

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

THE WELFARE COSTS OF MODERATE INFLATION:
THE ETHIOPIAN EXPERIENCE 1991/2-2001/02

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A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN
PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MSc IN ECONOMIC POLICY
ANALYSIS IN THE DEPARTMENT OF ECONOMICS

JUNE 2005
ADDIS ABABA



**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**The Welfare Costs of Moderate Inflation: The
Ethiopian Experience 1991/2-2001/02**

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ACKNOWLEDGEMENT

This study is inspired by the incessant search for optimal policy design in less developed economies. A deeper understanding of the economies is shackled by, among other things, the poor institution of record keeping. It is unfortunate that poor data and a limited history of indigenous economic thought have conspired to limit the adeptness with which present day African economists address problems and proceed to analyze them. This study, even though, sought to challenge the [now] conventional wisdom that 'monetary policy is an essential tool of short-term stabilization in less developed countries,' it, less delicately albeit intuitively, *draws a bow at a venture* by arguing that the complementarity of financial funds in the formal and informal sectors of the economy largely determine the effectiveness of monetary policy. In the absence of studies showing that *that is the case* one could only be comforted by the thought that *that 'assumption'* is innocuous and does little to diminish the integrity of the study.

Nevertheless, the study was enriched by the contributions of a number of people I should not go on without thanking. The reflective comments of my thesis advisor Prof. Teshome Mulat concerning the futility of policy analysis in isolation from institutions capable of carrying them out have given the study the present complexion. I'm indebted to Dr Alemayehu Geda, whose compendium of useful information on a host of subjects has aided my study and more. For their comments, data support and encouragement, I also thank Tamrat Workalemahu, Micheal Negash and my family. I'm also beholden to the AERC for its generous funding and for making possible a memorable JFE experience that taught me rich lessons in life.

Any remaining errors are my own.

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Signed Approval sheet by the board of examiners

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ABSTRACT

The study uses the concepts of the *welfare cost from inflation*, and *Armey curves* popularized by Martin Bailey and Richard Arney; respectively to show that *fiscal policy instruments* can serve a function further than progressively reducing fiscal deficits. In the absence of the abundance of financial institutions monetary policy measures, as tools of short-term economic stabilization, can be impotent. The study shows that with fiscal policy measures primarily aimed at progressively lowering budget deficits, the policy choices for short term macroeconomic stabilization have seen LDCs rely, inflexibly, on monetary policy measures that have failed to pay any dividends. The study also shows that the potential for *fiscal adjustment measures* can be exhausted pretty quickly and an economy could slump back into a corner solution on the policy space [*where fiscal policy measures are once again only good for reducing fiscal deficits*]. The study indicates that less developed economies that constantly put their faith on [short-term policy] measures that require intricate institutional development should realize that those set of measures are dominated by policy measures that do not require well structured institutions. Nevertheless, it cautions the enthusiasm with which *fiscal policy* options are reintroduced into the policy choice scene should not veil the need for immediate institutional improvement.

CHAPTER I

Introduction

I. Background and Problem Statement.

Although some studies have questioned the significance of a policy of low levels of inflation in the pursuit of economic development, particularly in low growth economies, reducing the level of inflation in the stagnant and impoverished economies of Sub-Saharan Africa (most of them with moderate inflation) is ill conceived by their central banks as a growth enhancing achievement [National Bank of Ethiopia, *NBE from now on*, (2003)]. Very low levels of inflation need not necessarily be taken as appropriate policy success, since it can also imply that possible public expenditure, and hence employment, might have been unnecessarily sacrificed [Alemayehu (2002)]. Some other recent studies have shown that [UNCTAD (2003) p.24, Narayan et.al (2000) p.21 and 150] the poor in some Sub-Saharan African countries do not consider inflation as a major problem, although other more general surveys show that inflation is, most frequently, regarded by the poor as one of the top three major problems impinging on their welfare [Easterly and Fisher (2001)]. This study is therefore aimed at investigating whether the size of the welfare costs of moderate inflation in Ethiopia warrants the adoption of non-inflationary macroeconomic policies as opposed to inflationary-expansionary macroeconomic policies. The study abandons the view that expansionary fiscal policy can be effective in light of the fact that the short-run Phillips curve relies heavily on the assumption that there is a well-behaved labour market. The study falls back on the position that fiscal policy can be effective, *temporarily*, if there is room for the reallocation of resources in the public sector [chapter III and IV deal with the matter at length.

Over the past two decades, growth in income in Sub-Saharan African countries has barely kept pace with population growth. After attaining a moderate increase in per-capita income during the 70s, growth in the region remained below 2.5% per-annum and in both the 1980s (2.1%) and the 1990s (2.4%). Despite a [real] recovery after the mid 1990s, per capita income in the region, at the turn of the millennium was 10% below the level reached 20 years earlier. Furthermore, the recovery has proved to be short-lived and longer-term growth projections are well below the levels required to meet poverty alleviation targets [UNCTAD (2002)].

Slow and erratic growth in the region has also been accompanied by regressive changes in income distribution [income was highly skewed]. On the other hand, the poorest segments of the population have experienced steeper decline in their per capita incomes than the economy as a whole: the decline in average per capita income for the poorest 20% of the SSA population is estimated to have been twice that of the population as a whole between 1980 and 1995 UNCTAD, (2001)¹.

While both sluggish growth and skewness in income distribution have contributed to rising poverty in Africa, it has been acknowledged that the solution cannot lie primarily in redistribution policies. It is precisely for this reason that the new policy orientation towards poverty alleviation can succeed only if it leads to rapid and sustained growth and job creation. A careful examination of the principal components of this approach suggests that it builds on conventional stabilization and structural adjustment and the programs are still based on the premise that liberalization and openness hold the key to rapid and sustained growth which in turn holds the key to poverty reduction. Thus, the autonomy of countries in designing their own growth and development strategies is circumscribed by the same considerations that dominated the structural adjustment programs.

UNCTAD (2002) declared that among 27 countries in SSA with Poverty Reduction Strategy Papers (PRSPs) and Interim Poverty Reduction Strategy Papers (I-PRSPs), -23 of the countries had an average level of inflation of around 3.5 % while the price level actually fell in five countries (Burkina Faso, Cape Verde, Cote d'Ivoire, Mali and Sierra Leone). The Experiences of Ethiopia are not far different from the five. Nevertheless, UNCTAD (2002) shows, even in the countries with inflation rates of 3-5%, disinflation continues to be emphasized in the policy advice contained in PRSPs primarily on the grounds that inflation generates regressive changes in income distribution.

¹ Cited in UNCTAD (2002)

“The main proclamation to the financial sector (and the banking sector in particular) is the Monetary and Banking Proclamation No.83/ 1994. It replaced the previous Monetary and Banking Proclamation No. 99/ 1976, which subjected the financial sector to the ultimate service of the ‘socialized sectors’. This new proclamation empowered the National Bank of Ethiopia (NBE) to be an autonomous body serving the purposes of any central bank in a market-oriented economy. The new proclamation, apart from defining the usual powers and duties of the central bank, specified the capital and reserves requirements, the required financial statements, and outlined the relations of the Bank with the government. Again the NBE acts as a fiscal agent for the government but with restrictions. For example, the limit to outstanding direct advances by the NBE to the government before any additional disbursements is 15 percent of average annual revenue of the government for three fiscal years immediately preceding the current one. It was 25 percent in the 1976 proclamation but was continually amended to fulfill the central government’s demands. The proclamation further delegates the NBE as the sole regulatory organ over banks, insurers and other financial institutions. Here the Bank regulates and controls credit, decides on discount rates, and may from time to time fix minimum and maximum rates of interest. The ultimate management of foreign exchange is also left to the NBE”.

Although gross government expenditure and per-capita government expenditure have expanded in the reform period, there have been constraints on aggregate domestic demand and hence stagnation in domestic economic activity. In spite of the expansion in domestic liquidity as well as the fiscal deficit, inflation measured by the Consumer Price Index, remained negative in recent years. For instance the rate of decline in headline inflation went up owing to the depressed food price index, which accounts for about 50% of the general price index. In the monetary sector, domestic liquidity as measured by broad money supply [narrow money + quasi money] increased in recent years due to the rebound in net foreign assets. In addition, the overall budget deficit widened as poverty related expenditures increased substantially [NBE (2003)].

It is also important to note that the dampening effect of a sustained flow of external funds has temporarily reduced foreign exchange shortages that the country faces, that combined with low demand for both consumer and intermediate goods due to growing losses in income caused by worsening terms of trade have perpetuated reductions in domestic prices. Ethiopia's monetary policy is mainly designed and geared towards containing inflation and fostering sound financial system. Taking into account the prevailing deflationary situation, slack in the business and investment activities and lower demand for bank credit, the National Bank of Ethiopia, lowered the minimum deposit interest rate from 6 to 3 percent effective March 2002. The Bank claims that the downward revision of interest rates is aimed at sending an inspiring signal to economic

agents to take up new business activities and build the trust in the economic environment, to reduce the excess liquidity of commercial banks, boost aggregate demand and consequently revive the overall economic activities through increased domestic consumption and investment. As inflation was excessively subdued and credit to the private sector falling, the monetary policy of the NBE, NBE (2003) reports, will have to be revising the adverse effects of the deflationary situation and slackening economy, using the indirect monetary instruments in following years.

II. The Objective of the Study

Envisioning an expansion of domestic activity through a reduction in minimum deposit rates is grounded in the assumption that private investment and non-public consumption expenditures are responsive to interest rate revisions and goes against the contending view that the Bank's move in revising interest rates is to make real rates accruing to savers modestly positive. One of the objectives of the study is, then, to estimate the 'prophesised' growth in welfare (denominated in growth in consumption) that results from a downward revision of the interest rate.

This study assumes that an adoption of a monetary policy move such as the NBE's, in trying to influence domestic absorption by a downward revision of interest rates is to mean that such a monetary policy is superior to a 'hypothetical' policy of reducing unemployment by a sufficiently expansionary government expenditure (an inflationary one). Since the latter fiscal policy move can also be used to stimulate aggregate demand, not to mention the blend of fiscal-monetary policies that can be deployed.

The study treats the choice of policy as a rational selection based on some measure of relative merit rather than dwelling on an argument that typifies the policymaker as a designer of an injudicious policy in an overzealous attempt to win the pockets of donors and international financial institutions. The study, also, assumes away the possibility of the policymaker 'pleading the natural escape-theory' that growth and inflation are negatively correlated³. There is no sufficient evidence to believe that inflation and growth are negatively correlated in a low-income

³ Barro (1995), Buderkin et.al (2000), Romer (1996)

country⁴. The study therefore construes the policymakers' [excessive] inflation-aversion as a manifestation of the convictions that the future income [consumption] losses from a permanently higher level of inflation are too costly to accept a policy of inflationary government expansion and that such a policy produces significant regressive changes in income distribution that does not favour the poor. The main objective of the study is, then, to test the hypothesis that the policymaker's choice of policy is grounded in the assumption that the perpetual welfare costs of an inflationary expansion have large welfare costs and that reducing the inflation rate further by removing the opportunity cost of holding money diminishes costly income losses.

The methodological base for the appraisal of the effectiveness of monetary policy is neoclassical in its incarnation, mainly to show that even though the foundations of consumer utility maximization are appealing, the imposition of structural assumptions on the portfolio of assets at the disposal of economic agents, the behaviour of money and the objective functions of the firms of less developed countries would produce results contrary to the results derived by the International Policy Establishment that monetary policy is an essential tool of short-term macroeconomic stabilisation.

III. Methodological Issues and Data requirement

The traditional measure of the welfare loss from inflation is the value of the liquidity services which society foregoes because of inflation, which is the area under the portion of the compensated demand curve which corresponds to the induced reduction in real money balances [Feldstein (1979)]. This implicitly assumes that inflation and the demand to hold money are intimately related and that the 'superficial' assumption that money is at a disadvantage since real assets yield an income stream whereas money yields nothing does not appeal to our common senses since the portfolio of real assets at the disposal of the average individual in a less developed economy are not composed of bonds, notes and equities but real assets (real property

⁴ Nell (2000), Easterly and Bruno (2001), Stanner (1996)...cited in Dawit Birhanu, "Is a low level of inflation desirable for economic progress-A study into the correlation between inflation and economic progress-The case of Ethiopia." Unpublished B.A thesis, Addis Ababa University, July 2003.

and inventories) whose nominal yields are affected more by price level changes [Kessle and Alchain (1962)]. Two important properties that need attention are that money can be used to hedge against both interest rate fluctuations and changes in relative prices.

