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FOREIGN AID AND ECONOMIC GROWTH IN GHANA (1970-2005)

A THESIS SUBMITTED TO THE DEPARTMENT OF ECONOMICS, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF ARTS DEGREE IN ECONOMICS

BY

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JULY, 2008

DECLARATION

I declare that, I have personally, under supervision, undertaken the study herein submitted.

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I declare that, I have supervised the student in undertaking the study herein submitted and I confirm that the student has my permission for assessment.

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DEDICATION

This work is dedicated to my sweet mother for her unflinching support, love and inputting into my education.

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ABSTRACT

This study examines the long and short-run relationships between foreign aid and economic growth as well as some selected macroeconomic variables as inflation and money supply in Ghana for the period 1970 to 2005 by means of time series analysis. This study employs the ARDL cointegration technique to examine the possible long and short-run effects among the investigated series. Also, a macroeconometric method is used to estimate the fungibility of aid to Ghana. The results suggest that, the impact of foreign aid on economic growth in Ghana is significantly negative, which is attributable mainly to the fungibility of aid. Among numerous policy recommendations, the study suggested policies which aimed at properly formulating and implementing good monetary and fiscal policies, as aid works effectively in good macroeconomic environment. Also, it is recommended that foreign aid should help reassign resources away from activities that produce normal goods towards activities that produce public goods, which benefit more people. Furthermore, there is a need to properly monitor aid-utilizing projects to avoid the misutilization and the mismanagement of the foreign capital resources.

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LIST OF ACRONYMS & ABBREVIATIONS

3SLS	Three Stage Least Squares
ADF	Augmented Dicker-Fuller
AIC	Akaike Information Criterion
AR	Autoregressive
ARDL	Autoregressive Distributed Lag
BOP	Balance of Payments
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Square
ECM	Error Correction Model
ERP	Economic Recovery Programme
FDIs	Foreign Direct Investments
GDP	Gross Domestic Product
ICOR	Incremental Capital Output Ratio
IMF	International Monetary Fund
ISSER	Institute of Statistical Social and Economic Research
LDCs	Less Developed Countries
ODA	Official Development Assistance
OECD	Organisation of Economic Co-operation for Development
OLS	Ordinary Least Squares
PP	Phillips Perron
PSBR	Public Sector Borrowing Requirement
SAP	Structural Adjustment Programme
SBC	Schwarz Bayesian Criterion
UN	United Nations
VAR	Vector Autoregression
WDI	World Development Indicators

CHAPTER ONE

GENERAL INTRODUCTION

1.0 Background to the Study

An important objective of much Official Development Assistance (hereafter 'foreign aid') to developing countries is the promotion of economic development and welfare, usually measured by its impact on economic growth. Yet, after decades of capital transfers to these countries, and numerous studies of the empirical relationship between aid and growth, the effectiveness of foreign aid in achieving these objectives remains questionable. Many poor aid-recipient countries view foreign aid as a critical ingredient in their development strategy, even though its development effectiveness remains in question among many economists. At the same time, the level and trends of foreign aid are increasingly becoming sensitive issues in donor countries' budgetary discussions, with analysts observing increasing signs of "donor fatigue". In particular, International Financial Institutions have expressed concerns regarding the level of overall development aid and the possible crowding out of poor traditional recipients by former socialist economies.

A significant body of work in recent years including Van der Walle and Johnston (1996), Dollar and Burnside (1998), World Bank (1998), Dollar and Svensson (1999) among others have focused on the links between foreign aid and economic performance by countries. Researchers have explored the role that different types of aid play in reform – financial versus non-financial aid, policy-based versus unconditional aid. They have also studied how to maximize aid effectiveness and the role of donors in achieving that goal.

One damning conclusion is that "recent cross-country evidence has shown that foreign aid has a strong, positive effect on a country's economic performance if the country has undertaken certain policy and structural reforms. However, the evidence shows that aid in general has not been going to countries that have undertaken these reforms. Donors give less assistance to countries with good policies than to ones with poor or mediocre policies" (T. Holmgren, 1998).

Ghana's experience with foreign aid does not match the conclusion above. During the 1980s when it undertook far-reaching economic reforms, it was not only a prominent recipient of aid but also one of the most successful reformers.

1.1 Statement of the Problem

Between 1983 and 1991, Ghana was both a prominent economic reformer and a good performer (Tsikata, 1999). From a state of economic collapse, Ghana's economy rebounded with sustained economic growth during the first decade of reform. This stellar performance was accompanied by an exponential increase in aid inflows from both bilateral and multilateral sources. The impetus for reform appears to have been both the economic crisis in which the country found itself and an evolution in the thinking of policy makers as they faced political survival. Aid, especially of the financial kind, was important in sustaining reform. Aryeetey and Tarp (2000) have argued that the growth of the 1980s in Ghana came about as a result of the expansion of capital application, largely as a consequence of increased aid inflows, which was similar to the expansion that occurred in the 1960s financed largely through accumulated reserves from the 1950s.

Total aid flows remained at a low level in the 1970s. This was a period of mostly chronic domestic economic mismanagement. An earlier default on foreign loans by the military government in 1972 did not help, further discouraging foreign assistance. With the emergence of a democratically elected government in September 1979, aid flows rose for two consecutive years. This trend reversed after 1981 following the coup d'etat by the armed forces. Starting in 1985, however, a clear and sustained increase in aid flows occurred as donors perceived greater commitment by government to better economic management and economic reform. Indeed, between 1985 and 1996 total aid flows to Ghana increased threefold from US$150.7 million to US$450.8 million in 1995 (Tsikata, 1999). The especially rapid increase between 1990 and 1991 was linked to the then upcoming multiparty democratic elections and was driven primarily by increased grants to support various institutional-building activities.

Furthermore, though there have been many empirical studies on the linkage between aid and growth, a sterling criticism of most of these studies concerns the underlying models of growth, which are typically poorly specified. These authors have used econometric analysis to test the aid-growth relationship at the macro level, complemented by case-study evidence at the project level. While micro-based evaluations have found that in most cases 'aid works' (e.g. Cassen *et al.*, 1986), those at the macro level have yielded more ambiguous results, often failing to find significant growth effects. This conflict is what Mosley (1987) refers to as the 'micro-macro paradox'. The reasons for it remain unclear but the econometric aid-growth literature has been criticized on several grounds including sample size and composition, data quality, econometric technique and specification. Most aid-growth investigations, for example, either pre-date or ignore

many of the recent advances in growth theory which have allowed more sophisticated empirical growth equations to be specified. If foreign aid is to be reliably identified as a growth determinant it is important that it is included within a robustly specified empirical growth model. In addition, the data periods used were relatively short to make meaningful inferences from the results. Using a more robust equation specification and alternative time periods of a span of over thirty years, the present study seeks to complement existing studies by estimating a robust aid-growth model using the most current data available. These facts among others bring the issue of examining the relationship between foreign aid and economic growth in Ghana to the fore.

1.2 Objectives of the Study

The major aim of this study is to empirically assess the relationship between foreign aid and economic growth in Ghana over the period 1970 to 2005.

Specifically, the study aims at achieving the following:

- Analyze the trends in aid in Ghana over the study period.
- Empirically estimate the sensitivity of aid together with key macroeconomic and policy variables on economic growth.
- Estimate the fungibility of aid in Ghana.
- Suggest appropriate policy measures arising from the empirical findings to support the need for foreign aid in Ghana.

1.3 Research Hypotheses

The study seeks to test and validate the following theoretical hypotheses;

1. H_0: Foreign aid does not have positive impact on economic growth in Ghana.

H_1: Foreign aid does have positive impact on economic growth in Ghana.

2. H_0: Foreign aid is not fungible in Ghana.

H_1: Foreign aid is fungible in Ghana.

1.4 Justification of the Study

Total aid fell in 1992 following the democratic elections but overall remained higher than pre-election levels (Tsikata, 1999). The drop was due to fiscal "slippage" in the reform program. This was linked to an 80 percent increase in wages to civil servants among other factors. The immediate consequence was a suspension of World Bank disbursements between November 1992 and the middle of 1993. This episode was short-lived, and by the end of 1993, both the World Bank and the IMF were disbursing funds and programs were back on track. Following this brief interruption, flows resumed to pre-interruption levels. Additional fiscal slippage in 1996, however, led to a temporary derailment of the IMF supported program under the Extended Structural Adjustment Facility (Ibid). Delving deeper into the relationship between foreign aid and economic growth is crucial for understanding of how aid flows in the country affect economic growth, thus giving empirical guide for policy formulation. It will also shed light on the determinants of economic growth and provide invaluable feedback for the design and implementation of stabilization policies as aid flows into the country increases with stable macroeconomic and political environments.

1.5 Method of Study

1.5.1 Data Type and Sources

Developing countries in general and Ghana in particular have traditionally been net importers of capital. Their two main sources of supply are official financing, including Official Development Assistance (ODA), and private capital. The study employed mainly secondary macroeconomic time series data in its analysis. All data used in the analysis were taken from IMF, International Financial Statistics, Government Finance Statistics and the World Bank Development Indicators (CD-ROM) and The State of the Ghanaian Economy (various issues). Other augmenting sources included published articles and journals, working papers, textbooks and relevant internet resources.

1.5.2 Data Analysis

The data collated were analyzed both descriptively and quantitatively. Charts such as trend graphs and tables were employed to aid in the descriptive analysis. Additionally, stationarity tests were carried out on all variables to ascertain their order of integration to avoid the spurious regression problem. Further, the study adopted the newly developed Autoregressive Distributed Lag econometric model for cointegration procedure introduced by *Pesaran et al* (2001) to estimate both the short and long run relationship of economic growth and its determinants, particularly foreign aid. Also macroeconometric model was used to estimate the fungibility model for Ghana. All estimations were carried out using the econometric packages Microfit 4.1 and Eviews 6.1 except the fungibility model estimation which used Microsoft Excel in addition.

1.6 Scope of Study

The research is limited to the period 1970-2005 where we specify the growth model incorporating foreign aid and other macroeconomic variables. The choice of the study period is dependent on data availability on most of the variables used in the study.

1.7 Organization of the Study

The study is organized into five main chapters with each chapter comprising appropriate sections including the general introduction. The rest of the study is organized as follows. Chapter two seeks to undertake a review of relevant literature including theoretical and empirical reviews with respect to the theories of foreign aid and growth models. Chapter three presents the research methodology adopted for the study, touching on issues such as data description and definition, and model specifications. The fourth chapter also analyses the estimated growth models. The research concludes in chapter five, with a summary of major findings, policy implications of results and recommendations, practical limitations of the study, issues for further research and conclusion.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

As pointed out in Chapter 1, sound economic management and the quality of the state and institutional capability in recipient country do matter for improving the effectiveness of foreign aid. To clarify this point, this chapter investigates theoretical and empirical studies of aid effectiveness. Through surveying these studies, light can be shed on the puzzle of why foreign aid may not always have an impact on economic growth.

The traditional economic justification for foreign aid is that aid will increase growth in the recipient country. For example, foreign aid under the Marshall Plan represented a transfer of US$13.2 billion in the 1948-52 period from the United States of America to Europe, spurring economic recovery in that region after the end of World War II (OECD, 1985). Theoretical support for this view can be tracked back to Rostow (1963) who illustrated that developing countries in the first stage of development need foreign capital to “kick start” their economy. In Rostow’s growth stages theory, developing countries can then "take-off' to a stage of self-sustaining growth. Later, Chenery and Strout (1966) put this idea into a theoretical framework, the so called “two-gap” theory. This model incorporated the growth process of the Harrod-Domar growth model, which considers the level of investment in physical capital (measured by the ratio of physical capital to GDP) and the incremental capital output ratio (ICOR) as the main driving force for output growth. Developing countries have surplus labour but their ability to invest is constrained by a lack of domestic savings (saving gap) and foreign exchange

availability (trade or foreign exchange gap), thus there are not enough of these relevant resources to lead to the achievement of higher levels of growth. In this context, the two-gap model illustrates that aid inflows would supplement domestic savings and foreign exchange earnings one-for-one. Therefore, more aid inflows will lead to higher investment and ultimately to higher growth.

However, the theoretical basis of the two-gap model outlined above has been challenged on various grounds. One major criticism is the underlying principles of the two-gap model. With an emphasis only on capital accumulation for growth strategy, the two-gap model is too simplistic to represent the growth process. Indeed, many aid effectiveness studies have incorporated various growth theories to derive an analytical framework in ascertaining the effect of foreign aid on growth. This issue is discussed in Section 2.2. The other major criticism is the assumption of the two-gap model which states that aid inflows will be matched by a one-for-one increase in investment. Much of the aid effectiveness literature points out that there are possibilities that this assumption may be incorrect (White, 1998, p. 6). Enquiry along this line has led to the development of displacement theories, as White (1998) has dubbed them. Displacement theories examine various links in the chain from aid to growth; this is discussed in Section 2.2.2.

2.1 Aid and Policy in Growth Theories

The past three decades have witnessed a large number of studies on aid effectiveness. The aid-growth nexus has been approached from different ideological and methodological aspects. To see this, the following sections present theoretical and empirical approaches of the aid-growth nexus model. Firstly, Section 2.1.1 demonstrates

the aid-growth regressions employed in the various growth models. Secondly, Section 2.1.2 presents the empirical evidence focusing on the relationships between aid, policies and growth.

2.1.1 Aid-Growth Regression Analysis in Various Growth Models

The earliest growth model focused on the growth of aggregate output and resource mobilization. The underlying analytical framework applied to ascertain the economic-growth nexus was the Harrod-Domar growth model. It links output growth to aggregate investment in a linear function. The rate of output growth in the Harrod-Domar model can be captured in the production function with capital as the sole input. This production function represents the basic premise of developing countries, which are characterised by a surplus of labour and the shortage of capital. Therefore, the production function of developing countries can take the following form:

$$Y(t) = f(K(t)) \tag{2.1}$$

where $Y(t)$ is aggregate output at time *t* and $K(t)$ is capital stock at time *t.* By taking the derivative of equation (1) with respect to time (t) and dividing by *Y*, this gives the growth rate of output as follows:

$$\frac{\dot{Y}}{Y} = \frac{1}{\frac{\partial K}{\partial Y}} \frac{I}{Y} \tag{2.2}$$

where $\frac{\dot{Y}}{Y}$ is the rate of output growth, $\frac{\partial K}{\partial Y}$ is the incremental capital-output ratio (*ICOR*), $\frac{I}{Y}$ is the ratio of investment to output, and $\dot{K} = I$.

The implication of this model is that capital accumulation is the key to prosperity in development. This model was extended in 1966 to add a foreign exchange constraint

into the Chenery-Strout two-gap model. The potential impact of aid on growth is simply seen as an increment to the stock of physical capital, and can be captured in the planned investment identity, as follows:

$$I = S_d + A + OF \tag{2.3}$$

where S_d is domestic savings, A is the inflow of aid, and OF is other source of capital inflows.

By combining equations (2.2) and (2.3) and holding the incremental capital-output ratio (*ICOR*) constant, the rate of output growth in the two-gap model simply depends on the accumulation of physical capital, which in turn depends on aid inflows, domestic saving and other sources of capital inflows. The empirical approach in the two-gap model takes the following form:

$$\frac{\dot{Y}}{Y} = \alpha_0 + \alpha_1 \frac{A}{Y} + \alpha_2 \frac{S_d}{Y} + \alpha_3 \frac{OF}{Y} + \varepsilon \tag{2.4}$$

where $\frac{\dot{Y}}{Y}$ is the rate of output growth, $\frac{A}{Y}$, $\frac{S_d}{Y}$, $\frac{OF}{Y}$ are respectively aid inflow, domestic saving and other source of capital inflows as percentage of *GDP*, ε is an error term.

Various studies published before the 1980s have been based on the above single equation to ascertain the effectiveness of aid (for example, Griffin, 1970; Massell *et al.*, 1972; Papanek, 1972; Gupta, 1975; and Stoneman, 1975). Some researchers have also endogenised the right hand side (*RHS*) variables of equation (2.4) to tackle the simultaneity issues (for example, Mosley, 1980).

It should be noted that throughout the periods of aid flows there have been several changes in development policies. Many developing countries have had to comply with

new growth strategies in order to steer their economies into the path of sustainable growth. The change obviously makes the empirical approach of the two-gap model (equation (2.4)) inappropriate because it has no part that allows for capturing the change in those development policies. Therefore, equation (2.4) may suffer from omitted variable bias, which implies that the model would yield inconsistent estimator of aid-growth coefficients.

Over the past few decades, growth theory has undergone a radical process of renewal and has remarkably enlarged its scope, resulting in the development of various growth theories offering different growth strategies. For instance, the export-led growth model (Lamfalussy, 1963) emphasises export growth as an important factor that will encourage more investment, bring in technical progress and increase the ability to import, thus improving the capacity to grow. The financial liberalisation model (McKinnon, 1973; Shaw, 1973) illustrates that financial distortion in developing countries is caused by governments' policies and regulations. Also, the central bank tends to distort the real interest rate and causes credit rationing. This distortion has an unfavourable impact on savings and investment hence retarding economic growth. Liberalising financial markets will encourage domestic savings in the banking system. Financial deepening[1] will increase so credit rationing will be ruled out. Neoclassical and endogenous growth theories consider productivity growth to have a leading role in the growth process.

[1] Financial deepening is defined as a proportion of demand deposits to Gross Domestic Product (GDP)

Therefore, shifting more resources into improving human capital, technological innovation or research and development (*R&D*), and institutional quality are the keys to successful development. The re-emergence of political economy emphasises the role of political factors in the determination of economic growth. This literature has illustrated that political institutions can influence the efficiency of resource allocation. Many studies have indicated that countries are likely to sustain economic growth where their political institutions promote socio-economic stability, create good quality public services, offer freedom and civil liberties, provide credible and predictable policy changes, as well as delivering stable property rights and fair law enforcement. However, it is not clear which type of political institution could provide such an environment. Furthermore, the recent growth literature considers other factors, including *inter alia* the influence of economic growth on developed countries through international trade, as the factors that are important for the long-term growth for developing countries (Easterly, 2000; Dollar and Kraay 2000).

To improve the estimation of the aid-growth coefficient, many studies of aid effectiveness have incorporated a number of factors accounting for policy and institutional quality into the model of the aid-growth nexus. The aid-growth regression takes the following form:

$$\frac{\dot{Y}}{Y} = \alpha_0 + \alpha_1 \frac{A}{Y} + \alpha_2 \frac{S_d}{Y} + \alpha_3 \frac{OF}{Y} + \alpha_4 Z + \varepsilon \qquad (2.5)$$

where Z is a vector of control variables including the growth rate of various factor inputs and policy variables affecting growth. Dowling and Hiemenz (1982) add four policy variables emphasising the role of an open-trade regime and domestic resource

mobilization in the growth process. Rana and Dowling (1988) add the rate of export growth to the study of nine Asian countries. In addition to domestic savings, Mosley (1987) adds growth in literacy rates, various types of foreign capital inflows and export growth into the aid-growth regression. Hadjimichael *et al.* (1995) add human capital and various macroeconomic variables that they hypothesized to affect growth. The macroeconomic variables used in various other studies include terms of trade, real effective exchange rate, rate of inflation and the size of the budget deficit.

