

THE EFFECTS OF AID ON INFLATION:
THE ROLE OF FINANCIAL MARKET DEVELOPMENT

A Master's Thesis

by
AYÇA DÖNMEZ

Department of
Economics
Bilkent University
Ankara
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To Ömer

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THE ROLE OF FINANCIAL MARKET DEVELOPMENT

The Institute of Economics and Social Sciences
of
Bilkent University

by

AYÇA DÖNMEZ

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ANKARA

September 2005

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Asst. Prof. Selin Sayek
Supervisor

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Asst. Prof. Ümit Özlale
Examining Committee Member

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Economics.

Asst. Prof. Levent Akdeniz
Examining Committee Member

Approval of the Institute of Economics and Social Sciences

Prof. Dr. Erdal Erel
Director

ABSTRACT

THE EFFECTS OF AID ON INFLATION: THE ROLE OF FINANCIAL MARKET DEVELOPMENT

Dönmez, Ayça

M.A., Department of Economics

Supervisor: Asst. Prof. Selin Sayek Böke

Co-supervisor: Asst. Prof. Bilin Neyaptı

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This thesis investigates the relationship between foreign aid and inflation considering the effect of financial market development (FMD) on this relationship. The main hypothesis is that aid has a significant positive impact on inflation. When the financial markets are developed enough, the upward effect of aid on inflation is expected to be diminished. The dynamic relationship is analyzed utilizing generalized method of moments (GMM) estimation which accommodates the use of an unbalanced panel data set, covering 60 countries in the period 1975-2004, where available. The results of the empirical analysis support the hypothesis. Furthermore, the results are robust to several control variables, and alternative measures of financial market development.

Keywords: Aid, Inflation, Financial Market Development (FMD)

ÖZET

İKTİSADİ YARDIMIN ENFLASYON ÜZERİNDEKİ ETKİLERİ:

MALİ PİYASADAKİ GELİŞMENİN ROLÜ

Dönmez, Ayça

Yüksek Lisans, İktisat Bölümü

Tez Yöneticisi: Yrd. Doç. Dr. Selin Sayek Böke

Ortak Tez Yöneticisi: Yrd. Doç. Dr. Bilin Neyaptı

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Bu tez uluslararası iktisadi yardım ile enflasyon arasındaki ilişkiyi mali piyasalardaki gelişmenin bu ilişki üzerindeki etkisini de dikkate alarak araştırmaktadır. Ana hipotez, iktisadi yardımın enflasyon üzerinde anlamlı pozitif bir etkiye sahip olduğudur. Mali piyasalar yeterince gelişmiş olduğunda iktisadi yardımın enflasyonu arttırıcı etkisinin azalması beklenmektedir. Dinamik ilişki, 60 ülke için 1975-2004 döneminin mümkün noktalarını kapsayan dengesiz panel veri kullanımına imkan sağlayan genelleştirilmiş momentler metodu (GMM) yardımıyla incelenmektedir. Araştırma sonuçları hipotezi desteklemektedir. Ayrıca, sonuçlar birçok kontrol değişkeni ve farklı mali piyasalardaki gelişme ölçütleri karşısında tutarlıdır.

Anahtar Kelimeler: İktisadi Yardım, Enflasyon, Mali Piyasalardaki Gelişme

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CHAPTER 1

INTRODUCTION

Since the early 19th century to date, the term “foreign aid” has been used in the literature to mean transfer of resources or income from a donor country or international agency to another country to achieve predetermined objectives. Although, at the beginning, aid was used to fund wars (Moger, 1999), now, it is used for more humanistic purposes like making poverty history, evident from the campaign announced during the recent G8 summit. Indeed, the G8 summit held in June 2005 ended with an agreement to boost aid for developing countries by \$50 billion (£28.8 billion), of which \$25 billion would go to Africa over the next five years. Moreover, G8 members from the European Union (EU) committed to reach a collective foreign aid target of 0.56% of GDP by 2010, and 0.7% by 2015. The discussions addressing whether the decisions made by the G8 are enough to make poverty history or not have been going on. However, before dealing with these discussions, we believe that the effects of aid on the recipient economies need to be studied further so as to shed some light on the ambiguity in the aid literature. Our motivation for this study receives its strength from this point. We believe that upon clarifying the “good” and/or “bad” effects, as well as the conditions influencing the overall impact of foreign aid, it becomes possible to discuss

thoroughly the decisions about the direction, timing, amount, usage, etc. of aid flows.

The sizable literature on aid generally focuses on the causality from aid to domestic investment and growth. While Boone (1994 and 1996) says, aid has no effect on the recipient country's growth and investment, Burnside and Dollar (1997 and 2000) state that aid is beneficial to real gross domestic product (GDP) growth if recipient government has good economic policies. The ambiguity of the effect of aid is also reflected in studies on the relation between aid and real exchange rate. For instance, while Younger (1992) and Vos (1998) find empirical evidence that aid inflows cause real exchange rate appreciation, Nyoni (1998) finds that aid inflows cause depreciation. Furthermore, Dijkstra and van Donge (2001) find no impact of aid on real exchange rate.

Among the studies seeking to elucidate the impact of aid on fiscal, monetary and trade policies, our focus will mainly be on the nominal effects of aid. Although there are some studies commenting on inflationary or deflationary effects of aid (Roemer, 1989; Younger, 1992 and Buffie et al., 2004), to the best of our knowledge, existing empirical work has not explored the importance of aid in the dynamics of inflation. This paper attempts to fill the void in the literature by modeling inflation as being influenced by foreign aid. The importance of this study is improved by the consideration of the effect of financial market development (FMD) on this relation. The main hypothesis is that foreign aid has a significantly positive impact on inflation. If financial markets are well developed, however, the upward effect of aid on inflation is expected to be diminished since

it is presumed that the recipient economy's capacity to absorb or manage inflows of aid increases as financial sector develops.

When foreign aid inflows to an economy, the net foreign assets of the central bank is expected to be increased, and this cause a rise in money supply. In addition, as government spending increases, as a result of increased income after aid inflow, the aggregate demand increases. This increase in aggregate demand gives rise to an increase in prices.

In detail, when aid results in an increase in money supply, total demand for both tradable and nontradable goods and services¹ increase as a result of the increase in welfare or income of the recipient country's public after the inflow. If the foreign aid is spent only on imports², it will have no direct impact on the money supply or aggregate demand in the economy because the balance of payment will show both a capital account and an offsetting current account deficit. Moreover, the increased demand for tradable can be satisfied directly by imports, without changing the structure of domestic production. However, the increased demand for nontradable pushes the prices of domestic goods and services upward unless there exists excess capacity of production³.

When the central bank believes there is too much inflationary pressure in the economy, it interferes to reduce the level of aggregate demand. In other words, the

¹ Tradable goods and services include imports and domestically produced import substitutes, and their prices are determined in world markets. On the other hand, nontradable consist of domestically produced and consumed goods and services, and their price is determined by the changes in domestic supply and demand.

² Note that, the recipient government is more likely to use some portion of incoming aid on nontradable, such as public service, than to use the entire aid on imports.

³ As a result, a shift in production from exportable to nontradable occurs and this leads a decrease in competitiveness in international market. This phenemona is called Dutch disease in literature and the volume of the damage depends on the share of nontradable in the aggregate consumption.

central bank may choose to offset, or namely sterilize, the monetary expansion when the expansion results in fostering inflation. By selling foreign exchange, central bank may already decrease money supply but appreciates the exchange rate. By selling government bonds, i.e. domestic debt, to the private sector in exchange for domestic currency on the open market, central bank does bond sterilization but may cause the price of bond to fall. Since bond prices inversely related to interest rates, a fall in the price of bonds is followed by a rise in interest rates. Hence, if central bank tries to shrink money supply by selling bonds, it may drive up interest rates as well.

Since the sterilization is processed through financial markets, such as the bond markets, the structure of financial markets plays a crucial role on the consequences of sterilization. Especially, the amount of the change following the sterilization depends on the structure of financial markets. As financial markets become more developed, the magnitude of the changes in the real exchange rate or in the domestic interest rate are diminished since central bank has more room to do sterilization with less cost then.

During the modeling of inflation, as introduced in the traditional Phillips curve⁴, we primarily consider the persistence of inflation. A model dealing with the dynamic pattern of inflation is going to be used. This dynamic relationship is analyzed using an unbalanced panel data set, consisting of 60 countries over the 1975 to 2004 period, where available. The study includes other controls, such as real GDP growth, growth of reserve money, and openness to trade. The estimation

⁴ According to Gordon (1997), the Phillips curve explains inflation with the help of three basic factors: inertia, demand, and supply.

is based on the method developed by Arellano and Bond (1991) that utilizes generalized method of moments (GMM) and the computer software packages Give Win 2.1 and Ox Version 3.10 are the tools of the model estimation. The results of the empirical analysis mainly provide robust evidence in favor of the hypothesis. It is observed that the effect of foreign aid on inflation is significantly positive and as financial markets develop, this upward pressure of aid on inflation lessens, indeed.

The remainder of the study is structured as follows: Chapter 2 provides a review of literature on inflation determinants, capital flows and foreign aid. Chapter 3 describes the econometric methodology utilized during the analysis while laying down the theoretical background for the basic model, the hypothesis tested, the sources of data and the variables. Chapter 4 provides a more detailed model specification of inflation and reports the results of the regression analysis of these models. Chapter 5 makes concluding remarks, and provides a summary as well as a brief discussion on main findings.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews three branches of literature related to the subject of this study. The first part of the literature is about inflation, which defines inflation and identifies cross country determinants of inflation as well as the country specific determinants of inflation studied in the recent literature. In section 2.1.1, inflation is defined thoroughly, and measures of inflation are mentioned. Since the literature is too extensive to cover entirely, a brief summary of this literature is presented in section 2.1.2, where some traditional and recent theories on inflation are reviewed. Following this discussion, second part of the literature review is about capital flows. This part helps build a bridge between the capital flows and foreign aid literatures. In section 2.2, the reader can find the literature review of the effects of capital inflow on the economy, the actions taken to absorb large capital inflows and relation between foreign aid and capital inflows. Finally, the third part sheds some light on the foreign aid literature. This literature investigates the relationship among aid, growth, real exchange rate and the “Dutch Disease” phenomena. The sections 2.3.1 and 2.3.2 deal with the definition and the history of aid, respectively. While section 2.3.3 basically studies the aid and growth relation, section 2.3.4 includes studies on aid and “Dutch Disease” relation as well as aid’s impact on the real exchange rate.

2.1 Explaining Inflation

Since the literature on the determinants of inflation is very extensive, we limit our review to a sample of cross-country studies and some country base studies. Before discussing the cross-country and country specific literature related to inflation in sections 2.1.2 and 2.1.3, respectively, the definition of inflation and its measures are provided in section 2.1.1.

2.1.1 Definition of Inflation

In economics, the inflation rate is the percentage rate of increase in the price index that measures the average price level. For our study, we use GDP deflator as the price index⁵.

As stated by Dornbusch, et. *al* (1998), the calculation of real GDP gives us a useful measure of inflation known as the GDP deflator. The GDP deflator is the ratio of the total amount of money spent on GDP (nominal GDP) to the inflation-corrected measure of GDP (constant-price or "real" GDP). In a more compact way, it is the average price of the flow of domestically produced goods and services (IMF, 1993).

In IMF (1993), the GDP deflator is reported to be a more accurate measure of domestic demand and supply conditions since it is not directly affected by

⁵ Note that there is no single true measure of inflation. However, because each measure is based on other measures and models of inflation, the probable bias either in measurement or in the model of inflation is considered by economists. In 1995, the Boskin Commission found the consumer price index produced by the U.S. Department of Labor's Bureau of Labor Statistics to be a biased measure, and stated that inflation was overstated by this measure.

changes in import prices. Since it is the broadest measure of the price level, that is, it is based on a calculation involving all the goods produced in the economy (not tied to a specific basket of consumer goods in a base year), we decided to use this price index as a measure of inflation⁶.

2.1.2 Determinants of Inflation

At the Wincott Memorial Lecture in London on September 16th, 1970, Nobel Prize Laureate economist Milton Friedman verbalized his famous lines: “Inflation is always and everywhere a monetary phenomenon.” Up till now, this epigram of Friedman has been repeated, studied, and approved many times by many of his colleagues and, as a result, inflation is accepted to be a monetary phenomenon in the theoretical literature. A recent study of IMF (2001), for instance, reported inflation to be the result of government financing its fiscal deficits through issuing money (which is called seigniorage) or the result of time inconsistent monetary policy.

The voluminous literature on inflation determinants studies the impact of monetary policy, fiscal deficits, inflation inertia, and external shocks on inflation. Briefly, the results of the research about the triangle of fiscal deficits, seigniorage, and inflation change from one study to another as reported in IMF (2001). Besides these main inflationary factors, the role of the institutional structure, and trade related policies have also been studied. For instance, the empirical studies dealing with the relationship between central bank independence and inflation support

⁶ The other examples of common measures of inflation used in literature are: the consumer price index, the producer price index, the cost of living index, the wholesale price index, the commodity price index, and the personal consumption expenditures price index.

negative significant relationship⁷. Besides, as summed up in IMF (2001), the results of the impact of openness to trade on inflation changes from sample to another, however greater openness to trade is mainly associated with lower inflation⁸. There are also studies dealing with inflationary effects of monetary expansion, price inertia, nominal exchange rate changes, and the world price of oil and other commodities. While, inflation inertia, changes in money growth or supply⁹, and nominal exchange rates' changes are all found to be powerful in explaining inflation, changes in world price of oil and other commodities have been found to have less power in explaining inflation¹⁰. On the other hand, according to IMF (1996), output gap is not a powerful tool for explaining inflation in developing countries.

While investigating the literature about inflation and money growth relation the quantity theory of money leads us to some related studies. The foundation of the quantity theory of money is introduced in David Hume's essays of 1752, *Of Money* and *Of Interest*¹¹. There are two important statements of Hume shaping the quantity theory. According to the first statement of Hume, the changes in money have proportional effects on all prices expressed in terms of money. Secondly, these changes are assumed to have no real effect on how much people work, produce or consume.

⁷ See Neyaptı(2003), for instance.

⁸ In IMF (2001), it is found that the effect of openness on inflation may, over the long term, occur largely through fiscal policy and financial developments that affect the size of inflation tax base.

⁹ In order to maintain the equilibrium point of supply and demand for money, monetary models support an increase in prices when the amount of money in the economy becomes greater than the amount of the public's desire to hold. That is, an excess supply of money can be followed by an upward pressure on inflation like an excess demand for goods does.

¹⁰ See IMF (1996) and IMF (2001).

¹¹ See Lucas (1996) for details and discussions.

Lucas (1996) develops Hume (1970)'s merely verbally introduced methods empirically. Lucas (1996) states: "This tension between two incompatible ideas -that changes in money are neutral units' changes and that they induce movements in employment and production in the same direction- has been at the center of monetary theory at least since Hume wrote." Furthermore, he adds: "Perhaps he (Hume) simply did not see that the irrelevance units' changes from which he deduces the long-run neutrality of money has similar implications for the initial money changes as well." A very close correlation between the rate of growth of monetary aggregates and inflation is strongly supported in Lucas (1996).

McCandless and Weber (1995) find a 45-degree line fit for the graph of average annual inflation rates and average annual growth rates of M2 over the period of 1960-90 with 110 countries. They report the simple correlation between inflation and money growth as 0.95. The simple correlation becomes 0.96 when only OECD countries considered, while it is equal to 0.99 for 14 Latin American countries. McCandless and Weber (1995) do calculations using other monetary aggregates like M0 (high-powered money or the monetary base) and M1 for the whole sample and again find strong positive correlation (0.92 when M0 is used and 0.96 when M1 is used).

James (1999) examines the forecasting performance of inflation with alternative indicators replacing unemployment in Phillips curve. Not supporting the previously mentioned studies on money growth and inflation, he found that the

models that use variables of money growth rates do not perform well¹². On the contrary, Dwyer (2002) supports empirically that money growth is more useful for forecasting inflation in U.S. than other variables besides past inflation.

The relationship between money growth and output growth shows ambiguity depending on the data set as stated by Lucas (1996). For instance, McCandless and Weber (1995) find a weak positive relation for OECD countries. When the whole sample of 110 countries is considered, however, there seems to be no relation.

The increase in prices is linked to the choice of the policy response to stabilize the price level in Bahmani-Oskooee and Domaç (2003). They support the existence of strong correlation between the growth of monetary aggregates and inflation in Turkey. According to Bahmani-Oskooee and Domaç (2003), central banks can eliminate inflation by interfering with monetary aggregates, particularly, the monetary base. However, it is noted that the supported correlation between money and prices is not an indicator of the direction of causality. In Bahmani-Oskooee and Domaç (2003) the external shocks followed by exchange rate depreciations, changes in public sector prices, and inflationary inertia are all found to be factors influencing inflation in Turkey.

In 1970s, it is observed that the changes in the growth of money are divided into two different groups; anticipated and unanticipated, since they are observed to have different effects. Briefly, anticipated monetary expansions were found to have inflation tax effects and cause inflation cost on nominal interest rates while

¹² In the set of the measures for money and credit quantity aggregates in James (1999), there are variables named FMFBA (monetary base, adj for reserve requirement changes, seasonally adjusted)) and FMBASE (monetary base, adj for reserve requirement changes, seasonally adjusted).

unanticipated monetary expansions were concluded to cause a probable rise in production. However, Lucas(1996) claims: “But I think it is clear that none of the specific models that captured this distinction in the 1970s can now be viewed as a satisfactory theory of business cycles”.

An exogenous shock in the form of unanticipated price adjustments that do not hit the inflation target of central bank fosters nominal demand for money following the increase in consumer price index (CPI). When there is no persistency of inflation in the economy, central bank can solve this problem by increasing the supply of base money. On the contrary, if the economy faces persistent inflation, then the inflationary expectation of the public may grow which can be followed by an increase in wages and non-tradable goods prices. Hence, for high inflationary countries, an exogenous shock may result in inflation and monetary base growth (Bahmani-Oskooee and Domaç, 2003). As a result, it can be concluded that the relationship among inflation and economic fundamentals could differ across countries with different inflation levels.

In addition, the literature on determinants of inflation suggests different groups of determinants of inflation for industrialized and emerging market economies one by one. As summed up in Domaç (2004); while the main determinants of inflation in industrialized countries consists of real factors, in emerging markets nominal factors are found to be good at explaining inflation.

Especially in emerging economies, the exchange rate is an important variable in explaining inflation. Domaç (2004) states: “The pass-through of depreciation into domestic prices in these countries could be much larger than the share of imported goods in the consumption basket would indicate. This is

because an increase in the price of imports in the face of depreciation would also affect inflation expectations”. According to Domaç (2004), increases in inflation expectations can be followed by exchange rate depreciation since the monetary authority buys foreign currency to keep purchasing power stable.

While considering the determinants of inflation we came across with some studies modeling inflation with lagged inflation. These studies are all considering the persistency of inflation and the inflation inertia on the base of Phillips curve. In Céspedes, et *al.* (2003) inflation inertia is pointed out to be a delayed and gradual response of inflation to monetary policy shocks, while inflation persistence is defined as long-lasting, steady-state deviations of inflation after a monetary policy shock.