The intuition in the use of the area under the money balances function lies behind the argument that as the area under the demand curve for apples is used to calculate the consumer surplus that accrues from apple consumption when the market clears at a certain price, so one can do the same with money. If money is a consumption good then one can compare the area under the demand curve for money when nominal rates are r percent with when they are zero, and thereby derive a measure of the benefit of reducing steady-state nominal interest rates [Bakshi (2002)].

The study will employ the techniques used in Lucas (2000) that is, essentially, grounded in a simplified form of Sidrauski's (1967) traditional neoclassical general equilibrium optimisation model. The welfare estimation equations in Sidrauski's simplified model are solutions to a dynamic-intertemporal household optimisation problem that are roughly congruent with the non-parametric derivations of Lucas. Sidrauski assumes that the forces governing the choices of households are similar [i.e. the household is a maximizer of utility], and therefore employs a deterministic representative agent model, in which households gain utility from the consumption of a single non-storable good, and from their holdings of real balances. Each household is endowed with one unit of time, which is inelastically supplied to the market and produces consumption goods. These assumptions combined with the 'Friedman rule'⁵-referred to frequently as Friedman's rule of the optimal monetary policy (1969)-that finds that the equalization of the rates of return of the portfolio of assets, at the disposal of the economic agent, at a nominal rate of zero (real rates equalling the rate of deflation) maximizes the household's discounted utility, Sidrauski finds that the welfare cost function converges to the

⁵ As long as interest rates are positive people could be made better off if money growth, and hence the average inflation rate and interest rate were reduced. Friedman argues that the supply of real money balances can be increased without social cost; and therefore it is in principle optimal to eliminate the opportunity cost of holding money balances and argues that the effect of inflation is to move the economy from this optimum.

area under the money balances function⁶. The real balances function is defined traditionally as

$$\frac{M_t}{P_t} = L(r_t, y_t), \text{ where the function } L \text{ takes the form } L(r, y) = m(r) \cdot y.$$

Lieberman's (1980) basic form of the formal aggregate money demand allows functional forms that could range from a semi-log specification to a log-log one, $m = Ar^{-\lambda}$ and $m = Be^{-\zeta r}$ respectively⁷, where A and B are chosen so that they pass through the geometric means of the data pairs. λ and ζ represent the interest elasticities of money demand.

Then to translate the evidence on money demand into a welfare cost estimate, we first employ the method of Bailey (1956)⁸ defining the welfare cost of inflation as the area under the inverse demand function—the consumer surplus that could be gained by reducing the interest rate from 'r' to zero. That is let $m(r)$ be the estimated aggregate money demand function, let $\psi(m)$ be the inverse function, and define the welfare cost function $w(r)$ by

$$(1.1) \quad w(r) = \int_{m(r)}^{m(0)} \psi(x) dx = \int_0^r m(x) dx - rm(r)$$

Since the function has the dimensions of a ratio to income, so does the function w and the value of $w(r)$ is interpreted as the fraction of income people would require as compensation in order to make them indifferent between living in a steady state with an interest rate constant at r and an otherwise identical steady state with an interest rate near zero. Lucas's estimates of the welfare functions for the two forms of specifications are: for the log-log aggregate money demand function $m(r) = Ar^{-\lambda}$:

$$(1.2) \quad w(r) = A \frac{\lambda}{1-\lambda} r^{1-\lambda} \quad \text{and};$$

For the semi-log specification $m = Be^{-\zeta r}$ it takes the form:

$$(1.3) \quad w(r) = \frac{B}{\zeta} (1 - [1 + \zeta r] e^{-\zeta r})$$

⁶ A complete solution to the maximization problem of the household is presented in the body of the study.

⁷ Where m represents the ratio of money balances to national income.

⁸ Cited in Lucas (2000).

An OLS regression is used to find the functional form that best represents the data and also find the interest elasticities that define the welfare estimates. This, essentially, represents a short-run analysis of the welfare loss from tolerating a higher level of inflation that represents a welfare loss that depends on the speed with which the actual inflation rate adjusts to its equilibrium value and the speed with which the members of the public adjust their inflationary expectations.

When the analysis is expanded to examining the perpetual stream of instantaneous losses from a permanently higher level of inflation, it depends on the rate at which the instantaneous losses grow in the future and the choice of the appropriate factor used to discount the future [Feldstein (1979)]. Then if ' w_0 ' is considered the instantaneous welfare loss when the initial inflation rate increases and the loss grows at a rate g , while the discount rate is fixed at a rate d . The present value of the perpetual welfare loss from a permanently higher rate of inflation can be obtained from:

$$(1.4) \quad w = \int_0^{\infty} w_0 e^{(g-d)s} ds$$

The initial instantaneous welfare loss w_0 at any time ' s ' results when the rate of inflation increases from π to $\pi + d\pi$ and is represented by the value of the services lost when real balances are reduced from m_1 to m_2 represents the area under the compensated demand curve (the shaded area).

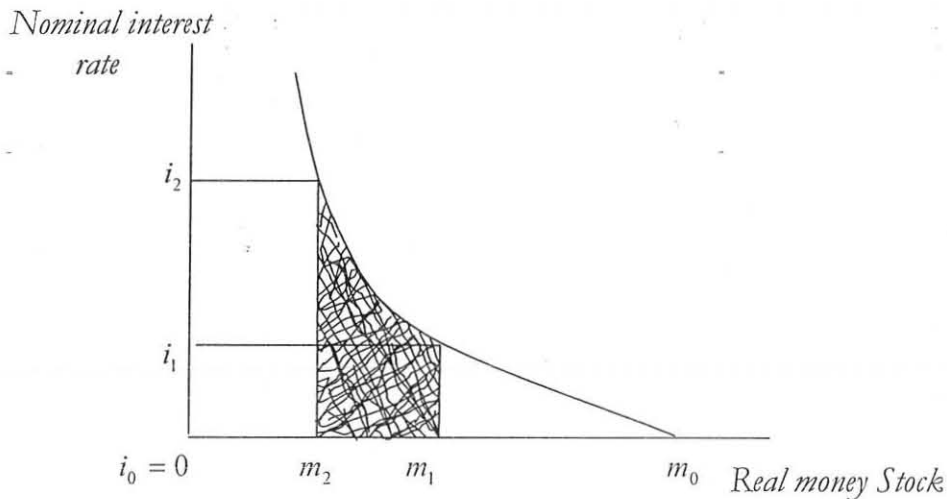
Assuming that a change in inflation produces a proportionate change in nominal interest, the traditional welfare loss calculations imply:

$$(1.5) \quad w(s) = -\frac{\partial m(s)}{\partial i} \cdot i \cdot d\pi ;$$

Where $\frac{\partial m(s)}{\partial i}$ is the slope of the compensated demand curve for real money balances and therefore expression 1.5 can be rewritten as⁹:

⁹ Where E_{mi} in 1.7 represents a constant elasticity of money demand, assuming structural stability in the money demand function.... but it is evident that a practical application would have to substantiate that assumption

$$(1.6) \quad w(s) = \frac{\partial m(s)}{\partial i} \cdot \frac{i}{m(s)} \cdot m(s) \cdot d\pi$$



(Fig. 1)

$$(1.7) \quad w(s) = m(s) \cdot E_m \cdot d\pi$$

In choosing the factor to use to discount future welfare losses we use a rate that corresponds to the marginal rate of substitution since the additional welfare loss is measured by the compensating increment to the consumption of individuals for the net effect of higher inflation. An average nominal interest rate for a period of forty years (1961-1998) is used as a proxy for the discount factor to note the distinction between consumption by a single individual at two different times and the consumption of members of two different generations. The study uses secondary data from the IFS CD-ROM [2002], World Bank World Development Indicators (2004) and World Bank African Development Indicators (2004) and a series of National Bank of Ethiopia Annual Reports.

IV. Limitations and Scope of the Study

In posing the question of whether the gains from an expansionary macroeconomic policy outweigh the losses entails the assumption that policy can be at least temporarily effective in

reducing unemployment. And the analysis that follows neglects real distortions of saving, portfolio choice and real investment that occur because tax liabilities are designed based on nominal capital income instead of real capital income. The preoccupation of this study with the particular welfare loss that results from conserving on real balances emanates from the gap that exists in empirical findings: some studies have argued that this form of welfare loss is insignificant and therefore should not be considered, while still others caution the imprecision of that argument¹⁰. Another fact that motivated the focus on this form of welfare loss is that while other forms of distortions that result from inflation can be removed by either designing contracts based on real capital income [in the case of capital distortions] or by nominal indexations [in the case of relative price distortions that do not favour real wage], welfare loss from holding cash balances can only be removed by a downward revision of nominal interest rates. The significance of the concept of a welfare loss from conserving on cash balances should not be neglected since the rate of inflation determines the amount of revenue from inflation-tax and permits a determination of the rates of the other distortionary taxes. It should also be noted that money constitutes a significant proportion of a household's portfolio of assets in a less developed economy.

¹⁰ Nordhaus (1973) and Feldstein (1979) provide a good example of the debate.

CHAPTER II

Literature Review

I. Theoretical Framework

Inflation and Economic Progress¹¹

Is low inflation essential for economic progress? This question has been a centre of stark controversy for the past five decades and remains a debatable subject. In the 60's the problem of inflation in relation to economic development has been extensively discussed in the context of both developed and less developed economies. But no continent has been severely struck by the problem of inflation than Latin America, to the extent that a public controversy arose, which gave birth to two conflicting schools of thought: the Monetarist and Structuralist schools of thought. Of the three fundamental differences in the positions of the two groups one is critical for this study [*i.e. the compatibility of inflation with economic development.*]

The Structuralists argue¹² that in developing economies-with numerous structural maladjustments and with rapid urbanization, the structural rigidities themselves are responsible for imbalances that cause unavoidable price increases. They further argue that attempts to restrain such price increases are tantamount to stagnation and unemployment. In analysing the inflationary mechanics, the Structuralists distinguish between basic/structural/ factors, circumstantial factors, cumulative factors and propagation factors. The structural factors are brought about by sectoral imbalances, susceptibility to supply shocks, bottlenecks in production and distribution, a narrow tax base, underdeveloped financial markets, low and unstable capacity to import and rigidities of income distribution and a host of other factors. Because of these distortions and rigidities, the Structuralists contend, an upward pressure on prices is in order, and this pressure is necessary concomitant of economic development. The Structuralists are of the belief that stringent price stabilizing policies in an economy would result in slowing down the rate of economic growth [H. S. Odeh (1968)].

¹¹ A good review of the literature on the inflation-growth link is presented in Dawit (2003).

¹² David Felix, Dudley Seers, Joseph Grünwald, A. O. Hirschman, Raul Prébish and Osvaldo Sunkel are among the strongest proponents [cited in Odeh (1968)].

The Monetarist¹³ school, on the other hand, considers inflation as a primarily monetary phenomenon born out of, and perpetuated by large budgetary deficits, constant drive for higher wages; uncommitted monetary authorities import restrictions and control of key prices [especially of electricity, oil and basic food stuffs]. The Monetarist school contends that inflation arises when people attempt living beyond their means. It claims that price stability, a subset of monetary stability, is a prerequisite for sustained economic development and it should be the immediate target of economic policy. The Monetarist school claims that inflation is harmful to growth since it diminishes the real resources available for domestic investment by reducing national savings. Inflation therefore diverts investment into uses that are not beneficial to economic progress [H.S Odeh (1968)].

The ambiguity of the direction of the effects of inflation on savings, investment and growth in the theoretical literature did not lead to the abrupt end of the discussion as many theories for and against the negative effect of inflation on economic progress emerged in the 80's and 90's.

According to the Mundell-Tobin Effect, higher anticipated inflation leads to lower real interest rate, which necessitates portfolio adjustment away from real money balances and towards real capital. Therefore, a higher anticipated inflation is expected to lead to higher and higher real investment and faster economic progress. However, the transmission mechanism has a notable twist to it in the context of less developed countries with underdeveloped domestic capital and financial markets. In this case the portfolio adjustment would be from real money balances to real assets denominated by land, livestock, jewellery and consumer durables, which are not a subset of private investment. Thus in less developed countries, higher anticipated inflation would lower investment. As indicated at the beginning of the section inflation serves as a signal of the authenticity of the monetary authorities' commitment to a stable macroeconomic environment. Therefore, the presence of high and variable inflation in an underdeveloped country is expected to lower investment and domestic savings and hence, economic progress [HadjiMichael and Ghura (1996)].