More recently, the research on aid effectiveness includes the possibility of the interaction between aid and the policy index in the aid-growth regression. The research pioneered by Burnside and Dollar (1997) focuses on the necessity of sound policy management as conducive to sustainable economic growth. They modify the neoclassical growth model to show how distortionary policy may affect economic growth in developing countries. As illustrated in neoclassical growth theory, the marginal return to investment in poor countries is high, thus countries tend to grow faster when their capital accumulation is rising (see, for example Romer, 1996, Chapter 1). However, Burnside and Dollar argue that:

> *With a subsistence consumption constraint and imperfect international capital markets, poor countries will tend to grow slowly despite a high marginal return to investment. In this context, foreign aid can accelerate growth rates in the transition to a steady state. Furthermore, various institutional and policy distortions can lower the return to capital and reduce transitional growth rates.*
>
> Burnside and Dollar (1997, p. 2).

Though the role of aid in this model is similar to the two-gap model in the sense that aid will raise investment and savings in the recipient country, Burnside and Dollar (1997) incorporate aid and policy variables into the neoclassical growth framework. They point out that the aid-growth relationship depends on the recipient country's position on the growth path and the level of distortion in economic policy. As such, they suggest:

> …*one would find* a *positive relationship between aid and growth,* as *long* as *the recipient's GDP is below the level corresponding to its peak transitional growth rate...[also] one would find* a *negative relationship between distortionary taxes and growth.*
>
> Burnside and Dollar (1997, p. 8)

To test the interactive effect of aid and economic policy on growth, Burnside and Dollar (1997) incorporate aid into a Barro-type growth regression (Barro (1991) and Barro and Sala-i-Martin (1995). They also include the interactive term for an aid variable and a policy index into the regression. The aid variable and policy index are endogenised in order to tackle the simultaneity issues. The analytical-framework consists of three equations as follows:

$$\frac{\dot{Y}}{Y} = \beta_{0Y} + \beta_{1Y} YPC + \beta_{2Y} \frac{A}{Y} + \beta_{3Y} P + \beta_{4Y} \frac{AP}{Y} + \beta_{5Y} Z + \varepsilon_Y \quad (2.6)$$

$$\frac{A}{Y} = \beta_{0A} + \beta_{1A} YPC + \beta_{2A} P + \beta_{3A} Z + \varepsilon_A \quad (2.7)$$

$$P = \beta_{0P} + \beta_{1P} YPC + \beta_{2P} \frac{A}{Y} + \beta_{3P} Z + \varepsilon_P \quad (2.8)$$

where YPC is income per capita measuring the difference of initial income across countries, P is an index measuring the distortion of macroeconomic policy, $\frac{AP}{Y}$ is the variable to capture the interactive effect of aid and the economic policy index, and Z is a

vector of control variables, including *inter alia* government consumption spending, institutional quality index, political instability and country-region variables.

So far, aid appears as a component of physical capital investment in the model of the aid-growth nexus and is assumed to have an impact on growth if the appropriate policies are in place. As such the level of aid flow and its interaction with macroeconomic policy variables is included in the aid-growth regression for testing the positive effect of aid on the recipient economy. Nevertheless, there is a view that aid may do more harm than good to the recipient economy when the level of aid inflow is high. This view has been recognized in the analysis of the two-gap model, where it is also known as the "absorptive capacity constraint" (Durbarry *et al.*, 1998, p. 10). The reasoning behind this view is that high aid inflows which exceed those which can feasibly be used in profitable investment are likely to be allocated to unprofitable investment or consumption. This is also known as the issue of aid fungibility which will be further discussed in Section 2.2.1. Therefore, if a sufficiently large amount of aid is allocated to unproductive investment, aid will reduce productivity of investment, thus high aid inflows will have a negative effect on growth (see for example, Griffin, 1970; Mosley *et al*., 1987; and Lavy and Seheffer, 1991).

To provide a theoretical rationale, Lensink and White (1999) apply an endogenous growth model that exhibits a negative return to aid at higher aid levels. The underlying theoretical model is one in which the level of technology is endogenised in the system and depends on the level of aid flow. They show that there exists a certain value of aid flow for turning the growth rate of output into a negative value. "The implication of this analysis is that there may exist an *aid Laffer curve*: for small levels of aid, aid has a

positive effect on economic growth, while for high levels of aid, aid negatively affects growth" (Lensink and White, 1999, p. 10). The potential side effect of high aid inflow on the productivity of investment has also been emphasized in the "fiscal response" and "Dutch disease" literatures (discussed in detail in Section 2.2.2). To test the possibility of an inverse relationship between aid and growth, many researchers have included a quadratic term of aid flow in the aid-growth regression equation, which is basically an extension of equation (2.6) (see for example, Hadjimichael *et al.*, 1995; Durbarry *et al.*, 1998; Hansen and Tarp, 1999; Lensink and White, 1999; Collier and Dollar,1999).

On the other hand, there is a view that the impact of aid on economic growth is determined by the stability of the flow, not by the level of aid *per se* (Lensink and Morrissey, 1999). As mentioned in Chapter 1, policy conditions have been attached to aid; aid disbursement may also be subject to the recipient country's achieving certain criteria. For this reason, the failure of the recipient country to fulfil such policy conditionality may relate to the uncertainty of aid inflow, which in turn can have an adverse effect on the level of investment and thus on economic growth. As Lensink and Morrissey argue:

> *If the recipients are unsure whether they will achieve the policy targets required to trigger the release of a tranche of aid…uncertainty may be increased…uncertainties with respect to [aid] inflows may render aid less effective as investors, confronted with uncertainty, may decide to postpone or even cancel investment decisions. Uncertainty may have similar effects on the investment decisions and broader fiscal behaviour of government.*
>
> Lensink and Morrissey (1999, p. 1)

Lensink and Morrissey employed three forecasting equations to capture the expected value of aid flow. Those forecasting equations are as follows:

$$\left(\frac{A}{Y}\right)_t = \beta_0 + \beta_1 t + \beta_2 \left(\frac{A}{Y}\right)_{t-1} + \beta_3 \left(\frac{A}{Y}\right)_{t-2} + e_t \quad (2.9)$$

$$\left(\frac{A}{Y}\right)_t = \beta_4 + \beta_5 \left(\frac{A}{Y}\right)_{t-1} + \beta_6 \left(\frac{A}{Y}\right)_{t-2} + e_t \quad (2.10)$$

$$\left(\frac{A}{Y}\right)_t = \beta_7 + \beta_8 t + \beta_9 t^2 + e_t \quad (2.11)$$

where *t* is a time trend. Then, the uncertainty proxies or the volatility of aid flow can be obtained by calculating the standard deviation of the residuals of those forecasting equations (i.e. equations (2.9) to (2.11)).

Lensink and Morrissey (1999) test whether the uncertainty of aid flow affects the relationship between aid and growth in the model of aid-growth regression as follows:

$$\frac{\dot{Y}_{pc}}{Y} = \beta_0 + \beta_1 Y_{PC} + \beta_2 SECR + \beta_3 \frac{1}{Y} + \beta_4 \frac{A}{Y} + \beta_5 UA + e \quad (2.12)$$

where $\frac{\dot{Y}_{pc}}{Y}$ is the growth rate of per capita GDP, Y_{PC} is the initial level of per capita *GDP*, *SECR* is the initial secondary-school enrolment rate, $\frac{1}{Y}$ is the total investment as a percentage of *GDP*, and *UA* is the uncertainty proxy of aid inflow.

It should be noted that including both investment and aid variables (i.e., $\frac{I}{Y}$ and $\frac{A}{Y}$, respectively) in the aid-growth regression is problematic because aid and investment are likely to have strong linear relationship between them. In addition, the aid-growth regression could be misspecified, as many variables that correlate with growth are

excluded from the regression (see the critique to equation (2.4)). In other words, equation (2.12) may suffer from the presence of multicollinearity and the omitted variable bias, thus it could yield unreliable estimates of the aid-growth coefficient.

However, Lensink and Morrissey (1999) applied equation (2.12) to test the effect of the volatility of aid flow on the relationship between aid and growth rather than estimate the impact of aid on growth. Moreover, they estimate equation (2.12) with and without investment in order to demonstrate the efficiency effect of aid on growth *(ibid.,* pp. 10-11). They also conduct a large-scale stability analysis to test the reliability of the regression result. The variables they include in the stability analysis are a civil liberties index, a political rights index, political instability variables and various macroeconomic variables *(ibid.* pp. 18-19).

In summary, the role of aid in the growth theories is seen as a factor input that contributes to economic growth through a direct increment of the stock of physical capital. Nevertheless, whether aid is effective for spurring economic growth still depends on the policies of both donor and recipient countries and the potential side effects of aid inflows. On the one hand, aid may have a positive effect on economic growth if appropriate policies are in place. This argument is based on the hypothesis that market forces in association with the government adopting sound management may be enough to generate economic development. On the other hand, aid may have a negative effect on growth if a high level of aid inflows leads to the decline in the productivity of capital investment, and if the volatility of aid inflows leads to delaying or cancelling investment decisions. The next section discusses the possible effects of aid on growth in the empirical frameworks.

2.1.2 The Empirical Evidence of the Effectiveness of Aid

The empirical work on aid effectiveness has been dominated by cross-country analysis. The selected studies of aid effectiveness indicate that the impact of aid on growth is mixed. Some studies find a statistically significant correlation between aid and growth and some do not. For example, Papanek (1973) using data covering the 1955-65 period for a sample of 34 *LDC*s, obtains a significant positive impact of aid on growth. Gupta (1975) and Stoneman (1975) obtain a similar result for a wider sample of *LDC*s and data. On the other hand, Griffin and Enos (1970) report a negative impact of aid on growth for a sample of 32 Latin American countries for the 1957-64 period. Voivodas (1973) uses data covering the1956-68 period for a sample of 22 *LDC*s and obtains a negative impact of aid on growth, although the aid-growth coefficient is not significant. Thus, it is not surprising that the ambiguity of the effectiveness of aid may partly arise from using the *OLS* technique for estimating the aid-growth coefficient.

Despite many studies augmenting the aid-growth nexus model to include policy variables and employing more sophisticated estimation techniques during the 1980s-90s period, the results of the impact of aid on growth still remain controversial. For example, Mosley (1980) uses data covering the 1970-77 period for 83 *LDC*s and employs *3SLS* techniques. He finds that the effect of aid on growth is not significant, except for the 30 poorest countries where aid has a significant positive effect on growth. In the follow up study, Mosley *et al.* (1987) introduce other explanatory variables into the regression equation. These variables include the growth rate of exports, growth of literacy and a variable to cover other source of financial inflows. They apply both *OLS* and *3SLS* technique to estimate the impact of aid on growth. Neither method yields a statistically significant aid-growth coefficient. They conclude that this result may relate to the issues

of aid fungibility and the crowding out of investment in the private sector. On the other hand, Dowling and Hiemenz (1983) examine the aid-growth nexus using data covering the 1968-79 period for 13 Asian countries, and control for a number of policy variables such as trade, finance and government intervention. They obtain a positive and significant impact of aid on growth.

In the last few years, the empirical studies on aid effectiveness still show no sign of agreement. Nevertheless, a majority of aid effectiveness studies have paid more attention to the policies which recipient governments have followed. For example, Mosley *et al.* (1992) examine the role of policy orientation in the determination of the effectiveness of aid by including the index of policy-orientation in the aid-growth regression. Using a sample data covering 1980-88 for 71 *LDC*s, they obtain a positive coefficient of aid and policy index variables, despite the latter being not statistically significant. Their explanation for the insignificant statistical result of the policy variable is due to the problem of data aggregation. They note that 55 percent of the countries in the group of “high aid, high growth” category adopted “moderately” to “strongly outward-oriented” development strategies, while 35 percent of the countries in the group of “low aid, low growth” category adopted "strongly inward-oriented" development strategies. Therefore, as the group of countries that adopted outward-oriented policies is larger and the sign of policy orientation is positive, they suggest that aid may be effective in an environment of "outward-oriented" policies. Hadjimichael *et al.,* (1995) investigate the impact of macroeconomic policy, structural reforms and external factors (terms of trade, foreign aid) on savings, investment and growth in 31 Sub-Saharan African countries for the 1987-92 period. They find that aid is effective for the group of "sustained adjusters" who pursue stable macroeconomic policies and implement the "adjustment programmes", so

that this group of countries is able to maximize beneficial effects of aid and attract adequate aid inflows.

On the other hand, Bowen (1998) investigates the impact of aid on growth through the potential interactive effect between aid and savings, investment and export growth. His results from *2SLS* estimation based on data covering the 1970-1988 period for a sample of 67 *LDC*s shows that aid has a negative impact on growth in the countries with income less than US$1000 (i.e. about 55 percent of the sample). Otherwise, aid has a positive impact on growth. Based on this finding, he concludes that the effectiveness of aid increases with the level of development. He also finds that aid displaced domestic savings, which he gives as the main reason for the poor record of economic performance in the developing countries. Boon (1994; 1996) employs data covering the 1970-92 period for a sample of 56 *LDC*s to examine aid effectiveness. He finds no significant relationship between aid and growth and criticized recipient governments for not having appropriate economic policies. Similarly, Burnside and Dollar (1997) examine the interactive effect of aid and policy conditionality on growth for a sample covering 56 *LDC*s over the 1970-93 period. While their results indicate a negatively insignificant statistic of the aid-growth coefficient, they illustrated that sound policy management is conditional for aid to have a positive effect on growth. They conclude that aid only works when government policies are good, and that aid should be given to countries where governments pursue sound policy management.

In the study by Burnside and Dollar (1997), the policy index is formed by three variables: the level of inflation, the size of budget surplus, and the openness to trade; the measure of institutional quality involves an assessment of the strength of the rule of law,

the quality of public services, and the pervasiveness of corruption. Using these criteria, a country with sound policy management would be one with low inflation, small fiscal imbalances, an open trade regime, and a high score for the institutional quality. The World Bank's report of *"Assessing Aid"* cites the empirical findings of Burnside and Dollar (1997) and concludes as follows:

> *Aid generally has* a *large effect in* a *good-management environment:* 1 *percent of GDP in assistance translates to* a *sustained increase in growth* of *0.5 percentage points* of *GDP. Some countries with sound management have received only small amounts of aid and have grown at* 2.2 *percent per capita. The good-management, high-aid group, however, grew much faster [at]* 3.7 *percent per capita. There is no such difference for countries with poor management. Those receiving small amounts of aid have grown sluggishly,* as *have those receiving large amounts. Introducing other variables does not change the picture.*
>
> The World Bank (1998, p. 14).

Although the study by Burnside and Dollar (1997) is considered pivotal to a new generation of aid effectiveness studies, it has been criticized for its intriguing policy implication (Hansen and Tarp, 1999). Beynon notes that:

> *... the original [Burnside and Dollar] research was undertaken partly in response to critics on the right who argued that aid was ineffective and therefore wasted, and to critics on the left who argued that structural adjustment policies were failing...*
>
> Beynon (1999, p. 2).

The central message of the study by Burnside and Dollar (1997) is that aid only really works when government policies are good and that aid should be allocated to countries with good policies. This conclusion is broadly in line with the "Washington Consensus" view on development policies (Hansen and Tarp, 1999). According to Hansen and Tarp (1999; 2000), foreign aid can induce growth both in countries with salutary and unfavourable policy environments, and increased foreign aid has a positive impact on growth so long as the ratio of aid to *GDP* is not excessively high or beyond a certain threshold, the "optimal level of aid inflows". Hadjimichael *et al.,* (1995) and Hansen and Tarp (1999) estimate the optimal level of aid inflows to *GDP* as equivalent to 25 percent, while Durbarry *et al.,* (1998) and Lensink and White (1999) have estimation results which range between 40 to 50 percent of *GDP*.

The crux of the ongoing dispute is the interpretation of the interactive term (A*P) between foreign aid (A) and policy index (P) in the earlier work by Burnside and Dollar (1997). The statistical significance of the coefficient for this interactive term may imply that foreign aid can affect growth, but only when policies are right. However, Lensink and White (2000, p. 6) demonstrate that the A*P interactive term can be interpreted as either aid can affect growth if policies are right or policies work better if supported by aid inflow. Although the statistical robustness of this interactive term has been re-examined in many studies, there remains no agreement as to whether policy conditionality is a necessary condition to improve the effectiveness of foreign aid (Beynon, 2001, pp. 23-24). This may imply that the theory of the aid-growth nexus is incomplete. Indeed, Dalgaard and Hansen (2000, p. 7) demonstrate that the links between good policy and foreign aid are substituted for each other in the model in which

both variables decrease the probability of social unrest, and they conclude that "the links between aid, growth and good policy are ambiguous" on account that "while good policies spur growth they may at the same time lead to the decreasing effectiveness of foreign aid". Empirically, part of the ambiguity may be due to the methodological weaknesses of the aid-growth regression, as the estimated aid-growth coefficient is found to be highly sensitive to the choice of the set of control variables (Lensink and White 2000; Hansen and Tarp, 2000).

Although there remains controversy regarding the effect of aid on growth, a new wave of studies into aid effectiveness has acknowledged that sound policy management is crucial for developing countries to maintain sustainable economic growth. For example, Durbarry *et al.,* (1998) found that a stable macroeconomic policy environment contributes to a greater beneficial effect of aid on growth. They also found that the growth performance of developing countries depends on the external economic environment, i.e. an increasing integration into the world economy through the ongoing process of globalization and liberalisation. Lensink and Morrissey (1999) found that the uncertainty of aid flows has a negative impact on investment, and hence on growth. For this reason, they suggested that the stability of the donor-recipient relationship is crucial for enhancing the effectiveness of aid because such stability has fostered the implementation of appropriate economic policies.

Until now, the effectiveness-of-aid literature has demonstrated that foreign aid contributes to economic growth through the impact of aid flow on the accumulation of the domestic capital stock and the productivity of capital investment. It has also emphasized the need for appropriate policy to accommodate aid flows in order to

enhance the effectiveness of aid. The next section further explores the potential effects of aid and policy on the accumulated capital stock and the productivity of capital investment in the saving-investment and the export-import channels.

2.2 Aid and Policy in Displacement Theories

Displacement theories suggest that there are possibilities that more aid inflows may not raise investment by as much as of the value of aid inflow and therefore an increase in aid may not lead to higher rates of economic growth. One possibility is that aid inflows may displace domestic savings and/or "crowd out" private investment. The debate on this view has been reproduced within the "savings debate" and the "fiscal response" literature. Another possibility concerns the impact of aid on the real exchange rate. Aid could erode export earnings, which in turn reduces the ability to import and thus the ability to increase investment as required. This is the subject of the "Dutch disease" literature, which is discussed in Section 2.2.2.

2.2.1 Aid Fungibility and the Fiscal Response Effects

Stable aid inflow contributes to economic growth even when it is fungible, which imply that aid fungibility posed no concerns for aid allocation. However, the implications of aid fungibility remain a topic of vigorous debate. According to the World Bank policy research report, Assessing Aid (World Bank, 1998), foreign aid is largely fungible, indicating that recipient governments are effectively able to avoid donor attempts to target aid flows to specific sectors. Assessing Aid reinforces the point that donors should not consider giving aid to governments that are not committed to sectors for which this

aid is targeted, as "where donors and governments do not agree on the allocation of expenditure, …spending is not likely to be effective" (World Bank, 1998).

As argued in the aid-savings displacement theory, Griffin (1970) indicated that recipient countries tend to substitute aid inflow for domestic resources. As most of the aid goes to support public expenses, recipient governments may reduce their tax efforts. If this is the response recipient governments pursue to accommodate aid inflows, it could create an unfavourable environment for encouraging domestic savings and private investment. Indeed, by reducing tax revenues, governments could face chronic budget deficit problems, as government spending could rise to accommodate the escalation of aid inflows. Sooner or later the recipient governments may not be able to avoid the need to print money and/or to raise public sector borrowing requirement (*PSBR*) to finance their budget deficits. These moves could affect private savings (investment) through the negative effects of high inflation (high interest rates), which may occur due to the growth of high-powered money (the increase in *PSBR* will bid up the interest rate). Besides, the government may change the composition of its expenditure towards unproductive investment and/or consumption (i.e., the issue of aid fungibility). The influence of foreign aid on public investment may thus be unproductive and not promote economic growth.