The model of Céspedes, et *al.* (2003) considers slow (inertial) and prolonged (persistent) change in inflation following a permanent or highly persistence monetary policy shock (for instance, permanent changes in the inflation rate target). Rather than slow response of marginal cost to these shocks, this model supports the long-run or inflation updating component of firms’ pricing policies as the reason for inflation inertia or persistency in inflation.

Another study, which considers the change in inflation and economy, is Fischer and Modigliani (1980): “Depending on two major factors, the effects of inflation can vary enormously. First, one is the institutional structure of the economy; and the second one is the extent which inflation is or is not fully anticipated. Because the institutional structure of the economy adapts to ongoing inflation, the real effects (and costs) of inflation can be expected to vary, not only among different economies, but also in the same economy”. This comment

supports our consideration of the role of institutional structure, especially the structure of financial markets. Indeed, we are expecting that the change in the structure of financial markets (namely, development level of financial markets in our model) has an effect on the inflationary process, and the impact of economic fundamentals on inflation.

The effects of financial markets on inflation have also been studied in the literature. There are some studies about the effect of the financial system on the relationship between interest rates and inflation (or output). According to La Porta *et al.* (1996 and 1997) the character of the financial markets in a country depends on the legal structure of that country. Cecchetti (1999) then goes on to argue that a country's legal system affecting the structure of financial markets forms the basis for the impact of monetary policy on output and prices. Hence, Cecchetti (1999) supports that the legal system in a country, financial and monetary structure are linked to each other. While studying effects of introducing euro, Cecchetti (1999) finds empirically that the impact of an interest rate change on output and inflation is low for countries with better legal protection for shareholders and debtors in EU countries. Therefore, the impact of the interest rate changes on output and inflation can be determined by the state of the countries' financial systems.

Among others, the study that forms the basis of ours is Neyaptı (2003). According to Neyaptı (2003), inflation can be modeled dynamically as a function of its first lag, budget deficits, the rate of growth of base money, and the rate of growth of real GDP in addition to a variable that measures both central bank independence (CBI) and FMD. It is concluded that budget deficits have a significant positive effect on inflation. Moreover, it is stated that budget deficits

lead to inflation primarily when the central bank is not independent and the financial market is not developed enough in Neyaptı (2003). That is, this study also supports the important role played by institutions in the relationship between economic fundamentals and inflation.

2.1.3 Recent Studies on Modeling Inflation

We next examine some recent studies which models inflation with different, mostly country specific variables.

Among other studies on inflation inertia, Lim and Papi (1997) support that inertial factors are quantitatively important in explaining inflation in Turkey. Moreover, they find that monetary variables such as money or real exchange rate direct the inflationary process of Turkey. Domaç (2004) supports these findings for Turkey by stating: “The empirical findings show that inflationary pressures in Turkey have their origin in the following factors: (i) the presence of external shocks which engender sharp exchange rate depreciations; (ii) changes in public sector prices; and (iii) inflationary inertia”.

It is emphasized in Liu and Olumuyiwa (2000) that the dynamic specification of inflation in Iran can be represented in terms of excess money supply, changes in exchange premium¹³, monetary growth (i.e. nominal money

¹³ This term, calculated by subtracting weighted average official exchange rate from the parallel market rate, is added to control the effect of exchange liberalization in Iran on inflation. Weighted average official exchange rate is used as a measure of the degree of exchange restrictions in Iran where a depreciation in the weighted average exchange rate means a relaxation of the exchange rate control.

growth), and lagged variable of the rate of inflation (which is used as to measure inflation expectation). This model differs from similar ones because it takes into account the disequilibria in markets for foreign exchange, money, and goods. For Iran, it is empirically supported that excess money supply, lagged inflation rate, and nominal money growth all have positive significant effect on inflation. In addition, changes in exchange premium variable is found to be negatively significant, which means an ease in exchange control results in an increase in inflation.

Rother (2000) models the inflation in Albania with the help of the change in relative prices. Basic concern of Rother (2000) was the impact of relative price changes (at the level of individual goods) on inflation in transition economies like Albania. He claims that the asymmetry in relative price adjustments has a significant effect on inflation and proves empirically that positively skewed individual price adjustments has an upward pressure on inflation. Rother (2000) modeled change in logarithm of price level with the help of money supply, real income, level of interest rates (i.e. the return of the money balances rather than opportunity costs), depreciation of domestic costs, the world market price level, and the skewness on inflation. He empirically finds that money supply has a positive impact on price level.

2.2 Capital Flows: Their Effects and a Comparison with Aid

Since foreign aid is a form of capital flow, its effects are expected to be similar to those of capital flows. For this reason, we will briefly discuss the effects of capital flows and aid flows on the economy, separately.

Almost all authorities agree that globalization serves as a catalyst for major changes in today's world. The tremendous increase in the mobility of international capital is just one single unit in this whole bunch of changes. In the nineties, sharp decrease in official capital flows and an increase in private investment, particularly portfolio capital was evident. The net private capital flows to emerging markets in 1996 is seven times larger than the one in 1990 by Kohli (2001). That is why the degree of international capital mobility facing developing countries has been a major topic. While the results of individual studies vary, the most common conclusion is that there is high and growing international especially for many developing countries¹⁴.

The studies about capital inflows generally state that it affects the recipient economy through its effects on exchange rates, interest rates, foreign exchange reserves, domestic monetary conditions as well as savings and investment. Some examples of such studies are Calvo *et al.* (1993), Chohan, *et al.* (1993), Khan and Reinhart (1995), Gunther, *et al.* (1996), Gruben and McLeod (1996), Kamin and Wood (1998), Borensztein, *et al.* (1998), Bosworth and Collins (1999), Edwards

¹⁴ See Prasad, *et al.* (2004), Willet, *et al.* (2002), and Haque and Montiel (1991) for the discussions about the measurement of capital mobility. Willet, *et al.* (2002) claim that the capital mobility is not so high as indicated by other studies, such as Haque and Montiel (1991).

(1999), Carkovic and Levine (2002), Alfaro, et al. (2004), among others¹⁵. Celasun et al. (1999) questioned the experience of capital flows to Turkey and state that capital flows contributed to economic growth through their impact on private consumption and investment, but also rendered monetary policy ineffective and inflation path unchecked, given particularly policy mix of real exchange rate targeting and high fiscal deficits.

Kohli (2001), undertaking an empirical study about the capital flows to India, gives opportunity to understand the mechanism behind this capital inflows and its effects system. According to him, an inflow of foreign capital results in an appreciation of the real exchange rate by increasing domestic expenditure and then raising the demand for nontradable goods¹⁶. The process goes on with an adjustment of prices which leads to a reallocation of resources from tradable to non-tradable goods and a consumption shift to nontradable. Moreover, since aggregate expenditure increases as domestic one does, the demand for tradable also increases. This leads to a rise in imports and a widening of the trade deficit. Kohli (2001) goes on with mentioning the importance of the exchange rate regime on the appreciation¹⁷. As he states, while the appreciation occurs through a nominal appreciation in a regime with a floating exchange rate and no central

¹⁵ While Calvo et al. (1993) and Edwards (1999) claim that capital flows contribute to both real appreciation and reserve money accumulation in Latin American countries, Kohli (2001) supports the reconsideration of this point since he believes that there are some other factors, different than capital flows, affecting the fluctuations in real exchange rates.

¹⁶ The same reasoning is applied to effects of aid studied by many researchers. In addition, although it is not stated directly as “Dutch Disease”, the symptoms indicated are the same.

¹⁷ Dornbusch (1976) studies the exchange rate dynamics in detail and supports an immediate depreciation of the exchange rate in the short run, following a monetary expansion. This accounts for fluctuations in the exchange rate and the terms of trade. During the adjustment process, Dornbusch (1976) states that “Rising prices may be accompanied by an appreciation in exchange rate so that the trend behavior of exchange rates stands potentially in strong contrast with the cyclical behavior of exchange rates and prices”. Dornbusch (1976) also adds that the current level of exchange rate is directly linked to the expectations about the future path of economy.

bank intervention, it occurs through an increase in the domestic money supply, aggregate demand and the prices of nontradable in a regime with fixed exchange rate. In addition, it can also be said that when the exchange rate regime is a pure float without intervention by the central bank, the net increase in capital assets following capital inflows can be associated with a similar increase in imports as well as current account deficit, and there is no impact on domestic money supply. If the exchange rate regime is fixed and the central bank intervenes instead, then increases in foreign exchange reserves (which affect the monetary base) can be directly attached to capital inflows. However, these two regimes are rarely observed in today's world while the policy choice of today's authorities becomes to a decision of the size of intervention which is directly related to the degree of exchange rate flexibility¹⁸.

Buffie et al. (2004) argue large capital inflows may cause rapid monetary expansion under managed exchange rate regimes. Initial response to capital flows comes from central bank by foreign exchange intervention which includes mostly sterilization of these inflows. However, foreign reserve accumulation results in an expanded monetary base which generates fear of inflation and "overheating". Moreover, bond sales as an instrument of sterilization can increase real interest rates. Calvo et al. (1994) observe that bond sales prevent interest rate differentials from falling. Shadler (1993) also supports the unusefulness of sterilization when

¹⁸ Many markets, especially emerging markets, which have suffered from severe crises of bank or currency, still follow non-floating exchange rate regimes, although they have announced they will allow their exchange rate to float. Calvo and Reinhart (2000) acknowledge that as a result of lack of credibility; liability to dollarization and limitation on central bank's ability as an effective lender, fear of floating, volatile interest rates, and procyclical interest rate policies emerge in countries which are decided to enter international capital markets. If credibility is not achieved, expectations will lead the day. As Goldstein (2000) suggests, if countries manage to have either hard pegs or floating exchange rates, speculative attacks and currency crises will disappear.

the inflows are persistent. When the inflow is persistent, Buffie et al. (2004) suggest that “There is little to recommend a delayed real exchange rate adjustment. Monetary management should concentrate, instead, on avoiding short-run volatility around the new overshooting of real exchange rate, a burst of inflation, a slump in real activity, or a run-up in the real exchange rate.” When the inflow is temporary, however, Calvo, et al. (1995) and Prati, et al. (2003) both support targeting the real exchange rate, letting inflation and/or the real interest rate increase in order to prevent adverse effects of a temporary real appreciation.

According to Nuti (1996), the countries have been affected by capital flows similarly no matter what the regime is: initial gross undervaluation followed by rapid real revaluation. Interest rate differentials, higher than domestic currency devaluations, made foreign investment in domestic financial assets particularly attractive. Hence, these differentials caused large-scale capital inflows which are either inflationary or costly to sterilize (which the author calls *embrass de richesse*). Nuti (1996) declares that capital inflows or trade surpluses may ease the external constraint and attract potential investment and increase growth. On the other side, he believed that sooner or later huge capital inflows resulted either in an expansionary effect on money supply, which is inflationary, or in an obligation to take curing actions but which are indirectly or directly costly¹⁹. These actions reported in Nuti (1996) are revaluation, fiscal surpluses for offsetting reserve growth, costly sterilizations through open market operations, an interest rate reduction, capital controls, trade liberalization, widening exchange rate bands²⁰.

¹⁹ See Schadler et al. (1993) and Montiel (1995) for details of these costs.

²⁰ See Nuti (1996) for the explanation of possible results of all these actions.

According to Acharya (1999), the preferable policy response is to allow a nominal appreciation adjustment through gradual increases in domestic inflation. In addition, creating capital outflows through early servicing of external debt can be the part of the policy response, too. Here, it is better to note that there are some studies which state that differences in policy responses may affect the magnitude of real appreciation. For instance, Glick (1998) claims that the difference in the extent of real exchange rate appreciation in the Asian region and Latin American countries can be explained by the differences in policy response.

There are some studies that shed light on the relation between capital flows and aid inflows. The earliest studies deal with their impact on growth. For instance, Papanek (1973) find that aid inflows have a greater impact on growth than either savings or private capital inflows. Dowling and Hiemenz (1982) show that private capital inflows affect growth more than official inflows, whereas Singh (1985) supports domestic savings' effectiveness on fostering growth compared to aid.

Although private capital flows have received no attention during the discussions of aid management, recently, Buffie et al. (2004) study the link between official aid flows and private capital flows. According to Buffie et al. (2004), persistent official capital flows is related to strength of private portfolio substitution. Buffie et al. (2004) suggest that: "African central banks have been correct to intervene substantially in the face of recent increases in aid, and to discount the argument that rapid domestic liquidity expansion necessarily calls for

a combination of bond sterilization and cleaner floating”²¹. Indeed, they support central bank’s strict attitude towards preventing nominal appreciation and its overwhelming effort to control liquidity by selling bonds when large and persistent aid inflow to a low-income country. Moreover, to manage this kind of inflows, they suggest a heavily managed float with little or no sterilization and add that under managed float “...the central bank uses unsterilized foreign exchange intervention to target the modest real appreciation needed to absorb the aid inflow. Real interest rates then stay low and macroeconomic adjustment is rapid.” If the central bank’s effort to control liquidity results in rapid nominal money growth, then it can be concluded that a large and persistent aid inflow is followed by a substantial increase in real money demand. Buffie et al. (2004) empirically show that a persistent aid inflow to a post-stabilization low-income country brings down expected seignorage and expected inflation, therefore cause a large increase in demand of real money.

On the other hand, under crawling peg, Buffie et al. (2004) state that a short-run spike in inflation can happen but this spike can be precluded by bond sterilization if the cost of rapidly increasing interest burden is acceptable. The results for pure float is worse. As Buffie et al. (2004) tell: “Portfolio pressures produce a nominal appreciation that is an order of magnitude larger than the required real appreciation, and unless the prices of nontraded goods are perfectly flexible, the real exchange rate overshoots and substitution effects produce a potentially deep recession”.

²¹ However, if central banks intervene then they are in agreement with the argument indicated. Hence, they do not discount that argument.

2.3. Explaining Aid

The voluminous literature about the effects of aid on recipient economy have mainly studied the relation of aid and economic growth, real exchange rates, savings, government spending, investment, competitiveness, exports and imports; overall, fiscal, monetary and trade policies. Of these studies, our focus will mainly be on the nominal effects of aid, i.e. real exchange rate, interest rate, and inflation. These effects are related to Dutch Disease. Furthermore, since these nominal effects occur simultaneously with the real effects, we will also touch up on the largest portion of the aid literature: aid effectiveness and aid-growth relation. Although there are some studies on inflationary or deflationary effects²² of aid, to the best of our knowledge, the literature presents no example of an empirical study in which inflation is explained by aid. Thus, investigating this relationship is one of the contributions of this study to the literature.

Before discussing the literature related to inflation and aid, the definition of aid, and a historical perspective on aid will be provided in section 2.3.1 and 2.3.2, respectively. This discussion will be followed by section 2.3.3 where macroeconomic effects of foreign aid, especially aid and growth relationship is considered. Section 2.3.4 is divided into two subsections: section 2.3.4.1: Aid and Real Exchange Rate, section 2.3.4.2: Aid and the Dutch Disease.

²² Younger (1992) states; following large aid inflows to Ghana, the increase in aggregate demand for Ghanaian goods will begin to drive prices up, fostering the inflation's persistence in Ghana. In contrast, Roemer (1989) (see also Clement, 1989 and Goreux, 1990) points out that there is a fairly large literature on food aid which argues deflationary impact of food aid. In Buffie et al. (2004), a persistent aid inflow in post-stabilization low-countries is observed to reduce expected inflation.

2.3.1 Definition of Aid

In World Bank (1998) the difference between official development assistance and official development finance is described as: “The first (official development assistance) is a subset of the second and comprises the grants plus concessional loans that have at least a 25 percent grant component. Official development finance is all financing that flows from developed country governments and multilateral agencies to the developing worlds. Some of this financing is at interest rates close to commercial rates.” Following, it is reported that “Foreign aid is usually associated with official development assistance and normally targeted to the poorest countries”.

Aid can be defined in a more compact approach as transfer of resources or income from a donor country or an international agency to another country (usually to a less-developed country) to achieve predetermined objectives. These economic objectives can be listed as:

- Improving Economic Growth : In today’s world, it is hardly possible for many people to meet her/his daily needs like food or sheltering. With the help of aid, a donor can provide support government in lower-income countries to improve their levels of income. As reported in World Bank (1998), fostering growth helps the improvement of per capita incomes and social indicators, as a result, improvement in life expectancy, school enrollment, infant mortality, and child malnutrition. That is, an increase in income of the poor gives opportunity to ameliorate their health, education, and living standards. Moreover, lessening of

poverty can be achieved since the factors contributing to long-term growth, such as improved education, boost the reduction of poverty as well²³. In addition, rehabilitating the economies of war-devastated countries can be another point in

- Improving Agriculture: Agricultural development is one of the most important tools of increasing productivity and trade in a country. Besides, farmers and livestock producers are responsible for most of the food supply to consume and export in a country²⁴.

- Improving Education and Training: More than 900 million adults are not able to read and write, primarily in developing countries. More than 125 million children who should be in school are not. Aid in this area can help for rising living standards of people by increasing the number of literates.

- Improving Global Health: Donors are assisting in this area to save lives, prevent epidemic fatal diseases like HIV/AIDS or Hepatitis, and create a brighter future for people in the developing world²⁵.

- Protecting Natural Resources: Growing populations are consuming and polluting growing amounts of natural resources day by day. In order to maintain the supply of their basic needs to live, the nine billion people that the world is expected to have by 2050 will certainly in need of these resources.

²³ See Collier and Dollar (1999) for the efficient allocation of aid (under the assumption that aid has no effect on policy) to reduce poverty. Moreover, in the World Bank report *Assessing Aid* (1998), it is reported: "A \$10 billion increase in aid would lift 25 million people out of poverty – but only if it favors countries with sound economic management. By contrast, an across-the-board increase of \$10 billion would lift only 7 million people out of their hand-to-mouth existence." It is claimed in this report that 1 percent of GDP in assistance leads to 1 percent decline in poverty in country with sound economic management.

²⁴ In World Bank (1998), the share of agriculture in GDP is used as a measure of development and it is supported empirically that countries that have a larger share of GDP for agriculture are relatively less developed and have relatively less government spending. See Pack and Pack (1990) for an empirical study on aid and agricultural expenditure relation.

²⁵ For instance, there are programs under UN to prevent such illnesses. The Global Fund for Aids is an example for these programs.

Donors could also provide aid for strategic interests and political reasons. However, due to the economic focus of this study we will not detail them.

Foreign aid can be divided into two groups: bilateral (from one country to another) or multilateral (from international financial institutions to countries). As reported in World Bank (1998), bilateral aid is directed by donor agencies, such as U.S. Agency for International Development of Overseas Economic Cooperation of Japan. Some donor countries giving bilateral aid put an obligation on recipient to acquire goods and services from the donor. This type of bilateral assistance is called “tied”. Besides, Multilateral aid is distributed through international agencies, such as United Nations Development Programme and the World Bank or International Monetary Fund, and it is accumulated by contributions of wealthy countries.

Aid can be in the form of money, goods, services or technical assistance. It may be given as a grant, without repayment obligation, or as loans which will be repaid at lower rates and over longer periods than commercial bank loans (World Bank, 1998).

2.3.2 History of Foreign Aid

Aid has been shown as driven by the donor’s political or commercial interest²⁶. Then, gifts from one king to another in classical times should be encountered as aid too. However, since we defined aid as a general benefit to

²⁶ See Alesina and Dollar (1998); they found that the pattern of aid giving is affected by political and strategic considerations, indeed.

population of the recipient country we can omit the classical times while we are interesting in history of aid.