¹³ Roberto de Olivera Campos, Patel and Berstein, Felipe Pazos [cited in Odeh (1968)]

A cash-in-advance model developed by Stockman (1981) shows that anticipated inflation, by raising the cost of capital, lowers capital accumulation thereby economic progress. A related study by Jose De-Gregorio [cited in HadjiMichael and Ghura (1996)] concluded that inflation is negatively related to economic growth. De Gregorio outlines two types of endogenous growth models to elucidate that inflation can adversely affect growth in the steady state through a compounded effect on both the rate and efficiency of investment. In the first model, De Gregorio argues that increases in inflation forces firms to economise on their real money holdings and suffer the consequences of higher transaction costs and reduction in the value of their capital holdings. A reduction in the rate of investment follows suit, being an inextricable concomitant of increases in the price of capital goods, which in turn reduces capital accumulation and growth. In his second model, De Gregorio relates the productivity of capital to inflation by apriorily assuming that employment influences the productivity of capital. Then he argues that a rise in inflation increases the inflation tax and therefore results in cut backs in labor hour [*entailing a fall in employment*] that in turn leads to a fall in economic progress.

The empirical findings relating inflation have, similar to the theoretical postulates, have yielded mixed results and the debate over the technicalities of analysing the relationship has intensified. It appears that most of the empirical analyses are beset by the problem of casual choices of explanatory variables and results being concealed by heavy data aggregation. Furthermore, the precedence of multivariable, statistically refined econometric studies over atheoretic analysis and vice-versa has complicated the way modelling should be approached, while debated over the philosophy of *correlation determining cause* [or not] has added another dimension to the problem of building coherent and consistent models. A brief summary of the empirical literature on the relationship between inflation and economic progress is following paragraphs. The studies are summarised in accordance with the chronology of *time* to help the *reader* appreciate the evolution of empirical studies on the subject.

An earlier study by Terborgh (1971) contends that the effects of inflation on economic progress are not clear, except for runaway inflation, and that the empirical evidence on the matter does not provide an answer to the debate either. By making use of indices of inflation rates and real GDP growth, published by the Statistical Office of the United Nations, he investigated the

possible correlation between inflation rates and growth rates. Terborgh explored the relationship for two successive 7-year periods, 1953-60 and 1960-1967 and for three groupings of a total of 98 countries. The countries investigated were grouped into: all countries, for which a complete data set is available, developed countries and less developed countries.

The analysis of Terborgh shows that for the total pool, *if there has been any correlation between inflation rates and real per-capita income it has been slight*, with the obvious exception that countries with average rates of inflation exceeding 10% per annum showed lower growth than countries with moderate inflation. The results also showed that the picture is blurry among less developed countries. Terborgh's conclusions were derived out of a classification of countries into three groups: those with average rates exceeding 10%, the top half of the remainder and the bottom half of the remainder. He then proceeded to compare the growth rates, average and median, of these distinct groups with their inflation rates. Terborgh concluded that nothing much could be made out of the data for less developed countries. But, Terborgh cautions, *the growth effects of inflation rates within the under-10% range are not disclosed by the evidence.*

Similar studies by Barro (1995) and Alexander (1997)-[cited in Stanners (1997)] show that inflation hinders in the long run. Barro (1995), by pooling data for around 100 countries, shows that *the impact effects from an increase in average inflation by 10% points a year are reductions in the growth rate of real per-capita GDP by 0.2-0.3% points a year and a decrease in the ratio of investment to GDP by 0.4-0.6%.* The study also notes that there is enough reason to believe that these relations suggest causal influences from inflation to growth and investment. The investigation does not, only, purport to show the direction of causality between inflation and economic growth but also contends that a shift in monetary policy that raises the long-term average inflation rate by 10% per year is estimated to lower the level of real GDP after 30 years by 4-7%, which Barro suggests is more than enough to justify the a strong interest in price stability.

The latter study, on the other hand, deals with pooled time series of 11 OECD countries over the period 1966-1988. He starts by establishing that empirical works that regress simple growth data against inflation are flawed and that the best way to go about the analysis is to regress growth data on capital and labour increments and successively adding the annual inflation rate,

the annual change in the inflation rate, government expenditure and imports. The regression results of Alexander show that highly significant coefficients are found for all parameters—positive for capital and labour inputs and for government consumption and export, negative for inflation and change in the annual inflation rate. Alexander claims that there is sufficient evidence to reject a hypothesis that there should be no association between inflation and real growth. He argues that a reduction in inflation from, say 6% to 2% would imply an improved growth performance of the order of 0.93% or close to 1% per annum.

A study conducted by Stanners (1996), boldly concludes that there is no evidence to support the notion that a low rate of inflation has, in the past and in various countries been associated with improved growth rate. Criticising Alexander's conclusion, Stanners argues that assuming that the complex real economy of a country behaved according to one of the six models developed by Alexander and assuming that none of the other variables changed during a certain period, then any changes in the rate of interest would be accompanied by a change of opposite sign in the rate of growth would be stretching the truth a bit too long.

On the other hand, a study by Richard Buderkin *et.al.* (2000) shows that the effects of inflation on growth change substantially as the inflation rate rises. The study shows that the threshold at which inflation first to seriously, negatively affect growth in output is around 8% for industrial economies, but only 3% or less for less developed countries. The study also shows that the marginal growth costs of inflation for developing countries declines noticeably for inflation rates exceeding the 50% mark. On a related note, Nell (2000) investigates whether inflation at any level is harmful to economic growth. By dividing the inflation experiences in South Africa over the past four decades into four periods, Nell's analysis shows that inflation within the single digit zone may be beneficial to growth, while inflation in the double digit zone culminates in heavy costs in terms of slack growth performances. But, Nell indicates, even in periods when the growth performances have improved as a result of deflationary policies, the costs of inflation far exceed the benefits.

The Welfare Costs and Benefits of Steady Inflation

Most economists, nowadays, reject the view that a permanent reduction in unemployment appears to be possible if a nation was willing to pay the price of a permanently high rate of inflation. According to Feldstein (1979) even rather pessimistic estimates of the slope of the Phillips curve, in some early studies, suggested that the price was well worth paying. But, Feldstein notes, the observed Phillips curve is only a short-run relationship and that the long-run equilibrium rate of unemployment is independent of the rate of inflation. This new understanding has radically transformed the perception of the policy problem. Since a permanent increase in the rate of inflation buys only a temporary reduction in unemployment, deciding whether to pursue an expansionary macroeconomic policy or not requires comparing the present value of the perpetual welfare loss caused by the increase in the inflation with the welfare gain of the temporary reduction in unemployment¹⁴.

Most studies concede that inflation's short-term costs are not too well understood¹⁵ and that the gap between the popular view of inflation and the costs of inflation that economists can identify is large. The dislike for inflation 'borderlines paranoia', yet economists have a hard time identifying substantial costs of inflation. An observation by Ball and Romer (2003) indicates that in many models steady inflation is characterized as adding equal amounts to the growth rate of all prices and wages and to the nominal interest rates of all assets; and therefore does not entail variations in relative prices, real wages or real interest rates and makes it even harder to identify large costs of inflation [Romer (1996)]. The only argument that invalidates the allusion that steady inflation has no real costs is the zero nominal returns that are associated with high-powered money that necessarily reduces its real return. This necessitates a small and frequent conversion of other assets into currency, but since high-powered money is costless to produce the time spent in minimizing cash holdings have no special benefits and, thus represent a cost of inflation. Friedman (1969) argues that the time spent on the futile efforts of conserving on

²⁵ The literature on the subject is too expansive to be cited in detail here, but its essential flavor can be gleaned from the following sample: Bailey (1956), Blanchard and Fisher (1988), Easterly and Fisher (2001), Feldstein (1979), Lucas (2000), Simonsen and Cynse (2001), Cooley and Hansen (1991), Love and Wen (1999), McClure (1986) and Sidrauski (1967).

¹⁵ Feldstein (1979), Ball and Romer (2003)

money balances can be eliminated if inflation is chosen so that the nominal interest rate (the opportunity cost of holding money) is zero and since real interest rates are typically modestly positive, this requires slight deflation.

Another readily identifiable cost of inflation is that it distorts the tax system in that income from capital gains and interest and deduction for depreciation and interest expenses are computed in nominal terms. This would raise the effective tax rate on capital income and distorts the relative attractiveness of investments and eventually displace business capital. The cost of inflation through tax distortions may be larger in scope in developed economies.

Since individual prices do not adjust continuously, even steady, anticipated inflation is seen to cause variations in relative prices as different firms adjust their prices at different times. The inflation induced relative price variability is inclined to cause disruptions in the formation of long-term relationships between customers and firms. But more importantly steady inflation may be costly, although its costs are nothing but a mirage, because people dislike it. Various studies have shown that people have the misapprehension that large changes in wages and prices affect their welfare negatively even if they have no consequences for their real wage. But, the studies show that since the ultimate goal of policy is the public's welfare these potential misapprehensions should represent genuine costs mainly because they are considered 'noise' in decision making of economic agents.

Ball and Romer (2003) also concede that economists are yet to give a clear account of why steady inflation is costly. They note that an appealing but vague theme in many discussions is the allusion that inflation reduces the efficiency of the price system. They characterize inflation as being associated with the Fisherian concept of "*relative price variability that is unrelated to relative scarcities*" and hence leads to misallocation of resources. The study contends that conventional economic models dispute the fact that relative price variability affects consumer welfare. If markets are Walrasian, price variability raises consumer welfare because indirect utility functions are quasi-convex in prices. Price variability benefits consumers because it creates opportunities for substitutions towards low-price goods. They also argue that the same holds in the case that

consumers have to search across sellers; in this case, price variability reduces consumer welfare not only because prices have an allocative role but also because they have an informational role. The study asserts that a model in which consumers enter into long-term relationship with sellers. In deciding to enter a relationship potential customers use a firm's current prices as a signal of the prices that it will charge in the future. When inflation causes relative prices to vary, it reduces the information about future prices in current prices and this loss of information is considered to harm consumers substantially.

The works that are usually credited for bringing out the benefits of steady inflation are Tobin (1972) and Summers (1991)¹⁶. The former argues that when firms find it difficult to cut nominal wages, real wages can make needed adjustments to sector specific shocks more rapidly when inflation is higher. The latter, on the other hand, argues that the since nominal rates can not be negative, low inflation (by suppressing nominal rates) may limit the ability of Central Banks to stimulate aggregate demand in response to contractionary shocks.

II. Empirical Framework

Feldstein (1979) argues that the output costs of permanent inflation are too large to accept the view that the costs of sustained inflation are small relative to the costs of unemployment. Setting aside the intergenerational consequences of the welfare loss of optimal liquidity, Feldstein finds that (by considering a representative individual who will live for *40 years* (1 generation) facing a 2% economic growth rate and a 1% real discount rate) the first year welfare loss of the individual is multiplied by:

$$\int_0^{40} e^{(0.02-0.01)t} dt = 49$$

The first year welfare loss for all members of the current generation (1977-2077) of an increase in the inflation rate by 1% is equal to the product of 0.01 with the real money supply and the elasticity of demand with respect to the rate of interest. The estimates for the US economy show that with narrow money (M_1) equal to approximately \$300 million in 1977 and the elasticity of

¹⁶ Cited in Romer (1996).

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money demand at one-third, the first year loss is approximately \$1 billion. The present value of the total loss that would be experienced by the current generation is thus estimated at approximately \$49 billion or 2.5% of the GDP in 1977. Feldstein claims, therefore, that the loss to the current generation alone of, even a 1% increase in inflation is thus far from trivial.

Feldstein (1979), then, extends his analysis (by using a representative individual's market rate of discount) to an aggregation of the consumption of members of different generations as well as the consumption by a single individual in different years. This extension is based on the proposition that generations are interlinked to each other by what Feldstein refers to *dynastic altruism*, which causes the current generation to allocate consumption between itself and future generations and that the preferences of the current generation are ethically appropriate basis for a social welfare evaluation. The evidence that $r = 0.01$ while $g = 0.033$ would suggest that the present value of the welfare loss caused by a permanent increase in the level of inflation is infinite and therefore concludes that no temporary reduction in unemployment, no matter how large or long lasting could justify a permanent increase in inflation.

Nordhaus (1973), on the other hand, tries to determine the effects of inflationary policies on the distribution of lifetime income. In the spirit of simulation studies, Nordhaus (1973) follows a microeconomic approach. Given wealth and current labor income it is possible to determine future labor income and hence lifetime wealth. From the data and from specific assumptions about individual utility function, the path of potential consumption is then derived. Since the economic mechanisms that generate and transmit inflation differ from one paradigm to the other, Nordhaus defines the sources of inflation in classical, neo-classical, and Keynesian economies.