There are two main approaches to the estimation of aid fungibility coefficients. The most popular of the aid fungibility models, the "fiscal response" model, was first developed by Heller (1975). This model was further extended by Mosley *et al.* (1987), Gang and Khan (1991) and Franco-Rodriguez *et al.* (1998). In this approach, the government minimizes

a loss function subject to expenditure constraints to obtain empirical frameworks in the form of structural or reduced-form equations. The aid fungibility coefficients can be obtained by estimating the fiscal behavioural coefficients from such an equation system. Another aid fungibility model was developed by Pack and Pack (1990; 1993), in which the aid fungibility coefficient can be obtained by regressing government spending on a range of variables. Although this approach is an atheoretical model, it can tackle the essence of the bureaucratic decision-making process (Pack and Pack, 1990, p. 189). Other researchers applying similar approaches to that of Pack and Pack (1990; 1993) are, for example, Khilji and Zampelli (1991; 1994), Feyzioglu *et al.* (1998) and Swaroop *et al.* (2000). Each of these studies derives the empirical framework from a utility maximizing problem. Aid is said to be fungible at the aggregate level if the following conditions are satisfied:

$$\frac{\Delta IG}{\Delta A} < 1 \tag{2.15}$$

$$\frac{\Delta CG}{\Delta A} > 0 \tag{2.16}$$

$$\frac{\Delta T}{\Delta A} < 0 \tag{2.17}$$

where *CG*, *IG*, *T* and *A* are government consumption spending, public investment, taxation and aid inflows, respectively.

Equation (2.15) indicates that aid intended to be used for public investment does not increase public investment to the extent of the value of aid inflow. This implies that the recipient government is able to avoid donor attempts to target aid, and some of released resources that are available due to an increase in aid inflow can be used to increase

consumption (equation (2.16)) or to fund tax cuts (equation (2.17)). To estimate the aid fungibility coefficient, the first approach employs a structural model which is represented by a system of equations as follows:

$$DI_t = f_1\left(DI_t^*, T_t, A_t\right) \tag{2.18}$$

$$IDI_t = f_2\left(CG_t^* IDI_t^*, T_t, A_t\right) \tag{2.19}$$

$$CG_t^* = f_3\left(CG_t^* IDI_t^*, T_t, A_t\right) \tag{2.20}$$

$$T_t = f_4(T_t^*, CG_t^*, CG_t, DI_t, A_t) \tag{2.21}$$

Equations (2.18) through to (2.21) consist of fiscal-choice variables. These variables are: direct public investment *(DI),* indirect public investment *(IDI)* (here *IG= DI+ IDI),* government consumption spending (*CG*), government revenue and total aid *(A)* which can be classified into grant aid and loan aid. An asterisk (*) denotes the fiscal-target variables which are defined in equations (2.22) through to (2.25) as follows:

$$DI_t^* = f_5(Y_{t-1}, IP_t) \tag{2.22}$$

$$IDI_t^* = f_6\left(Enr_t, Y_t, GY_t\right) \tag{2.23}$$

$$CG_t = f_7\left(CG\right) \tag{2.24}$$

$$T_t^* = f_8\left(Y_t, M_{t-1}\right) \tag{2.25}$$

where *Y* is real income and *GY* is growth of real income, *IP* is private investment, *Enr* is primary school enrolments and *M* is imports. Estimation of the target variables in equations (2.22) through to (2.25) is crucial for the subsequent estimation of the aid fungibility coefficients in equations (2.18) through to (2.21).

Other approaches to estimate the aid fungibility coefficient are represented by equations

(2.26) through to (2.29):

$$T_t = f_9\left(A_t, Z_t\right) \tag{2.26}$$

$$CG_t = f_{10}\left(A_t, Z_t\right) \tag{2.27}$$

$$IG_{i,t} = f_{11}\left(A_{i,t}, A_{\neq i,t}, Z_t\right) \tag{2.28}$$

$$CG_t + \sum_{s=1}^{n} IG_{i,t} = T_t + A_t + PSBR_t \tag{2.29}$$

where *T, CG, IG,* and *A,* are defined as before, $A_{i,t}$ is aid allocation to sector *i* at time *t,* $A_{\neq i,t}$ is aid allocation to other sectors at time *t, PSBR* is public sector borrowing requirements and Z is a vector of control variables. Pack and Pack (1990, 1993) use *GDP* as the control variable, while Feyzioglu *et al. (1998)* use the infant mortality rate, average years of schooling in the labour force, average ratio of a neighbouring country's military expenditure to *GDP*, and ratio of agricultural output to *GDP*. Equation (2.28) is employed to capture sectoral-aid fungibility coefficients of the public investment (i.e., the coefficient of $\frac{\Delta IG_{i,t}}{\Delta A_{i,t}}$). The aid fungibility coefficient of the public investment at the aggregate level (i.e., the coefficient of $\frac{\Delta IG}{\Delta A}$) can be obtained by summing up the sectoral aid fungibility coefficients.

Although the fiscal response model provides useful information about the effectiveness of aid, it implicitly indicates that aid fungibility could affect economic growth through affecting the marginal productivity of aid. To solve this puzzle, Mosley *et al.* (1987) extended Heller's framework to incorporate a production function. This analytical framework highlights the relationship among aid, growth and private investment. The

impact of aid on growth can be derived from the simplified equations noted by White (1992a), as follows:

$$U = \gamma_0 - \frac{\gamma_1}{2}(G - G^*)^2 - \frac{\gamma_2}{2}(T - T^*)^2 \quad (2.30)$$

$$G = \gamma_3 A + \gamma_4 T \quad (2.31)$$

$$G^* = \gamma_5 IP \quad (2.32)$$

$$T^* = 0 \quad (2.33)$$

$$IP = \gamma_6 A \quad (2.34)$$

$$Y = Y(KP, KG, L) \quad (2.35)$$

where U is the government's utility in the form of a welfare-loss-function, G is government spending *(G=IG+CG),* G* *is* the government spending target, T is taxation, T^* is the taxation target, A is foreign aid, IP is private investment, Y is production, KP and KG are respectively, fixed capital stock of private and government sectors, and L is the labour force.

In this model, equation (2.30) implies that the welfare loss function depends on how a government's budget is allocated. The government can maximize the value of social welfare so long as its actual and target budget levels are the same (i.e., at G = G* and T = T^*). Thus the value of the welfare loss function is positive, ($U = \gamma_0 > 0$), indicating that the social welfare function is maximized, and any allocations that deviate from the target will lower the value of social welfare (i.e., $U = \gamma_1 < \gamma_0$). Equation (2.31) is the government's budget constraint, assumed to depend only on aid inflows and taxation revenue. To simplify the model, the taxation target is set equal to zero in equation (2.33). Equation (2.32) captures the influence of government spending on private investment, as

governments can set their spending targets to promote private investment. In other words, governments can set their spending targets to encourage private investment. Equation (2.34) captures the direct impact of aid on private investment. On the supply side, production is driven by the stock of private and public capital and the labour force (equation (2.35)).

By minimizing the welfare loss subject to a budget constraint, the model yields a set of equations that determine the coefficient of governmental behaviour. The substitution of the reduced forms of *IG* (obtained from first order condition) and *IP* into the growth function gives the solution for the impact of aid on growth, as follows:

$$\frac{\partial \dot{Y}}{\partial A} = \left(\frac{\partial Y}{\partial KP} \gamma_6 \right) + \left(\frac{\partial Y}{\partial KP} \frac{\mu}{1+\mu} \gamma_5 \gamma_6 \right) \tag{2.36}$$

where $\mu = \frac{\gamma_2}{\gamma_1 (\gamma_4)^2} > 0$.

Equation (2.36) illustrates that aid affects growth through three channels. The first term captures the impact of aid on growth through private investment (γ_6) and the marginal productivity of private capital $\left(\frac{\partial Y}{\partial KP} \right)$. The second term captures the impact of aid on growth through public investment (γ_3) and the marginal productivity of public capital $\left(\frac{\partial Y}{\partial KG} \right)$. The last term captures the impact of aid on growth through the interactive effect of public and private investment $(\gamma_5 \gamma_6)$ and the marginal productivity of public capital $\left(\frac{\partial Y}{\partial KG} \right)$.

Despite the coefficient of government behaviour *(μ)* entering into the last two terms of equation (2.36), this does not give a clear-cut view as to whether the issue of aid fungibility can be considered as a sufficient condition to solve the puzzle of why aid may or may not have an impact on growth. As White (1992a) argued, the fall in tax revenue due to the increase in aid inflows might not be observed. This is because aid may raise current income and hence increase tax collection. He further elaborated that the impact of the low level of public savings on private savings and investments perhaps depends on how governments finance their spending. Therefore, the most striking implication of equation (2.36) is that the impact of aid on growth mainly depends on the impact of aid on the private sector and the impact of aid fungibility on the productivity of public and private capitals, which in turn depend on the government's sound policy management. In this context, White and McGillivray (1992) applied a simple economic model to examine the relationship between aid and private investment with various sets of fiscal responses. The model consists of two equations as follows:

$$I_p = I_p(r) \text{ and } I_p' < 0 \qquad (2.37)$$

where I_p private investment, which is assumed to have an inverse relationship with the real interest rate *(r).*

$$PSBR = G - (T + A) \qquad (2.38)$$

where *PSBR*, the public sector borrowing requirement, is equal to the government's budget deficit. Table 2.1 below provides a summary of the sets of fiscal response to aid inflows under various conditions which may explain why aid fungibility may or may not have impact on private investment, and hence on economic growth.

To evaluate the fiscal response effect from the aid inflow or the impact of aid fungibility

Table 2.1: LDC Fiscal Response to Foreign Aid Inflows

Case	Conditions	Description	Effect on I_p
1	$\frac{\Delta T}{\Delta A} = \frac{\Delta G}{\Delta A} = 0$ $\Rightarrow \frac{\Delta PSBR}{\Delta A} = -1$	Government uses aid to finance planned expenditure, taking opportunity to reduce PSBR (i.e., reducing future government expenditure); present value of reduction equals the value of aid inflow.	Crowding In
2	$\frac{\Delta T}{\Delta A}=0$, $0<\frac{\Delta G}{\Delta A}<1$ $\Rightarrow \frac{\Delta PSBR}{\Delta A} < 0$	Weaker version of Case 1 in which *(1-dG/dA)* is used to reduce PSBR, with remainder used to increase government expenditure.	Crowding In
3	$\frac{\Delta T}{\Delta A} = 0$, $\frac{\Delta G}{\Delta A} = 1$ $\Rightarrow \frac{\Delta PSBR}{\Delta A} = 0$	No fungibility with all aid used to finance increased expenditure.	None
4	$\frac{\Delta T}{\Delta A} = 0$, $\frac{\Delta G}{\Delta A} > 1$ $\Rightarrow \frac{\Delta PSBR}{\Delta A} > 0$	Government increases expenditure by more than the value of aid inflows (as in, for example, counterpart funding requirement); PSBR increases.	Crowding Out
5	$\frac{\Delta T}{\Delta A} = 0$, $\frac{\Delta G}{\Delta A} < 0$ $\Rightarrow \frac{\Delta PSBR}{\Delta A} < -1$	Government reduces expenditure in response to aid inflows on belief that aid expenditure is more efficient than domestically financed expenditure.	Crowding In
6	$1 < \frac{\Delta T}{\Delta A} < 0$, $\frac{\Delta G}{\Delta A} = 0$ $\Rightarrow \frac{\Delta PSBR}{\Delta A} < 0$	Aid inflows used to both offset PSBR and reduce taxes.	Crowding In
7	$\frac{\Delta T}{\Delta A} < 0$, $0 < \frac{\Delta G}{\Delta A} < 1$ $\Rightarrow \frac{\Delta PSBR}{\Delta A} < 0 \; if \; \frac{\Delta G}{\Delta A} - \frac{\Delta T}{\Delta A} < 1$	Aid inflows partly used to finance increased expenditure and partly to reduce taxes, net result being a decrease in PSBR.	Crowding In
8	$\frac{dT}{dA} < 0, 0 < \frac{dG}{dA} < 1$ $\Rightarrow \frac{dPSBR}{dA} > 0 \; if \; \frac{dG}{dA} - \frac{dT}{dA} > 1$	Aid inflows partly used to finance increased expenditure and partly to reduce taxes, net result being an increase in PSBR.	Crowding Out
9	$\frac{\Delta T}{\Delta A} < 0, \frac{\Delta G}{\Delta A} > 0$ $\Rightarrow \frac{\Delta PSBR}{\Delta A} = 0 \; if \; \frac{\Delta G}{\Delta A} - \frac{\Delta T}{\Delta A} = 1$	Aid inflows partly used to increase expenditure and partly to reduce taxes, net result being no change in PSBR.	None
10	$\frac{\Delta T}{\Delta A} > 0$, $\frac{\Delta G}{\Delta A} > 1$ $\Rightarrow \frac{\Delta PSBR}{\Delta A} > 0$	Government increases expenditure by more than the value of aid inflows; taxation revenue increases due to an income multiplier effect.	Crowding Out

Source: White and McGillivray (1992)

on growth, the coefficients of the impact of aid on tax, government spending and the public sector-borrowing requirement are needed. Table 2.2 below provides empirical evidence of the fiscal response effect and adding aid fungibility variables to the information provided by White and McGillivray (1992).

Table 2.2: The Fiscal Response Effect from Foreign Aid Inflows

Study	Data	$\frac{\Delta G}{\Delta A}$	$\frac{\Delta T}{\Delta A}$	$\frac{\Delta PSBR}{\Delta A}$	Is aid fungible in aggregated level?	Effect on private investment
Heller (1975)	*n*=11African 1960s-70s	0.96	-0.4	0.36	Yes	Crowding out (case 8)
Cashell & Craig. (1990)	*n*=46 LDC 1975-80s	3.60	0.00	2.60	Yes. soft-loan & grant are likely	Crowding Out (case 4)
McGuire (1987)	Israel	-0.52	0.00	-1.52	No	Crowding In (case 5)
Pack and Pack (1991)	Indonesia 1966-86	1.58	0.29	0.29	No	Crowding Out (case 10)
Gang & Khan (1991)	India 1961-84	-0.55	0.00	-1.55	No	Crowding In (case 5)
Khilji & Zampelli (1991)	Pakistan	0.26	-0.74	0.00	Yes	None (case 9)

Sources: As shown.

As can be seen from Table 2.2, the existence of aid fungibility is not always associated with the negative impact of aid on private investment. This is not a surprising result because the issue of aid fungibility is not a sufficient condition to indicate that aid may or may not have a negative impact on growth. Nevertheless, in the case of the aid fungibility crowding out private investment, the negative impact of aid on the private sector is due to the pressure on recipient governments to increase *PSBR*, which in turn could bid up the interest rate and lower investment demand. Moreover, there is a view that the negative impact of aid on the private sector could be channelled through the high level of aid inflows exerting upward pressure on the domestic price level,

especially on non-tradable prices. As Mosley *et al.*, claimed:

> *the transfer* of *aid money raises the prices* of *some goods, depresses the prices* of *some others and hence has side effects on the private sector.*
>
> Mosley *et al.* (1987, p. 617).

This claim, however, could indicate that aid inflows might have dual impacts (positive and negative) on the recipient economy. On the one hand, aid inflows exert upward pressure on non-tradable prices that may encourage producers to produce more non-tradable goods. On the other hand, the increase in non-tradable prices might cause the appreciation of the real exchange rate if non-tradable prices rise faster than tradable prices. The latter is the issue known as "Dutch disease" effect, which is discussed in the following section.

2.2.2 Aid and the "Dutch Disease" Effect

In the aid effectiveness literature, "Dutch disease" is used to refer to the situation where high levels of aid inflow may generate undesirable effects on the economy (Edwards and Van Wijnberger, 1989). "Dutch disease" arises when the high level of aid inflows brings about real exchange rate appreciation and creates booming sector (non-tradable sectors) at the cost of recession in other sectors (tradable sectors). The symptoms of "Dutch disease" can be observed once the increase of aid inflows draws resources away from tradable into non-tradable sectors. As a result, tradable production declines and hence threatens export performance (Corden and Neary, 1982). It is obvious that the effect of "Dutch disease" will erode the recipient's export earnings and hence the ability to import. Therefore, more aid inflows which may cause the "Dutch disease" will not be matched by a one-for-one increase in investment (White, 1998, pp. 6-7).

As “Dutch disease” arises due to the high level of aid inflow creating a booming sector in the economy, it is important to analyze the level of aid inflow that may cause the “Dutch disease” effect. White (1992a) indicates that the “Dutch disease” effect happens in both the developed and developing world; however, sector booms in the developed world, unlike those in the developing world, are not the result of high capital inflow. The “Dutch disease” syndrome arises when the booming sector accounts for a 6 to 15 percent share of *GDP* in developed countries, but in developing countries, the level of aid inflow to *GDP* varies from more than 5 percent to over 20 percent. Therefore, White suggests that there is a high potential that aid may bring in the “Dutch disease” effect (White, 1992a, pp. 166-67). In the past decade, studies of the “Dutch disease” effect have been approached from different methodologies. These range from the application of the single regression equation of aid-real exchange rate nexus models to the establishment of macroeconometric models or computable general equilibrium models (*CGE*). The appropriateness of an approach depends on the extent of aid inflows and the considerable economy-wide effects of aid on the recipient economies. Empirical evidence regarding the “Dutch disease” effect is highlighted below.

Van Wijnbergen (1986) applies a single regression equation to estimate the aid-real exchange rate nexus model for African countries. He finds a significantly negative relationship between aid and the real exchange rate in four out of six African countries. He also demonstrates that the effect of the “aid boom” permanently lowers the total productivity in the export sector. Despite the real exchange rate being allowed to depreciate after the effect of the “aid boom”, productivity does not return to the level before the "aid boom". Nevertheless, he argues that if capital markets were perfect, there

should have been no problem after the effect of the "aid boom" as the private sector can re-borrow and re-invest after the economic recovery from this effect.

Using the *CGE* model, Weisman (1990) investigates the impact of aid inflows to Papua New Guinea. He finds that aid inflows increased government spending, which in turn increased the prices of non-traded goods and services. Producers responded to the increase in prices of non-traded goods by increasing supply in this sector and shifting resources from the production of traded goods. Therefore, aid inflows brought about the "Dutch disease" effect that threatened the export earnings of Papua New Guinea. Collier and Gunning (1992) also apply the *CGE* model to examine "Dutch disease" effects in African economies. They find that aid supported government spending that raised aggregate demand and exerted upward pressure on the prices of non-tradable sectors. As a result of the booming of non-tradable sectors, labour and capital were drawn away from the tradable sector. They illustrated that devaluation does reduce this adverse effect on tradable sectors.

In summary, the "Dutch disease" literature regards the high level of aid inflow as the potential source of side effects on the recipient economy. For this reason, aid may not have a positive impact on growth if high levels of aid inflow make tradable sectors less competitive in the world market through the appreciation of the real exchange rate and the lowering of export earnings. Eventually, the "Dutch disease" effect will lower the ability to import, invest and grow.

