qquad \qquad (-0.40)
\end{aligned}$$

$$\begin{aligned}
& +0.06 \Delta \text{AID}_t + 0.04 \Delta \text{AID}_{t-1} + 0.04 \Delta \text{AID}_{t-2} \\
& (1.94) \qquad \qquad (1.1) \qquad \qquad (1.1)
\end{aligned}$$

$$\begin{aligned}
& -0.33 \Delta \text{GDP}_t - 0.11 \Delta \text{GDP}_{t-1} + 0.58 \Delta \text{GDP}_{t-2} - 0.50 \text{ECM}_{t-1} \\
& (-0.65) \qquad \qquad (-0.18) \qquad \qquad (1.03) \qquad \qquad (-0.86)
\end{aligned}$$

6. Debt Serving Expenditure

$$\begin{aligned}
\Delta \text{DSGS}_t = & -0.05 + 0.24 \Delta \text{DSGS}_{t-1} + 0.59 \Delta \text{DSGS}_{t-2} \\
& (-0.37) \qquad (0.85) \qquad \qquad (2.33)
\end{aligned}$$

$$\begin{aligned}
& + 0.25 \Delta \text{AID}_t + 0.12 \Delta \text{AID}_{t-1} - 0.08 \Delta \text{AID}_{t-2} \\
& (2.11) \qquad \qquad (1.02) \qquad \qquad (-0.64)
\end{aligned}$$

$$\begin{aligned}
& +1.07 \Delta \text{GDP}_t + 1.17 \Delta \text{GDP}_{t-1} - 1.31 \Delta \text{GDP}_{t-2} - 0.52 \text{ECM}_{t-1} \\
& (0.58) \qquad \qquad (0.70) \qquad \qquad (0.64) \qquad \qquad (-2.21)
\end{aligned}$$

7. Defense Expenditure

$$\begin{aligned}
\Delta \text{DFGS}_t = & -0.08 + 0.39 \Delta \text{DFGS}_{t-1} - 0.39 \Delta \text{DFGS}_{t-2} \\
& (-0.42) \qquad (0.52) \qquad \qquad (-0.40)
\end{aligned}$$

$$\begin{aligned}
& +0.08 \Delta \text{AID}_t + 0.03 \Delta \text{AID}_{t-1} + 0.03 \Delta \text{AID}_{t-2} \\
& (0.77) \qquad \qquad (0.32) \qquad \qquad (0.38)
\end{aligned}$$

$$\begin{aligned}
& +1.3 \Delta \text{GDP}_t + 0.88 \Delta \text{GDP}_{t-1} + 2.28 \Delta \text{GDP}_{t-2} - 0.18 \text{ECM}_{t-1} \\
& \qquad \qquad \qquad (-0.85) \qquad \qquad (-0.47) \qquad \qquad (1.42) \qquad \qquad (-0.21)
\end{aligned}$$