In the classical system inflation alters the distribution of income and wealth according to the relative holdings of money and fixed assets, while the neoclassical system is a generalization of the classical system and introduces production and savings functions and a mechanism of income distribution. Nordhaus establishes that in this regime inflation affects capital accumulation and via the production and distribution system. It affects real wages and real

interest rates, while these in-turn lead to changes in income wealth and consumption. In the Keynesian system, on the other hand, inflation varies inversely with unemployment and: as in the well known Philips curve.

The study assumes that any inflation initially occurring is fully anticipated and that the shock that is administered thenceforth becomes anticipated. In the Keynesian system the level of inflation is associated with a given level of unemployment, while the other two systems are completely neutral to fully anticipated inflation. The estimation results show that the tendency of inflation as an equalizing factor exceeds its tendency to produce income losses. Nordhaus argues that money is a concern because the yield on non-interest bearing debt cannot adjust to inflation and any change in the rate of interest will reduce the real yield on this debt by the same amount. Since the alternative assets have yield, the inflation can be considered a tax on holdings of non-interest bearing debt, with difference between zero and alternative yields on assets accruing to the government in the form of expenditure foregone. But, the study acknowledges that the tax on real balances coming through inflation is on the order of one-tenth to one-hundredth as important as other effects considered-*especially its effect as a tax on capital accumulation.*

The background to Cooley and Hanson (2003), on the other hand, is the extinction of the view that a little bit of inflation is good for the economy. The Phillips curve, in its earliest incarnations, implied that moderate inflation was worth tolerating because it would permit lower unemployment. In their study they examine the consequences of achieving the goal of targeting zero inflation. The study examines how the presence of other distorting taxes affects the welfare costs of inflation and aside from that the study analyses the consequences of policies that are designed to reduce the inflation rate to zero. The study analyses policies in which inflation is simply reduced to zero and policies in which the revenue from inflation tax must be replaced by increasing the taxes on labor and capital income. In addition the study ventures to appraise the dynamic consequences of reducing the inflation rate to zero, having the change be temporary rather than permanent, unlike Feldstein (1979).

The study employs an equilibrium growth model with money, where money is introduced as a cash-in-advance constraint. It assumes that there are two kinds of goods, a 'cash good' and a

'credit good' and that individuals must purchase the 'cash good' with currency. Both capital and labor income are taxed and the money that is held to purchase the 'cash good' is subject to the inflation tax. The study also makes the simplifying assumptions of *no uncertainty* and *no government debt*.

The results of the study indicate that the presence of other distorting taxes approximately doubles the estimated welfare costs of inflation tax and decreases the revenue potential of the tax. The study finds that a policy that reduces the inflation rate from 5% to zero in an economy with taxes on labor and capital income has the effect of lowering the discounted present value of government revenue by about 2.4% and welfare by only 0.33% of GNP relative to the original policy.

By using data for the period 1900-1994 for the US economy, Lucas (2001) finds that the gains from reducing the annual interest rate from 10% to zero is equivalent to the increase in real income of slightly less than one percent. But, Lucas acknowledges that using aggregate data only, it may not be possible to reliably estimate the gains from reducing inflation further to a rate consistent with zero nominal rate of interest. Lucas claims that the estimated welfare gain of a reduction in the rate of interest varies a great deal, depending on the specific model one uses.

CHAPTER III

Can the revision of nominal variables quell contractionary shocks?

The restraint on inflation has been one of the most important considerations of macroeconomic policy making. On some occasions, drastic measures have been taken to halt the progress of inflation. These policies were followed by significant unemployment and the loss of output. However, decades of inflationary experiences have prompted some economists and politicians to look for new and less vicious tools to combat inflationary tendencies [Nordhaus (1973)]. While it has been established by many that price stability is essential, there are divergent views about the actual costs of inflation.

The overriding objective of monetary policy by the NBE has been containing inflation and fostering sound financial management following the general premise set by International financial institutions that macroeconomic stability has valuable growth dividends. However, although that combined with fiscal austerity has been the major focus of policy for much of the 90s, and remains an integral component of macroeconomic policy in the country after the turn of the millennium, Ethiopia and much of Sub-Saharan Africa remain the growth tragedies of the developing world.

The IMF source book defines macroeconomic stability in terms of current account and fiscal balances consistent with low and declining debt levels and, inflation in the single low digits and rising per capita GDP. Thus, instability implies: large current account deficits financed by short-term borrowing, high and rising levels of public debt, double-digit inflation rates and stagnant and declining GDP levels [IMF cited in UNCTAD (2002)]. This definition does not define the threshold beyond which debt-financed government expansion becomes a liability nor does it measure the degree of price instability that could be tolerated without undermining the long-term expansion of an economy.

Even if only inflation in the single digits is widely considered beneficial to growth, there is a rich collection of studies [mostly citing the economies of Africa] that brands that view as a gross generalization¹⁷ and argues that the threshold may even be larger than that. But the popularly held notion does not seem to budge, overwhelmed by studies providing the antithesis and still remains the corner stone of the evaluation of the performance of economies by International Financial Institutions and a crucial condition making less developed economies eligible for development assistance.

Because of factors that have less to do with stringent government policies to maintain price stability, general price levels declined in Ethiopia for the better half of the 90s. It is argued that the favorable agro-climatic conditions in the consecutive years of the second half of the 90s that gave rise to a boost in agricultural production is the primary factor for continued price decline in the country.

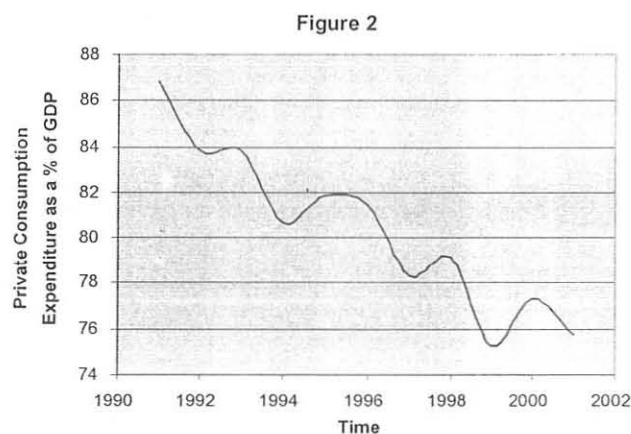
...During the second quarter of 2001/02, the general price level and of food items plummeted down by 0.2 and 1% respectively, while for non-food items it crippled up by 0.6%. The continuous decline in prices, especially that of agricultural products, has a serious impact on the peasantry that consists of 85% of the population.

[NBE (2003)]

The National Bank has taken measures that are aimed at counterbalancing the problem. The set of measures includes a downward revision of the minimum deposit rate by 3%, beginning March 4, 2002, after which the Commercial Banks have revised their lending rates down by 3%. This measure is expected to bring a boost in consumption demand and investment. However, the Bank notes, the strength of this effect depends on the sensitivity of financial savings and investment. Even though the Bank notes that the effectiveness of such a policy measure has been criticized for yielding little in less developed countries, it would seem as if the Bank does not feel compelled to justify its policy choice by showing that [the] alternative policy measures pay even smaller dividends.

¹⁷ The works of Barro (1995), Buderkin et.al (2000), Romer (1996), Nell (2000), Easterly and Bruno (2001), Stanner (1996) provide a consummate summary of the debate.

Commenting on the effect that the push for macroeconomic stability has had, Montiel and Servén (2004) contends that the growth payoff of macroeconomic stability which has endeared it to International Financial Institutions may have been oversold. The study expounds that even though macroeconomic instability inhibits investors' ability and willingness to undertake investment, for macroeconomic stability to deliver growth, those opportunities must exist in the first place and that the creation of opportunities is a task that is carried out by other sort of reforms, mainly of the microeconomic and institutional variety. The very low levels of gross domestic savings in Ethiopia that have averaged a meager 4.64% of GDP for the period 1991/92-1999/2000 testify to that.



Even though the late 90s was constantly cited as a period where the magnitude of the contractionary shock in the Ethiopian economy was strong, both the size of consumption expenditure and gross domestic savings as a percentage of national income have not shown remarkable change beginning the early stages of the reform period [see figure 2], giving the impression that the contractionary shock in the economy may have been tolerated for so long.

An important part of the proposed policy changes in the structural adjustment programmes focuses on fiscal adjustment and the restructuring of the public sector. The World Bank and IMF purport, the structural imbalances that are the major causes of economic stagnation, have been caused to a large extent by high fiscal deficits and a large and inefficiently functioning

public sector [Hermes and Lensink (2001)]. Although the fund has been rethinking its position as a 'crisis manager' and is exercising restraint on its stringent push for fiscal probity [that earned it the label 'a monolithic institution'], the fund has not changed its policy direction concerning Ethiopia and continues to advise that the economy should run a 'sustainable' deficit level and over the course of the reform period has constantly urged authorities to find ways to increase government revenue. The IMF¹⁸ insists on incapacitating fiscal policy instruments as tools of short-term stabilization until the economy establishes itself on a strong fiscal platform [the tax base improves and government revenue grows] and extricates itself from dependence on foreign assistance. The major premise underlying the argument that budget deficits should be kept small is that it might trigger a hard landing in which the demand for domestic assets collapses.

The initial effect of budget deficits is the reduction in national savings [National savings being the sum of private savings (the after tax income that households save rather than consume) and public saving (the tax revenue that government saves rather than it spends)] [Ball and Mankiw (1995)]. Running a budget deficit implies, then, negative public saving and therefore that national saving is reduced below private savings. However, when budget deficits reduce national savings, they must reduce investment, net exports or both¹⁹ and therefore have long-term growth consequences.

¹⁸International Monetary Fund, "The Federal Democratic Republic of Ethiopia: Fifth Review Under the three year arrangement under the Poverty Reduction and Growth Facility-Staff Report; Press Release on the Executive Report Discussion; and statement by the Executive Director for the Democratic Republic of Ethiopia". *IMF country Report No. 04/65*, March 2004.

International Monetary Fund, "The Federal Democratic Republic of Ethiopia: 2004 Article IV Consultations and Sixth Review Under the three year arrangement under the Poverty Reduction and Growth Facility-Staff Report; Staff Statement and Public Information notice and Press Release on the Executive Board Discussion". *IMF country Report No. 02/25*, January 2005.

Federal Democratic Republic of Ethiopia (FDRE) and Ministry of Finance and Economic Development (MOFED), "Ethiopia: Sustainable Development and Poverty Reduction Program", July 2002, Ethiopia.

¹⁹ If Y denotes Gross Domestic Product, T taxes, C consumption, and G government purchases, then private savings is $Y - C - T$, and public saving is $T - G$. Therefore national saving S :

$$S = Y - C - G$$

Using the Keynesian accounting identity $Y = C + I + G + NX$ and replacing for S :

$$S = I + NX$$

Even if, in general, budget deficits are assumed to have a negative impact on growth, in some models²⁰, emphasis is put on the role of specific deficit adjustments on growth. These models show that reducing expenditure on particular components of the government budget may provide a positive signal with respect to the seriousness of the government to implement a fiscal adjustment programme. Cutting the wage bill and reducing subsidies on primary goods are difficult to implement from a political economy point of view [Hermes and Lensink (2001)]. Thus, cuts in these kinds of government expenditures may lend credibility to the adjustment efforts of the government, which may stimulate private investment. Therefore, the relationship between fiscal policy and growth is not always clear-cut and in some cases, theories differ in their view on the direction of the relationship between the two variables. The varying methods employed in empirical investigations to determine the impact of fiscal policy on growth attest to the divergent theoretical expositions on the subject. Two of the dominant approaches have been a focus on aggregate variables of fiscal policy [taxation, investment and consumption spending] that largely determines that the composition of fiscal policies does not matter and rules out the possibility that different policies may have different effects on growth, and at the other end, are studies that rely on the specific components of fiscal policy and their effects on growth [Adam and Bevan (2001)].

While the present chapter discusses the size of the welfare loss from inflation, the next chapter is devoted to the investigation of the divergent views on fiscal policy and evaluates the validity of the argument that there is room for growth enhancing fiscal adjustment while also holding the view that there is a threshold to growth enhancing government expansion. The presentation is backed by a revision of the institutional set up required to make systematic deficit financing possible, holding the general premise that fiscal expansion without a developed institution of deficit financing is not possible. The present chapter tries to answer the question: Is the welfare cost from inflation lowered by the reduction in the return from capital assets. It shows that a policy of interest rate revisions fails to expand consumption by triggering higher money demand

²⁰ Bertola and Drazen (1993), Giavazzi and Pagano (1990 and 1996) and Sutherland (1997) [All cited in Hermes and Lensink (2001)].