The assessment of aid effectiveness discussed in the preceding sections of this chapter reveals that foreign aid has contributed to economic growth, although there remains

some dispute as to whether policy conditionality is sufficient to support economic growth. It may be plausible to claim that foreign aid has a positive impact on economic growth because in past decades aid has been mainly allocated to investments in physical and human capital, factors presumed to be the fundamental driving force for economic growth.[3] But why, have the majority of developing countries not achieved sustained economic growth, despite the receipt of substantial amounts of foreign aid over the past decades?

In fact, developing countries have not only experienced a low record of economic growth but also a high record of economic volatility (Easterly *et al.*, 2000, p. 4). Recent research by Gavin and Hausmann (1998) shows that economic volatility correlates negatively with economic growth and that a volatile macroeconomic environment leads to a significantly lower rate of investment, undermines educational attainment, harms the distribution of income and increases poverty.

Apart from terms of trade fluctuation and other external shocks, macroeconomic policies (i.e., fiscal and monetary policy and the exchange rate regime) and political instability are the most important determinants of economic volatility (Gavin and Hausmann, 1998, pp. 97-98). Although policy index, institutional quality and political instability variables have been included in the assessment of aid effectiveness, none of the previous studies explicitly focused on the interrelationship among these factors. To solve this puzzle, a clear understanding is required of how the interaction between aid and the recipient

[3] According to data from the Geographical Distribution of Financial flow to Developing Countries on CD-ROM (OECD, 2001), about 60 to 70 percent of total aid flow during the 1973 to 1999 period has been allocated to investments in physical and human capital.

country's incentive regimes (i.e. the state and institutional capability to implement the policy conditions) may affect economic growth and economic volatility. In this context, the subsequent sections introduce the theory of the aid-growth nexus focusing on development issues of the Least Developed Countries (*LDC*s).

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter focuses on the econometric framework of the empirical model of the study. The chapter is organized as follows: Section 3.2 presents the specification of the operational models (aid-growth and the aid-fungibility models). Section 3.3 introduces the estimation methods of the models while Section 3.4 presents the sources and time series properties of the data and variable definitions.

3.1 Specification of the Operational Models

In this section, two models are specified. Model I is used to test the impact of aid on economic growth. Model II will be used to test the impact of aid fungibility on investment.

Model I: Aid-Growth Equation Specification

In this section, we specify the equation for real *GDP* that will be estimated and analyzed in the next chapter. While the standard neoclassical growth model predicts that labour and capital inputs are able to explain the bulk of economic growth patterns in a given country, there is still scope to account for the role of other explanatory variables in deriving output changes. Such factors may be considered on the basis of further theoretical foundations as well as country-specific characteristics. Among such factors, the recent literature on growth has centred on foreign aid, measured as official development assistance as a percentage of *GDP*, total net private capital flows as a

percentage of *GDP*, trade as a percentage of *GDP* to account for the degree of openness of the economy, etc as possible growth enhancing variables. Stated alternately, observing from theory the possible growth promoting roles of foreign aid, this study and its data analysis is modelled in an aggregate production function framework. The standard *APF* model has been extensively used in econometric studies to estimate the impacts of foreign aid on growth in many developing countries. The aggregate production function assumes that, along with "conventional inputs" of labour and capital used in the neoclassical production function, "unconventional inputs" like foreign aid and trade openness may be included in the model to capture their contribution to economic growth. The APF model has been used by Feder (1983), Fosu (1990).

The factors of production and the production technology determine the level of output in an economy which can be summarized as:

$$Y_t = A_t L_t^{\beta_1} K_t^{\beta_2} e^{\varepsilon_t} \tag{3.1}$$

where *Y* denotes the aggregate production of the economy (real *GDP*) at time *t* and *K, L, A* denote the amount of capital stock, labour stock and total factor productivity (*TFP*) respectively. Assuming constant technology, any increase in the amount of labour and/or capital will increase the level of output in the economy. In this case, *'A'* captures the total factor productivity (*TFP*) of growth in output not accounted for by increase in labour and capital. Since this study seeks to investigate the impacts of aid inflows on economic growth through changes in *TFP*, we assume therefore that *TFP* is a function of foreign aid inflows and other factors. Thus, it is assumed that;

$$A = f\left(AID, PRIV, OPENNESS, MONEY, INF, D\right) =$$

$$AID^{\beta_3} PRIV^{\beta_4} OPENNESS^{\beta_5} MONEY^{\beta_6} INF^{\beta_7} D^{\beta_8} \tag{3.2}$$

where; *AID*: Official development assistance as a percentage of gross domestic product (*GDP*); *PRIV*: Total net private capital flows as a percentage of *GDP*; *OPENNESS*: Trade liberalization (Trade as a percentage of *GDP*); *MONEY*: Financial development (money supply (*M2*) as a percentage of *GDP*) and *INF*: Inflation (which is expected to proxy general macroeconomic instability) and *D*: Dummy (proxy for constitutional regime).

By substituting (3.2) into (3.1), we obtain;

$$Y = L^{\beta_1} K^{\beta_2} AID^{\beta_3} PRIV^{\beta_4} OPENNESS^{\beta_5} MONEY^{\beta_6} INF^{\beta_7} D^{\beta_8} e^{\varepsilon} \quad (3.3)$$

From (3.3), the specific operational model for real *GDP* growth for Ghana in an estimable econometric form is:

$$\ln Y_t = \beta_0 + \beta_1 \ln L_t + \beta_2 \ln K_t + \beta_3 \ln AID_t + \beta_4 \ln PRIV_t + \beta_5 \ln OPENNESS_t + \beta_6 \ln MONEY_t + \beta_7 \ln INF_t + \beta_8 D_t + \varepsilon_t \quad (3.4)$$

Where all variables are as previously defined except ε_t, which represents the white noise error term, *t*, is time and *In* denotes natural logarithm. Equation (3.4) shows the long–run equilibrium relationship. A few words must be said regarding the intuitive sign for each independent variable.

Increase in labour input (*L*), which is measured here as the aggregate labour force is expected to lead to an increase in real *GDP*. All things being equal, the higher the labour force the higher the supply of labour and hence output. Therefore, the coefficient of labour is expected to be positive ($\beta_1 > 0$).

Theoretically capital measured by gross domestic capital formation as a percentage of *GDP* is expected to exert a positive impact on the rate of growth of real *GDP*. Consequently, the study expects the coefficient of capital to be positive ($\beta_2 > 0$) on a priori

and theoretical grounds, thus the higher the rate of investment, the higher the rate of real *GDP* growth, all things being equal.

Similarly, foreign aid should generally be expected to exert a positive effect on real output, as it is considered as an inflow of foreign capital to complement domestic capital. It is therefore expected that an increase in the inflow of *AID* will lead to an increase in aggregate output and hence its rate of growth. Thus coefficient of *AID* is expected to be positive ($\beta_3 > 0$). The study is however; interested in testing whether the impact of foreign aid on real *GDP* is statistically significant.

As sources of physical capital accumulation, private inflows (as a percentage of the GDP) is expected to have a positive impact on investment and therefore on economic growth. In consequence, the study expects $\beta_4 > 0$.

Openness to trade is often hypothesized to raise growth through several channels, such as access to advanced technology from abroad, possibilities of catch-up, greater access to a variety of inputs for production, and access to broader markets that raise the efficiency of domestic production through increased specialization. Frequently used measures include the ratio of total trade to *GDP* and changes in the terms of trade. Thus, on a priori and theoretical grounds, the effect of openness of the economy on *GDP* growth is positive ($\beta_5 > 0$).

Furthermore, *M2* over *GDP* is used as a proxy for financial development. Financial development stimulates economic growth by enlarging the services provided by financial intermediaries such as savings mobilization, project evaluation, and risk management.

The size of financial intermediaries, traditionally measured by the ratio of *M2* to *GDP*, is assumed to be positively associated with the provision of financial services. Financial repression is also expected to be detrimental to growth. Many developing countries over-regulate their financial sectors through controls on interest rates on deposits and restrictions on credit to the private sector, which hamper its ability to intermediate savings efficiently (World Bank, 1989). Although financial liberalization is usually argued to foster growth, it may not be effective if it also creates macroeconomic instability. For example, a reduction in forced lending to government could increase the availability of financing for private investment. However, if the government then resorts to inflationary finance, the move could be counter productive. Consequently, we expect the coefficient of *MONEY* to be ambiguous.

The inflation rate indicates the overall ability of the government to manage the economy: high inflation rates implying that the government has lost control. Inflation is expected to proxy the general macroeconomic instability. We expect that this variable will be negatively related to growth (i.e. $\beta_7<0$).

A regime of constitutional rule ensures well functioning democratic institutions, which is a precondition for a favourable investment climate and hence economic growth. Non-constitutional transfers of executive power (i.e. coups) are particularly likely to increase uncertainty (Stasavage, 2002). Thus, a socio-politically stable environment where property rights and contracts are enforced through a properly functioning judicial system will have a positive impact on economic growth. Thus, the dummy variable in the model is expected to be positive.

Model II: Aid Fungibility Model Specification

The interplay between various economic sectors and economic feedback mechanisms can be used to track the potential impact of aid inflows on various macroeconomic variables. Although aid may affect both the demand side and the supply side of the economy, the modelling of the impact of aid fungibility on investment is focused on the demand side of the economy.[1] This is because aid may have some influence on the decisions relating to demand for consumption, savings and investment in both public and private sectors through the impact of aid inflows on economic prices and income. In this context, an aid fungibility model for the case of Ghana is developed from the structure of the Keynesian approach to macroeconomic modelling. The model explicitly allows for the interaction between the public and private sectors. Although external sector is included in the model, it is treated as an exogenous variable and is allowed to affect both the private and public sectors through the transmission mechanism in the equilibrium condition of the model. The aid fungibility model for the case of Ghana consists of seven equations, in which five are stochastic (i.e. equation 3.5 - 3.9) and two are definitional and equilibrium conditions (i.e. equation 3.10 - 3.12). The specifications of the model are expressed in a generic form as follows:

[1] Gupta and Lensink (1995) construct a macroeconometric model of fungibility with heavy emphasis on the impact of aid on the demand side of the economy. The model explicitly allows for interaction between four sectors in response to aid inflows. Those sectors are the non-bank sector, the government sector, the banking sector and the external sector.

Model of Aid Fungibility

Behavioural equations

Public sector

$$CG_t = f_1(T_t, A_t, INF_t) \quad (3.5)$$

$$IG_t = f_2(T_t, A_t, INF_t) \quad (3.6)$$

$$T_t = f_3(Y_t, A_t, FDI_t, INF_t) \quad (3.7)$$

Private sector

$$IP_t = f_4(IG_t, Y_t, FDI_t, INF_t, REER_t) \quad (3.8)$$

$$CP_t = f_5(Y_t, INF_t) \quad (3.9)$$

Identity equations

$$DI_t = f_1(DI_t^*, T_t, A_t) \quad (3.10)$$

$$AD_t = AS_t = Y_t \quad (3.11)$$

where

CG : Government consumption spending

IG : Government capital expenditure

T : Government revenue

IP : Private investment

CP : Private consumption

AD : Aggregate demand

Y : Income

A : Total aid inflows

FDI : Foreign direct investment

INF : Inflation

REER = Real exchange rate

AS : Aggregate supply

In the public sector, aid inflow (*A*) is included in the functions of the fiscal choice variables (i.e. equation (3.5) to (3.7), to capture the influence of aid on the government's fiscal behaviour. This is in line with the model employed by Pack and Pack (1990, 1993).

Apart from aid inflow, the Ghana Government has relied on government revenue (*T*) to finance public consumption (*CG*) and provided the counterpart funds for public investment (*IG*). In this regard, *T* is included as an explanatory variable in equation (3.5) and (3.6). Furthermore, the Ghana Government has mainly derived tax revenue from income tax; excise tax and other non-income tax (i.e. profit tax, turnover tax, trade tax, and royalties). Foreign firms have been a main source of non-income tax. Thus, in equation (3.7), foreign direct investment (*FDI*) is used as a proxy variable for non-income tax and excise tax. Inflation (*INF*) is included in equations (3.5) to (3.7) to capture the feedback effect due to inflation tax policy.[2]

In the private sector, investment function (equation (3.8)) is derived from the accelerator theory, which assets that "investment spending is proportional to the change in output" (Dornbusch and Fischer, 1994, p.348). Thus, disposable income (*YD*) is included as a proxy variable for the change in output. It is assumed that the investment function is dominated by fiscal policy, foreign private capital inflow and macroeconomic instability.

As discussed in the fiscal response literature in section 2.2.2, public investment (*IG*) is therefore included to capture the crowding out (or crowding in) effects. The inflow of foreign direct investment (*FDI*) is also used as an explanatory variable because private investment in Ghana is dominated by the *FDI* inflows. Macroeconomic instability may create an uncertain environment for investment decisions, which in turn causes the delay

[2] Inflation tax is an implicit tax levied by the government by means of base money creation (e.g. printing money). Inflation tax has long been recognized as an important source of government revenue in many developing countries. This is no exception for Ghana. Inflation tax can have a positive or negative effect on real government revenue. In this context, INF is used as an explanatory variable linking the inflation tax and the collector of tax revenue.

or even cancellation of investment decisions (Dixit and Pindyck, 1994). To capture the effect of macroeconomic instability on private investment, inflation is used as a proxy variable for macroeconomic instability. With respect to consumption, the consumption function (*CP*) is derived from the Keynesian consumption function, which asserts that consumption increases in proportion with disposable income (*YD*). The inflation variable is also used as an explanatory variable because it can have a direct effect on real consumption, as the consumers suffer from money illusion or if money enters a consumer's utility function (see for example Deaton, 1977; Juster and Wachtel, 1972a, 1972b; and von Furstenburg, 1980).

With respect to identity equations, equations (3.10) and (3.11) represent the national account identity for aggregate demand and disposable income respectively. The final equation (3.12) equates aggregate demand, aggregate supply and income.

3.2 Unit Root and Cointegration Tests

The specific model used in this study is cointegration. This statistical concept introduced by Granger (1983), Granger and Weiss (1983) and Engle and Granger (1987) has received wide attention and is beginning to be applied to test the validity of various theories and models.

Cointegration is a property possessed by some non-stationary time series data. In this concept, two variables are cointegrated when a linear combination of the two is stationary, even though each variable is non-stationary. In particular, if we if consider two time series, *X* and *Y* that are non-stationary, conventionally one would expect that a linear combination of two the variables would also be non-stationary. In order to avoid

the problem of non-stationarity it is necessary to make use of first (or higher) differentiated data. Such differencing, however, may result in a loss of low frequency information or long-run characteristics of the series data. However, Engle and Granger (1987) showed that, if there is an equilibrium relationship between such variables, then for this relationship to have any meaning a linear combination of these variables the disequilibrium error should fluctuate about zero i.e. should be stationary. Testing for cointegration involves two steps.

1. Determine the degree of integration in each of the series, a unit root analysis.
2. Estimate the cointegration regression and test for integration

3.2.1 Unit Roots

A two variable cointegration test requires that the variables be integrated of order one. In other words the series data should be stationary only in their first differences, and not in levels. A number of alternative tests are available for testing whether a series is stationary or not, the Augmented Dickey-Fuller (*ADF*), Dickey and Fuller (1979), as well as the Phillips Perron (PP) test developed by Phillips (1987) and Phillips and Perron (1988). The *PP* tests are based on the following *ADF* regression, and the critical values are the same as those used for the *ADF* tests:

$$\Delta X_t = \lambda_0 + \lambda_1 X_{t-1} + \lambda_2 T + \sum_{i=1}^{n} \psi_i \Delta X_{t-1} + \varepsilon \qquad (3.13)$$

where Δ is the difference operator, X is the natural logarithm of the series, T is a trend variable, λ and ψ are the parameters to be estimated and ε is the error term. The *PP* unit root test is utilized in this case in preference to *ADF* unit root tests for the following reasons. First the *PP* tests do not require an assumption of homoscedasticity of the error

term (Phillips, 1987). Secondly, since lagged terms for the variable of interest are set to zero there is no loss of effective observations from the series (Perron, 1988), which is especially useful if the number of data points is limited. The *PP* unit root test corrects the serial correlation and autoregressive heteroscedasticity of the error terms. This aims at providing unit root tests results that are robust to serial correlation and time dependent heteroscedasticity of errors.

In both the *PP* and *ADF* unit root tests the null hypothesis is that the series is non-stationary and this is either accepted or rejected by examination of the t-ratio of the lagged term X_{t-1} compared with the tabulated values. If the t-ratio is less than the critical value the null hypothesis of a unit root (i.e. the series is non-stationary) is accepted. If so the first difference of the series is evaluated by equation (3.13) and if the null hypothesis is rejected the series is considered stationary and the assumption is that the series is integrated of order one *I*(1). Critical values for this t-statistic are given in Mackinnon (1991).

3.2.2 The ARDL Cointegration Approach

A large number of past studies have used the Johansen cointegration technique to determine the long-term relationships between variables of interest. In fact, this remains the technique of choice for many researchers who argue that this is the most accurate method to apply for *I*(1) variables. Recently, however, a series of studies by Pesaran and Shin (1996); Pesaran and Pesaran (1997); Pesaran and Smith (1998) and Pesaran *et al*. (2001) have introduced an alternative cointegration technique known as the 'Autoregressive Distributed Lag (*ARDL*)' bound test. This technique has a number of

advantages over Johansen cointegration techniques. First, the *ARDL* model is the more statistically significant approach to determine the cointegration relation in small samples (Ghatak and Siddiki 2001), while the Johansen co-integration techniques require large data samples for validity.

A second advantage of the *ARDL* approach is that while other cointegration techniques require all of the regressors to be integrated of the same order; the *ARDL* approach can be applied whether the regressors are *I*(1) and/or *I*(0). This means that the *ARDL* approach avoids the pre-testing problems associated with standard cointegration, which requires that the variables be already classified into *I*(1) or *I*(0) (Pesaran et al, 2001).

If we are not sure about the unit root properties of the data, then applying the *ARDL* procedure is the more appropriate model for empirical work. As Bahmani-Oskooee (2004:485) explains, the first step in any cointegration technique is to determine the degree of integration of each variable in the model but this depends on which unit root test one uses and different unit root tests could lead to contradictory results. For example, applying conventional unit root tests such as the Augmented Dickey Fuller and the Phillips-Perron tests, one may incorrectly conclude that a unit root is present in a series that is actually stationary around a one-time structural break (Perron, 1989; 1997) The *ARDL* approach is useful because it avoids these problems.

Yet another difficulty of the Johansen cointegration technique which the *ARDL* approach avoids concerns the large number of choices which must be made: including decisions such as the number of endogenous and exogenous variables (if any) to be included, the treatment of deterministic elements, as well as the order of *VAR* and the optimal number

of lags to be used. The estimation procedures are very sensitive to the method used to make these choices and decisions (Pesaran and Smith 1998). Finally, with the *ARDL* approach it is possible that different variables have different optimal numbers of lags, while in Johansen-type models this is not permitted.

According to Pesaran and Pesaran (1997), the *ARDL* approach requires the following two steps. In the first step, the existence of any long-term relationship among the variables of interest is determined using an F-test. The second step of the analysis is to estimate the coefficients of the long-run relationship and determine their values, followed by the estimation of the short-run elasticity of the variables with the error correction representation of the *ARDL* model. By applying the *ECM* version of *ARDL*, the speed of adjustment to equilibrium will be determined.