According to Moger (1999), all economic assistance was used to fund wars in the beginning. He declares “The only foreign aid, if one could call it that, dispersed by French economist Jacques Necker, studied during French Revolution years, was to the colonists in the New World who were fighting a rebellion against France’s enemy: England”. Another point in time of aid history is related to Industrial Revolution in the nineteenth century. After the revolution, England became the richest country in the world also which became the richest donor. England supported India to build railroads not only to support the industrial development of India but also to connect cotton industry and the armed forces in India.

As stated in Hjertholm and White (2000), the roots of aid can be traced as far back as the nineteenth century. The Act for the Relief of the Citizens of Venezuela in 1812 and in 1896, the beginning of the transfer of United States (U.S.) food surplus for the development of new markets are the two events at the beginning of US aid history. First discussion of official finance for colonies under Chamberlain in 1870s and first Colonial Development Act in 1929 are mentioned in the early years of U.K. assistance. Foreign aid in U.S. is reported to begin (1941) during World War II with lend-lease. U.S. foreign aid was in the form of grants which were planned to be used for the reconstruction projects of the postwar world. The International Bank for Reconstruction and Development (IRBD; also known as the World Bank) and the International Monetary Fund (IMF) were the sources of loans for these projects. After the formation of United

Nations (UN) in 1942, the United Nations Relief and Rehabilitation Administration (UNRRA) was established in 1943 to provide funds for postwar reconstruction. UNRRA, a large proportion of the funds of which were provided by U.S., spent \$4 billion for reconstruction. The Marshall Plan was announced in 1947 by George C. Marshall as a result of little UNRRA aid to Western Europe. Marshall Plan, known as the European Recovery Program, distributed over \$12 billion from 1948 to 1951. In 1956, the Soviet Union's aid program to the underdeveloped nations was announced. Soviet aid reached over \$6 billion by 1966 and it was generally in the form of technical and economic assistance with low-interest loans. Since the collapse of the Soviet Union, the American rationale for foreign aid has become politically more vulnerable.

As White (1992)²⁷ states; "Aid has grown dramatically in the post-war period, increasing by 4.2 percent per annum in real terms over the period 1960-88, to reach nearly US \$70 billion by 1988. In 1988 prices and exchange rates almost US\$ 1.4 trillion (thousand billion) has been disbursed during the last three decades"²⁸. Like cold war times²⁹, a large proportion of the foreign aid is shifted from economic to military assistance today. However, according to U.S. Agency for International Development, the Agency for International Development and the Export-Import Bank still provides loans for economic development.

²⁷ White (1992) basically study aid's macroeconomic and microeconomic impact on economic growth by introducing the macro-micro paradox of Mosley(1986).

²⁸ When recent data is examined (Source: World Development Indicators Online), while in 1970 world wide aggregate official development assistance is 6.9 billion US\$, in mid 1990s, jumps up to 68 billion US\$.

²⁹ During the period of cold war, U.S. foreign aid to Western Europe shifted from economic to military assistance.

While Japan was the world's largest foreign aid donor, followed by U.S., France, and Germany in the 1990s; in 2001, U.S. became the world's largest aid donor as a result of Japanese cutbacks in foreign aid. In addition, U.S. uses a third of its total assistance to Egypt and Israel; Japan's aid goes to the countries which vote identically with Japan in UN meetings; France gives aid to its former colonies (Alesina and Dollar, 1998). Recently, in 2004, the U.S. began the Millennium Challenge aid program. Today, about 15% of foreign aid is provided by international institutions like the World Bank (or IRBD), IMF, the International Development Association, and the International Finance Corporation; regional development banks; the European Development Fund; the UN Development Program; and specialized agencies of the UN, such as the Food and Agriculture Organization³⁰. Although it is stated in Burnside and Dollar (1997) and in Bulir and Lane (2002) that the support for aid within rich countries been declined in recent years, the recent G8 summit held in June 2005 ended with an agreement to boost aid for developing countries by \$50 billion (£28.8 billion) which means an increase in aid to GDP ratio of rich countries.

2.3.3 Macroeconomic Effects of Foreign Aid: Aid and Growth

Due to the main objective of aid, which is to increase the welfare of the population of the recipient nation, the impact of aid on the level of national income, growth and income distribution are the most studied areas in the

³⁰ See, "Foreign Aid National Interest Report: Promoting Freedom, Security, and Opportunity," U.S. Agency for International Development (2002).

literature. During this section, first, discussions and different approaches about the aid and growth relationship are going to be introduced. In the last part of this section, the focus will be on nonlinear models of growth in this literature including policy restrictions and aid interaction term, as well as the quadratic term of aid.

In White (1992) it is emphasized that some writers believe that the objective of increasing welfare is only a façade. For some writers on the left, the purpose of aid is spreading capitalism and support for political motives of the neo-classical powers and so they conclude, with other critics on left, that aid hurts rather than helps the poor (White, 1992). In addition, according to Burnside and Dollar (1997), the left believes that agencies have enforced structural adjustment policies on recipient countries but policies have not delivered the promised benefits, while the right believes aid supports large and inefficient governments that create bad environment for economic structure. White (1992) says critics from the right either see aid as an indefensible extension of the power of the state, supporting bureaucratic centralized states against the interests of economic development, or as a legitimate, but unsuccessful, attempt to procure political support from the developing world. However, as Burnside and Dollar (1997) conclude, both the right and the left were wrong in the period 1970-93 since foreign aid had no systematic impact on the economic policies that effect growth; strong positive effect on growth happened only in a habitat with both aid and good policies.

Some studies on aid and growth relation supports that a very large portion of foreign aid is wasted and has no effect on the recipient country's growth,

investment, and macroeconomic policies (Jepma, 1997; Boone, 1994 and 1996)³¹. Hansen and Tarp (2001), however, find a one-to-one relation between increased aid flows and increased investment, and their results confirm the existence of a relationship between aid, investment, and growth which is not dependent on good policy. On the other hand, there are some studies saying that the production shift from traded goods to non-traded goods as a result of aid inflows will reduce the rate of technical progress and, hence the growth rate of the economy (de Melo, 1988).

While the above mentioned studies look into the direct effect of aid, with no consideration of possible effects across different environment, there are some studies which supports aid is beneficial, or not wasted, only when macroeconomic policy of the recipient is stable and appropriate (Burnside and Dollar, 1997). Collier and Dollar (1999) state that aid is more effective for countries with sound policies. Similarly, Tornell and Lane (1999) show weak institutional structure combined with fractionalization of the governing elite produce wasteful spending of aid inflows. In Burnside and Dollar (2000), it is stated that aid is beneficial to real GDP growth if recipient government has good economic policies, such as those good at decreasing inflation, budget deficits and increasing trade openness. Due to this “ if ” part influencing the aid-growth relation, studies on aid’s impact conditional on different factors like macroeconomic policy (Burnside and Dollar, 1997 and 2000), geography (Hansen and Tarp, 2001; Dalgaard, Hansen, and Tarp, 2002), local financial markets (Favara, 2003; Nkusu and Sayek, 2004), external

³¹ Before these studies, Pearson (1969) acknowledge that there is no correlation between aid and growth. However, the absence of correlation is irrelevant when causality is studied.

shocks (Guillaumont and Chauvet, 2001; Mosley, 1980) and on the role of government policy (Dowling and Hiemenz, 1982), savings and taxes (White, 1992; Bowles, 1987), investment (Levy, 1987; Chaudhuri, 1978) or competitiveness (Rajan and Subramanian, 2005a; Rajan and Zingales, 1998), emerged.

Recipient country's situation and foreign aid relation is also discussed by Rajan and Subramanian (2005b) with a new perspective to explain aid-growth relation with their instrumentation strategy. Their instrumentation strategy is crucial since, as they stated, aid may go to countries currently suffering from a natural disaster which would explain a negative correlation between aid and growth or it may go to ex-aid receivers who have used it well before which implies, if growth is persistent, there will be a positive correlation between aid and growth. That is, there may be a negative or positive correlation between aid and growth but this would not reflect the causation from aid to growth. Rajan and Subramanian (2005b) find no significant evidence that aid works better in better policy or institutional or geographical environments, or that certain types of aid work better. Besides, Easterly (2001) argues that neither good policies nor exogenous shocks can explain much of the poor growth performance in developing countries. On the contrary, Burnside and Dollar (1997), Roodman (2004), and Clemens *et al.* (2004) find that aid affects growth. In order to explain this unrobust relation of aid and growth White (1992) introduces the macro-micro paradox of Mosley (1986) which states that "Even though summaries of micro-level evaluations have been, by large, positive those of the macro evidence are, at best, ambiguous". White (1992) also states that if aid either allows government

expenditure to be redirected into non-productive activities (that is, it crowds out public investment) or crowds out private activity then it may have little or no impact on the level or rate of growth of national income. Younger(1992) also adds that aid usually can not be used to acquire foreign assets, even though some private inflows could be offset by private foreign asset purchases.

Another growth-aid relation study is Bulir and Lane (2002) arguing aid promotes economic growth since the recipient country is able to finance more rapid accumulation of capital. They substitute the Harrod-Domar model (in which effectiveness of aid in contributing growth depends on the productivity of capital endogenous growth model) by the endogenous growth model and observe that this substitution causes aid to affect growth by aid's usage of human capital.

As reported in Lensink and White (2001), aid to developing countries has risen to large amounts during the last two decades. According to Lensink and White (2001), "Whereas in the late 1970s only eight countries had aid to GNP ratios in excess of 20 per cent, and none higher than 50 per cent, by the first half of the 1990s 26 countries had aid ratios of 20 per cent or more, with four countries having ratios greater than 50 per cent." Moreover, it is added in Lensink and White (2001) that "A greater number of countries can be classified as high aid recipients in the 1990s than was the case in the 1970s, and that there has emerged a class of very high aid recipients". Since \$50 billion boost for aid to developing countries was committed during the recent G8 summit held in 2005, this pattern seems to preserve its validity in the future.

There are some theoretical and empirical works analyzing the effects of high aid inflows. It is believed that there exists a capacity for each country to absorb or

to manage further inflows of aid. The acceptance of such a limit point brings the notion of diminishing returns to aid as well. The World Bank report *Assessing Aid* supports that if an inflow of aid is above a certain amount, then it turns out to have negative effects on the recipient economy. Lensink and White (2000 and 2001) also support that this negative returns of further inflows of aid at high levels.

The negative return of further inflows of aid after a certain level is in fact suggestive of an aid Laffer curve³². It represents the benefits from aid increase at initial stages, however decreasing after a certain level of aid inflow. Thereby, the aid Laffer curve supports that aid below a certain level is more beneficial for the recipient country.

In Lensink and White (2001), the existence of an aid Laffer curve is confirmed. However, while modeling growth, Lensink and White (2001) observe that significance of the quadratic term of aid is quite sensitive to the countries included in the estimate.

In the literature of growth and aid relation, Hadjimichael, *et al.* (1995), Durbarry *et al.* (1998), Lensink and White (1999 and 2001), Burnside and Dollar (1997 and 2000), Hansen and Tarp (2000 and 2001), and Nkusu and Sayek (2004) all build non-linear models to explain growth with the help of foreign aid. Burnside and Dollar (2000) introduce an interaction term between aid and an index of economic policy, and support empirically that the interaction term of aid and policy has a threshold effect, which leads aid's positive contribution to growth under good policy condition. In World Bank (1998), the estimated impact of aid in

³² See Griffin (1970) or Lensink and White (1999 and 2001) for details. According to Griffin (1970), aid scales down the productivity of investment, therefore, if this effect is sufficiently large, then aid may contribute to decrease in growth.

country with good policies is found to be positively significant, and this conclusion is based on a growth model with a significant interaction term of aid and policy and insignificant aid term. On the other hand, although the estimated impact of aid with poor policy environment is found to be negative, it is not significant. Hadjimichael, et *al.* (1995), Durberry et *al.* (1998), Lensink and White (1999) all include aid squared as a regressor in the growth model and find positive, but decreasing marginal returns to aid flows, that is, significantly positive aid term with a significantly negative aid squared term. In Lensink and White (2001), for instance, the quadratic term of aid is found to be significant when extreme outliers in the data set are omitted. Hansen and Tarp (2000), on the other hand, note that both squared aid and interaction terms can be included in the model as a second order approximation of standard Solow growth model. Following, the general model Hansen and Tarp (2001) include aid, aid squared, aid times policy index, and policy squared. Policy squared term and interaction term of aid and policy are not found to be significant. It is found that aid increases growth in any policy condition. The decreasing marginal returns of aid is captured by significantly negative coefficient of aid squared term. However, significance of this term depends on the choice of estimators and control variables in the model of Hansen and Tarp (2001).

Nkusu and Sayek (2004) study whether the development level of financial markets affects the effectiveness of aid on growth. It is stated that the choice of sterilization instruments as well as the volume and timing of sterilization becomes crucial because of its effect on interest rate and nominal exchange rate. Nkusu and Sayek (2004) add that while sterilization through sales of large foreign exchange

creates real exchange rate appreciation via the nominal exchange rate appreciation, the sterilization through treasury bills in a shallow domestic money market increases both level and volatility of domestic interest rate. At this point, the level of financial market development is used as a measure of the absorptive capacity of the domestic securities and foreign exchange markets.

As stated in Nkusu and Sayek (2004) developed financial markets facilitate efficient allocation of financial resources and ease the monetary authorities' control on monetary and exchange rate management, so as to reduce the possible negative effects of foreign aid on the economy. Moreover, as stated in Neyapti (2003), developed financial markets which prefer extending credit to the private sector rather than the public sector, offer less inflationary opportunities to the central bank by allowing the central bank to generate maximum profits. The upward impact on domestic spending indicates only a small portion of overall effect of foreign aid on the recipient economy. The rest can be related to the changes in the level and variability of interest rates and real exchange rate, caused by increased domestic liquidity and foreign exchange availability, depending on the level of aid's management by recipient authorities (Nkusu and Sayek, 2004). Nkusu and Sayek (2004) support empirically that financial market depth, an indicator of monetary authorities' capacity to manage aid inflows, boost aid effectiveness.

Following such studies, the effect of aid on the improvement of receiving countries' policies is questioned. Bauer (1979) concludes that aid is an inefficient instrument for stimulating development in low-income countries and it played a significantly negative role in those countries by encouraging waste and corruption.

Likewise, Knack (2001) and Alesina and Weder (2002) support the hypothesis that aid levels decrease the quality of governance or increase corruption. On the contrary, Burnside and Dollar (1997) state that there has been a shift among developing countries in favor of better policies. Similarly, Alesina and Dollar (1998) show that aid encourages the adoption of democratization and openness.

2.3.4 Aid and the Dutch Disease

We decide to divide this section into two; in section 2.3.4.1, we first review the relation of real exchange rate and aid, and in section 2.3.4.2, we link the real exchange appreciation to the “Dutch Disease” in the context of foreign aid literature.

2.3.4.1 Aid and Real Exchange Rate

Literature on aid provides many examples of the effects of aid on real exchange rate as well as the impact of it on growth. Among many of them, while Younger (1992) and Vos (1998) supported empirically the effect of aid inflows on real exchange rate appreciation, Nyoni (1998) found aid inflows to depreciate it. Moreover, Dijkstra and van Donge (2001) found no impact. De Melo (1988) suggests that aid over GDP ratios are neither unstable nor high enough for the real exchange rate to be affected significantly by foreign aid. However, as White (1992) explains; “...Whilst this may be true for large countries (such as India) or low aid recipients (mostly in South East Asia and Latin America), it is not so for most of Sub-Saharan Africa where aid is both high and unstable”.

White (1992) goes on his explanation about aid effects with the model of the dependent economy in which capital is accepted to be sector specific, labor is mobile between sectors and relative price of non-traded goods is the real exchange rate, then the increase in the relative price of non-traded goods means a real appreciation³³. The model supports the hypothesis of an increase in relative price of non-traded goods (which can also be stated as the appreciation in real exchange rate) as a result of spending some part of the aid inflows on them. Moreover, it is added that this appreciation pressure in the real exchange rate is greater when: (i) the marginal propensity to spend on non-traded goods is greater, (ii) their supply responsiveness is lower, (iii) the demand responsiveness to price changes is lower, or (iv) the policy coordination to sterilize aid is lower³⁴. To consider the temporary behavior of aid inflows, a two-period process is designed for aid in White (1992). In the first period, an appreciation of real exchange rate followed by a shift of domestic resources from traded goods production to non-traded ones'. In the second period, aid flow is assumed to cease and the model takes account the shift of resources back into the traded goods sector. This depreciation in real exchange rate causes a welfare loss because of "learning by doing" in traded goods sector³⁵.

³³ See van Wijnberg (1985 and 1986) and Edwards and van Wijnbergen (1989) for details.

³⁴ This last statement is added by Bulir and Lane (2002) to White (1992)'s first three statements about the upward pressure on real exchange rate.

³⁵ As Bulir and Lane (2002) express, the shift in production from tradables to nontradables rises the possibility of a loss of positive externalities associated by "learning and doing" or another kind of distortion. However, following this, the distortion should be dealt with rather than discouraging aid inflows.

As a result, White (1992) supports the policy response of subsidizing export production in the first period. van Wijnbergen (1984 and 1985), also concluded that larger aid inflows causes larger export subsidies.

2.3.4.2 Dutch Disease

In Nkusu and Sayek (2004), it is stated that the impact of aid on real exchange rate appreciation can be examined in the context of “Dutch Disease” problem. Furthermore, White (1992) and Arellano, *et al.* (2005) both acknowledge that large aid inflows in low income countries may present similar effects to Dutch Disease, i.e. the logic behind the two is similar. Dutch Disease was extended to the effects of foreign direct investment in transition and emerging economies, as well.

The phrase “Dutch Disease” was first used during the discussions following the sudden discovery of large natural gas deposits in the Netherlands³⁶. It is the adverse impact of the gains of natural resource discoveries on the manufacturing sector, linked to a real exchange rate appreciation as explained by Arellano, *et al.* (2005). Moreover, they define Dutch Disease as a transfer problem, which is believed to result in higher imports and lower exports associated with the appreciation of real exchange rate. Besides, Younger (1992) declares that: “The Dutch Disease refers to problems that a booming export sector causes to the rest

³⁶ See Corden (1984), Gelb (1980), Cordon and Neary (1982) or Torvik (2001) for the details in definition of Dutch Disease. Especially for empirical examples in Africa see Musanda and Luvanda (1991) or Younger (1999).

of the economy”³⁷. Related with foreign aid, Bulir and Lane (2002) explain it as a decrease in the production of tradable goods of recipient country.

Like a number of observers have mentioned, Arellano, et *al.* (2005) state that aid increases tradable’ s supply and, *ceteris paribus*, decreases their price. Following that, it increases the demand for and price of nontradable. This mechanism redirects factors of production towards the production sector of nontradable. In Nkusu and Sayek (2004) it is stated that consumption increases in both goods after the aid inflow. The increased demand for tradable can be satisfied by imports, without changing the structure of domestic production. As Younger (1992)³⁸ also supports, the expenditure on imports creates no direct effect on the money supply or aggregate demand in the economy, i.e. the balance of payments shows a capital account and an offsetting current account deficit. However, demand for domestic goods and services create problems for macroeconomic management. As stated in Younger (1992), the increase in aggregate demand for Ghanaian goods will begin to drive prices up, fostering the inflation’s persistence in Ghana.