[The Supposed effect: \downarrow interest rates \Rightarrow \downarrow opportunity cost of holding money \Rightarrow \downarrow welfare cost of inflation from portfolio selection \Rightarrow \uparrow Money \Rightarrow \uparrow Aggregate Consumption Demand- may not be tenable].

Is the NBE justified in using the monetary policy rule? A Summary of Results

Using the method outlined in section II of chapter I in conjunction with the revised version of estimating the money demand function for a typical less developed country sketched out in appendix II, some general inferences can be drawn about the effectiveness of reducing minimum deposit rates in influencing money demand and ultimately aggregate consumption. The method adopted here is intended to show that the theoretical transmission mechanism that is laid out by the bank, in the previous section breaks down. Implying if the reduction in the minimum deposit rate that revises the rate of return on the portfolio of capital assets against money doesn't result in lower welfare costs from holding money that in turn doesn't raise the demand for money; the reduction in the minimum deposit rate does little to increase aggregate consumption demand.

Estimation of the Aggregate Money Demand Function

Ever since the ground breaking seminal work of Richard Porter and Susan Ranney [Porter and Ranney (1982)] expounded that macro-policy prescription that relied on advanced country macro-models²¹ to explain the economies of Less Developed Countries [from now on LDC's] often yielded non-standard results, it has been the preoccupation of LDC macro modellers to test the validity of policy prescriptions based on the components of 'traditional' advanced country macro-models

Prominent studies including Goldsmith (1969), Porter (1965), McKinnon (1973) and Ayre (1977) have identified the structure and activities of developing countries' markets for financial assets as being an essential source of the difference in macro-economic analysis of advanced and less developed economies. A unifying theme in the studies is that government policies in many LDC's has acted to perpetuate the underdevelopment and 'compartmentalization' of the

²¹ That outline equilibriums in the goods and the financial market and aggregate demand and supply.

financial mechanism often referred to as financial repression [a term coined by McKinnon and Shaw (1973)]. The authors note that the financial markets of LDC's are characterized, among other things, by [Porter and Ranney (1982)]:

- i. A low ratio of financial assets to national wealth (GNP).
- ii. Prevalence of self-financing of investment.
- iii. The spectrum of financial institutions in the modern sector is dominated by commercial banks that do not do much further than accept deposits and make well-secure loans for working capital purposes.
- iv. Beyond the organized sector, there is an extensive unorganised system of curb markets and moneylenders with, generally much higher interest rates.

Porter and Ranney have summarised the characteristics of a typical LDC's financial market outlined by their predecessors to describe theoretically the effects of the explanatory variables involved in defining an aggregate money demand function in an LDC [*Appendix II provides a summary of Porter and Ranney's theoretical model*].

Aggregate Money Demand Functions-a historical perspective

Attempts to construct empirical representations of aggregate money demand functions prior to mid-1960 focused primarily on the estimation of a long-run specification. The most striking feature of these models was that they operated under the assumption that the data generating process traced out intersections of demand and supply curves for real balances; the observed quantities of real money balances corresponded to the quantity of real balances that are desired at the current values of the arguments of the demand function. These studies were criticized on the grounds that although they subscribe to the assumption noted above they chose data that were generated over a long period of time. Thus, creating the ambiguity that the long run is a reference to the time span of the data series rather than the equilibrium assumption of the specification.

Two of the most celebrated works in the class of models described above is found in Melzer (1963) and Chow (1966). Both studies spotlighted the role of wealth or permanent income as an

argument of the equilibrium demand for real balances. Meltzer found that both theory and empirical evidence support the view that the long-run demand function is consistent with the classical quantity theory of money, which according to Meltzer has two arguments of equally potent explanatory power: “interest rates and non-human wealth”. Gregory Chow, on the other hand, concludes that permanent income is a better explanatory variable than both wealth and current income and that while the former is of slightly better explanatory power than current income, the latter figures in the long run relationship as a complementary variable [Hoffman and Rasche (1996)].

It was shown in various publications that the Chow-Meltzer models are almost identical by construction. The data and the solutions of the Chow and Meltzer models are reproduced in Hoffman and Rasche (1996) and De Wald, Anderson and Thursby (1986) [cited in Hoffman and Rasche (1996)]. It was observed that the results had appealing test statistics, all except for the Durbin-Watson d , a result akin to those that Granger and Newbold cautioned in their seminal article of 1974 as 'spurious'.

II. The Baseline Aggregate Money Demand Model-McCullum (1997)

The baseline model has its foundation in the optimization problem of the individual-this model is similar in its construction to the Baumol-Tobin inventory model, but possess a touch of generality that the former does not have²². The simplified result of the optimisation problem, by assuming specific functional forms for labour supply and utility, can be represented

as: $\frac{M_t}{P_t} = \frac{a\alpha}{1-\alpha-a\alpha} C_t \left(1 + \frac{1}{r_t}\right)$, where $\frac{a\alpha}{1-\alpha-a\alpha}$ represents the money multiplier and C_t and r_t represent aggregate consumption demand and prices

²² The formal presentation of the individual optimization problem is presented in Bennet McCallum (1997).

For general purposes of exposition the widely used version of the model is employed, which has the simplified form:

$$\frac{M_t}{P_t} = \gamma \frac{C_t}{r_t}$$

This representation is highly convenient for manipulation since it can be transformed into a log-linear form that is linear in the variables. But the transaction variable chosen in most, if not all empirical instances, is income y and therefore the appropriate log-linear transformation is:

$$\log\left(\frac{M_t}{P_t}\right) = \gamma_0 + \gamma_1 \log y_t + \gamma_2 \log r_t \quad \text{OR,}$$

$$\log\left(\frac{M_t}{y_t P_t}\right) = \beta_1 + \beta_2 \log r_t$$

$$\log m_t = \beta_1 + \beta_2 \log r_t$$

Where $\gamma_0 = \log \gamma$ and the individual's money demand function is aggregated to the economy to yield the aggregate money demand function for the economy, in which case the arguments presented in the above model are: real aggregate money demand, net national product [OR gross domestic product, which is chosen in some empirical studies as being the appropriate scale variable, Chow (1966)], and r represents the return on alternative forms of assets [McCallum considers 20 years of corporate bond yield]. In cases where there are no corporate bonds to consider or that the data for one is sketchy there is no alternative but to use the deposit rate adjusted for inflation. The expected signs of the parameters, from theory, is that $\gamma_1 > 0$ and $\gamma_2 < 0$. Lieberman's 1980 study for the U.S economy for the period 1897-1958 showed that although the estimated parameters of the model have signs as per expectation, the estimated value of γ_2 is larger than suggested by various other studies. In many studies that were conducted after WW.II quarterly rather than annual data were used to analyse aggregate demand functions. This gave researchers valuable data points to work with while the problem of accounting for sluggish adjustment by money holders to fluctuations in the determinants of money demand²³. In our

²³ Influential studies on the area include Goldfeld (1973) and Goodfriend (1985)

case the return on alternative capital assets r is proxied by time deposits to allow working with differenced data.

III. Estimation results

The transformed Porter and Ranney aggregate money demand function superimposed on McCullum's framework produces results that are summarized in Appendix iii. Both single equation cointegration and multivariate cointegration are used to show that, unlike the developed country aggregate money demand functions, the money income ratio trends upwards showing that there aren't material technical changes in the provision of transactions services and that money remains a significant component of monetary aggregates [money constitutes 40% of the monetary aggregates in Ethiopia]. The money income ratio therefore relates to time deposits positively which only could be inferred as national income is a more stronger determinant of aggregate money demand than interest rates are.

It should also be noted that the size of the welfare cost from inflation [i.e. *as the fraction of income people would require as compensation in order to make them indifferent between living in a steady state with an interest rate constant at r and an otherwise identical steady state with an interest rate near zero*] depends on the size of the interest elasticity of the money-income ratio. If the interest elasticity of aggregate money demand is greater than one in absolute value terms, the welfare estimates are bound to be negative.

Some studies have preferred to work with a semi-log specification of aggregate money demand, while a few others have opted to use the double log specification [McCullum (1997)]. The essential difference in the two is that the former enters the interest rate variable in levels since interest rate data do not exhibit remarkable jumps and therefore differencing them might render the variable insignificant or might increase the power of the test. Cox and Ericsson IV encompassing tests show that the semi-log specification [model II] is a better fit than the double-log specification [model I]. But pairing model II with the semi-log specification estimated using multivariate regression shows that model IV is the best fit.

Both model-selection information criteria and encompassing tests fail to choose between the semi-log and double-log specifications estimated using multivariate least squares. However, in all instances the estimated coefficients of the long-run processes are larger than what is theoretically expected rendering the welfare estimates negative. Negative welfare estimates imply, in aggregate terms, that households would pay not to see interest rates revised to zero or that the transaction services that money provides makes them ambivalent to interest rate changes that have less to do with their decisions of portfolio selection. Then if inflation produces a proportionate positive change in interest rates, an exogenous shock to interest rates from inflation is less than likely to produce portfolio selection away from money. A supporting argument could be that those that have experienced deflation are not at all terrified by the prospects of inflationary tendencies.

Another explanation to the counter intuitive (*to conventional wisdom, at least*) results may be due to the fact that lower interest rates cause lower prices. There is a strong claim that the economies of LDCs is structured in a way that the assumption of profit-maximization is less appropriate [Porter and Ranney (1982)] and that some sort of variable cost mark-up pricing is apposite in explaining *firms'* production decision. Correspondingly it is noted that entrepreneurs in LDCs borrow both from the formal sector and from the curb market at the margin, in order to finance their variable costs, so that relevant factor prices for profit maximization or mark-up calculations should internalize interest costs. If one believes that the overriding determinant of prices are cost considerations, then it should hold that as interest costs of firms go up the variable cost of the firms rises and therefore the price of their outputs go up. If the increase in prices somehow forces the price of inventories [*or real assets*] up, then people would shift from inventories [*real assets*] to money, a switch from one asset with a nominal return of zero to the other. If we believe that the Baumol-Tobin framework for portfolio selection holds, then in the absence of alternative capital assets to hold, people would be forced to hold all of their wealth in money and inventories [*and/or real assets*]. Porter and Raney (1982) have engendered results that are opposed to the justifications given above by claiming that formal financial market interest rates and curb market interest rates are complementary and therefore a rise in interest rates would cause people to be creditors at the curb market and hence results in people holding less of money. But the statistical results of the present study show that the effect postulated by Porter

and Ranney may well be shrouded by the inventory-money trade-off. The impulse response sketched out in *Appendix III* show that Money responds positively to one standard deviation increase in interest rates.

But it should be noted that the results that are reported in the *Appendices* do not at all purport that there are no welfare costs from inflation. They merely suggest that the absence of alternative capital assets renders the welfare cost calculations from portfolio adjustment useless and therefore even in periods of high inflation people could be forced to hold money, albeit liquidity means heavy inflation taxation. This result also holds that the standard monetary policy scenarios spanned out by traditional analysis would produce counterintuitive results. The welfare cost analysis indicates that even if there are welfare costs from holding money they do not exceed the transaction services that money offers. It also offers a policy-debate on what the pertinent policy measures that aid to catapult a less developed country out of a contractionary shock are. An important note that should be addressed is that in the absence of knowledge on how people behave to changes in monetary policy instruments, there has to be sufficient knowledge that the alternative policy measures to combating contractionary shocks would do an even worse job. One important inference that could be made from our analysis is that in a contractionary economic environment where prices are depressed because of low aggregate demand monetary policy that seeks to encourage spending becomes impotent as nominal interest rates hit the zero bound.

CHAPTER IV

Government Size and Economic Growth: Does a Fiscal Adjustment Programme make up for the pitfalls of an Expansionary Fiscal Policy as a viable short-run stabilization policy option?

Little could be disputed that where government did not exist, anarchy reigned and little wealth was accumulated. But after governments took hold, the rule of law and the establishment of property rights often contributed importantly to economic growth of countries. But it is also a fact that where governments have monopolized the allocation of resources, and other economic decisions, societies have not been successful in attaining relatively high levels of affluence. Economic progress is limited when government is zero percent of the economy but also when it is at or near 100 percent. Therefore one is compelled to ask just what is about right from the standpoint of maximizing economic welfare. A popular way of estimating the optimal size of government in an economy is by making use of an *Armey Curve* [that borrows from a technique popularised by Arthur Laffer]. Richard Armey argued that in a state of anarchy output per capita is low. Similarly when government makes all input and output decisions, output per-capita is likewise low. But where there is mix of private and government decisions, on the allocation of resources, however output is often larger [Armey (1995)].