In order to implement the bounds test procedure for cointegration, the following restricted (conditional) version of the *ARDL* model is estimated to test the long-run relationship between real *GDP* and its determinants:

$$\Delta \ln Y_t = \alpha_0 + \delta_1 \ln Y_{t-1} + \delta_2 \ln L_{t-1} + \delta_3 \ln K_{t-1} + \delta_4 \ln AID_{t-1} + \delta_5 \ln PRIV_{t-1} + \delta_6 \ln OPENNESS_{t-1} + \delta_7 \ln MONEY_{t-1}$$
$$+\delta_8 \ln INF_{t-1} + \delta_9 D_{t-1} + \sum_{i=1}^{n} \beta_i \Delta \ln Y_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta \ln L_{t-i} + \sum_{i=1}^{n} \pi_i \Delta \ln K_{t-i} + \sum_{i=1}^{n} \eta_i \Delta \ln AID_{t-i} + \sum_{i=1}^{n} \theta_i \Delta \ln PRIV_{t-i} +$$
$$\sum_{i=1}^{n} \varphi_i \Delta \ln OPENNESS_{t-i} + \sum_{i=1}^{n} \varpi_i \Delta \ln MONEY_{t-i} + \sum_{i=1}^{n} \tau_i \Delta \ln INF_{t-i} + \varepsilon_t \qquad (3.14)$$

where all variables are as previously defined and Δ is the first difference operator. The parameters $\beta, \gamma, \pi, \eta, \theta, \varphi, \varpi$ and τ denote the short-run dynamics of the model to be

estimated through the error correction framework and δ_i are the long run multipliers, in the *ARDL* model, α_0 is the constant term (drift) and ε is white noise error term.

3.2.3 Bounds Testing Procedure:

The first step in the *ARDL* bounds testing approach is to estimate equation (3.14) by ordinary least squares (*OLS*) in order to test for the existence of a long-run relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables, i.e.,

$H_N : \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = 0,$ against the alternative

$H_A : \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq \delta_7 \neq \delta_8 \neq \delta_9 \neq 0.$ We denote the test which normalize on $F_Y\left(Y/L, K, AID, PRIV, OPENNESS, MONEY, INF\right)$. Two asymptotic critical values bounds provide a test for cointegration when the independent variables are *I*(d) (where $0 \leq d \leq 1$): a lower value assuming the regressors are *I*(0) and an upper value assuming purely *I*(1) regressors. If the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship can be rejected irrespective of the orders of integration for the time series. Conversely, if the test statistic falls below the lower critical value the null hypothesis cannot be rejected. Finally, if the statistic falls between the lower and upper critical values, the result is inconclusive. However, given that Pesaran's critical values are based on simulated large sample size, this study uses the critical values developed by Narayan (2004) since it is more appropriate for small samples.

In the second step, once cointegration is established the conditional *ARDL* ($p, q_1, q_2, q_3, q_4, q_5, q_6, q_7$) long-run model for Y_t can be estimated as:

$$\ln Y_t = \alpha_0 + \sum_{i=1}^{p} \delta_1 \ln Y_{t-i} + \sum_{i=0}^{q_1} \delta_2 \ln L_{t-i} + \sum_{i=0}^{q_2} \delta_3 \ln K_{t-i} + \sum_{i=0}^{q_3} \delta_4 \ln AID_{t-i} + \sum_{i=0}^{q_4} \delta_5 \ln PRIV_{t-i} + \sum_{i=0}^{q_5} \delta_6 \ln OPENNESS_{t-i} + + \sum_{i=0}^{q_6} \delta_7 \ln MONEY_{t-i}$$
$$+ \sum_{i=0}^{q_7} \delta_8 \ln INF_{t-i} + \varsigma D_t + \varepsilon_t \qquad (3.15)$$

where all variables are as previously defined. The estimation of (3.15) involves selecting the orders of the *ARDL* ($p, q_1, q_2, q_3, q_4, q_5, q_6, q_7$) long-run model using the Akaike Information Criterion (*AIC*).

In the third and final step, we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is specified as follows:

$$\Delta \ln Y_t = \alpha_0 + \sum_{i=1}^{n} \beta_i \Delta \ln Y_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta \ln L_{t-i} + \sum_{i=1}^{n} \pi_i \Delta \ln K_{t-i} + \sum_{i=1}^{n} \eta_i \Delta \ln AID_{t-i} + \sum_{i=1}^{n} \theta_i \Delta \ln PRIV_{t-i}$$
$$+ \sum_{i=1}^{n} \varphi_i \Delta \ln OPENNESS_{t-i} + \sum_{i=1}^{n} \varpi_i \Delta \ln MONEY_{t-i} + \sum_{i=1}^{n} \tau_i \Delta \ln INF_{t-i} + \varsigma D_t + \vartheta ecm_{t-1} + \varepsilon_t \qquad (3.16)$$

Here $\beta, \gamma, \pi, \eta, \theta, \varphi, \varpi$ and τ are the short-run dynamic coefficients of the model's convergence to equilibrium and ϑ is the speed of adjustment to long-run equilibrium following a shock to the system.

3.3 Estimating and Analysing the Macroeconometric Fungibility Model

Once a macroeconometric model has been specified, the reduced form can be expressed in matrix form as follows.

$$A_0 x_t = A_1 z_t + A_2 z_{t-1} + A_3 x_{t-1} + e_t \qquad (3.17)$$

In this expression x_t is the ($n \times 1$) vector of endogenous variables, z_t is the ($m \times 1$) vector of exogenous variables, x_{t-1} and z_{t-1} are respectively the x_t and z_t vector lagged one period, and e_t is the ($n \times 1$) vector of residuals. A_0 is the ($n \times n$) matrix of the coefficients of the endogenous variable; A_1 is the ($n \times m$) matrix of the coefficients of the exogenous variables. A_2 is the ($n \times m$) matrix of the coefficients of the lagged exogenous variables. In the A_2 matrix, the entry of intercepts into the structural equations is accommodated by including a variable which always takes the value of unity. A_3 is the ($n \times n$) matrix of the coefficients of the lagged endogenous variables. There are various ways the macroeconometric model can be analysed. These issues are discussed in the following sections.

3.3.1 Estimation Methods

The estimation problem that is likely to be encountered in this study is the small sample size to estimate the cointegrating coefficients of the behavioural equations. This is because only 36 annual observations are employed for the estimation. Also, the variables included in the behavioural equations are likely to be cointegrated among themselves through a direct and/or indirect link from either the identity equations or the specification of behavioural equations of those variables. Therefore, the estimation strategy adopted here is an ad hoc technique to handle the abovementioned problems. The Autoregressive Distributed Lag (*ARDL*) approach to cointegration developed by Pesaran and Shin (1995) is used to estimate the dynamic structure of the behavioural equations.

The *ARDL* procedure involves two stages. In the first stage, each behavioural equation is transferred to the error correction form of the underlying ARDL model. The error correction version of the *ARDL* (*p*,*q*) in the variables X_t and Z_t is given by

$$\Delta X_t = \alpha + \sum_{i=1}^{p} A_i \Delta X_{t-i} + \sum_{j=1}^{q} B_j \Delta Z_{t-j} + C_0 X_{t-1} + C_1 Z_{t-1} + \mu_t \qquad (3.18a)$$

where X_t is an endogenous variable, α is an intercept, Z_t is an explanatory variable and μ_t is an error term.

The F-statistic for the joint test of the coefficients C_0 and C_1 is computed to test for the long-run relationship between X_t and Z_t. The null hypothesis is that the coefficients C_0 and C_1 in equation (3.18) are jointly equal to zero. In other words, the null hypothesis states that there is no long-run relationship between X_t and Z_t. Then, the computed F-statistic is compared with the critical value bounds of the F-statistic that Narayan (2004) have tabulated. If the computed F-statistic is higher (lower) than the upper (lower) bound of the critical value of F-statistic, the null hypothesis would be rejected (accepted).

In the second stage, if variables in each behavioural equation are found to be cointegrated (i.e. the null hypothesis is rejected), the *ARDL* method can be employed to estimate the dynamic structure of the behavioural equations using *OLS* method. The estimations proceed "without needing to know whether the underlying variables are *I*(0) or *I*(1)" (Pesaran and Pesaran, 1997, p. 304)[3].

[3]This method avoids the requirements of pre-testing of the order of integration, which is necessary in other cointegrating methodologies. Also, this method avoids the problem of serial correlation that arise in the residual-based cointegration methods by an appropriate augmentation (Pesaran, et al, 1996)

The dynamic structure of the *ARDL* (*p*,*q*) model takes the following form;

$$X_t = \alpha + \sum_{i=1}^{p} A_i X_{t-i} + \sum_{j=0}^{q} B_j Z_{t-j} + \mu_t \qquad (3.18b)$$

where p and q are respectively a number of the lag length of X_t and Z_t and μ_t is the random error term.

3.3.2 Methods for Analysing Macroeconometric Fungibility Model

A useful way to examine the properties of macroeconometric models is to consider how much the predicted values of the endogenous variables change when one or more exogenous variables change. This exercise is called "multiplier analysis", and there are two types of multiplier analysis. First, the "impact" or "short-run" multiplier is used to measure the change in the period *t* value of the n^{th} endogenous variable per unit increase in the period *t* value of the m^{th} exogenous variable, with all other determinants of endogenous variable held constant. Second, the "long run multiplier" is used to measure the total change in the value of the n^{th} endogenous variable per unit maintained increase in the period *t* value of the m^{th} exogenous variable.

To compute the multipliers requires deriving the reduced form of the linear macroeconometric system and can be done in the following procedure. Rewrite the reduced form of the macroeconometric system obtained from (3.17) as follows:

$$x_t = \Pi_{10} z_t + \Pi_{11} z_{t-1} + \Pi_{21} x_{t-1} \qquad (3.19)$$

where $\Pi_{10} = A_0^{-1} A_1, \Pi_{11} = A_0^{-1} A_2, \ \Pi_{21} = A_0^{-1} A_3$

$$\begin{pmatrix} x_t \\ x_{t-1} \end{pmatrix} = \begin{pmatrix} \Pi_{10} & \Pi_{11} \\ 0 & 0 \end{pmatrix} \begin{pmatrix} z_t \\ z_{t-1} \end{pmatrix} + \begin{pmatrix} \Pi_{21} & 0 \\ I & 0 \end{pmatrix} \begin{pmatrix} x_{t-1} \\ x_{t-2} \end{pmatrix} \tag{3.20}$$

Setting $x_t^* = \begin{pmatrix} x_t \\ x_{t-1} \end{pmatrix}, \Pi_{10}^* = \begin{pmatrix} \Pi_{10} & \Pi_{11} \\ 0 & 0 \end{pmatrix}, z_t^* = \begin{pmatrix} z_t \\ z_{t-1} \end{pmatrix}, \Pi_{21}^* = \begin{pmatrix} \Pi_{21} & 0 \\ I & 0 \end{pmatrix}, x_{t-1}^* = \begin{pmatrix} x_{t-1} \\ x_{t-2} \end{pmatrix}$

gives

$$\boldsymbol{x_t^* = \Pi_{10}^* z_t^* + \Pi_{21}^* x_{t-1}^*} \tag{3.21}$$

Lagging (3.21) by one period gives:

$$\boldsymbol{x_{t-1}^* = \Pi_{10}^* z_{t-1}^* + \Pi_{21}^* x_{t-2}^*} \tag{3.22}$$

Substituting (3.22) into (3.21) gives:

$$\boldsymbol{x_t^* = \Pi_{10}^* z_t^* + \Pi_{21}^* \Pi_{10}^* z_{t-1}^* + \left(\Pi_{21}^*\right)^2 x_{t-2}^*} \tag{3.23}$$

Lagging (3.22) by one period and substituting the result into (3.23) gives:

$$x_t^* = \Pi_{10}^* z_t^* + \Pi_{21}^* \Pi_{10}^* z_{t-1}^* + \left(\Pi_{21}^*\right)^2 \Pi_{10}^* z_{t-2}^* + \left(\Pi_{21}^*\right)^3 x_{t-3}^* \tag{3.24}$$

Continuing in this way for $t-1$ substitutions gives:

$$\begin{aligned} x_t^* = \Pi_{10}^* z_t^* + \Pi_{21}^* \Pi_{10}^* z_{t-1}^* + \left(\Pi_{21}^*\right)^2 \Pi_{10}^* z_{t-2}^* \\ + \left(\Pi_{21}^*\right)^3 x_{t-3}^* + \cdots + \left(\Pi_{21}^*\right)^{t-1} \Pi_{10}^* z_1^* + \left(\Pi_{21}^*\right)^t x_0^* \end{aligned} \tag{3.25}$$

From equation (3.25), the n, m^{th} impact multiplier is defined as the first period of dynamic multipliers and takes the value:

$$\frac{\partial x_t^n}{\partial z_t^m} = \Pi_{10}^{*nm} \tag{3.26}$$

The long run multiplier is defined as the sum total of dynamic multipliers which will exist if and only if all of the characteristic roots of Π_{21}^* are less than unity in absolute value. Therefore the n, m^{th} long run multiplier takes the value:

$$\frac{\partial x_t^n}{\partial z_t^m} = \lim_{t\to\infty}\left[\begin{array}{l}\Pi_{10}^* + \Pi_{21}^*\Pi_{10}^* + \left(\Pi_{21}^*\right)^2\Pi_{10}^* \\ \qquad + \left(\Pi_{21}^*\right)^2\Pi_{10}^* + \cdots + \left(\Pi_{21}^*\right)^{t-1}\Pi_{10}^*\end{array}\right] \tag{3.27}$$

$$\frac{\partial x_t^n}{\partial z_t^m} = \left[\left(I - \Pi_{21}^*\right)^{-1}\Pi_{10}^*\right] \tag{3.28}$$

3.4 Data Sources and Definition

3.4.1 Data Sources

The study employed mainly secondary sources of data for its analysis over the period 1970-2005. The data were drawn from the World Bank's World Development Indicators, 2007 (*CD-ROM*); World Bank's Africa Development Indicators, 2006 (*CD-ROM*); IMF's International Financial Statistics *CD-ROM* (various issues); Quarterly Digest of Statistics of the Bank of Ghana and the Ghana Statistical Services Department, Penn World Tables and The State of the Ghanaian Economy by *ISSER* (various issues).

3.4.2 Variable Definitions

The data definition is taken mainly from the World Development Indicators (2004: *CD ROM*) of the World Bank and other relevant sources.

- **GDP** (constant 1995 US$)

GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 1995 U.S.

dollars. Dollar figures for GDP are converted from domestic currencies using 1995 official exchange rates.

- **Labour Force, Total**

Total labour force comprises people who meet the International Labour Organization definition of the economically active population: all people who supply labour for the production of goods and services during a specified period. It includes both the employed and the unemployed.

- **Gross Fixed Capital Formation**

Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.

- **Aid**

Aid includes both official development assistance (ODA) and official aid. Ratios are computed using values in U.S. dollars converted at official exchange rates.

- **Total Net Private Capital Inflows**

Net private capital flows consist of private debt and non-debt flows. Private debt flows include commercial bank lending, bonds, and other private credits; non-debt private flows are foreign direct investment and portfolio equity investment.

- **Openness**

Openness is defined as percentage trade of GDP. Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.

- **Money supply**

Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government.

- **Inflation, Consumer Prices**

Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a fixed basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.

- **Government Consumption Spending**

General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation. Data are in constant 1995 U.S. dollars.

- **Real Effective Exchange Rate Index** (1995 = 100)

Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.

- **Real Public investment (**$US million; 1995 constant prices**)**

Public/Government investment is defined as central government outlays on additions to fixed assets plus net changes in the government's level of inventories. It includes

investment by state-owned enterprises in road construction, energy, telecommunication among other capital investments. Here, public investment is also expressed as a percentage of real *GDP*.

- **Real Private investment (**$US million; 1995 constant prices**)**

The series for real private investment is derived from the difference between the total gross capital accumulation and total gross investment by the government (i.e. public sector investment). Foreign Direct Investment (*FDI*) was subtracted from private investment to get domestic private investment. The data was normalized by expressing them as a percentage of real *GDP*.

- **Foreign Direct Investment**

Foreign direct investment is net inflows of investment to acquire a lasting management interest in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. Data are in current U.S. dollars.

- **D (Dummy Variable for Constitutional Regime)**

D represents a dummy constructed to capture the effect of periods of constitutional dispensation on economic growth. It is constructed such that it takes the value, one (1) for the period of constitutional regime and zero (0) for unconstitutional regimes.

CHAPTER FOUR

EMPIRICAL RESULTS AND ANALYSIS

4.0 Introduction

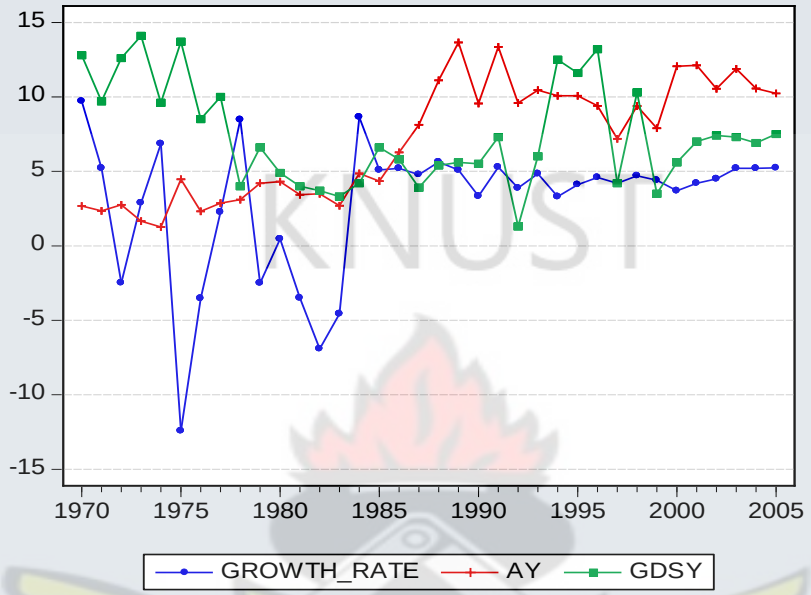
It has been emphasized in chapter two that it is necessary for aid-receiving countries to mobilize both domestic and external resources, as this effort will enable them to overcome resource and foreign exchange constraints on capital accumulation and economic growth. It has also been pointed out that a stable aid inflow contributes to economic growth even when it is fungible, which may imply that aid fungibility posed no concerns for aid allocation. To address the issue of aid fungibility and growth effects, this chapter presents the empirical results of the respective models outlined in the preceding chapter, analyses and discusses the results.

4.1 Aid and Savings in Ghana, 1970 – 2005

Figure 4.1 shows that, over the years under consideration, foreign aid exhibits a general upward trend, albeit with fluctuations. An increase in aid flow is associated with a decline in gross domestic saving, particularly for the period 1986-1993. However, this does not necessarily imply that a high level of aid inflow always reduces savings. Under the "Structural Adjustment Programmes", the Ghana Government was required to stimulate savings in the public sector. As public saving is itself a component of gross domestic saving (*GDS*), this policy directly raised *GDS*. Consequently, the increase in public savings for the period 1992-1996 led to the escalation in the gross domestic saving after 1992. The level of the *GDS* as a percentage of *GDP* doubled from the annual average of

about 4.9 percent for the 1983-1992 period to about 9.6 percent for the period 1993-1998 period.

Fig 4.1: Growth Rate, Aid as Savings as Shares in GDP in Ghana (1970-2005)



Source: Data Extracted from World Development Indicators (CD ROM, 2007)

Prior to 1985, the growth rate exhibited wide swings and reached the all-time low point of negative 12.43% in 1975 but since 1985 has hovered between 3.3% and 5.63%. It is also worthy of note that during the study period, Ghana experienced no less than three military *coups d'état* that sometimes led to significant changes in policy. Concerning foreign aid, it will be noticed that after remaining under 5% of *GDP* for the first one and half decades in the series, the variable has risen to levels between 6% and 14% since 1986.