At the same time, changing foreign exchange into local currency for making local purchases increases the money base. Moreover, as Nkusu and Sayek (2004) state, the increase in demand for nontradable can affect relative prices, international competitiveness, and the structure of domestic production since this type of increase would require a positive domestic supply response. Nkusu and Sayek (2004) state that if the price of nontradable increase but an excess capacity

³⁷ See Hill and Mokhehi (1989) or Cuddington (1989) for the details in temporary boom sector.

³⁸ According to Younger (1992), capital from aid is spent on either imports or domestic goods and services.

or idle production factors exist in the economy, the real exchange rate would appreciate without an alteration in the domestic production structure damaging to tradable, particularly exportable. “In the absence of excess capacity, such an alternation would occur” as Nkusu and Sayek (2004) say. Note that the export industry of a low-income country is crucial for its growth performance since trade is theoretically studied to be the engine of growth (Barro and Sala-i-Martin, 1997). Hence, more attention is now paid to studies about aid’s effects by way of decrease in exports rather than increase in imports.

As stated before, large aid inflows make the consumers of the recipient country spend more on both tradable and non-tradable goods. The change in relative shares of both goods, however, depends on the elasticity assumptions (Bulir and Lane, 2002). The elasticity conditions determine the changes in the structure of economy and factor gains³⁹ as well as the changes in the relative prices. Depending on the elasticity assumptions, aid can cause consumption shift⁴⁰ from tradable to non-tradable goods with higher relative price, or if it is used for investment in productive capacity that would not have been implemented in the absence of aid, it can cause Dutch disease (Bulir and Lane, 2002).

³⁹ See Bulir and Lane (2002) and White (1992) for details. Bulir and Lane (2002) say: “If capital and labor are free to move between sectors, the factor used intensively in the nontradable sector gains and the other factor loses; on the usual assumption that nontradable are more labor-intensive than tradable, economy-wide real wages rise and real returns to capital fall. Suppliers of any factor of production that is specialized in nontradable -e.g. workers with specialized skills- tend to gain at the expense of specialized factors used in the tradable sector.” Moreover, the shift in consumption from traded goods to non-traded goods is related with the fungibility of aid in Bulir and Lane (2002). In the case of consuming aid as tradable, which can be assured or obligated by donors, if aid is fully fungible then the effect of aid is similar with the one described in quotation mark.

⁴⁰ This shift was explained in a similar way of capital inflow consequences by Kohli (2001) and Buffie et al. (2004).

When the flow of aid is temporary, the structure of production and consumption is not required to adapt fully to the period of aid receiving. If the government suspects temporariness then ensuring saving rather than consuming is a preferable policy for the government. So the policy decision for temporary aid becomes where to invest: in foreign assets, domestic public assets, or domestic private assets. According to Younger (1992), the first option is the easiest and most practical since it not only saves the temporary income but also automatically sterilizes the impact on aggregate demand. Sterilization is achieved by offsetting the capital account credit directly while accumulating the foreign assets, and no demand falls on domestic goods. Last but not least, it allows government's reserves to strengthen by increasing foreign exchange stocks. According to Calvo, *et al.* (1995) and Prati, *et al.* (2003), when the inflow is temporary, targeting the real exchange rate, letting inflation and/or the real interest rate increase may help improving the welfare and preventing from "Dutch disease" or other adverse effects of a temporary real appreciation.

When aid is permanent, however, the correct policy is to absorb the aid with increased imports according to Younger (1992). To achieve this, an appreciation of the real exchange rate is vital in an economy with free trade. However, the government can still prevent real appreciation by removing the controls so as to foster the demand of import through liberalization rather than a real appreciation, to the extent that import or foreign exchange controls exist⁴¹. On the other hand, for managing a large and persistent aid inflow, Buffie *et al.* (2004) suggest little or

⁴¹ See Younger(1992) to examine the similar policy in Ghana where the real exchange rate has remained almost constant in recent years while import controls have been removed gradually.

no sterilization of increases in the monetary base as optimum short-run approach when the credibility of policymakers' commitment to low inflation is firm. The combination of changes in inflation, nominal and real exchange rates, and real interest rates becomes the most important decision for policymakers to absorb aid shock according to Buffie et *al.* (2004).

CHAPTER 3

METHODOLOGY AND DATA

3.1 The Methodology

To investigate the relationship between foreign aid and inflation, while considering the impact of FMD on this relation, the panel data approach is used. In this section, the methodology based on a panel data approach is going to be explained.

There are many benefits of panel data that motivates us during our study by expanding our opportunities. First of all, since it covers both time-series and cross-sectional data the size of the data set is obviously much larger. This situation is likely to produce more reliable parameter estimates, and most importantly, enables the researcher to study more complex and sophisticated models which incorporate less restrictive assumptions. The increase in sample size makes it possible to provide more information, more variability, less collinearity among the variables⁴², more efficiency and more degrees of freedom. One other crucial identity of panel data is its allowance for individual heterogeneity. Since we are studying a set of different countries, we should account for this country heterogeneity. Otherwise, our results may lead to serious misspecifications⁴³.

⁴² When the explanatory variables vary in two dimension they are less likely to be highly correlated.

⁴³ See Hsiao (1985) for a detailed account of the benefits and limitations of panel data.

Moreover, it gives opportunity to study the dynamics of adjustment. With the help of dynamic panel approach, we can consider not only the contemporaneous relation between aid and inflation, but also dynamic characteristic of inflation. While modeling inflation, we primarily take into account the persistence of inflation. Thus, adding the first lag of the inflation variable into the model is the main reason for us to use dynamic panel data approach, indeed.

Although panel data approach have many special feature that can not be managed neither by time-series nor by cross-country data approach, it has some limitations. For instance, data collection is an important problem for panel data⁴⁴. We have missing values for each series, indeed. As a result, our panel data is unbalanced.

The model we use during our study is given below:

$$y_{it} = \sum_{k=1}^m \alpha_k y_{i,t-k} + \beta'(L)x_{it} + \gamma_i + \varepsilon_{it} \quad i = 1, \dots, N; \quad t = m+1, \dots, T_i$$

with i denoting individuals, in our case countries, and t denoting time. The i subscript, therefore, denotes the cross-section dimension whereas t denotes the time-series dimension. Then, N is the number of individuals, T_i is the length of time period for the i th country and m is the maximum lag length in the model. In addition, α is a vector of scalars, $\beta(L)$ is a vector associated polynomials in the lag operator (β is $K \times 1$), x_{it} is a vector of explanatory variables (i.e., the it th observation on K explanatory variables), γ_i denotes the unobservable individual specific effect, and ε_{it} denotes the remainder disturbance.

⁴⁴ For other limitations like distortions of measurement errors, selectivity problems, and short time series dimension, see Baltagi (2003).

The number of time periods available for the i th country, T_i , is assumed to be small while N is large. $\gamma_i \sim \text{IID}(0, \sigma_\gamma^2)$ and $\varepsilon_{it} \sim \text{IID}(0, \sigma_\varepsilon^2)$ are independent of each other and among themselves. Autocorrelation due to the presence of a lagged dependent variable among the regressors and individual specific effects characterizing the heterogeneity among the individuals both make dynamic panel data approach problematic. For the fixed effects specification, the problem arises as a consequence of the relatively short time series component, typical of most panel data sets, which makes ordinary least square (OLS) estimators biased (Nickel, 1981). In the random effects specification, generalized least estimators are biased since y_{it} and $y_{i,t-k}$ is both a function of γ_i , as a result, $y_{i,t-k}$ is correlated with the error term ε_{it} (Sevestre and Trognon, 1985). The most favored form of consistent estimation method for both fixed and random specifications is that of instrumental variables and generalized method of moments (GMM) estimation. Among consistent estimators of GMM, like Anderson and Hsiao (1982), estimators proposed by Arellano and Bond (1991) generally perform more efficiently. Arellano and Bond (1991) propose a GMM estimator which optimally exploits all the linear moment restrictions linking to the assumption of no serial correlation in the errors, in an equation with individual effects, lagged dependent variables and no strictly exogenous variables⁴⁵.

The estimation method developed by Arellano and Bond (1991) that utilizes GMM and accommodates the use of an unbalanced panel data is facilitated during

⁴⁵ See Arellano and Bond (1991), Arellano and Bover (1995), Kiviet (1995), and Ahn and Schmidt (1995 and 1997) for more detail about dynamic panel data estimators.

our study. With the help of the computer software packages GiveWin2.1 and Ox Version 3.10 (see, Doornik, 2001 and Doornik, et *al.*, 2002) we managed to test the hypothesis which are going to be introduced below and do appropriate GMM estimations on our unbalanced dynamic panel data model. The code facilitated during the analysis is based on the sample code named “abest1.ox” presented in Doornik, et *al.* (2002).

The estimation method starts with taking first differencing of all variables in the model so as to remove the country specific fixed effects. As a result of this differencing procedure, degrees of freedom decreases by the number of cross-section observations, N . Moreover, if the disturbances ε_{it} are not serially correlated in the beginning, taking first differences cause differenced residuals (i.e. $\hat{\varepsilon}_{it} - \hat{\varepsilon}_{i,t-1}$) to have significant negative first order serial correlation but no second order serial correlation. Here, instrumental variable technique, which is consistent when the lagged dependent variable with further lags of the same variable is instrumented, becomes the essential tool to overcome this serial correlation problem. Our set of instrumental variables consists of all explanatory variables, except the first lag of the dependent variable (the real rate of depreciation), and GMM-type instruments consist of dependent variable from lag 2 to 99.

The use of too many instruments may result in overfitting biases. The validity of extra instruments in levels equations and moment conditions of the residual term can be tested using Sargan tests. The Sargan test is the only test that is based on the two-step GMM estimator and is heteroskedasticity consistent. The

null hypothesis of Sargan test is:

H₀: The instruments are valid

If the null hypothesis is not rejected, it can be concluded with the accepted level of confidence that the instruments are valid. The test statistic is asymptotically distributed as Chi-Square with as many degrees of freedom as overidentifying restrictions under the null.

The other test we consider during our study is the AR(m) tests which are used to test serial correlation of order m . As we mentioned before, since we are taking first differences of serially uncorrelated errors, ε_{it} , $E(\varepsilon_{it} \varepsilon_{i,t-1})$ need not to be zero, but the consistency of GMM estimators depends on the satisfaction of the assumption that $E(\varepsilon_{it} \varepsilon_{i,t-2})$ is equal to zero. Hence, there should be evidence of significant negative first order serial correlation in the differenced residuals but no evidence of second order serial correlation in the differenced residuals. Then, the null hypothesis of AR(m) tests is:

H₀: No serial correlation of order m in the error term (consistency of estimators)

If the null hypothesis is rejected, then there exists serial correlation of order m . DPD reports both the tests for the absence of 1st and 2nd order serial correlation in the first differenced residuals. Our main concern is the lack of second-order serial correlation in the first difference residuals. If the null of second-order serial correlation is not rejected then errors in the model can be concluded to be both uncorrelated and random walk in levels. In Arellano and Bond (1991), this test is called m_2 test. The test statistic is asymptotically distributed $N(0,1)$ under the null hypothesis.

The last test we are interested in is the Wald test. It can be used to test any group of explanatory variables' significance in the model. The Wald (joint) test statistics represented in the tables is based on all explanatory variables. The null hypothesis of Wald (joint) test is :

Ho: *The coefficients of all explanatory variables are equal to zero (i.e. $\beta = 0$)*

Then, by rejecting the null, it can be concluded that at least one explanatory variable in the model is statistically significant. Similarly, the null hypothesis of Wald (dummy) tests the significance of dummies (including the constant term if we attain constant term in the dummies set). In addition, Wald (*Aid aid*iprvtcred*) tests the joint significance of term *Aid* with term *aid*iprvtcred*, while and Wald (*Aid aid*iprvtcred sqaid*) tests the joint significance of *Aid*, *aid*iprvtcred*, and *sqaid* terms⁴⁶.

3.2 Data and Variables

Fundamentally, the econometric approach for the present study is based on the previous literature investigating determinants of cross-country and time-series variation in inflation. For the specification of our model that allows investigation of our hypothesis, we most follow Neyaptı (2003) closely but not replicate. Neyaptı (2003) develops a model of inflation as a function of its first lag, budget deficits, the rate of growth of base money, and the rate of growth of real GDP, all lagged two periods, in addition to various measures of both CBI and FMD.

⁴⁶ The decision rule used for each of the tests is rejecting the null hypothesis, *Ho* if p-value < α significance level.

From Neyaptı (2003) we observe the variables of interest. However, we do not initially considered lags in this relationship. As a robustness check later on, we explore the lagged effects of these variables. Initially, we try to model inflation as a function of its lag, aid in percentages of gross income (GNI), the rate of growth of reserve money and real GDP, and a variable which reflects aid and FMD interaction. Our contribution is the discussion of aid and aid's interaction with FMD. At early stages of modeling, budget deficit is pondered to be put in the model since it is accepted as a significant component to explain inflation in literature⁴⁷. However, there exists a relationship between aid and budget deficit since foreign aid can be used for financing budget deficits. Therefore aid's effect can be captured through budget deficit's positive effect on inflation. Since, in our model, the primary cause of inflation is thought to be aid, and not the deficit itself, we focus on aid rather than budget deficit.

Hence, our basic economic data set consists of GDP deflator, aid in percentages of GNI, the rate of growth of base money (currency plus bank reserves at the central bank); and the rate of growth of real GDP.

In addition, we consider the outliers in foreign aid and inflation series by including dummies. Furthermore, we allow for nonlinearities by including the product variable generated by the squared aid. For further steps in modelling, we also consider the volatility of growth of real GDP.

This study analyzes the dynamic relationship between dependent and independent variables with the help of a panel data set. The data set consists of 60

⁴⁷ In Neyaptı (2003) budget deficit is found to be inflationary. See Sargent and Wallace (1981) and Catao and Terrones (2003) for further discussions about fiscal deficits and the dynamic relationship between inflation and deficit, respectively.

countries over the 1975 to 2004 period. Each country's time series covers different number of observations, that is, the panel data is unbalanced. Full data set is drawn from three main sources: World Bank - World Development Indicators Online (WDI Online), The World Bank Financial Structure Database, and IMF's International Financial Statistics (IFS) CD-ROM version 1.1.54. Appendix A provides a detailed explanation of the panel data set including data sources, variable names and abbreviations, and all of the derivations (showing all calculations and formulations).

The main dependent variable is inflation in the model. Inflation is calculated as a percentage rate of increase in the GDP deflator (*GDPdef*). *GDPdef* series is compiled from World Bank national accounts data and Organization for Economic Cooperation and Development (OECD) National Accounts data files. *GDPdef* is measured by the ratio of GDP in current local currency to GDP in constant local currency in which the base year varies by country. However, to omit the possibility of biases resulting from large variance in inflation series, it is decided to use a transformed form of inflation which is denoted by D ⁴⁸ and corresponds to the real rate of depreciation in money stock. D is the perfect substitute of the inflation rate⁴⁹. In addition, in order to control the effects of past D on current D , the first lag of D ($D(-1)$) is inserted in the model as an explanatory variable. In the data set lowest D value is the St. Vincent & Grens. (1975), while the maximum is reached at Nicaragua (1988)⁵⁰.

⁴⁸ See Appendix A.2 for derivation: $D = \frac{\pi/100}{1 + \pi/100}$ where π denotes the inflation rate.

⁴⁹ Cukierman et al. (1992) and Neyaptı (2003) prefer to use this variable rather than the inflation rate for the same reasoning.

⁵⁰ See Appendix C Table of descriptive statistics for details.

Foreign aid (*Aid*) is measured as a share of GNI which includes both official development assistance (ODA) and official aid. Ratios are computed using values in U.S. dollars converted at official exchange rate. The source of this series is Development Assistance Committee of the Organization for Economic Cooperation and Development, and World Bank and OECD GNI estimates⁵¹. In our data set, the highest amount of foreign aid recipient is Rwanda (1994), while the lowest is Malaysia (1996).

Economic growth is measured as the rate of growth of real GDP (*gGDP*). *gGDP* series is compiled from World Bank national accounts data and OECD National Accounts data files. GDP growth rate is measured by annual percentage growth rate of GDP at market prices based on constant local currency. GDP 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 (WDI Online).

Reserve money (*resvM*) is compiled from IMF's International Financial Statistics (IFS) CD-ROM in national currency.

As mentioned before we search for the interaction of foreign aid and financial market development. There are several indicators of FMD suggested in the literature⁵². Financial deepening and the share of banking sector credit to the private sector in the total banking sector credit are among most commonly used measures of FMD in the literature. Burnside and Dollar (2000), Hansen and Tarp (2000), Neyaptı (2003), and Nkusu and Sayek (2004) are all used at least one of

⁵¹ Source: World Development Indicators (WDI) Online, World Bank.

⁵² See, King and Levine (1992 and 1993), and Ghani (1992).

these measures during their studies. Although neither of these indicated measures are the ideal measure for FMD (Neyaptı, 2003), to make sure our results are robust to the choice of FMD measures, we use a selection of FMD measures.

FMD is measured as follows, in line with literature. Four variables are included in our study. First, we introduce liquid liabilities to GDP (*Liqliab*) which is calculated by broad money (money and quasi money) as a share of GDP, i.e. M2 in ratio to GDP. This measure includes the central bank, deposit money banks, and other financial institutions, which makes it a measure of overall size of the financial sector without distinguishing between different financial sectors and institutions. Second, we use private credit by deposit money banks to GDP (*Prvtcred*), measured as the credit extended to the private sector by deposit money banks divided by GDP. Third, we use private credit by deposit money banks and other financial institutions to GDP (*Prvtcrednofi*), measured as the value of private credits extended by all financial intermediaries over GDP. Finally, the share of private sector credit in the total domestic credit in the financial system (*Shareprvt*) is used as an alternative measure of FMD. It is measured by dividing domestic credit to private sector (*Domcredtoprvt*) to domestic credit provided by banking sector (*Domcred*). While first measure captures the size, the last three measures all capture how much of financial intermediation is to the private sector, in other words is efficient.

While both *Domcredtoprvt* and *Domcred* are compiled from World Development Indicators Online, the other indicated measures of FMD are all compiled from The World Bank Financial Structure Database. To obtain variables that are easy to interpret before using them in interaction with aid, they are

normalized by dividing them to the maximum value in each series⁵³. Thus, the normalized variables of *liqliab*, *Prvtcred*, *Prvtcrednofi*, and *Shareprvt* (denoted as *iliqliab*, *iprvtcred*, *iprvtcrednofi*, and *ishareprvt*, respectively) have a scale ranging between zero and one.

Openness to trade, another determinant of inflation in the literature, is measured by trade as a share of GDP (*trade*). It is equal to the sum of exports and imports of goods and services measured as a share of GDP and compiled from World Bank national accounts data, and OECD National Accounts data files (WDI Online).

3.3. Hypotheses

During this section specification of the empirical inflation model and the motives while shaping the model are going to be presented depending on the previously introduced information about the variables.