The output enhancing effects of government dominate when government is very small and expansions in government size are associated with expansions in output. But at some point the expansion in government size ceases to cause an expansion in output and the growth retarding aspects of government grow larger and the growth enhancing features of government diminish. Further expansion of government contributes to economic stagnation and decline. In a world with 'little' government the rule of law is not unassailable and the strong can expropriate the assets of the weak with impunity, there is therefore little incentive to save and invest. Furthermore, without some collective action there is no protection from foreign intrusion. Collective action also facilitates the creation of roads that improve transportation and lower trading costs. Government can also create a reliable medium of exchange, further developing the gains from trade. Thus it is acknowledged that the establishment and early growth of

government is associated with rising levels of income and positive rates of economic growth. When government is small, political actions at income redistribution via tax policy or through payments to the poor are modest in magnitude. “As transfer payments and progressive taxation grow with increasingly large government, the negative effects of governmental spending magnify. In small amounts, welfare payments help the poor and do not dramatically influence behavior. As the payments grow larger and more comprehensive, they lead to pronounced work disincentive effects. Thus, it is to be expected that as government absorbs an increasingly large percent of national output, incremental spending will actually have an adverse effect on output²⁴”.

But “as governments grow the law of diminishing returns begins operating. While the construction of roads initially assists output expansion, the construction of secondary roads and the upgrading of primary roads start to have less added impact per money spent. Furthermore the taxes and/or borrowing levied to finance government impose increasing burden. Low taxes become higher and new taxes are added to low consumption levies, with increasingly adverse impact on human economic behaviour. Higher tariff rates start to thwart trade²⁵”. Hence new government spending no longer enhances economic growth

Empirical evidence concur that Armeij curves exist in most modern western economies and that they are located at the downward sloping portions of the Armeij curves where the reduction in the relative size of government has positive implications for growth [*there is no theoretical objection to the existence of Armeij curves in less developed economies*]. The Armeij curve is defined as a quadratic function in which government as a percent of total output G is related to total output (real gross domestic product), O and:

$$O = \alpha + \beta G - \phi G^2$$

²⁴ Richard K. Vedder and Lowell Gallaway. “Government size and economic growth”. Prepared for the Joint Economic Committee, Washington, December 1998.

²⁵ Vedder and Gallaway (1998).

The positive sign on the linear term, G , is designed to show the beneficial effects of government spending on output, while the negative sign for the squared term means the variable measures any adverse effects associated with increased governmental size. Since the squared term increases in value faster than the linear term, the presence of negative effects from government spending eventually will outweigh the positive effect,

Output also expands over time for reasons unrelated to government size. Human and capital resources grow, so one would expect that with the passage of time, T , output would grow. To control for this factor, it is customary to introduce the time variable T , defining the first year examined with the value one. In addition, output varies with the business cycle. We would expect output to be below the time-trend gross domestic product (GDP) in years in which the civilian unemployment rate, U , is high. Although that notion is theoretically plausible in developing economies where rain-fed agriculture makes a predominant component of national output fluctuations in rainfall is bound to determine how national output behaves. It can be observed from Ethiopian data that rainfall, on average, varies once every two years. Therefore, we will expand equation:

$$O = \alpha + \beta G - \phi G^2 + \delta T - \varphi O_{-2}$$

A bit of Empiricism: The works of Vedder and Gallaway (1998) and Teshome (1993) empirically reinforce the intuitive feel to the theoretical postulates discussed above.

Table (4.1) Modelling RGDP by OLS (using data from MoFED)
The estimation sample is: 1988 to 2002

	Coefficient	Std.Error	t-value	t-prob	Part.R ²
RGDP_2	0.621658	0.2160	2.88	0.016	0.4531
Constant	-63842.73	.714e+004	-1.72	0.116	0.2280
GperO	2010.63	2216.	0.908	0.385	0.0761
GperOSQ	-35.6436	34.33	-1.04	0.324	0.0973
TIME	1295.00	638.3	2.03	0.070	0.2916
Sigma	5719.76	RSS	327156334		
R ²	0.86943	F (4, 10) =	16.65 [0.000]**		
Log-likelihood	-148.018	DW	1.41		
No. of observations	15	no. of parameters	5		
Mean_(RGDP)	19915.5	var (RGDP)	1.6704e+008		

$$O = -63842.73 + 2010.63G - 35.6436G^2 + 1295T + 0.6217O_{-2}^{26}$$

(SE)	(-.714e + 004)	(2216)	(34.33)	(638.3)	(0.216)
	$R^2 = 0.87$			$D = 1.41$	

The latter study shows how the nationalization drive pursued by the Socialist Ethiopian regime, (during the period 1975-1991), and the extensive involvement of government in the economic sphere led to the rise in public sector employment and forced an unprecedented rise in the wage bill. The study articulates that the snowball effect of growth in government size has contributed significantly to the escalation of the fiscal burden on the economy and the successive reallocation of resources in favour of less productive activities and away from social services expenditures. The study shows that the rapid growth in government expenditure has contributed greatly to the failure of the revenue system to contribute to capital finance. Moreover the growing structural deficits stifled the growth of private investment in a manner that is more direct than what theoretical postulates suggest. The study cites the barring of entry into specific investment lines by the legislature, the private sector being rationed out of the scarce-credit market in which preferential treatment was given to government investment projects, the unwieldy bureaucratic arrangement in licensing and the frequent turnover in investment policy as being the primary factors that constrained private investment from thriving. The public sector, with all its inefficiency, was allowed to bask in the sunlight that shone bright for it while private sector investments, “with relatively higher yield and greater social utility²⁷”, were sidelined ultimately retarding domestic capital formation.

One would anticipate, then, from the theoretical postulates that in less developed economies there is room for [productive] expansion of government and hence one expects to find the

²⁶ $O = \alpha + \beta G - \phi G^2 + \delta T - \varphi O_{-1}$;

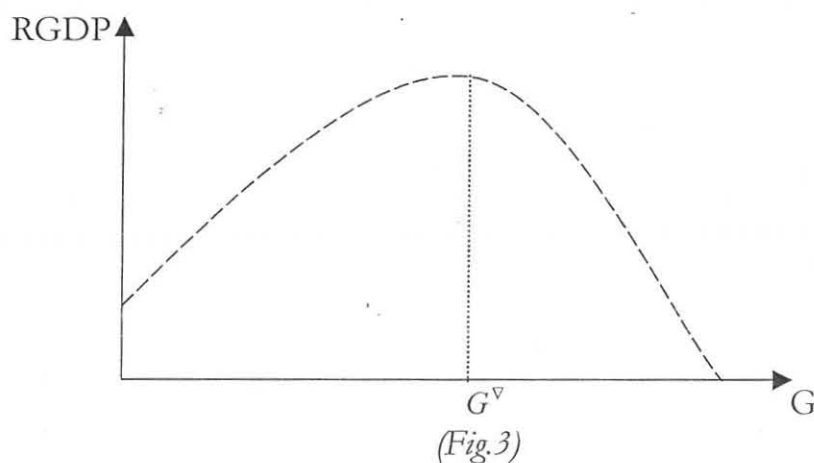
$$\frac{\partial O}{\partial G} = \beta - 2\phi G = 0$$

And therefore optimal government size is given by: $G^{\nabla} = \frac{\beta}{2\phi}$. Using the results from the above

table $G^{\nabla} = 28.7\%$.

²⁷ Teshome (1993)

government-to-output ratio G on the rising part of the Armeij curve (assuming the theory of Armeij curves is appealing enough). This expectation follows from the apprehension that institutional capabilities in property right enforcement,



establishment of a properly functioning judiciary, and developed infrastructure (among others) are not fully formed in less developed economies. But one can easily argue his way out of this proposition by showing that less resources are committed in institutional ground-work in less developed economies to materially alter national output. A structural decomposition of government budgetary allocation during the Socialist regime in Ethiopia reveals that “general services”, defence forming the single most important category, constituted a significant proportion of the annual budget [Teshome (1993)]. This has contributed to the premature development of the growth enhancing effects of enlargement in government size that are discussed in some detail above.

A test of the theory using Ethiopian data shows that, even though institutional capacity is at a premature stage in its development, the size of government in the relevant period of analysis is already negatively correlated with national output [but in latter years this trend has diminished significantly and government size has averaged 31% (see appendix VI, figure xi). In the relevant period of analysis and from the standpoint of growth optimisation, the curve peaks where

government spending equals 30 percent of national output. But in recent years federal spending has grossed a four-decade peak of 43 percent of national output, which suggests that government is around 13 percent too large (in 1998). But using figures reported by the World Bank [World Bank African Development Indicators (2004)] to calculate the optimal size of government would produce results that are counterfactual [due to the significant growth in official development assistance as a proportion of government expenditure calculations of government size would show that actual government size as a proportion of real national output [measured in Gross domestic product] is greater than 100% bordering an unprecedented 161% in the year 2000²⁸]. Moreover, the data would show that an Armeey curve in government expenditure doesn't exist. But IMF country reports on Ethiopia for the years 2004 and 2005 have projected optimal government size of around 34.8% and 32.8% under the 5th review for the year 2003/04 and under the revised version of the 5th review respectively. The figures 30.3% and 30.0% have been projected for the years 2004/5 and 2005/2006 under the 5th review while the revised version of the 5th review projects optimal government size of 30.7% and 29.2%²⁹. Setting aside differences in results derived from lack of correspondence in data from international and local sources and investigating the effects of government downsizing [or the possibility of government resource reallocation] by decomposing federal government spending into its key components³⁰ produces results that are summarized in table 4.1.

²⁸ Data on official development assistance was obtained from World Bank World Development Indicators (2004); for the sake of clarity the regression reported in Table I was repeated using data from World Bank African Development Indicators (2004).

²⁹ IMF Country Report No.05/25, [page 31] and IMF Country Report No. 04/65, [page 23].

³⁰ No attempt is made to treat all of the categories of federal spending. That would require running a myriad of regressions. Although a lot of insight could be gained from an expansive analysis, my attempts to paint a wholesome picture are shackled by enormous data requirements. Therefore categories of spending that are important and for which data is found are treated.

Table 4.2 Investigating the existence of Arney curves in public expenditure components

Components Investigated	Does a persistently negative spending growth relation ship exist?	Does the Arney Curve exist?	Data Periods	Calculated thresholds as %GDP	Average Budget Allocated For the periods as %GDP (1982-1995)	Statistical Significance
Total Recurrent Expenditure	No	Yes	1983-1995	26.5	18.1	25%
Expenditure for economic services	No	Yes	1984-1995	1.7	1.19	25%
Justice Expenditure	No	Yes	1984-1995	0.13	0.104	25%
Defence Expenditures	Yes	No	1982-2002	-	6.06	-
Education Expenditure	Yes	Yes	1985-2002	2.5	2.35	25%
Health Expenditure	No	Yes	1992-2002	1.37	0.73	25%
Pension Expenditure	Yes	No	1987-1995	-	0.8	-
Public Debt	No	Yes	1987-1995	2.85	2.2	25%
Public Expenditure for Subsidies	Yes	No	1987-1995	0.49	0.6	25%
General Public Services	Yes	No	1984-1995	11.79	8.25	25%

Key to equations presented in Appendix V

Total Recurrent Expenditure is labelled (tre) in equation 3, while (treSQ) refers to the square term defining the nonlinearity of the effect of the components of government spending on growth.

Expenditure for economic services in equation (4) is labled (es), with the nonlinear term (esSQ)

Justice Expenditure in equation (5) is labelled (j) with thw nonlinear term (jSQ)

Education Expenditure in equation (1) is labelled as (education) with the nonlinear term (educationSQ)

Health Expenditure in equayion (2) is labelled as (health) with the nonlinear term (healthSQ)

Public debt in equation (6) is labelled as (pub debt) with the nonlinear term (pub debtSQ)

General Public Services in equation (7) is labelled as (gps) with the nonlinear term (gpsSQ)

The results reported above show that there could be gains in national output from reducing expenditure on defence (for instance) [Taylor approximations to the quadratic expression could provide the approximate gains in output growth from a reduction in expenditure on defence]. The results reported on table 4.2 also show that public expenditure on *justice* and public expenditure for *subsidies* may be higher than their thresholds from an output maximization point of view, while public expenditures on *education*, *health*, *economic services*, *total recurrent expenditure*, *public debt* and *general public services* are below their threshold from an output maximization point of view. The table also shows that there is a persistent negative relationship between growth and *defence* and *public sector contribution to the pension fund*. The results testify to the fact that even though government downsizing can be contested on the grounds that the application of different data sets produces results that are varied³¹, a case could be made that the reallocation of resources in the public sector produces valuable output growth. This move could limit the negative effects of drawing new resources into the public sector through distortionary taxation.

Does the Institutional Framework for Resource Transfer Exist?