4.2 Unit Root Test Results

For a long time it was common practice to estimate equations involving non-stationary variables in macroeconomic models by straight-forward linear regression. It was not well understood that testing hypothesis about the coefficients using standard statistical inference might lead to completely spurious results. However, most time series variables are non-stationary and thus using them in the model might lead to spurious regressions

Table 4.1: Results of the Unit Root Tests

Panel A: Level				
Variable	**ADF**		**PP**	
	Constant No Trend	Constant Trend	Constant No Trend	Constant Trend
Data Period: 1970-2005				
ln*Y*	-1.902187	-4.173922**	-1.610641	-1.174744
ln*K*	-1.114965	-2.300395	-1.111031	-2.300363
ln*L*	-1.519155	1.046121	-1.949953	0.432501
ln*AID*	-1.360355	-1.552920	-1.412073	-3.015563
ln*PRIV*	0.034693	-3.323516*	-1.304462	-3.160226
ln*OPENNESS*	-1.591558	-3.159471	-2.302657	-2.866843
ln*MONEY*	-5.229952***	-3.848306**	-5.240666***	-5.055040***
ln*INF*	-4.200106***	-4.193094**	-4.193960***	-4.192715**
Panel B: First Difference				
Variable	**ADF**		**PP**	
	Constant No Trend	Constant Trend	Constant No Trend	Constant Trend
Data Period: 1970-2005				
$\Delta \ln Y$	-16.81843***	-18.90489***	-4.323096***	-5.087394***
$\Delta \ln K$	-5.975127***	-5.973530***	-6.013544***	-6.023454***
$\Delta \ln L$	-3.157288**	-3.144662*	-3.170929**	-3.086507*
$\Delta \ln AID$	-9.271091***	-9.149645***	-10.10392***	-10.00449***
$\Delta \ln PRIV$	-8.525902***	-5.877201***	-9.299780***	-9.580081***
$\Delta \ln OPENNESS$	-8.497271***	-8.375972***	-9.293614***	-9.279192***
$\Delta \ln MONEY$	-4.630774***	-4.825611***	-9.359366***	-9.701069***
$\Delta \ln INF$	-5.600115***	-5.704979***	-8.562700***	-9.022454***

The null hypothesis is that the series is non-stationary, or contains a unit root. The rejection of the null hypothesis for both ADF and PP tests is based on the MacKinnon critical values. *,** and *** indicate the rejection of the null hypothesis of non-stationary at 10% , 5% and 1% significance level, respectively

(Granger 1969). In order to ensure some variables are not integrated at higher order we complemented the estimated process with unit root tests. Though the *ARDL* approach to cointegration does not require the pre-testing of the order of integration, the variables need to be either *I*(0) or *I*(1), hence the need to test for unit root to ascertain the absence or otherwise of *I*(2) variables.

For this reason, all the variables are examined by first inspecting their trends graphically (see Appendix A). From the graph, it can be seen that, all the variables are non-stationary except money supply, inflation and net private inflows which exhibit some stationary trends at the levels. However, the plots of all the variables in their first differences exhibit some stationary trend.

To test the order of integration of the variables formally, we use the standard tests for unit root namely the Augmented Dickey-Fuller (*ADF*) and the Phillips-Perron (*PP*) tests proposed by Dickey and Fuller (1979) and Phillips and Perron (1988), respectively.

Results of these tests are either *I*(0) or *I*(1). For variable ln*Y*, however, the *ADF* results show that it is *I*(0) whiles the PP test indicates that it is *I*(1). Also, for variable in ln*AID*, the ADF results show that it is neither I(0) nor I(1) whilst the PP test indicates that it is I(1) at 1 percent level. Since we have confirmed the absence of *I*(2) variables, we can now apply the *ARDL* methodology to our model.

4.3 Bound Test for Cointegration

In the first step of the *ARDL* analysis, we first test for the presence of long-run relationships in equation (3.4) using equation (3.14). The results of this bound test procedure for cointegration analysis between economic growth and its determinant are presented in Table 4.2. The F- statistic is above the 10 percent upper critical bounds computed by Nayaran et al (2004), thus implying that the null hypothesis of no cointegration can be rejected. Put alternatively, there exists a long run relationship among the variables of our model.

Table 4.2: Bounds Tests for the Existence of Cointegration

Critical Value Bounds of the F-Statistic: intercept and no trend (Case II)						
K	90% Level		95% Level		99% Level	
	I(0)	*I*(1)	*I*(0)	*I*(1)	*I*(0)	*I*(1)
7	2.206	3.360	2.619	3.921	3.536	5.238
Calculated F-Statistic: $F_Y(Y/L,K,AID,PRIV,OPENNESS,MONEY,INF,D)$						3.7203*

Notes: Critical values are obtained from Narayan (2004a, b), Appendix A1-A3, pp.26-28.
* denotes statistical significance at the 10% level. *k* is the number of regressors.

Having established the existence of a long-run relationship amongst the variables, in the next step we use the *ARDL* cointegration method to estimate the parameters of equation 3.4

4.4 Results of the Long-run Relationship

Equation (3.4) is estimated for Ghana using annual data covering the period 1970-2005. Results are based on the Akaike Information Criterion (*AIC*) using a lag of one given the annual nature and the relatively short sample properties of the data. Table 4.3 shows results of the long-run estimate.

As indicated in the table, not all the estimated coefficients have their expected theoretical signs (labour, aid, openness and private inflows). In other words, the results indicate theoretically correct signs for the explanatory variables with the exception of labour, aid, openness and private inflows which are incorrectly signed.

Table 4.3: Estimated Long-Run Coefficients using the ARDL Approach

ARDL(1,0,1,0,0,0,0,0,0)selected based on *AIC*			Dependent variable: ln*Y*	
Regressor	**Coefficient**	**Standard Error**	**T-Ratio**	**P-values**
Constant	8.3444	2.8740	2.9034***	0.008
$\ln K_t$	0.18953	0.079671	2.3790**	0.026
$\ln L_t$	-0.096940	0.20273	-0.47818	0.637
$\ln AID_t$	-0.18008	0.073336	-2.4555**	0.021
$\ln PRIV_t$	-0.0010841	0.046873	-0.023129	0.982
$\ln OPENNESS_t$	-0.19299	0.15127	-3.7642***	0.001
$\ln MONEY_t$	0.071484	0.02605	2.7441**	0.004
$\ln INF_t$	-0.057559	0.012597	-4.5693***	0.000
D_t	0.14489	0.062409	2.3216**	0.029

Note: ***,**, denote significance at 1% and 5% respectively

The results also indicate that most of the coefficients are statistically significant at 5 percent or lower level of significance. The coefficients of the variables in the long run growth equation are the long run elasticities.

All the variables in the long run are inelastic. Specifically, the results confirm the theoretical conclusion that capital contributes positively to growth of *GDP* since the coefficient of capital in the long run growth equation is positive and significant at 5 percent level. This means that in the long run, increases in capital has the potential of stimulating growth in Ghana. From the results, the coefficient of capital (0.18953) indicated that a percent change in capital input results in a 0.19 percent change in real *GDP*, ceteris paribus. The result concurs with the results obtained by Aryeetey and Fosu

(2005) who obtained a positive relationship between capital and real *GDP*, though statistically insignificant.

The labour force variable is incorrectly signed and statistically insignificant, contrary to expectation. It was expected that additional labour adds to output but a rather unanticipated result is being obtained here. A possible explanation of this unexpected result is not far-fetched as the Ghanaian economy is characterized with growing unemployment and low level of productivity. Most developing economies and the Ghanaian economy in particular is based on land intensive agriculture and labour intensive petty trading which have limited employments and consequently income generation benefits for the country. Specifically, the results indicate that a percent increase in labour force reduces output by 0.1. The result is consistent with studies by Aryeetey and Fosu (2005).

The results also suggest that the impact of foreign aid on growth appears to be perverse; a significant negative effect is obtained whereas we would have expected a positive coefficient a priori. This unfortunate outcome of foreign aid in the long run may be attributable to several factors. Under the stabilization programmes, the Ghana government was encouraged to pursue demand-reducing policies which included cutting government expenditure, raising taxation to reduce budget deficits, raising interest rates and restraining domestic credit to improve the current account balance. Although the potential effects of these policy measures on economic growth are not explicitly included in the model, such policy measures have been found in other studies to have a negative impact on economic growth. For example, Khan and Knight (1985), Heller *et al* (1988)

and IMF (1998b) find that an austere fiscal policy often causes a reduction in private income and social spending and thus reduces economic growth. This effect is embedded in the long-run multiplier of aid with respect to output growth. Furthermore, the poor performance of aid in the long run may be attributable to the form with which aid comes into the country. Donor conditionality sometimes affects the efficient allocation of the loans and thus leads to poor impacts of aid on growth. Therefore a substantial amount of aid inflows into the country over the years under consideration came in the form of loans which become liability in the long run as the debt must be serviced. Lastly, the debilitating effect of aid on growth may be due to the fungibility of aid which will be examined in the latter part of this chapter. From the results, it is found that, in the long-run, a 1 percent increase in aid inflows will significantly impede growth by 0.18 percent. This result is consistent with several studies in developing countries: Griffin and Enos (1970) and Voivodas (1973).

The long run results reveal yet another petrifying outcome which is in contravention with expectation. The results indicate that the impact of private capital inflows on growth is inconsistent with a priori expectation: an insignificant negative effect is obtained. Thus an increase in private capital inflows does not raise economic growth but rather impedes growth. Specifically, a 1 percent increase in the inflow of private capital will reduce economic growth by 0.001 percent, though not statistically significant. This may reflect the unstable pattern of growth in private loans within the period under consideration.

Furthermore, an unconventional result was obtained for openness to trade. Openness to trade is often theorized to raise growth through channels such as access to advanced

technology from abroad, greater access to a variety of inputs for production and access to broader markets that raise the efficiency of domestic production through increased specialization. However, the results indicate the opposite. Openness to trade rather has a deleterious effect on economic growth. The result is not surprising in the Ghanaian case as businesses often complain of losing out of competition as trade liberation encourages the importation of cheaper commodities into the economy relative to locally manufactured ones. In consequence, several industries have frozen up and are out of operation. The results suggest that, in the long run, domestic producers in response to the increased foreign competition might have adopted some skill- biased technical change. Thus, trade liberalization worsened the income distribution, which in turn affected economic growth negatively. Thus a 1 percent increase in openness will reduce real *GDP* by 0.19 percent, which is contrary to theoretical proposition.

The results also indicate that, in the long run there is some confirmation that financial liberalization is beneficial to growth – the coefficient of *M2/GDP* (Money) is positive and statistically significant at 1 percent. Thus in the long run, there is not much regulation of the financial sector in the economy and has fostered growth over the years. The results specifically show that, in the long run, if we deepen the financial sector by 1 percent; there will be a 0.07 percent increase in real *GDP*.

As anticipated, inflation which is used to capture macroeconomic instability is appropriately signed. That is, the coefficient of inflation is significantly negative at 1 percent significance level. Thus the results indicate that, if the general price level

increases by 1 percent, growth will significantly fall by 0.06 percent. However, more stable inflation appears to be conducive to faster growth.

Finally, consistent with expectation, the dummy variable measuring constitutional regime came out with a positive sign and is statistically significant at 5 percent. The coefficient of the dummy variable suggests that sustained political climate is a stimulant for private investment and consequently economic growth.

4.5 Results of the Short Run Dynamic Model

Having estimated the long run cointegration model, the last step is to investigate the short run dynamics within the *ARDL* framework. Thus the lagged value of all level variables (a linear combination is denoted by the error-correction term ECM_{t-1}) is retained in the *ARDL* model. Estimation results based on the Akaike Information Criterion are presented in Table 4.4.

As discussed, the error correction term indicates the speed of adjustment to restore equilibrium in the dynamic model. The *ECM* coefficient shows how quickly variables converge to equilibrium and it should have a statistically significant coefficient with a negative sign. According to Bannerjee *et al* (1998), the highly significant error correction term further confirms the existence of a stable long-run relationship.

Table 4.4 shows the expected negative sign of *ECM* is highly significant. This confirms the existence of the cointegration relationship among the variables in the model yet again. The coefficient of ECM_{t-1} is -0.36 and implies that the deviation from the long-term

growth rate in *GDP* is corrected by 36 percent in the model by the coming year. In other words, the highly significant error correction term suggests that more than 36 percent of disequilibrium in the previous year is corrected in the current year. This findings show that the speed of adjustment is relatively low in the model.

Table 4.4: Estimated Short-Run Error Correction Model using the ARDL Approach

ARDL(1,0,1,0,0,0,0,0,0) selected based on *AIC* Dependent variable: $\Delta \ln Y$

Regressor	Coefficient	Standard Error	T-Ratio	P-Values
Constant	2.9634	1.7441	1.6991*	0.102
$\Delta \ln K_t$	0.067311	0.021457	3.1371***	0.004
$\Delta \ln L_t$	-5.5048	1.8108	-3.0400***	0.005
$\Delta \ln AID_t$	-0.063953	0.026071	-2.4531**	0.021
$\Delta \ln PRIV_t$	-0.003850	0.016611	-.023178	0.982
$\Delta \ln OPENNESS_t$	-0.068537	0.021696	-3.1590***	0.004
$\Delta \ln MONEY_t$	0.025387	0.006763	3.7538***	0.001
$\Delta \ln INF_t$	-0.020442	0.014136	-1.4460	0.161
ΔD_t	0.051455	0.023219	2.2161**	0.036
ECM_{t-1}	-0.35514	0.11831	-3.0018***	0.006

*ECM = lnY – 0.18953*lnK + 0.096940*lnL + 0.18008*lnAID + 0.0010841*lnPRIV + 0.19299*lnOPENNESS – 0.071484*lnMONEY + 0.057559*lnINF – 0.14489*D – 8.3444*C*

The coefficient of the capital variable in the dynamic growth equation is positive and significant at 1 percent level of significance. This is consistent with the result of the long-run growth equation. This indicates the crucial role that capital plays in Ghana's growth process as its coefficient is positive in the dynamic growth model just as in the long run model.

The coefficient of labour in the dynamic growth equation maintains its negative coefficient as in the long-run growth equation. This indicates that, the immediate impact

of labour on economic growth is negative which presupposes the unemployment and underemployment problem facing Ghana. The coefficient of labour in the dynamic model is also statistically significant at 1 percent level.

Furthermore, the coefficient of *AID* also maintained the negative sign consistent with the long run results. That is, in the long-run, the impact of an increase in *AID* is not growth enhancing. The results corroborated that of studies like Griffin (1970), Mosley et al (1987) and Lavy and Sehefer (1991) who found negative impact of aid on growth. The statistically significant coefficient of aid in the short run also indicates that, large amount of aid has been allocated to unproductive investment which consequently reduced the productivity of investment.

Another intriguing result is that of the impact of private inflows on economic growth. It also maintained the unanticipated negative sign just as in the long-run growth equation. Thus, in the short run, an increase in private capital inflows has a negative effect on economic growth, although the coefficient is statistically insignificant. The results indicate that, the immediate impact of changes in private capital in economic growth is negative and statistically insignificant. This may be a reflection of unstable pattern of growth in private loans in the Ghanaian economy. Within the period under consideration, high interest rates deterred most private businesses to acquire loans which consequently might have affected investment and hence economic growth.

Turning to openness, it can readily be discerned that this variable also has a deleterious effect on economic growth. Stated differently, the changes in trade liberalization do not

impact on economic growth positively. This is also quite implausible, as it is asserted that trade promotes growth through knowledge and transfer of technology. A conflicting result is however, obtained in the case of the Ghanaian economy. The coefficient of this variable is also statistically significant at the 1 percent level of significance.

Financial liberalization positively affects economic growth in the short run. Economic growth will increase by 0.03 percent, should the financial sector be deepened by 1 percent. This is also significant at 1 percent level of significance. This result presupposes the need to liberalise the financial sector to promote loans, reducing interest rates and the consequential effect on investment, which eventually foster growth.

The coefficient of inflation in the short run is negative, consistent with the long run findings. The results thus suggest that if inflation goes up by 1 percent, economic growth falls by 0.02 percent. The results indicate how important it is to control inflation in the Ghanaian economy by putting in the appropriate policies. Its impact both in the short and long run appears to be debilitating as inflation generally proxy macroeconomic instability.

Finally, a relatively stable socio-political environment is relevant for accelerated growth in the economy. This is reflected in the significant positive impact of the dummy variable proxying the periods of constitutional regimes. From the results, economic growth will increase by 0.05 if the stable political climate improves by 1 unit. This finding corroborates those found by Stasavage (2002) where major constitutional change was found to stimulate the flow of private investment and consequently on economic growth.

4.5.1 Model Diagnostics and Stability Tests.

In order to check for the estimated ARDL model, the significance of the variables and other diagnostic tests such ad serial correlation, functional form, normality; heteroskedasticity and structural stability of the model are considered. As shown in Table

Table 4.5: Model Diagnostics and Goodness of Fit

Model Criteria/Goodness of Fit			
R^2	0.78879	$\overline{R}^2$	0.71746
S.E. of Regression	0.034909	F-stat. F(9, 25)	3.8183[0.004]
Akaike Info. Criterion	63.3649	Schwarz Bayesian Criterion	54.8105
DW-statistic	1.5029	Residual Sum of Squares	0.029248

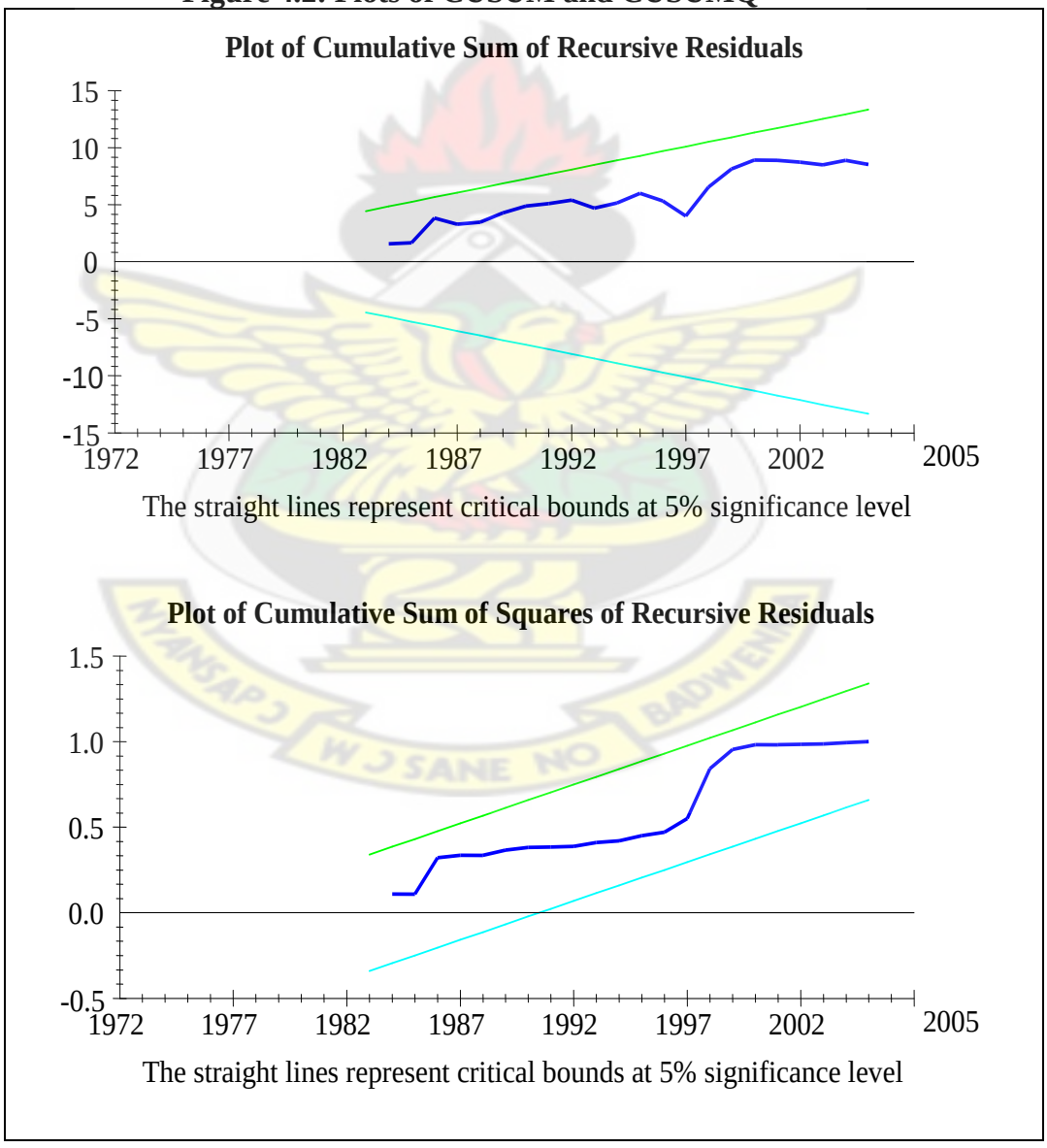
Diagnostics	***Test Statistic***
$F_{Auto}(1, 23)$	1.8274 [0.190]
$\chi^2_{Auto}(1)$	2.5762 [0.108]
$\chi^2_{Reset}(1)$	0.18093 [0.671]
$\chi^2_{Norm}(2)$	0.60227 [0.740]
$\chi^2_{White}(1)$	1.9297 [0.165]

χ^2_{Auto}, χ^2_{Reset}, χ^2_{Norm} and χ^2_{White} are Lagrange multiplier statistics for test of serial correlation, functional form misspecification, non-normal errors and heteroskedasticity, respectively. These statistics are distributed as Chi-square values with degree of freedom in parentheses. Values in parentheses [ ] are probability values.