In order to explain inflation, this study incorporates some variables parallel to the inflation and foreign aid literature. Especially, the foreign aid is the most discriminating explanatory variable among others, since to the best of our knowledge, the literature presents no example of an empirical study in which inflation is explained directly by aid. Even though, among others, Roemer (1989) and Younger (1992) mention about aid's impact on inflation, they do not report a significant relationship or an empirical study. We hypothesize aid inflows have

⁵³ Burnside and Dollar (2000) and Neyaptı (2003) also use indices.

inflationary effects, however, when the financial markets are developed enough this effect lessens.

To capture the impact of past inflation on current inflation and consider the persistency of inflation, lagged values of the dependent variable are included in models. Both Liu and Olumuyiwa (2000) and Neyaptı (2003) (among others) propose lagged values of inflation and find a positive and significant relationship between past and current values of inflation. After adding $D(-I)$ to the set of explanatory variables, this study also hypothesizes that there is positive causality from previous to present inflation, that is, high inflation in the past foretells higher inflation at the present.

Like $D(-I)$, GDP growth is also acknowledged to be a commonly used determinant of inflation in the literature. It captures the generally approved traditional Phillips curve behavior which supports the negative relation of unemployment and inflation. Since $gGDP$ measures the economic growth rate, it changes as the amount of principal resources of capital and labor in the economy changes. Moreover, as unemployment of factors of production increases, production decreases. Hence, there exists a positive relationship between inflation and $gGDP$ since unemployment and $gGDP$ negatively related. As a result, we expect a significant positive coefficient of GDP growth in the model.

The growth of reserve money variable ($gresvM$) works here to include expansionary monetary effects. It captures the inflationary effect of an excess supply of money. In order to maintain the equilibrium point of supply and demand for money, monetary models support an increase in prices when the amount of money in the economy becomes greater than the amount of the public's desire to

hold. That is, an excess supply of money can be followed by an upward pressure on inflation like an excess demand for goods does. As a result, as the growth of reserve money increases we expect inflation to increase⁵⁴.

As reviewed in the previous chapter, literature on foreign aid presents different scenarios of aid effects, such as altering the level and variability of both interest rates⁵⁵ and real exchange rate, since it increases domestic liquidity and foreign exchange availability, as well. Some studies, like Burnside and Dollar (2000), Hansen and Tarp (2000), Neyaptı (2003), and Nkusu and Sayek (2004), linked the magnitude of all these changes to the recipient economy's capacity to absorb or manage inflows of aid. Especially, sterilization was referred as an action to manage aid, or namely to decrease inflationary pressure (Buffie *et al.*, 2004)⁵⁶. The management is reported to be successfully performed in developed financial sector, especially in deep financial markets, since developed financial markets facilitate efficient allocation of financial resources and ease the monetary authorities' control on monetary and exchange rate management (Nkusu and Sayek, 2004). Moreover, Maliszewski (2003) experienced for Georgia that "further accumulation of foreign reserves and development of indirect monetary control instruments, which would be facilitated by deeper treasury bill market, would increase the capacity of the central bank to respond to shocks". That is, the state of financial system, namely financial depth, is accepted to be the main

⁵⁴ McCandless and Weber (1995) empirically supports a very close correlation between the rate of growth of monetary aggregates and inflation. See Lucas (1996) for details.

⁵⁵ In Nkusu and Sayek (2004), it is stated that the sterilization through treasury bills in a shallow domestic money market increases both level and volatility of domestic interest rate.

⁵⁶ For instance, if it is possible, decreasing the amount of incoming aid flow to that country may be another way of preventing from inflationary pressures.

indicator of this capacity in the literature. As it is widely used in the literature, it is going to be measured by M2 as a share of GDP⁵⁷.

The high share of private sector credit in the total banking sector, by the way, indicates that banks are working effectively since it also indicates that banks are able to give more credit to private sector rather than public sector, i.e. less loans to state sector. This means private sector is managed to be involved in the economy more and financial and state sectors become more independent (Neyaptı, 2003). Hence, while capturing the efficiency level of the market mechanism, this variable reflects of the development level of financial markets, as well.

We hypothesize that developed financial markets improves the overall effect of aid on inflation. After identifying the characteristics of FMD measures, it can be concluded that higher values of each measure means higher development level for financial markets. Since it is hypothesized that good financial environment affects the performance of foreign aid, aid term interacted with a measure of financial development variable.

The previous literature on growth and aid relation has supportive examples of improved aid effectiveness on countries with deeper financial markets⁵⁸. These studies also make us eager to test the significance of aid and financial depth interaction.

⁵⁷ Among others, Burnside and Dollar (2000), Hansen and Tarp (2000), Neyaptı (2003), and Nkusu and Sayek (2004), all use M2 in ratio to GDP as an indicator of financial market development. In addition, it is accepted to be a valid measure of the management or absorptive capacity of the domestic securities and foreign exchange in these studies.

⁵⁸ See Nkusu and Sayek (2004).

After introducing the list and the description of the control variables, the general form of the relationship follows as:

$$D = f(\text{lagged } D, \text{Aid}, \text{other control variables}) \quad (3.3.1)$$

As a starting point, we merely look at the direct effect of aid on inflation without considering the effect of FMD. This can be specified as:

$$D = f(\text{lagged } D, \text{Aid}, \text{gresvM}, \text{gGDP}) \quad (3.3.2)$$

With the help of equation (3.3.2) we try to search for the mere relation between aid and inflation.

After checking for causality between aid and inflation, we start to look for the effect of FMD, and hence our model becomes:

$$D = f(\text{lagged } D, \text{Aid}, \text{gresvM}, \text{gGDP}, \text{Aid}*\text{FMD}) \quad (3.3.3)$$

where $\text{Aid}*\text{FMD}$ denotes interaction between aid and financial markets. Aid is also included as explanatory variables in the analysis as our vital explanatory variable. We use separately the FMD indicators on different runs to check for the robustness of the findings.

For robustness check, we create dummies for inflation (di) and aid series (da) in order to deal with hyperinflation cases and omit outliers in foreign aid series, respectively⁵⁹. The dummy for inflation, di , is equal to one when inflation is greater than 100 %, otherwise zero. As stated in Bahmani-Oskooee and Domag (2003), the relationship among inflation and economic fundamentals could differ across countries with different inflation levels. Thus, creating a dummy variable for high inflationary countries may help capture this feature. The dummy for aid,

⁵⁹ In Appendix E see Figure.1 of π versus Aid and Figure.2, Figure.3, and Figure.4 of D versus Aid for detecting the outliers. See Appendix A.3 for the description of dummies and A.2 for variables created.

da, helps omitting an aid variable which takes a value greater than 40 % of GNI⁶⁰. In the following steps, we create a dummy for focusing on countries with positive growth in addition to the previously indicated dummies since it is suspected that when growth is negative, due to a negative supply shock, a positive relationship between GDP growth and inflation may be violated. This dummy of growth, *dg*, is equal to zero when GDP growth is less than 0, otherwise one.

Moreover, we create square of aid, *sqaid*, variable to take into account the nonlinearity of the series. The models with *Aid* and *sqaid* help define whether Laffer curve behavior exist for our data set or not. Aid Laffer curve supports that the benefits from aid increase at initial stages, and decreases after a certain level. Hadjimichael, et *al.* (1995), Durberry et *al.* (1998), Lensink and White (1999) all include aid squared as a regressor in growth model and find positive, but decreasing marginal returns of aid flows in growth models, that is, significantly positive coefficient of aid term with significantly negative coefficient of aid squared term. Although we are dealing with aid inflation specification, rather than aid growth specification, these studies motivate our introducing of squared aid term and foster our curiosity about the effect of this term in our model. It is decided to examine that whether same pattern as in previous studies on growth is able to be established for inflation or not. If aid has a nonlinear effect on the real side of the economy, as shown in these previous studies, then investigating if such nonlinear effects are evident on the nominal side is already worth to examine.

In the following, we consider volatility of GDP growth as an additional regressor. Our data set consists of aid recipient countries, which are mostly

⁶⁰ There are 14 outliers in *Aid* series and 69 hyperinflation cases. See Appendix E for details.

developing countries. Therefore, we suspect about variability of economic growth in these countries. Given that such economies could be ridden by volatile GDP patterns, we are interested in whether or not this characteristic of economies has any significant impact on inflation. In order to capture this variability we add volatility of GDP growth calculated with the values of series in three respective years, i.e. for the observation at time t , it is the standard deviation of observations at times $t-1$, t , and $t+1$ ⁶¹.

Furthermore, we analyze the effect of openness to trade as an additional explanatory variable in our model. IMF (2001) reports that although the effect of openness to trade on inflation seems to change from sample to another, greater openness to trade is mainly associated with lower inflation⁶². In order to examine whether our sample of aid recipient countries also supports this generalized result or not, we add a measure of openness to trade in our model. In IMF (2001), it is additionally reported that the effect of openness on inflation may, over the long term, occur largely through fiscal policy and financial developments that affect the size of inflation tax base. Since our model already accounts for FMD, the effect of openness on inflation can be captured more accurately. The variable *trade* is a measure of openness to trade; openness to trade increases as it gets larger.

Above all, we insert all these variables into our model so as to capture the dynamics of inflation and, hence, to obtain a more reliable or a more accurate model for inflation.

⁶¹ In the following steps, we also use a measure calculated with five respective years, i.e. for the observation at time t , it is the standard deviation of observations at times $t-2$, $t-1$, t , $t+1$ and $t+2$, in order to check robustness of the volatility measure.

⁶² Besides, Burnside and Dollar (2000) comment on the effect of openness to trade on the relationship of aid and economic growth. They say that aid is beneficial to real GDP growth if recipient government has good economic policies, such as those good at decreasing inflation, budget deficits and increasing trade openness.

CHAPTER 4

MODELS AND REGRESSION RESULTS

This chapter essentially presents the econometric models tracing the objective of the analysis and subsequently the results obtained with the help of these models. We first introduce the model specifications, and follow up with a discussion of the regression results. In addition, this chapter provides support for detailed specification of models introduced in section 3.3. The models are all based on the general form of the model (3.3.1). In section 4.1, we do regression runs to determine the behavior and significance of the explanatory variables. In section 4.2, we shape our model depending on the results obtained in previous section and depending on the model of Neyaptı (2003). Especially, we focus on the models including the first lags of some explanatory variables in section 4.2.

4.1 Determining the General Form

Initially, we merely look at the direct effect of aid on inflation without considering the effect of FMD as introduced in model (3.3.2) and estimate the following equation by GMM:

$$D_{it} = \beta_{0i} + \beta_1 D_{i,t-1} + \beta_2 Aid_{it} + \beta_3 gGDP_{it} + \beta_4 gresvM_{it} + \varepsilon_{it} \quad (4.1.1)$$

where β_{0i} denotes the country specific fixed effects.

Since we are investigating whether foreign aid has an inflationary impact on recipient economy or not, the main hypothesis is that there exists a positive and significant relation between foreign aid (Aid) and the real rate of depreciation in money stock (D). We also investigate the effect of other basic variables like the first lag of the real rate of depreciation in money stock ($D(-1)$), growth of GDP ($gGDP$) and growth of reserve money ($gresvM$).

For this and all succeeding regressions, the dynamic panel data estimation technique described in section 3.1 is used and estimation is carried out with the help of software program Ox 3.10. The set of instrumental variables consists of the level of all explanatory variables except $D(-1)$ and instruments of GMM-type, i.e. second and further lags of D .

The regression results of model (4.1.1) are reported in column I of Table 4.1.1 in the next page.

Wald (joint) statistic in column I helps us to reject the null hypothesis of the Wald test which means at least one of the coefficients are statistically significant. Sargan test statistics tells us that instruments are found to be valid. Finally, according to the AR(2) test statistics it can be concluded that there is no second order correlation. The coefficients are all significant, Aid with 5% significance and others with 1% significance. D is strongly persistent since the coefficient of $D(-1)$ is significantly positive. The expectations about the signs of coefficients of all explanatory variables but $gGDP$ are satisfied. It is found that, contrary to a priori expectations, $gGDP$ has a statistically significant but negative effect on current real rate of depreciation. However, our hypothesis of positive causality from foreign aid to inflation is supported.

Table 4. 1. 1: Regression results for the models (4.1.1) and (4.1.2)

Dependent Variable: <i>D</i>			
Explanatory Variables:	Columns:	I	II
<i>D(-1)</i>		39.93*** (23.40)	38.40*** (19.00)
<i>Aid</i>		0.05** (2.05)	0.16* (1.92)
<i>sqaid</i>		...	-0.02 (-1.43)
<i>gresvM</i>		0.01*** (35.40)	0.01*** (36.00)
<i>gGDP</i>		-0.33*** (-12.60)	-0.34*** (-13.30)
<i>Constant</i>		-0.25*** (-9.24)	-0.22*** (-7.80)
No. of observation		1386	1386
Wald (joint)		2964 [0.000]	2296 [0.000]
Wald (dummy)		85.38 [0.000]	60.89 [0.000]
Sargan test		48.84 [1.000]	44.55 [1.000]
AR(2) test		1.11 [0.269]	1.05 [0.292]

Note: The coefficient of *sqaid* in 2nd column is multiplied with 1000 while all other coefficients are multiplied with 100. Numbers in parentheses are the t-probabilities; numbers in brackets are the p-values; *** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level. See Appendix F.1 and F.2 for the detailed Wald test results of joint significance between explanatory variables of the given models in Table 4.1.1.

In column II of Table 4.1.1, square of aid (*sqaid*) component is added to search for nonlinearity in aid series and Laffer curve behavior of *Aid*. The model 4.1.1 transforms into:

$$D_{it} = \beta_{0i} + \beta_1 D_{i,t-1} + \beta_2 Aid_{it} + \beta_3 gGDP_{it} + \beta_4 gresvM_{it} + \beta_5 sqaid_{it} + \varepsilon_{it} \quad (4.1.2)$$

It can be concluded that *sqaid* variable is not significant, i.e. there is no nonlinearity in the effect of aid on inflation. In addition, *Aid* is still significant and positive, which still supports our main hypothesis. The significant negative sign in the coefficient of *gGDP* further remains while the other variables' coefficients

have the expected signs. According to Wald (joint) test statistics in column II, at least one of the coefficients is significantly different than zero. In addition, with the help of the Sargan statistics, it can be concluded that the instruments are appropriate. Furthermore, AR(2) test results supports the nonexistence of the second order serial correlation among error term.

After finding a significant relationship between D and Aid , we go on our investigation with the effect of FMD. In order to examine the role of FMD in explaining the relationship between D and Aid , the interaction between aid and financial markets development is used as an additional explanatory variable to the model (4.1.1). Thus, we run the regression below:

$$D_{it} = \beta_{0i} + \beta_1 D_{i,t-1} + \beta_2 Aid_{it} + \beta_3 gGDP_{it} + \beta_4 gresvM_{it} + \beta_5 (Aid * FMD)_{it} + \varepsilon_{it} \quad (4.1.3)$$

Following related literature review in previous chapters, we hypothesize that as the level of financial markets' development increases, the capacity of absorbing or managing inflationary effects of aid increases. Thus, we expect negative relationship between foreign aid-FMD interaction and inflation.

In Table 4.1.2, each column represents the regression result with different measure of FMD; while first column presents the measure of the financial market's size, the other columns present the measure of the share of private sector credit in different aggregate values.

Table 4. 1. 2: Regression results for the model specification (4.1.3)

Dependent Variable: <i>D</i>						
Explanatory Variables:	FMD =	<i>iliqliab</i>	<i>iprvtcred</i>	<i>iprvtcrednofi</i>	<i>ishareprvt</i>	<i>IshareprvtL</i>
<i>D</i> (-1)		38.11*** (15.10)	36.64*** (15.00)	39.22*** (20.40)	38.27*** (20.90)	38.27*** (21.40)
<i>Aid</i>		0.25*** (6.00)	0.33*** (5.52)	0.24*** (4.72)	0.07*** (2.64)	0.06** (2.29)
<i>gresvM</i>		0.01*** (46.20)	0.01*** (38.50)	0.01*** (32.10)	0.01*** (33.70)	0.01*** (33.20)
<i>gGDP</i>		-0.43*** (-15.90)	-0.44*** (-17.50)	-0.43*** (-15.80)	-0.34*** (-12.20)	-0.34*** (-11.00)
<i>Aid</i> *FMD		-0.67*** (-4.55)	-1.18*** (-4.12)	-1.01*** (-4.05)	-5.19** (-2.35)	-0.20*** (-3.17)
<i>Constant</i>		-0.28*** (-7.28)	-0.30*** (-7.83)	-0.29*** (-7.02)	-0.26*** (-8.22)	-0.25*** (-7.70)
No. of observation		1218	1208	1214	1366	1346
Wald (joint)		3968 [0.000]	4107 [0.000]	4433 [0.000]	2662 [0.000]	2656 [0.000]
Wald (dummy)		53.03 [0.000]	61.37 [0.000]	49.29 [0.000]	67.59 [0.000]	59.26 [0.000]
Sargan test		45.96 [1.000]	44.58 [1.000]	48.52 [1.000]	47.55 [1.000]	46.68 [1.000]
AR(2) test		0.71 [0.481]	0.66 [0.511]	0.72 [0.470]	1.08 [0.282]	1.08 [0.279]

Note: All of the coefficients are multiplied with 100. Numbers in parentheses are the t-probabilities; numbers in brackets are the p-values; *** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level. In column I, *iliqliab* calculated by *Liqliab*, the series of liquid liabilities to GDP. In column II, *iprvtcred* calculated by *Prvtcred*, the series of private credit by deposit money banks to GDP. In column III, *iprvtcrednofi* calculated by *Prvtcrednofi*, the series of private credit by deposit money banks and other financial institutions to GDP. In column IV, *ishareprvt* calculated with the help of *Domcredtoprvt* and *Domcred*. In column V, *ishareprvtL* is the series of *ishareprvt* without Lesotho, i.e. for country Lesotho all inputs are “na”, not available. See Appendix A.1 and A.2 for variable details.

As shown in Table 4.1.2, all explanatory variables in columns I, II, and III are significant with %1 percent confidence and have expected signs, except *gGDP*. *Aid* is still significantly positive. Moreover, Wald test, Sargan test and AR(2) test results support our model. Furthermore, the interaction term *Aid**FMD is found to be negatively significant across three measures of FMD represented in columns I to III, as hypothesized. Hence, the results in columns I, II, and III

supports our expectations about the effect of FMD on inflation associated with foreign aid inflows.

In column IV, it can be seen that index of the share of banking sector credit to the private sector in the total banking sector credit (*ishareprvt*) is significant, and its coefficient is much smaller than the previous measures. When *Shareprvt* series is examined in detail, it is observed that there exists a significant outlier value (Lesotho-1977). As reported in Table 4.1.3, when we omit the outlying country Lesotho (the new series is called *ishareprvtL*) we obtain a more homogenous⁶³, and thus, a more reliable data set. The regression results in column V are the recalculated results after omitting the outlier country and it is accepted that these results are valid since *ishareprvtL* is observed to be a more reliable measure of the share of banking sector credit to the private sector in the total banking sector credit.