One cannot be certain that resource transfers from one public sector to the other require developed deficit financing institutions. An elaborately developed institution of deficit financing is important where the components of the government budget: government revenue and government expenditure are not properly aligned. But in the particular case of fiscal adjustments that is discussed in previous sections resource transfers can be carried out at the beginning of a fiscal year. It should be noted that reducing the size of the budget allotted to a particular sector does not necessarily imply that the resources committed to that sector grow less [in absolute terms]. That necessarily depends on the growth of national output. In order to avoid significant social dislocation, in the event that national income is low in the years of adjustment, *which implies the budget that is allocated to sectors with lower social return is low in absolute terms compared to periods before the resource transfer*, the fiscal adjustment can be carried out in series of steps over a number of years complemented by programmes of social safety-nets.

³¹ Although data from World Bank World Development Indicators (2004) and African Development Indicators (2004) both declare the existence of an Armeij curve in government size unsound, IMF country reports 2004 and 2005 have both projected figures that are very close to what our estimates of the Armeij curve in government have come up with.

CHAPTER V

Conclusions

One should note that even if this study is titled *adopting a general equilibrium framework to the estimation of the welfare costs of inflation*, it uses the notion of the welfare cost from inflation as it applies to the choice of short-term stabilization policy. The welfare calculations serve as a bridge in the evaluation of which policy direction, in the broadest sense: Monetary vs. Fiscal policy, has the largest dividend. It is shown that the predilection for monetary policy by international financial institutions as an instrument to quell contractionary shocks/ for short term stabilization, in general, may well be a position that has warranted a second thought. The renascent belief that fiscal policy can be a viable policy choice in subduing contractionary tendencies [short-term stabilization] in an economy is long overdue.

The study reinstates fiscal policy as a tool of short-term macroeconomic stabilization and assigns it a function beyond a commitment on the part of policymakers to progressively lower deficit. It should be noted that these claims do not oppose the underlying premise of structural adjustment/poverty reduction programs [*i.e. it is imperative that less developed economies should reduce structural imbalances that have led to the stagnation of their economies*] but, essentially, help to place back the economies of less developed countries back to the interior of the policy space. With fiscal policy measures primarily aimed at progressively lowering budget deficits, the policy choices for short term macroeconomic stabilization have seen LDCs rely, inflexibly, on monetary policy measures that have a host of problems. These conclusions are not surprisingly original, and in fact give, one who is even faintly acquainted with the works of Adam and Bevan (2001) and Hermes and Lensink (2001) a strong sense of déjà vu. It was shown in *Chapter III* that, in the absence of the abundance of formal financial institutions and therefore no reliance on rates of interest in portfolio selection on the part of private decision makers the National Bank of Ethiopia's brand of monetary policy is ill-omened

The study shows that the recommended fiscal adjustment reforms, in *chapter IV*, do not require highly structured institutions [*financial or otherwise*]. If one is convinced that the adoption of institutions [*which it itself an essential by-product of economic development that is achieved over a long period of*

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Appendix I. An Extended version of the Sidrauski optimization problem [For a shorter summary refer to Lucas (2001)]

The simplified version of the general equilibrium model of Sidrauski (1967) provides the framework for the consumer surplus equations of Lucas (2001). Consider a representative agent model, in which the households gain utility from the consumption c of a single non-storable good, and from their holdings $z = \frac{M}{P}$ of real balances. Household preferences are

$$\sum_{t=0}^{\infty} (1 + \rho)^{-t} U(c_t, z_t) \dots \dots \dots (1)$$

Where the current period utility function U is given by

$$U(c, z) = \frac{1}{1 - \sigma} \left[c \varphi \left(\frac{z}{c} \right) \right]^{1 - \sigma} \dots \dots \dots (2)$$

provided $\sigma \neq 1$. These homothetic preferences are consistent with the absence of trend in the ration of real balances to income and the constant relative risk aversion form is consistent with balanced growth.

Each household is endowed with one unit of time, which is inelastically supplied to the market and which produces $c_t = y_t \approx y_0 (1 + \gamma)^t$ units of the consumption good in period t . Hence one equilibrium condition is

$$c_t = y_t \approx y_0 (1 + \gamma)^t \dots \dots \dots, (3)$$

Households begin period t with M_t units of money, out of which they pay a lump sum tax H_t (or, if $H_t < 0$, receive a lump sum transfer). The price level is P_t , so the cash flow constraint for households is

$$M_{t+1} = M_t - H_t + P_t y_t - P_t c_t \dots \dots \dots (4)$$

in nominal terms. In real terms, it is

$$(1 + \pi_{t+1}) z_{t+1} = z_t - h_t + y_t - c_t \dots \dots \dots (5)$$

Where $h_t = \frac{H_t}{P}$ and $(1 + \pi_{t+1}) = \frac{P_t}{P_{t-1}}$

The Bellman equation¹ for the constrained optimisation problem is,

$$\bar{v}(z, y) = \max_c \left\{ \frac{1}{1-\sigma} \left[c \varphi \left(\frac{z}{c} \right) \right]^{1-\sigma} + \frac{1}{1+\rho} \bar{v}(z', y(1+\gamma)) \right\} \dots\dots\dots(6)$$

Where $z' = \frac{z - h + y - c}{1 + \pi}$ and $y_{t+1} = y(1 + \gamma)$

the homogeneity assumption implies that the above expression can be approximated by

$$\bar{v}(z, y) = v(m)y^{1-\sigma} \text{ where } m = \frac{z}{y}$$

and therefore, $\bar{v}(z', y(1 + \gamma)) = v(m')y^{1-\sigma} (1 + \gamma)^{1-\sigma}$

from the homogeneity assumption it follows that

$$\bar{v}(z, y) = v(m)y^{1-\sigma} = \max_c \left\{ \frac{1}{1-\sigma} \left[c \varphi \left(\frac{z}{c} \right) \right]^{1-\sigma} + \frac{1}{1+\rho} \bar{v}(z', y(1+\gamma)) \right\} \dots\dots\dots(7)$$

¹ For a given utility function $U = r(x_t, c_t)$, and an individual lives for two periods [where x_t is the capital stock (and state variable) and c_t represents consumption (and the control)], and the production function is given by $x_{t+1} = f(x_t, c_t) = Ax_t^\alpha - c_t$. The maximization of the two-period utility function by the method of dynamic programming is represented as $\max \{r(x_1, c_1) + \beta r(x_2, c_2)\}$. The steps involved in the maximization problem are given by: Step I. $\max_{c_2} \{r(x_2, c_2)\} : \frac{\partial r(x_2, c_2)}{\partial c_2} = 0 \Rightarrow c_2 = g(x_2)$ [The optimum decision

function for period II],

Step II. The value function for the period is given, then, by $v_2(x_2) = r(x_2, g_2(x_2))$

Step III. Write down $r(x_1, c_1) + \beta v_2(x_2)$

Step IV. $\max_c \{r(x_1, c_1) + \beta v_2(f(x_1, c_1))\} \Rightarrow \frac{\partial r(x_1, c_1)}{\partial c_1} + \beta \frac{\partial f(x_1, c_1)}{\partial c_1} \cdot \frac{\partial v_2(f(x_1, c_1))}{\partial x_2} = 0 \Rightarrow c_1 = g_1(x_1)$

Then the Bellman equation is given by: $v(x_1) = \max_{c_1} \{r(x_1, c_1) + \beta v_2(x_2)\}$

Therefore the steady state Bellman equation for a t-period problem is given by $v(x_t) = \max_{c_t} \{r(x_t, c_t) + \beta v(x_{t+1})\}$

if ω is made to represent the ratio: $\omega = \frac{c}{y}$

the above equation can then be transformed in

$$\bar{v}(z, y) = v(m)y^{1-\sigma} = \max_{\omega} \left\{ \frac{1}{1-\sigma} \left[\omega y \varphi \left(\frac{z}{\omega y} \right) \right]^{1-\sigma} + \frac{1}{1+\rho} y^{1-\sigma} (1+\gamma)^{1-\sigma} \bar{v}(z', y(1+\gamma)) \right\} \dots\dots(8)$$

$$v(m)y^{1-\sigma} = \max_{\omega} \left\{ \frac{1}{1-\sigma} \left[\omega \varphi \left(\frac{z/y}{\omega} \right) \right]^{1-\sigma} y^{1-\sigma} + \frac{(1+\gamma)^{1-\sigma}}{1+\rho} (1+\gamma)^{1-\sigma} \bar{v}(m') y^{1-\sigma} \right\} \dots\dots(9)$$

$$v(m)y^{1-\sigma} = \max_{\omega} \left\{ \frac{1}{1-\sigma} \left[\omega \varphi \left(\frac{m}{\omega} \right) \right]^{1-\sigma} + \frac{(1+\gamma)^{1-\sigma}}{1+\rho} (1+\gamma)^{1-\sigma} \bar{v}(m') \right\} y^{1-\sigma} \dots\dots(10)$$

$$v(m) = \max_{\omega} \left\{ \frac{1}{1-\sigma} \left[\omega \varphi \left(\frac{m}{\omega} \right) \right]^{1-\sigma} + \frac{(1+\gamma)^{1-\sigma}}{1+\rho} (1+\gamma)^{1-\sigma} \bar{v}(m') \right\} \dots\dots\dots(11)$$

Where $m' = \frac{z'}{y(1+\gamma)} = \frac{z-h+y-c}{y(1+\gamma)(1+\pi)} = \frac{m-v+1-\omega}{1+\mu}$ since $1+\pi = \frac{1+\mu}{1+\gamma}$

The first order and envelope conditions for the above expression evaluated at $\omega = 1$, which holds along any equilibrium path \Rightarrow

$$\frac{1}{1-\sigma} \left\{ (1-\sigma) \omega^{-\sigma} \left[\varphi \left(\frac{m}{\omega} \right) \right]^{1-\sigma} + \omega^{1-\sigma} (1-\sigma) \left[\varphi' \left(\frac{m}{\omega} \right) \right] \left[\varphi \left(\frac{m}{\omega} \right) \right]^{-\sigma} (-m\omega^{-2}) \right\} + \frac{(1+\gamma)^{1-\sigma}}{1+\rho} v'(m')[-1] = 0$$

evaluated at $\omega = 1$,

$$[\varphi(m)]^{1-\sigma} - m\varphi'(m)[\varphi(m)]^{-\sigma} = \frac{(1+\gamma)^{1-\sigma}}{(1+\rho)(1+\mu)} v'(m')$$

defining $\frac{1}{1+r} = \frac{(1+\gamma)^{1-\sigma}}{(1+\mu)(1+\rho)}$, the usual sum of the real rate and the rate of inflation [for small values of the parameters approximated by $\rho + \sigma\gamma + \mu - \gamma$]

$$[\varphi(m)]^{1-\sigma} - m\varphi'(m)[\varphi(m)]^{-\sigma} = \frac{1}{(1+r)}v'(m') \dots\dots\dots(12) \text{ and ;}$$

$$v'(m) = [\varphi(m)]^{-\sigma} \varphi'(m) + \frac{1}{1+r} v'\left(\frac{m-v}{1+\mu}\right) \dots\dots\dots(13)$$

Putting together 12 and 13, provided that along the steady state m is constant:

$$\frac{\varphi'(m)}{\varphi(m) - m\varphi'(m)} = r \dots\dots\dots(14)$$

If $m(r)$ is made to represent the m value that solves equation 14, expressed as a function of the interest rate. The value of the m that satisfies the steady state solution is what is identified with as a 'money demand function'. The discounted flow of the utility of the households' that satisfies equation 14 is $U(y, m(r)y)$ where y is growing at the constant rate γ and provided that $m'(r) < 0$, this utility is maximized over non-negative nominal interest rates at $r = \sigma^2$. If the welfare cost of inflation is defined as the income compensation that is needed to leave the household indifferent between r and zero, then the welfare cost of inflation defined as a function of the nominal interest rate [$w(r)$] is the solution to the compensation identity

$$U[(1+w(r))y, m(r)y] = U[y, m(0)y]$$

then using equation 2

$$\frac{1}{1-\sigma} \left[(1+w(r))y \varphi\left(\frac{z}{(1+w(r))y}\right) \right]^{1-\sigma} = \frac{1}{1-\sigma} \left[y \varphi\left(\frac{z}{y}\right) \right]^{1-\sigma}$$

$$\frac{1}{1-\sigma} \left[(1+w(r))y \varphi\left(\frac{z}{(1+w(r))y}\right) \right]^{1-\sigma} = \frac{1}{1-\sigma} \left[y \varphi\left(\frac{z}{y}\right) \right]^{1-\sigma}$$

$$(1+w(r))\varphi\left(\frac{m(r)}{1+w(r)}\right) = \varphi[m(0)] \dots\dots\dots(15)$$

² Friedman's rule of optimal monetary policy: the rate of deflation equalling the rate of real interest rate.