4.5, both models generally pass all diagnostic tests in the first stage. The diagnostic test in Table 4.5 shows that there is no evidence of autocorrelation and the models pass the normality and the test proved that the error is normally distributed. The R^2 shows that around 72 percent of the variation in real *GDP* is explained by the regressors in both models. Additionally, both models pass the white test for heteroskedasticity as well as the RESET test for correct specification of the model.

Finally, when analyzing the stability of the long-run coefficients together with the short-run dynamics, the Cumulative Sum (*CUSUM*) and Cumulative Sum of Squares (*CUSUMQ*) are applied. Following Pesaran and Pesaran cited in Bahmani-Oskooee (2001), the stability of the regression coefficients is evaluated by stability tests and they can show whether or not the regression equation is stable over time. This stability test is appropriate in time series data, especially when we are uncertain about when structural change might have taken place.

Figure 4.2: Plots of CUSUM and CUSUMQ



The null hypothesis is that the coefficient vector is the same in every period and the alternative is simply that it is not (Bahmani-Oskooee, 2001). *CUSUM* and *CUSUMQ* statistics are plotted against the critical bound of 5% significance. According to Bahmani-Oskooee (2002), if the plot of these statistics remains within the critical bound of the 5% significance level, the null hypothesis (i.e. all coefficients in the error correction model are stable) cannot be rejected. The plot of the cumulative sum of recursive residual is presented in Figure 4.3. As shown, the plot of both the *CUSUM* and *CUSUMQ* residuals are within the boundaries. That is to say that the stability of the parameters has remained within its critical bounds of parameter stability. It is clear from both the graphs in Figure 4.3 that both the *CUSUM* and *CUSUMQ* tests confirm the stability of the long-run coefficients of the real *GDP* function in equation 3.3.

4.6 Aid Fungibility and its Effects on Investment

As discussed in the displacement theories in chapter two, aid fungibility may lower the effectiveness of aid if aid is allocated to low productive sectors and/or an increase in aid inflow leads to lowering tax revenue. The latter effect may crowd out private investment through the need to raise Public Sector Borrowing Requirement (*PSBR*). It is made clear in "Assessing Aid" that effective aid does not replace private initiative but acts as a magnet and crowds in private investment (World Bank, 1998).

To address the issue of aid fungibility mentioned above, this section employs a macroeconometric model of aid fungibility to analyse the impact of aid fungibility on investments in the case of the Ghanaian economy.

4.6.1 Estimation Results and the Multiplier Analysis of Aid Fungibility and its Impact on Investment.

Table 4.6 reports the results of testing for the long-run relationship and the critical value bounds for each behavioural equation employed in the macroeconometric model of aid fungibility. As the computed F- statistic for each behavioural equation exceeds the upper bound of the critical values of F-statistic, a conclusive decision can be made that the variables in each behavioural equation are cointegrated. Therefore, the *ARDL* methodology can be applied to estimate the behavioural equations.

Table 4.6: Results for Testing the Long-run Relationship of Behavioural Equations in Macroeconometric model of Aid Fungibility: F-Statistic

Models	Computed F-Statistics	Testing the existence of a long run relationship: Critical Values of the F-Test	
		F-Statistic	Significance Level
$CG_t = f(T_t, A_t, INF_t)$	8.7216	4.480 - 5.700	99%
$IG_t = f(T_t, A_t, INF_t)$	4.5115	2.618 - 3.502	95%
$T_t = f(Y_t, A_t, FDI_t, INF_t)$	6.8813	4.097-5.580	90%
$IP_t = f(IG_t, Y_t, FDI_t, INF_t)$	8.0231	4.097-5.580	99%
$CP_t = f(Y_t, INF_t)$	4.9161	3.458 - 4.343	90%

Table 4.7: Estimation Results of the Behavioural Equations

EQ 3.5: **Government Consumption Spending (CG)**

$$CG_t = 82.4532 + 0.62798CG_{t-1} + 0.086T_t + 0.11991A_t - 0.24417A_{t-1} - 0.35126INF_t$$
$$(35.3129)^{**}\quad (0.1491)^{***}\quad (0.0754)\quad (0.1329)\quad (0.1327)^{*}\quad (0.3274)$$

$$R^2 = 0.90 \qquad DW = 1.62 \qquad Durbin's\ h\text{-}statistic = 2.38$$

EQ 3.6: **Government Capital Expenditure (IG)**

$$IG_t = -38.8182 + 0.4049IG_{t-1} + 0.2427T_t + 0.2391A_t + 0.4875INF_t$$
$$(35.2235)\ \ (0.1357)^{***}\ \ (0.8412)^{***}\ \ (0.1304)^{*}\ \ \ (0.4833)$$

$$R^2 = 0.90 \quad DW = 2.09 \quad Durbin's\ h\ statistic = -0.48$$

EQ 3.7 **Government Revenue (T)**

$$T_t = -194.9356 + 0.8618T_{t-1} + 0.0959Y_t - 0.3593A_t + 0.4159A_{t-1} + 0.2031FDI_t - 0.4756INF_t$$
$$(109.7091)^{*}\ \ (0.1436)^{***}\ (0.0594)\ \ (0.2138)\ \ \ (0.2181)^{*}\ \ \ (0.2450)\ \ \ \ (0.4849)$$

$$R^2 = 0.97 \quad DW = 1.04 \quad Durbin's\ h\ statistic = 5.38$$

EQ 3.8 **Private Investment (IP)**

$$IP_t = -550.9047 + 0.2952IG_t + 0.2669Y_t + 0.2197FDI_t - 0.3219INF_t$$
$$(72.9186)^{***}\ (0.1533)^{*}\ \ (0.0281)^{***}\ \ (0.2544)\ \ \ \ (0.4812)$$
$$R^2 = 0.93 \quad DW = 1.83$$

EQ 3.9 **Private Consumption (CP)**

$$CP_t = 118.9546 + 0.5907CP_{t-1} + 0.16971Y_t - 0.1510Y_{t-1} - 0.0755INF_t$$
$$(37.6448)^{***}\ (0.1371)^{***}\ \ (0.040)^{***}\ (0.0447)^{***}\ \ (0.1717)$$
$$R^2 = 0.92 \quad DW = 1.96 \quad Durbin's\ h\ statistic = 0.21$$

Note: the number in parenthesis under the coefficient is the corresponding standard error. Statistical significance of a coefficient at the 1%, 5% and 10% levels respectively are represented with ***, ** and *.

The estimation results of the behavioural equations are presented in Table 4.7. Overall, all behavioural equations have a relatively high explanatory power in terms of R^2. The estimation results support the potential effects that aid may have on various endogenous variables. Especially, an increased aid inflow has not only a positive effect on both government spending (*CG*) and public investment (*IG*) but it also has a negative effect on government revenue (*T*). An increase in *FDI* as expected has a positive impact on

government revenue (*T*) and private investment while public investment has a positive effect on private investment (*IP*).

4.6.2 Empirical Evidence of Aid Fungibility and its Impact on Investments

The impact of aid fungibility on investment is measured by aid fungibility coefficients at the aggregate level or the multiplier effect of aid on the fiscal variables (*CG, IG, T*). These coefficients are summarized in Table 4.8.

Table 4.8: Short Run and Long Run Multiplier effects of Foreign Aid

Endogenous Variable	Short run Multiplier for Aid Variable	Endogenous Variable	Long run Multiplier for Aid Variable
CG	0.040	*CG*	0.119
IG	0.256	*IG*	0.485
T	-0.165	*T*	-0.213
IP	0.462	*IP*	0.947
Y	1.166	*Y*	1.342

The figure in each column represents the multiplier effect on each endogenous variable for every one unit increase in the exogenous variables.

An increased aid inflow tend to raise both government consumption spending (*CG*) and public investment (*IG*) and also lower government revenue (*T*) as pointed out in the preceding sections. This seems to suggest that aid is fungible. To certify this result, the conditions of aid fungibility discussed in chapter two are applied as follows:

Short run Multiplier **Long run Multiplier**

$$\frac{\Delta IG}{\Delta A} = 0.256 < 1 \qquad \frac{\Delta IG}{\Delta A} = 0.485 < 1$$

$$\frac{\Delta CG}{\Delta A} = 0.040 > 0 \qquad \frac{\Delta CG}{\Delta A} = 0.119 > 0$$

$$\frac{\Delta T}{\Delta A} = -0.165 < 0 \qquad \frac{\Delta T}{\Delta A} = -0.213 < 0$$

The estimated multiplier values indicate that aid is fungible on three counts. First, an increase in aid by 1 unit led to a short-run and long-run increase in public investment by 0.256 and 0.485 units respectively. This implies that aid intended for public investment did not increase the value of public investment by as much as the value of aid inflow. According to the displacement theory, this circumstance would imply that the Ghana government was able to avoid donor attempts to target the allocation of aid for public investment projects. Second, an increase in aid by 1 unit led to a short run and long run increase in government consumption by 0.04 and 0.119 units respectively. Third, an increase in aid by 1 unit led to a short and long run decrease in government revenues by 0.165 and 0.213 units respectively. The last two counts would indicate that the Ghana government was able to use resources released due to an increase in aid inflow, to increase consumption or reduce tax revenue.

Although aid is found to be fungible, this does not imply that aid fungibility lowers the effectiveness of aid. For instance, an increase in government consumption improves the wellbeing of public officials. Furthermore, the weakness in fiscal institutions and the low

income per capita of Ghana have resulted in low tax collections. Thus, it is not surprising to observe an increase in aid associated with a decline in government revenue.

To clarify the puzzle as to whether aid fungibility issues lower the effectiveness of aid, the analysis is extended to focus on the impact of aid fungibility on private investment. This can be examined using the condition of fiscal response to aid inflow proposed by White and McGillivray (1992), as discussed in chapter 2. By substituting the long run multiplier of the fiscal response to aid inflow, the long run impact of aid fungibility on private investment is expressed mathematically as follows:

$$\frac{\Delta G}{\Delta A} = \frac{\Delta CG}{\Delta A} + \frac{\Delta IG}{\Delta A}$$

$$= 0.119 + 0.485 = 0.604$$

$$\Rightarrow 0 < \frac{\Delta G}{\Delta A} < 1 \qquad (i)$$

$$\frac{\Delta T}{\Delta A} = -0.213 \Rightarrow \frac{\Delta T}{\Delta A} < 0 \qquad (ii)$$

$$\frac{\Delta G}{\Delta A} - \frac{\Delta T}{\Delta A} = 0.604 - (-0.213) = 0.817 \qquad (iii)$$

$$\Rightarrow \frac{\Delta G}{\Delta A} - \frac{\Delta T}{\Delta A} > 0 \quad \therefore \quad \frac{\Delta PSBR}{\Delta A} > 0 \qquad (iv)$$

The conditions indicated in (*i*), (*ii*) and (*iii*) capture the Ghana government's fiscal behaviour in response to aid inflow. These three conditions are consistent with case 8 expressed in Table 2.1, which implies that the Ghana government's fiscal policy may crowd out private investment. This is because aid inflows, partly used to finance an increase in government consumption expenditure and partly to fund tax reduction, led to

an increase in the public sector borrowing requirements (*PSBR*). However, as the magnitude of the difference between the increase in government spending and the decline in government revenue is almost equal to one (i.e. (*iii*) ≈ 1), this implies that an increase in *PSBR* is almost equal to zero (ie (iv) $\approx$ 0). Thus, it can be said that conditions indicated in (i), (ii) and (iv) are consistent with case 9 expressed in Table 2.1, which indicates no crowding out effect on private investment.

As discussed in the preceding sections, an increase in aid inflow is unlikely to crowd out private investment. This indication is supported by the aid multiplier, by which an increase in aid inflow indirectly raises private investment (*IP*) through the direct effect of an increase in public expenditure (i.e. the variable capturing the crowding effect of fiscal policy). As indicated in Table 4.7, an increase in aid inflows by 1 unit raise private investment to 0.462 units in the short run and 0.947 units in the long run.

Based on the above discussion, it can be concluded that an increase in aid did raise both public and private investment, then it should be expected that aid might contribute to economic growth, albeit aid is fungible in the case of Ghana. Indeed, as illustrated in Table 4.7, aid has a positive effect on income; i.e., every 1 unit increase in aid inflow leads to a short run and long run increase in income by 1.166 and 1.342 units, respectively. It must be emphasized here, however, that the aid fungibility model developed in this chapter is a demand-driven model, in which the trade sector and aggregate supply side are treated as exogenous variables. Thus, this interpretation of the impact of aid on growth should be taken with caution because the foreign exchange

constraints on either investment or capacity utilization have not been incorporated into the supply side of the economy.

CHAPTER FIVE

SUMMARY, POLICY IMPLICATIONS, RECOMMENDATIONS, LIMITATIONS AND CONCLUSION

5.0 Summary of Empirical Findings

The belief that foreign aid promotes sustainable economic growth in developing countries has permeated much thinking in international development cooperation throughout the past decades. Thus drawing on existing literature done for most developing countries, this study seeks to empirically examine the impacts of foreign aid on economic growth in Ghana for the period 1970 to 2005. Empirical findings analysed in the preceding chapter are summarised as follows:

The revelations in chapter 4 indicate that increase in aid inflow is associated with a decline in gross domestic savings. However, this does not necessarily imply that a high level of aid inflow always reduces savings. Under the *SAP*s, the Ghana Government was required to stimulate savings in the public sector. Since public saving, is itself a component of gross domestic saving (*GDS*), this policy directly raised *GDS*.

As anticipated, capital stock has positive effects on economic growth in both the short and the long run growth models. Thus, increases in capital have the potential of stimulating growth in Ghana in both the short and the long run.

The results indicated that, labour force variable has an unconventional negative impact on economic growth. This is indicative of the low level of productivity and the massive

unemployment which have characterised the Ghanaian economy within the period under consideration. Also the Ghanaian economy is mostly based on land intensive agriculture and labour intensive petty trading which have limited employments and consequently income generation benefits for the country.

Moreover, a rather pervasive result is obtained for the foreign aid variable. Hence, factors such as increases in government expenditure, raising taxation to reduce budget deficits, raising interest rates to restrain domestic credit to improve the current account balance under the stabilisation programmes are attributable to this result. The result can also be attributed to the fungibility of aid to Ghana as well as strict donor conditionalities which affect the efficient allocation of loans resulting in poor impacts of aid on growth.

Furthermore, contrary to theory, the results indicate that the impact of private capital inflows on growth is negative. Thus an increase in private capital inflows does not raise economic growth but rather impedes growth. The result may somewhat, reflect the unstable pattern of growth in private loans within the period under consideration.

In addition to the above, openness registered a negative impact on economic growth in the short as well as the long run. A possible explanation to this unexpected result is the inability of domestic producers to compete their foreign counterparts, thus fizzling out most of their activities.

As anticipated, the money supply variable as a proxy for financial liberalization is appropriately signed which confirms the importance of deregulating the financial sector

which reduces credit rationing to firms and consequently improves economic growth through increases in investment.

As anticipated, inflation which is used to capture macroeconomic instability is appropriately signed and statistically significant. Thus higher rates of inflation have a deleterious effect on economic growth. However, more stable inflation appears to be conducive to faster growth.

Moreover, consistent with expectation, the dummy variable measuring constitutional regime came out with a positive sign and is statistically significant at 5 percent. The coefficient of the dummy variable suggests that sustained political climate is a stimulant for private investment and consequently economic growth.

Finally, the estimated multiplier values indicate that foreign aid to Ghana is fungible on three counts. First, aid intended for public investment did not increase the value of public investment by as much as the value of aid inflow. Second, an increase in aid inflow was used to increase government consumption and finally, an increase in aid inflow was used to fund tax cuts.

5.1 Policy Implications and Recommendations

Concerning the policy implications, the empirical results provide invaluable information for policy formulation and implementation. The results from the estimation indicated that the overall impact of foreign aid on economic growth is negative, thus aid seemed to have substituted for domestic savings and increased debt burden. As the various debt indicators depict that Ghana's debt burden increased over time and the country may be

caught in severe debt servicing problem if the macroeconomic management, foreign trade and domestic saving policies are not designed and implemented appropriately.

The projects that are most likely to have a positive long run impacts on growth in Ghana are those which produce public capital which improves the productivity of large groups of people and their private capital. In this case, aid can help reassign resources away from activities that produce normal goods towards activities that produce public goods, which benefit more people. Examples of these kind of public goods are projects which reduce corruption, research that helps eliminate diseases, systems that fortify ownership rights and projects that stimulate the adoption of technologies adequate for the country. Also, projects that help small and medium sized enterprises in the consumer goods sector have a relatively high potential for reducing poverty, as this sector benefits the two big groups of urban and rural poor. Thus it is highly recommended that aid be allocated to such sectors.

The policies are also important in the effectiveness of foreign aid, as the aid has a more positive impact on growth in countries with good fiscal, monetary, and trade policies. In the presence of poor policies, on the other hand, aid has no positive effect on growth. Accordingly, there is a need of not only good policies but also the implementation of these policies as well as the proper monitoring of the aid-utilizing projects is necessary in order to avoid the misutilization and the mismanagement of the foreign capital resources. Consequently we can say, aid may be helpful in boosting economic growth only under the presence of appropriate monetary, fiscal and the trade policies.