Table 4. 1. 3: Table of descriptive statistics for *ishareprvt* and *ishareprvtL*

	<i>Shareprvt</i>	<i>ShareprvtL</i> (w/o Lesotho)
Mean	2.056	0.70
Standard Error	1.35	0.08
Standard Deviation	55.53	3.18
Sample Variance	3083.66	10.13
Kurtosis	1669.76	418.63
Skewness	40.78	12.10
Range	2321.58	133.44
Minimum	-47.25 (Trinidad and Tobago 1975)	-47.25 (Trinidad and Tobago 1975)
Maximum	2274.33 (Lesotho 1977)	86.19 (Mauritania 1999)
Largest(2)	86.19 (Mauritania 1999)	58.03 (Mauritania 2001)
Smallest(2)	-42.51 (Lesotho 1999)	-31.56 (Bhutan 1991)

⁶³ Especially, it can be seen that standard deviation and sample variance are decreased significantly when we omit Lesotho.

It can be concluded for measures in columns I, II, III, and V that in an economy, a larger size of the financial market increases the capacity of financial absorption, making possible for policymakers to manage aid flows in a manner that fosters aid effectiveness while decreasing the inflationary effects.

After observing the significance of four measures of FMD in columns I, II, III, and V we decided to use private credit by deposit money banks to GDP index (*iprvtcred*) as a measure of FMD for the succeeding regression analysis since there seem to be no significant difference in the results of these columns. Although it is not tabled, in order to check the robustness of FMD measures once more, some of the succeeding regressions are run by other three measures and it is observed that the results do not change quantitatively.

In looking into the aid data, we observe outliers⁶⁴. In order to prevent possible bias as caused by these outliers, we create a dataset that excludes the outliers in *Aid* series with the help of the dummy variable “*da*”. Thus, the *da*Aid* series is purified of outliers. Here, the first model we are interested is given below:

$$D_{it} = \beta_{0i} + \beta_1 D_{i,t-1} + \beta_2 aid_{it} + \beta_3 gGDP_{it} + \beta_4 gresvM_{it} + (aid * iprvtcred)_{it} + \varepsilon_{it} \quad (4.1.4)$$

where *aid* is a variable which can be substituted by *Aid* or *da*Aid* variables.

⁶⁴ See Appendix E for the details about the outliers in *D* and *Aid* series.

Table 4.1.4 serves the results of the model (4.1.4).

Table 4. 1. 4: Regression results of models considering the outliers in *Aid*

Dependent Variable: <i>D</i>			
Explanatory Variables:	<i>aid</i> =	<i>Aid</i>	<i>da</i> * <i>Aid</i>
<i>D</i> (-1)		36.64*** (15.00)	38.82*** (23.10)
<i>aid</i>		0.33*** (5.52)	0.10* (1.66)
<i>gGDP</i>		-0.44*** (-17.50)	-0.43*** (-18.40)
<i>gresvM</i>		0.01*** (38.50)	0.01*** (40.50)
<i>aid</i> * <i>iprvtcred</i>		-1.18*** (-4.12)	-0.65*** (-3.41)
<i>Constant</i>		-0.30*** (-7.83)	-0.31*** (-8.39)
No. of observation		1208	1202
Wald (joint)		4107 [0.000]	3192 [0.000]
Wald (dummy)		61.37 [0.000]	70.38 [0.000]
Sargan test		44.58 [1.000]	50.07 [1.000]
AR(2) test		0.66 [0.511]	0.44 [0.659]
Wald (<i>aid</i> , <i>aid</i> * <i>iprvtcred</i>)		31.54 [0.000]	11.74 [0.003]

Note: All of the coefficients are multiplied with 100. Numbers in parentheses are the t-probabilities; numbers in brackets are the p-values; *** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level. In Wald (*Aid*, *aid***iprvtcred*) row the test statistics of joint significance is given. Dummy of *Aid* (*da*) is calculated by: $da = \begin{cases} "na" & \text{if } Aid > 40 \\ 1 & \text{if otherwise} \end{cases}$. Because of not available observations in FMD series for Mauritania

1976 and 1978, Sierra Leone 2001 and 2002, Guyana 1990 and 1991, Rwanda 1994 and 1995, we actually omit 6 outliers in *Aid* series. See Appendix E for the whole set of outliers in *Aid* series.

In the first column, *Aid* series is originally used but in the second column the outliers in *Aid* series are omitted with introducing *da***Aid*, rather than *Aid*. That is, the variable named *aid* in the set of explanatory variables is *Aid* series in the first column, and *da***Aid* series in the second column. Test results support the model and all coefficients are significant. After comparing the results in two columns, it

can be concluded that omitting the outliers in *Aid* series does not cause a significant change in test results as well as magnitudes of coefficients. The change in rejection probabilities of *aid* variable seems to be the only striking difference between the two column. But in both columns, *aid* variable is significant and has positive sign. With the help of Table 4.1.4 it can be concluded that outliers in *Aid* series do not have a significant effect on the analysis and, as a result, for the following series *Aid* series is going to be used. In addition, it can be concluded with the help of Wald (*aid*, *aid*iprvtcred*) row in Table 4.1.4 that both *Aid* and *da*Aid* is jointly significant with *aid*iprvtcred*. We suspected that *aid* and *aid*iprvtcred* series can show similar pattern since *aid*iprvtcred* involves *aid* series' dynamics. We did these Wald tests in order to check our suspect about these series.

After controlling the effects of outliers, it is decided to go on with checking the significancy of nonlinearity in *Aid* in a model considering FMD, which is presented in columns I and III of Table 4.1.5, and volatility of gGDP, which is presented in columns II and III of Table 4.1.5 in the next page.

Table 4. 1. 5: Regression results of models considering nonlinearity of *Aid* (*sqaid*) and volatility in *gGDP* (*vol3*)

Dependent Variable: <i>D</i>				
Explanatory Variables:	Column:	I	II	III
<i>D</i> (-1)		35.82*** (15.70)	41.07*** (22.10)	40.63*** (19.30)
<i>Aid</i>		0.02 (0.21)	0.29*** (5.79)	-0.01 (-0.08)
<i>sqaid</i>		0.01*** (5.08)	...	0.01*** (4.68)
<i>gresvM</i>		0.01*** (49.90)	0.01*** (33.10)	0.01*** (33.40)
<i>gGDP</i>		-0.44*** (-19.10)	-0.44*** (-19.40)	-0.43*** (-18.30)
<i>vol3</i>		...	0.38*** (8.11)	0.39*** (7.80)
<i>aid*iprvtcred</i>		-1.09*** (-4.07)	-1.16*** (-4.16)	-1.06*** (-3.78)
<i>Constant</i>		-0.30*** (-7.73)	-0.28*** (-10.60)	-0.29*** (-8.31)
No. of observation		1208	1208	1208
Wald (joint)		5463 [0.000]	4203 [0.000]	4729 [0.000]
Wald (dummy)		59.74 [0.000]	112.20 [0.000]	69.05 [0.000]
Sargan test		44.05 [1.000]	50.60 [1.000]	50.70 [1.000]
AR(2) test		0.64 [0.520]	0.69 [0.492]	0.68 [0.496]
Wald(<i>Aid</i> , <i>sqaid</i> , <i>aid*iprvtcred</i>)		89.54 [0.000]	...	46.10 [0.000]
Wald (<i>Aid</i> , <i>aid*iprvtcred</i>)		18.43 [0.000]	33.91 [0.000]	16.38 [0.000]

Note: The coefficients all coefficients are multiplied with 100. Numbers in parentheses are the t-probabilities; numbers in brackets are the p-values; *** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level. In Wald (*Aid*, *sqaid*, *aid*iprvtcred*) and Wald (*Aid*, *aid*iprvtcred*) rows the test statistics of joint significance of the variables in parentheses is given.

The test results of Sargan, Wald and AR(2) tests all support the models in each column of Table 4.1.5. We can see the inflation's persistency in each column with the help of the significant positive large coefficient of *D*(-1). In Table

4.1.5, the negative sign of $gGDP$ coefficient is still contradicting to our a priori expectations, but all other coefficients still have expected signs.

Remember that, we have found an insignificant $sqaid$ in model (4.1.2). In order to control nonlinearity further, we add $sqaid$ variable in a model considering FMD. In columns I and III, Aid is not significant, however, $sqaid$ is significant. Given the significance of the quadratic term $sqaid$ in a model with an insignificant Aid variable, it is decided to test the joint significance of Aid and $aid*iprvtcred$, and Aid , $sqaid$, and $aid*iprvtcred$. In Wald (Aid , $aid*iprvtcred$) and Wald (Aid , $sqaid$, $aid*iprvtcred$) rows of columns I and III, it can be seen that they are jointly significant. Then, we can conclude that inflationary effects of aid increases as the aid level increases beyond a certain threshold. This result is supported by positively significant $sqaid$ coefficients in columns I and III.

It is also decided to consider the volatility of GDP growth in the analysis. As mentioned before, since our data set consists of aid recipient countries, significant variability in growth series of these countries is expected due to the inherent macroeconomic instability experienced by these countries. In order to capture this variability we add a volatility component, named $vol3$, calculated with standard deviation of three respective values in the time-series of $gGDP$. The results in columns II and III of Table 4.1.5 for different models support the significant volatility in $gGDP$.

In Table 4.1.6 below, it is investigated whether using *vol5*, rather than *vol3*, affects the regression results or not.

Table 4. 1. 6: Regression results of models considering different measures for volatility in *gGDP* (*vol3* and *vol5*)

Dependent Variable: <i>D</i>					
Explanatory Variables:	Column:	I	II	III	IV
<i>D(-1)</i>		41.07*** (22.10)	40.63*** (19.30)	37.83*** (15.00)	37.24*** (16.60)
<i>Aid</i>		0.29*** (5.79)	-0.01 (-0.08)	0.30*** (4.74)	-0.04 (-0.45)
<i>sqaid</i>		...	0.01*** (4.68)	...	0.01*** (5.35)
<i>gresvM</i>		0.01*** (33.10)	0.01*** (33.40)	0.01*** (33.60)	0.01*** (45.30)
<i>gGDP</i>		-0.44*** (-19.40)	-0.43*** (-18.30)	-0.44*** (-17.50)	-0.43*** (-18.60)
<i>vol3</i>		0.38*** (8.11)	0.39*** (7.80)	...	...
<i>vol5</i>		...	...	0.22*** (4.77)	0.22*** (4.92)
<i>aid*iprvtcred</i>		-1.16*** (-4.16)	-1.06*** (-3.78)	-1.12*** (-4.10)	-1.00*** (-3.87)
<i>Constant</i>		-0.28*** (-10.60)	-0.29*** (-8.31)	-0.25*** (-6.41)	-0.26*** (-6.22)
No. of observation		1208	1208	1208	1208
Wald (joint)		4203 [0.000]	4729 [0.000]	3850 [0.000]	5260 [0.000]
Wald (dummy)		112.20 [0.000]	69.05 [0.000]	41.05 [0.000]	38.72 [0.000]
Sargan test		50.60 [1.000]	50.70 [1.000]	43.44 [1.000]	43.02 [1.000]
AR(2) test		0.69 [0.492]	0.68 [0.496]	0.68 [0.496]	0.67 [0.501]

Note: The coefficients all coefficients are multiplied with 100. Numbers in parentheses are the t-probabilities; numbers in brackets are the p-values; *** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level.

Here, *vol5* represents the volatility of GDP growth calculated with the values of series in five respective years, i.e. for the observation at time *t*, it is the standard deviation of observations at times *t-2*, *t-1*, *t*, *t+1*, and *t+2*.

It is observed that the difference in measures of volatility does not cause any significant change in regression results. As a result, it is decided to go on our analysis considering volatility with the help of *vol3* variable.

In Table 4.1.7 we introduced *di*gGDP* (in columns I and II) and *trade* (in columns III and IV) in order to examine the effects of macroeconomic instability and openness to trade on inflation, respectively.

Table 4. 1. 7: Regression results after introducing *di*gGDP* and *trade*

Dependent Variable: <i>D</i>					
Explanatory Variables:	Columns:	I	II	III	IV
<i>D(-1)</i>		36.79*** (15.20)	40.90*** (21.20)	42.01*** (18.6)	41.62*** (18.90)
<i>Aid</i>		0.31*** (5.38)	0.29*** (5.84)	0.22*** (4.12)	0.27*** (5.76)
<i>gresvM</i>		0.01*** (33.70)	0.01*** (28.90)	0.01*** (34.00)	0.01*** (36.40)
<i>gGDP</i>		-0.43*** (-16.60)	-0.43*** (-17.30)	-0.44*** (-17.40)	-0.44*** (-17.90)
<i>di*gGDP</i>		-0.43*** (-3.77)	-0.40*** (-3.69)	...	...
<i>vol3</i>		...	0.39*** (8.15)	0.06 (1.01)	...
<i>trade</i>		...	...	0.09*** (3.87)	0.10*** (3.94)
<i>aid*iprvtcred</i>		-1.11*** (-4.03)	-1.15*** (-4.25)	-0.98*** (-4.75)	-1.05*** (-5.47)
<i>Constant</i>		-0.31*** (-7.93)	-0.30*** (-11.00)	-0.29*** (-6.20)	-0.32*** (-7.01)
No. of observation		1208	1208	1207	1207
Wald (joint)		3699 [0.000]	3673 [0.000]	4163 [0.000]	4048 [0.000]
Wald (dummy)		62.94 [0.000]	120.20 [0.000]	38.43 [0.000]	49.08 [0.000]
Sargan test		44.38 [1.000]	50.61 [1.000]	46.09 [1.000]	48.94 [1.000]
AR(2) test		0.62 [0.535]	0.65 [0.517]	0.72 [0.474]	0.70 [0.486]

Note: All of the coefficients are multiplied with 100. Numbers in parentheses are the t-probabilities; numbers in brackets are the p-values; *** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level. Dummy of inflation (*di*) is: $di = \begin{cases} 1 & \text{if } \pi > 100 \\ 0 & \text{if otherwise} \end{cases}$.

Price pressures in hyperinflation economies are expected to dominantly be coming from the demand side since a positive supply side generally occurs in economies with good, or namely stable, macroeconomic conditions. As a result, it is decided to introduce a dummy variable, di , to examine the behavior of hyperinflation countries in detail where di is equal to one for hyperinflation countries and zero otherwise. We expect $di * GDP$ variable to have a positive sign. However, as we can see in Table 4.1.7, this is not the case; the coefficient of $di * GDP$ is significantly negative for each scenarios in columns I and II.

The effect of openness to trade on inflation also examined. In IMF (2001), it is reported that the effect of openness to trade on inflation seems to change from sample to another, however, it is also concluded that greater openness to trade is mainly associated with lower inflation. Thus, we were expecting a negative coefficient for our *trade* variable, given that it is significant. However, the regression results for models represented columns III and IV of Table 4.1.7 support the reverse. That is, as openness to trade increases, inflation rises. However, this result is again consistent with IMF (2001) report. Because it is reported that there may exist changes from sample to sample, only “in general” the expected result is obtained⁶⁵.

So far, we have included several nonlinear terms. To further ensure robustness regarding the nonlinearity we also control for FMD measure. This is in line with Hansen and Tarp (2001) whose general growth model includes aid, aid squared, aid times policy index, and policy squared. Actually in our basic analysis

⁶⁵ In an effort to identify whether the trade effect is via the pass through of import prices to domestic prices we include imports of goods and services (% of GDP) as an alternative openness measure. However, it is observed that the imports variable is insignificant for different scenarios.

we exclude FMD as a separate regressor since it is a mostly time invariant variable. Therefore, what we do here is to solely for robustness checks.

In order to check of the nonlinearity further, we examine the significance of FMD square term, i.e. squared of *iprvtcred*, in Table 4.1.8 for different scenarios.

Table 4. 1. 8: Regression results after introducing *sqiprvtcred*

Dependent Variable: <i>D</i>					
Explanatory Variables:	Columns:	I	II	III	IV
<i>D(-1)</i>		38.13*** (17.30)	41.38*** (17.00)	42.30*** (25.30)	42.53*** (25.80)
<i>Aid</i>		-0.07 (-0.76)	-0.09 (-0.98)	-0.20* (-1.89)	-0.20** (-2.09)
<i>sqaid</i>		0.01*** (5.26)	0.01*** (5.16)	0.01*** (5.51)	0.01*** (5.45)
<i>gresvM</i>		0.01*** (38.40)	0.01*** (33.00)	0.01*** (37.10)	0.01*** (36.10)
<i>gGDP</i>		-0.46*** (-17.60)	-0.46*** (-17.50)	-0.46*** (-18.10)	-0.46*** (-17.60)
<i>vol3</i>		...	0.39*** (7.26)	...	0.12* (1.65)
<i>trade</i>		...	...	0.09*** (3.40)	0.08*** (3.18)
<i>sqiprvtcred</i>		-22.17** (-2.15)	-24.62** (-2.31)	-16.81* (-1.68)	-18.69* (-1.82)
<i>aid*iprvtcred</i>		-0.97*** (-3.54)	-0.83*** (-2.9)	-0.68*** (-2.78)	-0.64*** (-2.61)
<i>Constant</i>		-0.26*** (-5.50)	-0.21*** (-4.64)	-0.25*** (-5.12)	-0.23*** (-4.76)
No. of observation		1208	1208	1207	1207
Wald (joint)		4135 [0.000]	3903 [0.000]	4793 [0.000]	22.64 [0.000]
Wald (dummy)		30.21 [0.000]	21.52 [0.000]	26.22 [0.000]	46.89 [1.000]
Sargan test		49.96 [1.000]	51.19 [1.000]	46.96 [1.000]	0.73 [0.466]
AR(2) test		0.69 [0.492]	0.70 [0.483]	0.72 [0.471]	48.15 [0.000]
Wald (<i>Aid</i> , <i>sqaid</i> , <i>aid*iprvtcred</i> , <i>sqprvtcred</i>)		61.77 [0.000]	53.20 [0.000]	56.44 [0.000]	19.84 [0.000]
Wald (<i>Aid</i> , <i>aid*iprvtcred</i>)		18.68 [0.000]	14.04 [0.001]	21.47 [0.000]	22.64 [0.000]

Note: All of the coefficients are multiplied with 100. Numbers in parentheses are the t-probabilities; numbers in brackets are the p-values; *** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level.

In table 4.1.8, it can be seen that *sqaid*, *sqiprvtcred*, and *aid*iprvtcred* have all expected signs and are significant. Although *Aid* is insignificant in columns I and II, Wald test of *Aid* and *aid*iprvtcred* shows that they are jointly significant. Therefore, our hypothesis is supported, and found to be robust.

Finally, it is decided to stress the effect of positive and negative growth. The regression results considering this discrimination is given in Table 4.1.9.