Finally, it is strongly recommended that, developing countries and Ghana in particular wean themselves from the overdependence on foreign aid and donor conditionalities for budgetary support. The aid model over the years has not worked in most developing countries. Developing countries can therefore rely on trade, foreign direct investment and intensify their capital markets as the main sources of enhancing growth.

5.2 Practical Limitations & Further Research

The major limitation the study encountered, typical of such studies in developing countries, was quality and limited availability of data on some of the key variables used in estimating the growth as well as the fungibility models. An attempt to extend the data length to 2007 or further was constrained by unavailability of these macro series from domestic official sources as the researcher had to fall on mainly foreign sources such as the World Bank, *IMF*, among others at a huge financial expense.

It is obvious that Ghana's ability to raise investment remains heavily reliant on the stability of foreign capital inflows and adequate reforms in the state institutions. However, the analysis carried out in this study did not elaborate on ways to strengthen state institutional capability to ensure that the country could achieve sustainable economic growth. Particularly, issues of maintaining the external viability are often related to adopting a prudent macroeconomic policy, attracting foreign aid and foreign direct investment and access to international trade. These are some very complex issues still to be evaluated. How to advance the capacity and capability of the state and institutions to improve the macroeconomic environment deserves further study.

In addition, the main contribution of this study lies in the application of econometric modelling to analyse the potential effects of foreign aid on economic growth. Although the models are capable of explaining how aid inflow may influence economic performance in the Ghana, the model developed in this study is in the aggregate form. It would be more interesting if the impact of aid on economic growth can be disaggregated in at least three major sectors: (i) the agricultural sector, (ii) the industrial sector and (iii) the services sector. By doing this, the channels though which aid may affect economic growth could be highlighted.

5.3 Conclusion

The main objective of the study is to empirically estimate and analyse the impacts of foreign aid on economic growth along with some key determinants of growth in Ghana over the period 1970-2005. Efforts have also been made to estimate the fungibility of foreign aid to Ghana using a macroeconometric modelling. Regarding the growth equation, the ARDL econometric approach is used to model the short and long run growth models for Ghana. A major revelation is that, foreign aid does not increase economic growth since aid is found to be fungible in Ghana.

These findings draw important policy implications as governments should put in place appropriate fiscal and monetary policies to steer the economy to a sustained growth. This view is contingent upon the fact foreign aid is found to stimulate economic growth under proper fiscal and monetary policies.

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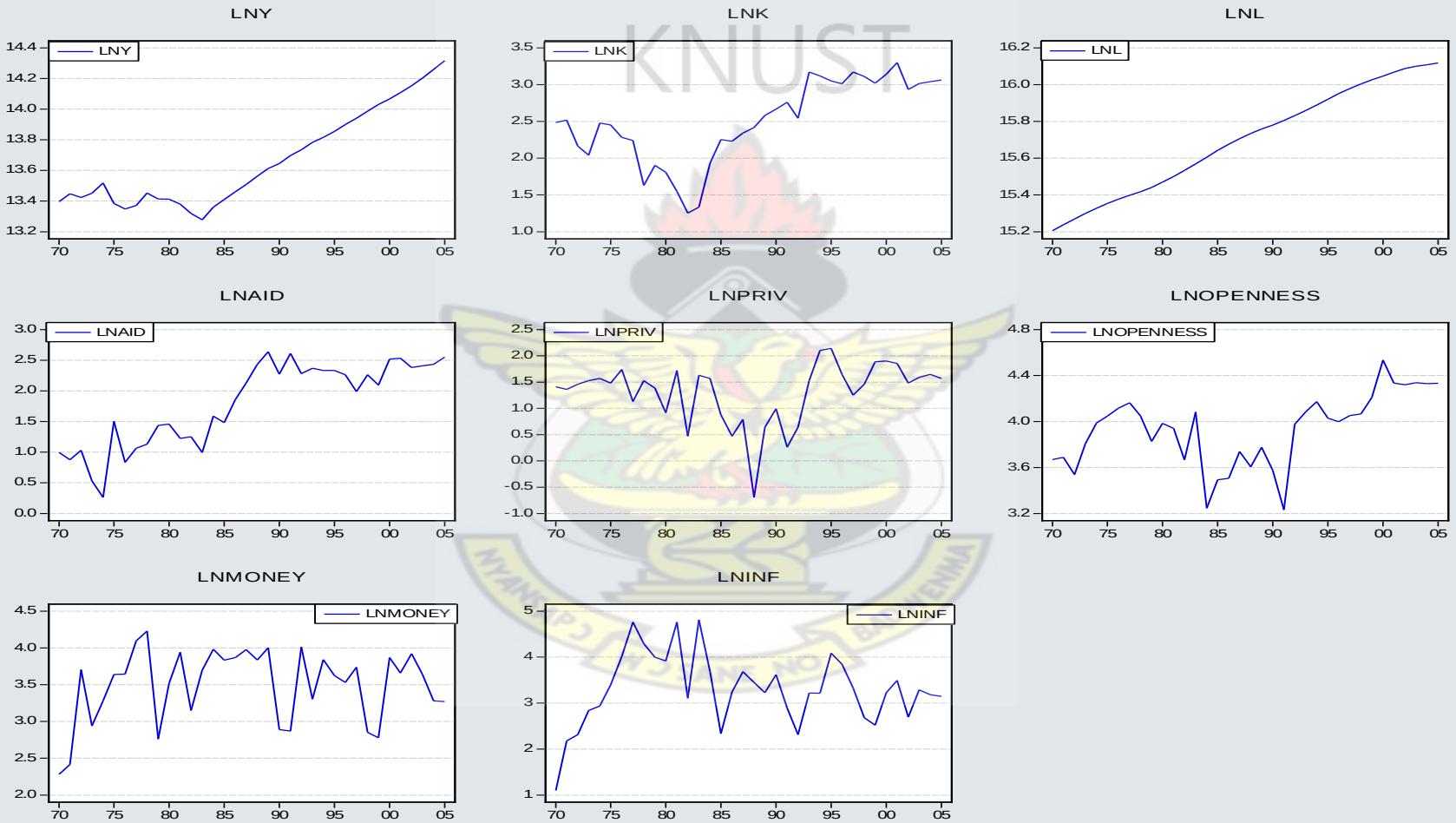
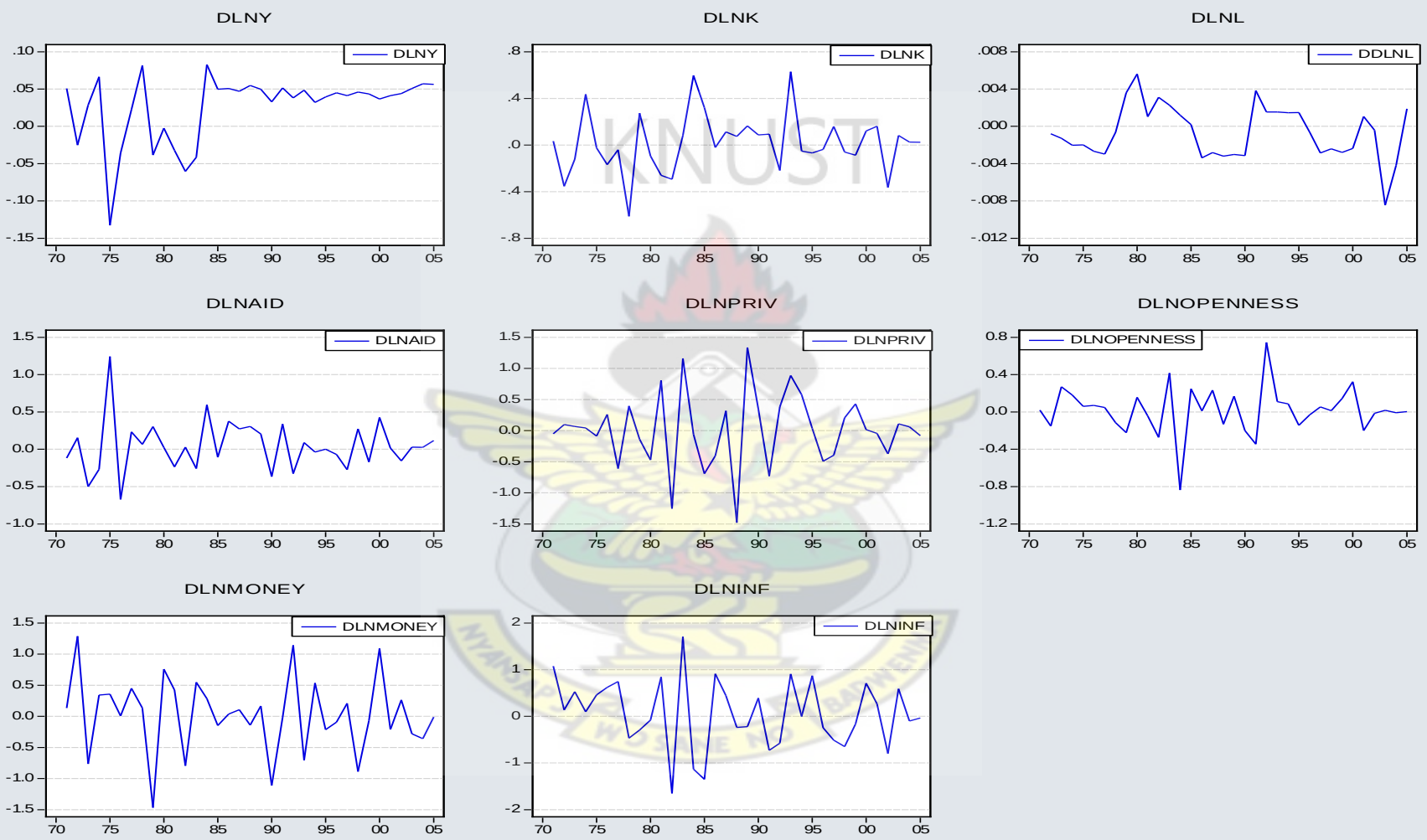
APPENDIX A

Figure AI: Plots of Variables in Levels and First Differences





Note: D denotes first difference operator; LN = Natural logarithm

APPENDIX B

SUMMARY STATISTICS AND CORRELATION MATRIX

Table AI: Descriptive Statistics

	ln *Y*	ln *K*	ln *L*	ln *AID*	ln *PRIV*	ln *OPENNESS*	ln *MONEY*	ln *INF*
Mean	13.66680	2.499749	15.69706	1.787202	1.303944	3.930798	3.496073	3.298723
Median	13.54018	2.501302	15.72016	2.039869	1.481605	3.992666	3.641525	3.234718
Maximum	14.31590	3.299534	16.11797	2.639057	2.140066	4.533674	4.228293	4.811371
Minimum	13.27796	1.252763	15.20594	0.262364	-0.693147	3.230804	2.282382	1.098612
Std. Dev.	0.310560	0.561738	0.290197	0.681273	0.578006	0.317130	0.496270	0.779152
Skewness	0.638908	-0.509196	-0.093961	-0.482356	-1.359755	-0.379966	-0.776895	-0.223635
Kurtosis	2.049078	2.356092	1.684782	1.950507	5.251812	2.530722	2.660993	3.586777
Jarque-Bera	3.805602	2.177608	2.647669	3.048157	18.69958	1.196577	3.793780	0.816536
Probability	0.149150	0.336619	0.266113	0.217822	0.000087	0.549752	0.150035	0.664801
Sum	492.0048	89.99095	565.0941	64.33928	46.94198	141.5087	125.8586	118.7540
Sum Sq. Dev.	3.375671	11.04422	2.947492	16.24463	11.69320	3.520010	8.619953	21.24772
Observations	36	36	36	36	36	36	36	36

APPENDIX B (Continued)

Table AII: Correlation Matrix

	ln *Y*	ln *K*	ln *L*	ln *AID*	ln *PRIV*	ln *OPENNESS*	ln *MONEY*	ln *INF*
ln *Y*	1							
ln *K*	0.833159	1						
ln *L*	0.896022	0.717366	1					
ln *AID*	0.737917	0.681221	0.883173	1				
ln *PRIV*	0.310890	0.274627	0.127433	-0.126165	1			
ln *OPENNESS*	0.625490	0.440587	0.475626	0.231595	0.586608	1		
ln *MONEY*	-0.035476	-0.128970	0.162143	0.164506	-0.068509	0.169592	1	
ln *INF*	-0.187510	-0.339155	0.000500	-0.043920	0.120875	0.207620	0.496756	1

APPENDIX C

Table AIII: Data used in the Estimation of the Aid-Growth Model

Year	Y	L	K	AID	OPENNESS	MONEY	INF	PRIV	D
1970	2549.57	3937937	609.4636	68.25	44.02	427.13	3.03	15.25	0
1971	2682.56	4016593	671.1875	62.93	36.00	474.65	9.56	23.94	0
1972	2615.83	4148074	442.4016	72.12	35.92	667.66	10.07	36.23	1
1973	2691.28	4280449	442.686	44.78	37.84	793.51	17.68	14.71	0
1974	2875.7	4411380	685.4095	36.35	40.13	1005.03	18.13	11.23	0
1975	2518.21	4537106	581.9676	112.67	37.78	1386.11	29.82	70.87	0
1976	2429.31	4657127	546.3176	56.34	31.76	1899.97	56.08	18.26	0
1977	2484.55	4767577	654.595	71.14	22.04	3045.65	116.45	19.22	0
1978	2695.14	4866173	555.1353	83.82	18.05	5132.83	73.09	9.70	0
1979	2627.36	4963659	518.6319	110.35	22.39	5942.11	54.44	2.80	1
1980	2639.75	5081311	489.2405	113.8	17.62	7950.55	50.07	15.60	1
1981	2547.28	5231069	431.4052	87.39	10.08	12030.57	116.50	16.26	1
1982	2370.92	5390781	332.7947	82.7	6.32	14839.23	22.30	16.30	0
1983	2262.71	5572668	326.1619	60.99	11.54	20805.48	122.87	2.40	0
1984	2458.38	5773799	372.1447	119.46	18.81	31962.2	39.67	2.00	0
1985	2583.56	5989377	456.6796	112.14	24.24	46718	10.31	5.60	0
1986	2717.88	6214163	387.7868	170.7	36.71	69112.4	24.57	4.30	0
1987	2848.2	6425617	381.8422	231.56	45.85	105970	39.82	4.70	0
1988	3008.5	6625543	453.7295	334.11	42.25	155010	31.36	5.00	0
1989	3161.51	6809868	549.6368	431.96	41.09	239750	25.22	15.00	0
1990	3266.75	6978191	585.799	312.25	42.73	271640	37.26	14.80	0
1991	3439.29	7128248	701.8062	459.38	42.49	377791	18.03	20.00	0
1992	3572.72	7309484	540.4416	342.63	45.99	575314.6	10.06	22.50	0
1993	3746	7506911	1113.21	391.8	56.67	768048.7	24.96	125.00	1
1994	3869.61	7721507	1061.329	389.97	62.02	1171808	24.87	233.00	1
1995	4028.75	7953782	1098.271	406.03	57.42	1677700	59.46	106.50	1
1996	4214.17	8205186	1431.593	396.14	72.20	2335331	46.56	120.00	1
1997	4391.01	8459140	1437.766	315.11	85.40	3364912	27.89	81.80	1
1998	4597.41	8696035	1594.765	431.88	80.60	3953412	14.62	167.40	1
1999	4799.99	8917967	1799.175	379.39	82.10	4958256	12.41	243.70	1
2000	4977.59	9120115	1193.287	600.43	116.70	7647820	25.19	165.90	1
2001	5186.64	9304716	1238.645	628.7	109.85	10071404	32.91	89.30	1
2002	5420.04	9503101	1292.61	571.74	96.92	14991299	14.82	58.90	1
2003	5701.89	9701701	1378.863	678.08	92.50	20122978	26.67	136.75	1
2004	5998.79	10619000	2539.715	633.28	99.68	25644668	12.62	139.27	1
2005	6012.64	10910000	3024.017	657.39	97.74	28041784	15.12	144.97	1

Source: World Development Indicators 2007 CD ROM, Africa Development Indicators 2006 CD ROM, Bank of Ghana's Quarterly Digest, State of the Ghanaian Economy (various issues), Ghana Statistical Service and Penn World Tables 6.2.

Table AIV: Data used in the Estimation of the Aid Fungibility Model

Year	Y	INF	IG	CG	T	FDI	IP	CP
1970	2549.57	3.03	140.29	327.62	493.55	3.06	220.48	3942
1971	2682.56	9.56	151.63	347.66	483.42	1.26	227.15	4102
1972	2615.83	10.07	101.54	329.86	389.08	0.54	84.19	3797
1973	2691.28	17.68	81.85	293.62	300.56	0.58	161.17	4256
1974	2875.7	18.13	91.77	351.12	357.24	0.49	283.5	4748
1975	2518.21	29.82	119.67	328.12	385.62	2.52	200.9	3958
1976	2429.31	56.08	157.25	297.35	323.78	-0.66	58.48	3801
1977	2484.55	116.45	217.99	313.8	253.93	0.60	56.8	3822
1978	2695.14	73.09	104.62	304.55	178.78	0.26	40.11	4342
1979	2627.36	54.44	85.17	270.36	242.05	-0.07	86.66	4219
1980	2639.75	50.07	37.24	294.6	181.78	0.35	111.11	4253
1981	2547.28	116.50	59.89	223.91	113.59	0.39	56.52	3892
1982	2370.92	22.30	26.33	153.64	131.75	0.40	53.81	3382
1983	2262.71	122.87	20.26	132.6	125.22	0.06	64.59	3443
1984	2458.38	39.67	47.59	178.48	197.43	0.05	121.55	3917
1985	2583.56	10.31	97.86	242.85	291.39	0.12	149.39	3900
1986	2717.88	24.57	187.45	300.87	370.75	0.08	66.94	4132
1987	2848.2	39.82	212.22	302.76	400.92	0.09	84.85	4409
1988	3008.5	31.36	180.27	292.13	407.08	0.10	159.69	4627
1989	3161.51	25.22	270.34	311.09	430.99	0.29	147.29	4742
1990	3266.75	37.26	287.15	304.13	385.09	0.25	184.57	4908
1991	3439.29	18.03	269.05	326.04	502.11	0.30	277.11	5093
1992	3572.72	10.06	367.7	432.66	425.23	0.35	89.61	5310
1993	3746	24.96	416.83	541.3	558.15	2.10	415.15	5415
1994	3869.61	24.87	515.29	530.91	742.97	4.28	411.87	5314
1995	4028.75	59.46	541.36	486.27	825.89	1.65	265.19	5128
1996	4214.17	46.56	565.63	507.39	741.69	1.73	327.77	4415
1997	4391.01	27.89	508.44	542.73	759.64	1.19	580.97	5073
1998	4597.41	14.62	516.2	474.45	841.33	2.24	546.26	4764
1999	4799.99	12.41	471.57	384	801.6	3.16	529.22	4950
2000	4977.59	25.19	456.64	389.25	881.93	3.34	736.49	5969
2001	5186.64	32.91	663.88	411.3	940.57	1.68	715.77	6065
2002	5420.04	14.82	331.67	620.59	976.14	0.96	740.42	6289
2003	5701.89	26.67	509.53	657.43	1184.45	1.79	796.2	6295
2004	5998.79	12.62	742.7	700.66	1426.67	1.57	891.97	6482
2005	6364.07	15.12	756.29	724.35	1563.89	0.99	897.42	6491

Source: World Development Indicators 2007 CD ROM, Africa Development Indicators 2006 CD ROM, Bank of Ghana's Quarterly Digest, State of the Ghanaian Economy (various issues), Ghana Statistical Service and Penn World Tables 6.2.