Table 4. 1. 9: Regression results after introducing $dg*gGDP$

Dependent Variable: <i>D</i>					
Explanatory Variables:	Column:	I	II	III	IV
<i>D(-1)</i>		36.68*** (15.70)	41.08*** (21.20)	42.18*** (20.90)	42.61*** (21.60)
<i>Aid</i>		0.31*** (5.55)	0.29*** (5.05)	0.27*** (6.21)	0.22*** (4.09)
<i>gresvM</i>		0.01*** (30.30)	0.01*** (31.80)	0.01*** (32.50)	0.01*** (33.10)
<i>gGDP</i>		-0.68*** (-11.50)	-0.54*** (-9.47)	-0.69*** (-11.00)	-0.61*** (-10.40)
<i>dg*gGDP</i>		0.32*** (4.04)	0.14* (1.66)	0.34*** (4.16)	0.23*** (3.00)
<i>vol3</i>		...	0.38*** (6.80)	...	0.06 (1.07)
<i>trade</i>		...	...	0.09*** (3.92)	0.09*** (3.70)
<i>aid*iprvtcred</i>		-1.07*** (-3.51)	-1.11*** (-3.65)	-1.02*** (-5.02)	-0.94*** (-4.43)
<i>Constant</i>		-0.28*** (-7.31)	-0.28*** (-10.20)	-0.30*** (-6.48)	-0.27*** (-6.03)
No. of observation		1208	1208	1207	1207
Wald (joint)		2854 [0.000]	3207 [0.000]	2104 [0.000]	2291 [0.000]
Wald (dummy)		53.41 [0.000]	103.60 [0.000]	41.95 [0.000]	36.32 [0.000]
Sargan test		43.44 [1.000]	50.61 [1.000]	48.32 [1.000]	46.64 [1.000]
AR(2) test		0.67 [0.502]	0.68 [0.495]	0.71 [0.477]	0.72 [0.469]

Note: All of the coefficients are multiplied with 100. Numbers in parentheses are the t-probabilities; numbers in brackets are the p-values; *** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level. Dummy of *gGDP* is

$$dg = \begin{cases} 0 & \text{if } gGDP < 0 \\ 1 & \text{if } \text{otherwise} \end{cases}.$$

In countries with supply shocks, there exists negative growth, combined with an increase in the inflation rate. For instance, the recent Hurricane Katrina, while hitting the supply side of US economy, lessens the economy's ability to produce goods and services. The rise in world oil prices over the last thirty years, on the other hand, can be proposed to be another example of supply shocks. The rise in oil prices may cause an increase in the variable costs of firms which use oil as an essential input during their production process. As a result, firms may raise the prices of their output to protect their gross profit and this cause a decrease in demand. Moreover, if the rise in oil prices affects sufficient industries across the economy, then the real output will fall. Hence, a supply shock such as this has an upward effect on inflation but a downward effect on real output⁶⁶.

As reviewed in previous chapters, literature on growth and inflation supports positive causality. In our data set, some portion of aid receiver countries has negative growth and some has positive. When growth is negative, due to a negative supply shock, we may not expect a positive sign for GDP growth in a model of inflation. Thus, we search for the expected positive relation of GDP growth and inflation in a subset of countries with positive GDP growth.

As seen in Table 4.1.9, the coefficient of $dg \cdot gGDP$ is significantly positive for different model specifications in each column. As a result, we can conclude that we capture our expected positive sign of $gGDP$ coefficient for countries with positive GDP growth.

⁶⁶ In order to equate supply and demand, the central bank may interfere to decrease aggregate demand by increasing interest rates after a negative supply shock.

4.2 Robustness Checks: Further Time Dynamics

When we go back to the model of Neyaptı (2003), it is seen that Neyaptı (2003) includes lags of $gGDP$ and $gresvM$, not the contemporary components of both. This necessitates that we ensure our results hold with Neyaptı (2003)'s lag structure⁶⁷. Despite testing different lag structures for all explanatory variables, we hypothesize that aid has an immediate effect on the economy. When aid inflows to a country, we hypothesize that it has an immediate upward effect on inflation. That is, economically, we are not interested in the past values of aid, we are searching for the contemporary effect of aid on contemporary inflation, and we believed that the change in inflation can be observed in one year. As a result, we do not consider the lag of *Aid*, thus, *aid*iprvtcred* or *sqaid* as well.

Tables 4.2.1 and 4.2.2 present the regression results of model specifications with lagged explanatory variables, except *Aid*, *aid*iprvtcred*, and *sqaid*.

⁶⁷ Neyaptı (2003) finds appropriate lag length for explanatory variables to be two. In our case, two lagged components are always observed to be not significant for different scenarios. When the first lagged explanatory variables considered, it is observed that *aid*iprvtcred(-1)* and *Aid(-1)* become insignificant in each different model specification. However, *gGDP(-1)* and *gresvM(-1)* preserves their significance with expected signs.

Table 4. 2. 1: Regression results with lagged variables

Dependent Variable: <i>D</i>					
Explanatory Variables:	Columns:	I	II	III	IV
<i>D(-1)</i>		40.33*** (24.40)	39.98*** (23.70)	39.11*** (21.80)	38.73*** (21.20)
<i>Aid</i>		0.02 (0.43)	0.03 (0.65)	0.01 (0.27)	0.02 (0.35)
<i>gresvM(-1)</i>		0.01*** (47.40)	0.01*** (41.70)	0.01*** (44.70)	0.01*** (39.70)
<i>gGDP(-1)</i>		0.09** (2.03)	0.08* (1.92)	0.08* (1.85)	0.08* (1.81)
<i>vol3(-1)</i>		...	0.00 (-0.08)	...	0.03 (0.61)
<i>trade(-1)</i>		...	...	0.03* (1.73)	0.04* (1.74)
<i>aid*iprvtcred</i>		-0.69** (-2.39)	-0.79** (-2.42)	-0.67** (-2.22)	-0.71** (-2.12)
<i>Constant</i>		-0.24*** (-9.21)	-0.24*** (-9.13)	-0.28*** (-10.70)	-0.28*** (-10.40)
No. of observation		1200	1200	1198	1198
Wald (joint)		6770 [0.000]	6077 [0.000]	4845 [0.000]	4371 [0.000]
Wald (dummy)		84.88 [0.000]	83.29 [0.000]	115.00 [0.000]	107.80 [0.000]
Sargan test		52.51 [1.000]	52.14 [1.000]	52.40 [1.000]	52.23 [1.000]
AR(2) test		0.14 [0.889]	0.14 [0.887]	0.09 [0.926]	0.086 [0.932]
Wald (<i>Aid, aid*iprvtcred</i>)		7.41 [0.025]	7.69 [0.021]	7.61 [0.022]	7.95 [0.019]

Note: All of the coefficients are multiplied with 100. Numbers in parentheses are the t-probabilities; numbers in brackets are the p-values; *** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level.

In Table 4.2.1, it can be seen that although *Aid* is insignificant, the joint significance Wald test of *Aid* and *aid*iprvtcred* shows that they are jointly significant with %5 confidence. As a result, we accept that these specifications including lags of control variables (except variables including aid series) again support our hypothesis that, when financial markets developed enough, the effectiveness of aid increases and it has a downward impact on inflation through a deep financial sector. Moreover, one-period-ahead dynamics of GDP growth, base

money growth, and openness to trade measure push present inflation upward, while volatility of GDP growth is insignificant. Note especially that, we found our expected sign of $gGDP$ for the past value (1 year before) of $gGDP$ different than previous section's models.

In Table 4.2.2, we add *sqaid* to the model specifications in Table 4.2.1.

Table 4. 2. 2: Regression results of models in Table 4. 2. 1 with *sqaid*

Dependent Variable: <i>D</i>					
Explanatory Variables:	Columns:	I	II	III	IV
<i>D(-1)</i>		39.85*** (24.40)	39.72*** (24.40)	38.70*** (21.40)	38.42*** (21.30)
<i>Aid</i>		0.36*** (4.61)	0.35*** (4.53)	0.35*** (4.63)	0.35*** (4.47)
<i>sqaid</i>		-0.01*** (-8.23)	-0.01*** (-7.89)	-0.01*** (-8.30)	-0.01*** (-8.04)
<i>gresvM(-1)</i>		0.01*** (39.50)	0.01*** (36.00)	0.01*** (37.00)	0.01*** (34.10)
<i>gGDP(-1)</i>		0.08** (1.97)	0.08* (1.91)	0.06 (1.62)	0.06 (1.60)
<i>vol3(-1)</i>		...	0.00 (0.11)	...	0.04 (0.83)
<i>trade(-1)</i>		...	...	0.04* (1.91)	0.04* (1.91)
<i>aid*iprvtcred</i>		-0.83*** (-2.94)	-0.88*** (-2.90)	-0.83*** (-2.84)	-0.86*** (-2.77)
<i>Constant</i>		-0.24*** (-9.47)	-0.24*** (-9.49)	-0.27*** (-11.00)	-0.27*** (-10.60)
No. of observation		1200	1200	1198	1198
Wald (joint)		6079 [0.000]	5292 [0.000]	5228 [0.000]	4747 [0.000]
Wald (dummy)		89.76 [0.000]	90.11 [0.000]	121.30 [0.000]	112.90 [0.000]
Sargan test		51.72 [1.000]	51.63 [1.000]	51.30 [1.000]	51.10 [1.000]
AR(2) test		0.13 [0.895]	0.13 [0.893]	0.09 [0.931]	0.08 [0.937]
Wald(<i>Aid</i> , <i>sqaid</i> , <i>aid*iprvtcred</i>)		166.90 [0.000]	158.60 [0.000]	163.60 [0.000]	151.90 [0.000]
Wald (<i>Aid</i> , <i>aid*iprvtcred</i>)		21.59 [0.000]	21.18 [0.000]	21.41 [0.000]	20.03 [0.000]

Note: All of the coefficients are multiplied by 100. Numbers in parentheses are the t-probabilities; numbers in brackets are the p-values; *** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level.

It is again observed that although *Aid* is insignificant, the joint significance Wald test of *Aid* and *aid*iprvtcred* shows that they are jointly significant. Thus, our hypothesis is still supported. Moreover, coefficient of the first lag of *gGDP* has the expected positive sign in columns I and II. However, when we add *trade(-1)* variable into the model, *gGDP(-1)* becomes insignificant, as displayed in columns III and IV of Table 4.2.2.

In fact, these findings resolve the problem regarding GDP growth effects. Therefore, these set of regressions could be preferred for final analysis. Given our hypothesis of positive relationship between aid and inflation holds in *all* regressions, we are not concerned about focusing on any one set discussed above⁶⁸.

⁶⁸ If data was monthly then we could have preferred other lag structures.

CHAPTER 5

CONCLUSION

Even though there exists a substantial amount of research on both inflation and foreign aid, to the best of our knowledge, this growing body of research in monetary theory has not presented a research on causality from aid to inflation, yet. This study attempted to fill this void in the literature by examining the significance of foreign aid in the set of inflation determinants. Therefore, we modeled inflation not only with the commonly referred to variables, such as money growth, lagged inflation or economic growth, but also with foreign aid. The scope of this study was extended by the consideration of the recipient economy's financial environment, which specifies the capacity to absorb or to manage inflows of aid. After aid inflows to a country, recipient authority can do sterilization in order to decrease inflationary pressure. However, this can be achieved by deep financial markets. An alternative way of controlling inflationary pressure can be to decrease the amount of incoming aid, before aid enters to that country. The role of financial environment was accounted for measures of financial market development in the model. As a result, while it is mainly hypothesized that aid has a significant positive impact on inflation, this upward effect of aid on inflation is also hypothesized to diminish as the financial markets become more developed.

The model was built to be dynamic since lag of inflation is used as an explanatory variable so as to carry the persistency feature of inflation into the model. Moreover, we included other commonly used determinants of inflation, such as the rate of base money growth and the rate of real GDP growth. Aid in percentages of GNI and interaction of aid with commonly used measures of financial markets development, financial deepening, are included to test our hypothesis. Aid term was interacted with a measure of financial development variable since it was suspected that good financial environment affects performance of foreign aid. This dynamic specification of inflation was analyzed utilizing GMM estimation with an unbalanced panel data set, covering 60 countries in the period 1975-2004, where available.

Empirical evidence supports the notion of positive impact of aid inflows on inflation. In addition, the econometric results support the significant role of financial environment. In detail, aid becomes less inflationary when the recipient's financial markets developed enough to absorb or manage inflows of aid. Moreover, we obtained expected signs for other control variables, except for growth of GDP. However, when we restrict our consideration on the subset of the countries with positive economic growth, it is observed that the coefficient appears to have expected positive sign. Moreover, the first lag of growth of GDP also seems to capture the expected positive sign, where real sector expansion becomes inflationary with a one period lag. When the model specification is converted to a specification including only the first lagged growth terms of reserve money and GDP, it is observed that all significant explanatory variables have

expected signs, and particularly, aid and FMD interaction is again negatively significant.

The results of especially foreign aid and aid - FMD interaction are strongly robust, which is accepted to be our main concern. In further steps, nonlinearity of aid was considered as well as the outliers in aid series. In addition, since the data set consists of aid recipient countries, possible and expected variability of economic growth in these countries was considered by inserting a volatility of GDP growth into the model. It was observed that outliers in aid series are negligible. However, the volatility of the real GDP growth appears to be a significant variable in most of the models, as expected. Furthermore, the regression results for that include squared aid showed that when foreign aid inflows rise with an increasing amount, it has a fostering upward pressure on inflation. Last but not least, the results of the empirical analysis are robust to several control variables, and alternative measures of financial markets development.

An additional issue which will likely focus further attention is the effect of exchange rate regime. As stated in Kohli (2001) and Buffie *et al.* (2004), exchange rate regime has an impact on appreciation and monetary expansion. Thus, since exchange rate regime matter for quantifying aid's effect on inflation, it can be a concern for our study as well. Besides, while changes in world price of oil have found to have less powerful in explaining inflation (IMF, 2001), the exchange rate is suggested to be an important variable in explaining inflation, especially in emerging markets (Domaç, 2004). In addition, the interaction of GDP growth and volatility can be considered for different scenarios in order to

measure further the effect of volatility of GDP growth on inflation. These variables can be considered as an additional control variable to explain inflation in future work. To sum up, the next stage to develop this empirical research should include considering different model specifications, testing some further control variables, such as world price of oil or real exchange rate, and controlling for the possibility for the effect of exchange rate regime of the recipient country.

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APPENDICES

Appendix A: List of variables: Abbreviations, Sources of Data, and Derivations

Appendix A.1 Primary Data

▪ **Aid (% of GNI) (Aid):** (Source: World Development Indicators Online (World Bank), Series Code: DT.ODA.ALLD.GN.ZS, Years: 1960-2004)

▪ **Domestic credit provided by banking sector (% GDP) (Domcred):** (Source: World Development Indicators Online (World Bank), Series Code: FS.AST.DOMS.GD.ZS, Years: 1960-2004)

▪ **Domestic credit to private sector (% GDP) (Domcredtoprvt):** (Source: World Development Indicators Online (World Bank), Series Code: FS.AST.PRVT.GD.ZS, Years: 1960-2004)

▪ **GDP deflator (base year varies by country) (GDPdef):** (Source: World Development Indicators Online (World Bank), Series Code: NY.GDP.DEFL.ZS, Years: 1960-2003)

▪ **GDP growth (annual %) (gGDP):** (Source: World Development Indicators Online (World Bank), Series Code: NY.GDP.MKTP.KD.ZG, Years: 1960-2003)

▪ **Liquid liabilities to GDP (Liqliab):** (Source: IMF/structure_data base, Years: 1960-2001. Calculated using the following deflation method: $\{(0.5) * [F_t/P_{et} + F_{t-1}/P_{et-1}]\} / [GDP_t/P_{at}]$ where F is liquid liabilities, P_e is end-of period consumer price index (CPI), and P_a is average annual CPI. Raw data are from the electronic version of the IMF's International Financial Statistics (IFS). Data on GDP in local currency, end-of period CPI, and annual CPI are from the electronic version of the IFS.

▪ **Private credit by deposit money banks to GDP** (*Prvtcred*): (Source: IMF/structure_data base, Years: 1960-2001) Calculated using the following deflation method: $\{(0.5) * [F_t/P_{et} + F_{t-1}/P_{et-1}]\} / [GDP_t/P_{at}]$ where F is credit to the private sector, P_e is end-of period CPI, and P_a is average annual CPI. Raw data are from the electronic version of the IMF's International Financial Statistics. Data on GDP in local currency, end-of period CPI, and annual CPI are from the electronic version of the IFS.

▪ **Private credit by deposit money banks and other financial institutions to GDP** (*Prvtcrednofi*): (Source: IMF/structure_data base, Years: 1960-2001) Calculated using the following deflation method: $\{(0.5) * [F_t/P_{et} + F_{t-1}/P_{et-1}]\} / [GDP_t/P_{at}]$ where F is credit to the private sector, P_e is end-of period CPI, and P_a is average annual CPI. Raw data are from the electronic version of the IMF's International Financial Statistics. Data on GDP in local currency, end-of period CPI, and annual CPI are from the electronic version of the IFS.

▪ **Reserve Money** (*resvM*): (Source: International Financial Statistics(IFS)-Economic Concept View-Monetary Authorities, Series Code: 14...ZF, Years: 1960-2004).

▪ **Trade (% of GDP)** (*trade*): (Source: World Development Indicators Online (World Bank), Series Code: NE.TRD.GNFS.ZS, Years: 1960-2004).

Appendix A.2 Variables Created

▪ ***aid*iliqliab*** is calculated using the following formula:

$$aid * iliqliab_t = Aid_t * iliqliab_t$$

▪ ***aid*iprvtcred*** is calculated using the following formula:

$$aid * iprvtcred_t = Aid_t * iprvtcred_t$$

▪ ***aid*iprvtcrednofi*** is calculated using the following formula:

$$aid * iprvtcrednofi_t = Aid_t * iprvtcrednofi_t$$

▪ ***aid*ishareprvt*** is calculated using the following formula:

$$aid * ishareprvt_t = Aid_t * ishareprvt_t$$

▪ ***aid*ishareprvtL*** is calculated using the following formula:

$$aid * ishareprvtL_t = Aid_t * ishareprvtL_t$$

▪ ***da*Aid*** is calculated using the formula: $da * Aid_t = da_t * Aid_t$

▪ ***dg*gGDP*** is calculated using the formula: $dg * gGDP_t = dg_t * gGDP_t$

▪ ***di*gGDP*** is calculated using the formula: $di * gGDP_t = di_t * gGDP_t$

▪ **Growth of Reserve Money (*gresvM*)**: calculated using the following formula:
$$gresvM_t = \left(\frac{resvM_t - resvM_{t-1}}{resvM_{t-1}} \right) * 100$$

▪ **Inflation (π)**: calculated using the below formula:

$$\pi_t = \left(\frac{GDPdef_t - GDPdef_{t-1}}{GDPdef_{t-1}} \right) * 100$$

▪ **Liquid liabilities to GDP index (*iliqliab*)**: calculated using the following formula:
$$iliqliab_t = \frac{Liqliab_t}{\max_t \{Liqliab\}}$$

▪ **Private credit by deposit money banks to GDP index (*iprvtcred*)**:
calculated using the following formula:
$$iprvtcred_t = \frac{Prvtcred_t}{\max_t \{Prvtcred\}}$$

▪ **Private credit by deposit money banks and other financial institutions to GDP index (*iprvtcrednofi*)**: calculated using the following formula:
$$iprvtcrednofi_t = \frac{Prvtcrednofi_t}{\max_t \{Prvtcrednofi\}}$$

▪ **Square of aid series (*sqaid*)**: calculated by taking the square of *Aid* series.

▪ **Square of private credit by deposit money banks to GDP index (*sqiprvtcred*)**: calculated by taking the square of *iprvtcred* series.

▪ **The real rate of depreciation in money stock (D):** calculated using the following formula: $D_t = \frac{(\pi_t / 100)}{1 + (\pi_t / 100)}$.

▪ **The share of banking sector credit to the private sector in the total banking sector credit ($Shareprvt$):** calculated by: $Shareprvt_t = \frac{Domcredtoprvt_t}{Domcred_t}$.

▪ **The share of banking sector credit to the private sector in the total banking sector credit index ($ishareprvt$):** calculated using the following formula: $ishareprvt_t = \frac{Shareprvt_t}{\max_t \{Shareprvt\}}$.

▪ **The share of banking sector credit to the private sector in the total banking sector credit without Lesotho ($ShareprvtL$):** It is the series of $Shareprvt$ without the inputs of Lesotho.

▪ **The share of banking sector credit to the private sector in the total banking sector credit index without Lesotho ($ishareprvtL$):** It is the series of $ishareprvt$ in which the inputs of the country Lesotho are omitted.

▪ **Volatility in growth of GDP ($vol3$ and $vol5$):** calculated using the following formulas:

$$vol3_t = stdev(gGDP_{t-1}, gGDP_t, gGDP_{t+1})$$

$$vol5_t = stdev(gGDP_{t-2}, gGDP_{t-1}, gGDP_t, gGDP_{t+1}, gGDP_{t+2})$$

where $stdev$ is the standard deviation function defined as

$$stdev = \sqrt{\frac{n \sum_i x_i^2 - (\sum_i x_i)^2}{n(n-1)}}.$$

Missing (or not available, na) observations were not used as zero valued observations during the calculations, they were just omitted.

Appendix A.3 Dummies

- **Dummy of Aid (% of GNI) (da):** $da = \begin{matrix} "na" & \text{if} & Aid > 40 \\ 1 & \text{if} & \text{otherwise} \end{matrix}$

- **Dummy of GDP growth (dg):** $dg = \begin{matrix} 0 & \text{if} & gGDP < 0 \\ 1 & \text{if} & \text{otherwise} \end{matrix}$

- **Dummy of Inflation (di):** $di = \begin{matrix} 1 & \text{if} & \pi > 100 \\ 0 & \text{if} & \text{otherwise} \end{matrix}$

Appendix B: Table of countries in the data set

No	Country Name	No	Country Name
1	Argentina	31	Jordan
2	Belize	32	Kenya
3	Bhutan	33	Lesotho
4	Bolivia	34	Madagascar
5	Botswana	35	Malaysia
6	Brazil	36	Mali
7	Burkina Faso	37	Mauritania
8	Burundi	38	Mauritius
9	Cameroon	39	Morocco
10	Chad	40	Nepal
11	Chile	41	Nicaragua
12	China, P. R.: Mainland	42	Nigeria
13	Colombia	43	Oman
14	Congo, Republic of	44	Papua New Guinea
15	Costa Rica	45	Peru
16	Côte d'Ivoire	46	Rwanda
17	Dominican Republic	47	Seychelles
18	Ecuador	48	Sierra Leone
19	Egypt	49	Sri Lanka
20	El Salvador	50	St. Vincent & Grens.
21	Ethiopia	51	Swaziland
22	Fiji	52	Thailand
23	Ghana	53	Togo
24	Grenada	54	Trinidad and Tobago
25	Guatemala	55	Tunisia
26	Guyana	56	Uganda
27	Haiti	57	Uruguay
28	Honduras	58	Venezuela, Rep. Bol.
29	India	59	Zambia
30	Indonesia	60	Zimbabwe

Appendix C: Table of descriptive statistics

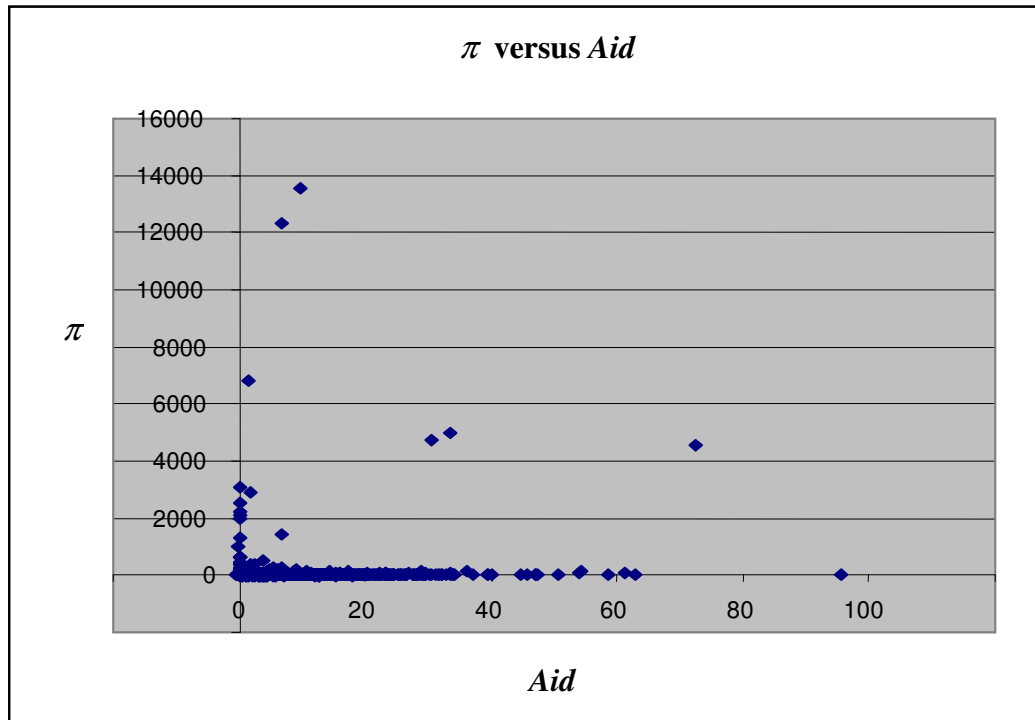
Variable	Mean	Min	Max	Std. Deviation
<i>D</i>	0.12	-1.26 (St. Vincent & Grens. 1975)	0.99 (Nicaragua 1988)	0.17
<i>gresvM</i>	52.33	-57.81 (Papua New Guinea 1980)	10420.00 (Nicaragua 1990)	435.49
<i>gGDP</i>	3.67	-50.25 (Rwanda 1994)	141.50 (St. Vincent & Grens. 1975)	6.43
<i>Aid</i>	7.08	-0.47 (Malaysia 1996)	95.56 (Rwanda 1994)	8.45
<i>Liqliab</i>	0.36	0.02 (Nicaragua 1990)	1.50 (China 2001)	0.22
<i>Prvtcred</i>	0.22	0.01 (Nicaragua 1990)	1.22 (Thailand 1998)	0.18
<i>Prvtcrednofi</i>	0.26	0.01 (Uganda 1987)	1.55 (Malaysia 1998)	0.20
<i>ShareprvtL</i>	0.70	-47.25 (Trinidad and Tobago 1975)	86.19 (Mauritania 1999)	3.18
<i>trade</i>	70.25	6.32 (Ghana 1982)	282.40 (Guyana 1992)	39.98

Appendix D: Table of correlations

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>	<i>N</i>	<i>O</i>	<i>P</i>	<i>Q</i>
Year	1.00																
D	-0.12	1.00															
gGDP	-0.06	-0.26	1.00														
di* ^a gGDP	0.01	-0.06	0.17	1.00													
dg* ^a gGDP	0.05	-0.16	0.61	0.22	1.00												
vol3	-0.19	-0.02	0.16	-0.01	-0.33	1.00											
vol5	-0.21	-0.01	0.15	-0.01	-0.29	0.84	1.00										
gresvM	0.00	0.44	-0.08	-0.21	-0.07	0.00	0.03	1.00									
Aid	0.05	0.00	-0.04	0.01	-0.14	0.19	0.19	0.04	1.00								
da* ^a Aid	0.03	-0.05	0.01	-0.01	-0.03	0.14	0.15	0.04	1.00	1.00							
sqaid	0.07	0.08	-0.11	0.02	-0.28	0.21	0.18	0.06	0.83	0.92	1.00						
sqipvtcred	0.25	-0.20	0.07	0.01	0.00	-0.04	-0.03	-0.04	-0.19	-0.20	-0.09	1.00					
aid* ^a liqliab	0.04	-0.13	0.05	0.00	0.03	0.11	0.12	-0.04	0.73	0.72	0.57	0.02	1.00				
aid* ^a ipvtcred	0.06	-0.15	0.04	0.00	0.03	0.07	0.08	-0.04	0.68	0.65	0.59	0.10	0.88	1.00			
aid* ^a ipvtcrednofi	0.05	-0.13	0.03	0.00	0.03	0.06	0.07	-0.03	0.69	0.64	0.64	0.09	0.89	0.98	1.00		
aid* ^a isharepvtL	0.03	-0.02	0.01	0.00	0.00	0.00	-0.01	0.00	0.11	0.12	0.07	-0.01	0.08	0.13	0.13	1.00	
trade	0.12	-0.24	0.11	0.00	0.06	0.00	0.03	-0.06	0.15	0.15	0.09	0.27	0.31	0.31	0.29	0.04	1.00

Appendix E: Graphs

Figure 1: Graph of π versus *Aid*



Note: The graphs in this appendix were drawn after omitting “na” data for series in x and y axes.

Table E. 1: The list of outliers in *Aid* series (*Aid* > 40)

Country Name	Year	Aid
Rwanda	1994	95.56
Nicaragua	1991	72.34
Zambia	1995	62.87
Guyana	1990	61.34
Nicaragua	1996	58.49
Guyana	1991	54.14
Rwanda	1995	54.05
Nicaragua	1992	50.68
Sierra Leone	2001	47.47
Mauritania	1978	47.12
Sierra Leone	2002	47.00
Nicaragua	1994	45.68
Nicaragua	1995	44.59
Mauritania	1976	40.25

Table E. 2: The list of hyperinflation cases ($\pi > 100$)

Country Name	Year	π
Nicaragua	1988	13571.88
Bolivia	1985	12338.66
Peru	1990	6837.33
Nicaragua	1990	5003.11
Nicaragua	1989	4728.57
Nicaragua	1991	4523.70
Argentina	1989	3059.39
Peru	1989	2928.48
Brazil	1990	2515.77
Brazil	1994	2239.13
Argentina	1990	2076.79
Brazil	1993	1996.64
Bolivia	1984	1444.12
Brazil	1989	1321.71
Brazil	1992	973.06
Brazil	1988	651.34
Argentina	1985	627.05
Argentina	1984	607.02
Nicaragua	1987	524.39
Argentina	1976	438.89
Brazil	1991	411.96
Argentina	1988	387.93
Argentina	1983	383.05
Peru	1991	379.89
Peru	1988	372.35
Chile	1975	334.65
Nicaragua	1986	279.63
Bolivia	1983	264.75
Chile	1976	250.61
Brazil	1985	231.13
Bolivia	1986	230.02
Brazil	1984	212.63
Argentina	1982	207.29
Brazil	1987	204.07
Argentina	1975	197.52

Country Name	Year	π
Uganda	1988	189.98
Uganda	1987	180.99
Nicaragua	1985	168.66
Peru	1985	166.58
Sierra Leone	1987	165.68
Zambia	1992	165.53
Guyana	1989	162.62
Argentina	1978	161.59
Argentina	1977	159.45
Bolivia	1982	158.47
Argentina	1979	147.09
Brazil	1986	146.00
Zambia	1993	143.66
Brazil	1983	140.30
Uganda	1986	137.28
Argentina	1991	132.95
Sierra Leone	1991	128.77
Argentina	1987	127.01
Guyana	1991	126.74
Ghana	1983	123.06
Uganda	1985	120.34
Grenada	1994	117.16
Venezuela	1996	115.52
Uganda	1989	115.45
Peru	1984	110.19
Zimbabwe	2002	107.51
Uruguay	1990	106.84
Brazil	1981	106.75
Argentina	1981	106.45
Zambia	1990	106.39
Chile	1977	105.79
Brazil	1982	105.10
Peru	1983	103.83
Uruguay	1991	100.81

Figure 2: Graph of D versus Aid

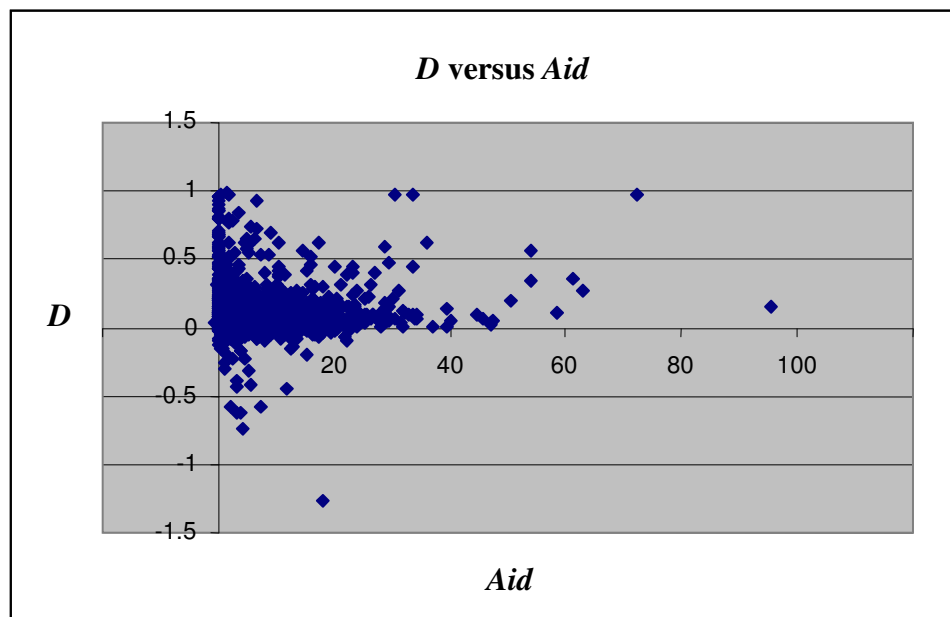


Figure 3: Graph of D versus Aid ($Aid > 40$ data is omitted)

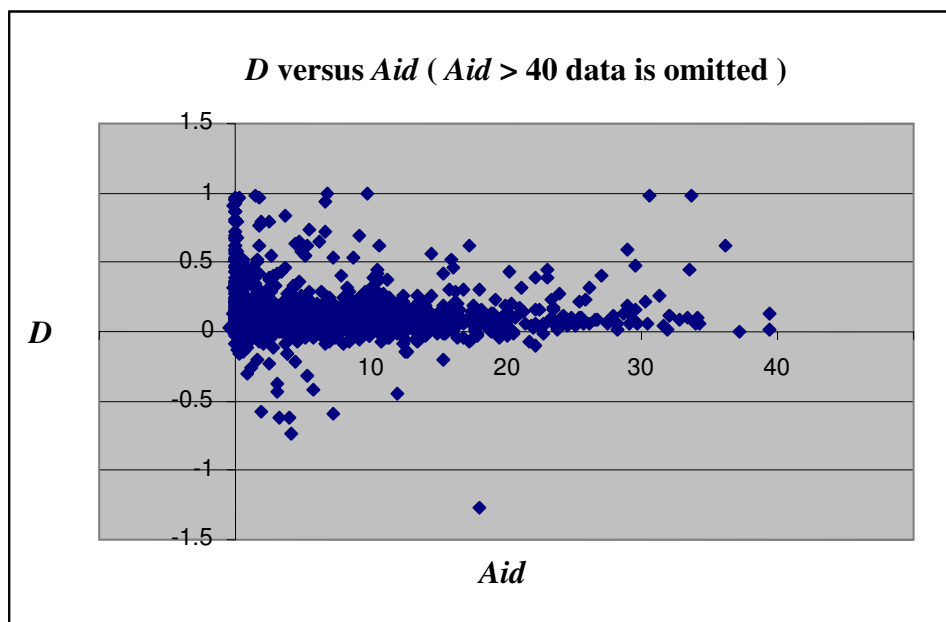
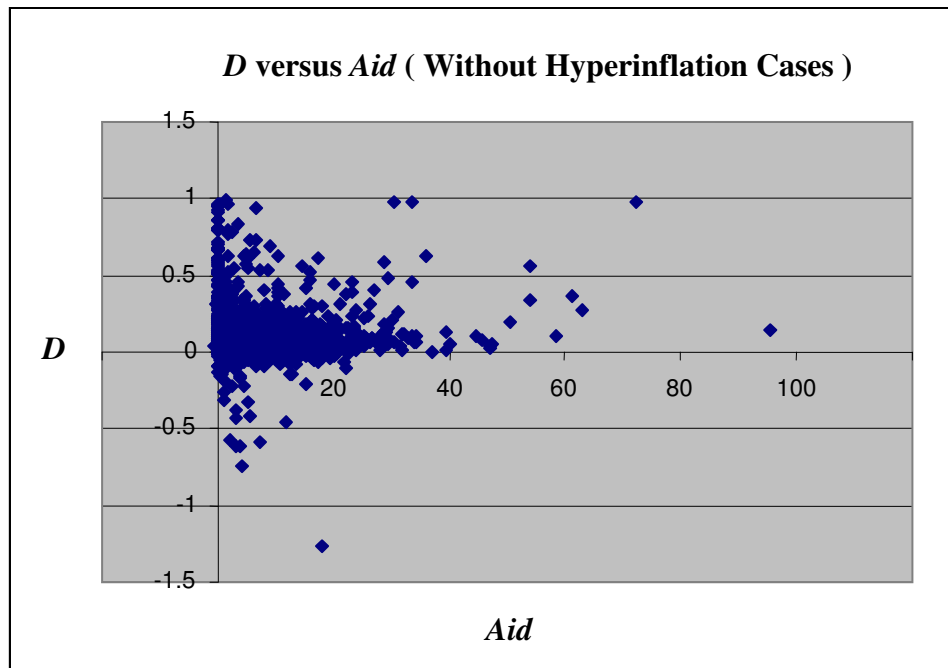


Figure 4: Graph of D versus Aid (Without Hyperinflation Cases)



Appendix F: The results of Wald tests for different model specifications

Appendix F. 1: The results of Wald tests for model (4.1.1)

<u>For model (4.1.1):</u>	Wald Test Statistics
Testing $DD(-1)$ and $DAid$:	686.9 [0.000]
Testing $DD(-1)$ and $DgresvM$:	2511. [0.000]
Testing $DD(-1)$ and $DgGDP$:	705.5 [0.000]
Testing $DAid$ and $DgresvM$:	1262. [0.000]
Testing $DAid$ and $DgGDP$:	160.3 [0.000]
Testing $DgresvM$ and $DgGDP$:	1610. [0.000]

Appendix F. 2: The results of Wald tests for model (4.1.2)

<u>For model (4.1.2):</u>	Wald Test Statistics
Testing $DD(-1)$ and $DAid$:	454.7 [0.000]
Testing $DD(-1)$ and $Dsqaid$:	409.6 [0.000]
Testing $DD(-1)$ and $DgresvM$:	2048. [0.000]
Testing $DD(-1)$ and $DgGDP$:	490.0 [0.000]
Testing $DAid$ and $Dsqaid$:	6.061 [0.048]
Testing $DAid$ and $DgresvM$:	1316. [0.000]
Testing $DAid$ and $DgGDP$:	178.3 [0.000]
Testing $Dsqaid$ and $DgresvM$:	1309. [0.000]
Testing $Dsqaid$ and $DgGDP$:	177.4 [0.000]
Testing $DgresvM$ and $DgGDP$:	1571. [0.000]