Using the money demand function specified above to solve for the welfare function, provided that there is a function $\psi(m)$ such that it is inverse to the money demand function $m(r)$

expanding 14 yields:

$$\begin{aligned}\varphi'(m) &= \psi(m)\varphi(m) - m(r)\varphi'(m)\psi(m) \\ \varphi'(m)[1 + m(r)\psi(m)] &= \psi(m)\varphi(m) \\ \varphi'(m) &= \frac{\psi(m)}{1 + m(r)\psi(m)}\varphi(m) \dots \dots \dots (16)\end{aligned}$$

differentiating 15 with respect to r

$$w'(r)\varphi\left(\frac{m(r)}{1+w(r)}\right) + \varphi'\left(\frac{m(r)}{1+w(r)}\right)\left[m'(r) - \frac{m(r)w'(r)}{1+w(r)}\right] = 0$$

applying $m = \frac{m(r)}{1+w(r)}$ to 16

$$\varphi'\left(\frac{m(r)}{1+w(r)}\right) = \frac{\psi(m)}{1 + \frac{m(r)}{1+w(r)}\psi(m)}\varphi\left(\frac{m(r)}{1+w(r)}\right)$$

substituting into 17 yields

$$\begin{aligned}-w'(r)\varphi\left(\frac{m(r)}{1+w(r)}\right) &= \varphi'\left(\frac{m(r)}{1+w(r)}\right)\left[m'(r) - \frac{m(r)}{1+w(r)}w'(r)\right] \\ -w'(r)\varphi\left(\frac{m(r)}{1+w(r)}\right) &= \frac{\psi\left(\frac{m(r)}{1+w(r)}\right)}{1 + \frac{m(r)}{1+w(r)}\psi\left(\frac{m(r)}{1+w(r)}\right)}\varphi\left(\frac{m(r)}{1+w(r)}\right)\left[m'(r) - \frac{m(r)}{1+w(r)}w'(r)\right] \\ -w'(r) - \frac{m(r)}{1+w(r)}\psi\left(\frac{m(r)}{1+w(r)}\right)w'(r) &= \psi\left(\frac{m(r)}{1+w(r)}\right)m'(r) - \frac{m(r)}{1+w(r)}\psi\left(\frac{m(r)}{1+w(r)}\right)w'(r) \\ w'(r) &= -\psi\left(\frac{m(r)}{1+w(r)}\right)m'(r) \\ w(r) &= \int w'(r)dr = -\int \psi\left(\frac{m(r)}{1+w(r)}\right)m'(r)dr\end{aligned}$$

Assuming that a change in inflation produces a proportionate change in nominal interest, the above expression is congruent to equation 1.3.

$$w(s) = -\frac{\partial m(s)}{\partial i} \cdot i \cdot d\pi$$

Appendix II. The Porter and Ranney alternative to aggregate money demand modeling.

Porter and Ranney (1982) developed an eclectic model of developing country financial markets, which showed that the demand for real balances by households is primarily for transaction purposes and is a function of real income y and the nominal interest rates i they can earn on alternative assets, ignoring the rates of return on capital and firms' equity as possible determinants of household demand for real balanced, purely for expositional reasons, and using the curb market loan rate i ,

they argue that the households demand for real balances $\frac{D_H}{P}$ is:

$$\frac{D_H}{P} = f_H(y, i)$$

On the other hand, firms demand money in order to finance their variable costs during the period of production- their costs are primarily composed of imported raw materials and labour³ thus:

$$\frac{D_F}{P} = f_F\left(\frac{wN + emy}{P}, i\right)$$

where 'e' and 'm' are the exchange rate and the proportion of output set aside for the import of raw materials.

Therefore the demand for real balances is the aggregate of the two components and is hence expressed as:

$$\frac{M_t}{P_t} = L(y, i) = f_H(y, i) + f_F\left(\frac{wN + emy}{P}, i\right)$$

The authors, then, proceeded to show that this characterization of the financial markets of less developed countries produces results that the traditional models of money demand would not support when subjected to the analysis of comparative statics.

³ Firms in less developed countries are considered net-importers of raw materials.

The study does not venture further to the specification of a mathematical model that could be tested econometrically. A simple method of capturing the effect of the additional variable [some composite measure of aggregate cost: $\frac{wN + emy}{P}$] is to superimpose it to the baseline aggregate money demand function of McCullum (1997) discussed in some detail above.

If $S = \frac{w\left(\frac{N}{y}\right) + em}{P}$, $Sy = \left[\frac{w\left(\frac{N}{y}\right) + em}{P} \right] y$, and assuming that the positive relationship that S has

with money demand can be translated by S entering the baseline model multiplicatively, for a double-log specification:

$$\frac{M_t}{P_t} = \lambda \frac{S_t^\delta y_t}{r_t^\nu}$$

$$\frac{M_t}{P_t y_t} = \lambda \frac{S_t^\delta}{r_t^\nu}$$

then applying the Lucasian expression $m_t = \frac{M_t}{P_t y_t}$, $\Rightarrow m_t = \lambda S_t^\delta r_t^{-\nu}$

For a semi-log specification: $\frac{M_t}{P_t y_t} = \zeta \frac{S_t^\delta}{e^{\theta r_t}} \Rightarrow m_t = \zeta S_t^\delta e^{-\theta r_t}$

Applying these transformations of the money demand function to the Lucasian measure of welfare results in welfare equations of the form

$$w(r) = S_{i(r)}^\delta r^{1-\nu} \lambda \left[\frac{\nu}{1-\nu} \right], \text{ for the log-log specification and}$$

$$w(r) = S_{i(r)}^\delta \frac{\zeta}{\theta} \left[1 - (1 + \theta r) e^{-\theta r} \right], \text{ for the semi-log specification.}$$

Money demand functions to be estimated:

For the double-log specification: $\log m_t = \log \lambda + \delta \log S_t - \nu \log r_t$

And for the semi-log specification: $\log m_t = \log \zeta + \delta \log S_t - \theta r_t$

*Appendix III. Modeling Aggregate Money Demand in a Less Developed Economy-the Porter and
Ranney Alternative.*

Model I

$$\log m_t = \log \lambda + \delta \log S_t - \nu \log r_t$$

$$\Delta \log m_t = \alpha + \mu \Delta \log S_t - \varphi \Delta \log r_t + \omega(ECM)$$

EQ (1) Modelling DLm by OLS (using data from MOFED)					
The estimation sample is: 1973 to 1998					
	Coefficient	Std.Error	t-value	t-prob	Part.R ²
Constant	0.0385182	0.01283	3.00	0.007	0.2907
DLS	0.214511	0.1256	1.71	0.102	0.1171
DLDEPOSIT	4.53380	2.554	1.78	0.090	0.1253
ECM	-0.0598792	0.08241	-0.727	0.475	0.0234
sigma	0.0600459	RSS	0.079321215		
R ²	0.33915	F(3,22) =	3.763 [0.025]*		
log-likelihood	38.4081	DW	2		
no. of observations	26	no. of parameters	4		
mean(DLm)	0.0483393	var(DLm)	0.0046165		

Solved static long run equation for Lm				
	Coefficient	Std.Error	t-value	t-prob
Constant	-45.7668	5.597	-8.18	0.000
LDEPOSIT	11.0748	2.525	4.39	0.000
LS	1.74209	0.2669	6.53	0.000
Long-run sigma = 0.185209				

$$ECM = Lm + 45.7668 - 11.0748 * LDEPOSIT - 1.74209 * LS;$$

WALD test: Chi²(2) = 84.5224 [0.0000]*

$$DLm = +0.03852 + 0.2145 * DLS + 4.534 * DLDEPOSIT - 0.05988 * ECM$$

(SE) (0.0128) (0.126) (2.55) (0.0824)

The Johansen Cointegrating Procedure (Model III)

Sample: 1975 -1998

Test Assumption: Linear deterministic trend in the data

Series: LM LS LDEPOSIT

Lag interval(in first differences): 1 to 2

Eigenvalue	Max-Eigen Statistic	5% critical Value	Probability	Hypothesized No. of CE's
0.587534	21.25445	21.13162	0.0481	None *
0.433063	13.62017	14.26460	0.0630	At most 1
0.109587	2.785681	3.841466	0.0951	At most 2

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values

Unnormalized Cointegrating Coefficients

LM	LS	LDEPOSIT
6.472754	-18.02227	-122.8100
7.900371	-8.914302	-22.43989
0.973957	-8.401287	70.63172

Unrestricted Adjustment Coefficients (alpha):

D(LM)	0.024341	-0.025551	-0.008445
D(LS)	0.074842	-0.008951	0.003991
D(LDEPOSIT)	0.000555	0.001086	-0.000712

Normalized cointegrating coefficients: 1 cointegrating equation (s)

LM	LS	LDEPOSIT
1.000	-2.784327	-18.97337
	(0.34344)	(3.66430)

Model III

EQ(3) Modelling DLm by OLS (using Cointegration.xls)					
The estimation sample is: 1973 to 1998					
	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	-241835	9.180e+004	-2.63	0.015	0.2398
DLS	0.280961	0.09438	2.98	0.007	0.2871
DLDEPOSIT	6.07042	2.248	2.70	0.013	0.2489
JOH [†]	-0.0491132	0.01864	-2.63	0.015	0.2398
sigma	0.0529786	RSS	0.0617481716		
R^2	0.485556	F(3,22) =	6.922 [0.002]**		
log-likelihood	41.6638	DW	2.52		
no. of observations	26	no. of parameters	4		
mean(DLm)	0.0483393	var(DLm)	0.0046165		

$$DLm = - 2.418e+005 + 0.281*DLS + 6.07*DLDEPOSIT - 0.04911*JOH$$

(SE) (9.18e+004) (0.0944) (2.25) (0.0186)

[†] JOH represents the cointegrating equation and enters the equation capturing the long-run relationship between the variables.

The Johansen Procedure (Model IV)

Sample: 1973-1998

Test Assumption: Linear deterministic trend in the data

Series: LM LS DEPOSIT

Lag interval: 1 to 3

Eigen Value	Max-Eigen Statistic	5% critical Value	Probability	Hypothesized No. of CE's
-------------	------------------------	----------------------	-------------	-----------------------------

0.587840	21.27223	21.13162	35.65	None *
0.431217	13.54214	14.26460	20.04	At most 1
0.108156	2.747136	3.841466	6.65	At most 2

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values

Unnormalized Cointegrating Coefficients

LM	LS	LDEPOSIT
6.299340	-17.88165	-13.22018
8.058318	-9.431258	-2.566586
0.873040	-8.241473	7.667226

Unrestricted Adjustment Coefficients (alpha):

D(LM)	0.024955	-0.025184	-0.008234
D(LS)	0.075069	-0.007476	0.004008
D(DEPOSIT)	0.004884	0.010038	-0.006633

Normalized cointegrating coefficients: 1 cointegrating equation (s)

LM	LS	DEPOSIT
1.000	-2.838655	-2.098661
	(0.35276)	(0.40750)

Log Likelihood = 127.1917

Model IV

EQ(4) Modelling DLm by OLS (using Cointegration.xls)					
The estimation sample is: 1973 to 1998					
	Coefficient	Std.Error	t-value	t-prob	Part.R ²
Constant	-0.565219	0.2284	-2.47	0.022	0.2177
DLS	0.281295	0.09443	2.98	0.007	0.2874
DDEPOSIT	0.656458	0.2434	2.70	0.013	0.2485
JOH2	-0.0489861	0.01857	-2.64	0.015	0.2403
sigma	0.0529999	RSS	0.0617977519		
R ²	0.485143	F(3,22) =	6.91	[0.002]**	
log-likelihood	41.6534	DW	2.52		
no. of observations	26	no. of parameters	4		
mean(DLm)	0.0483393	var(DLm)	0.0046165		

DLm = -0.5652 + 0.2813*DLS + 0.6565*DDEPOSIT - 0.04899*JOH2
 (SE) (0.228) (0.0944) (0.243) (0.0186)

Encompassing test statistics: 1973 to 1998

Model IV is: DLm on

Constant DLS DDEPOSIT JOH2

Model II is: DLm on

Constant DLS DDEPOSIT ECM 1

Instruments used:

Constant DLS DDEPOSIT JOH2 ECM 1

Sigma [M1] = 0.0529999 sigma [M2] = 0.0594536 sigma [Joint] = 0.0542423

Test

Model IV vs. *Model II*

Model II vs. *Model IV*

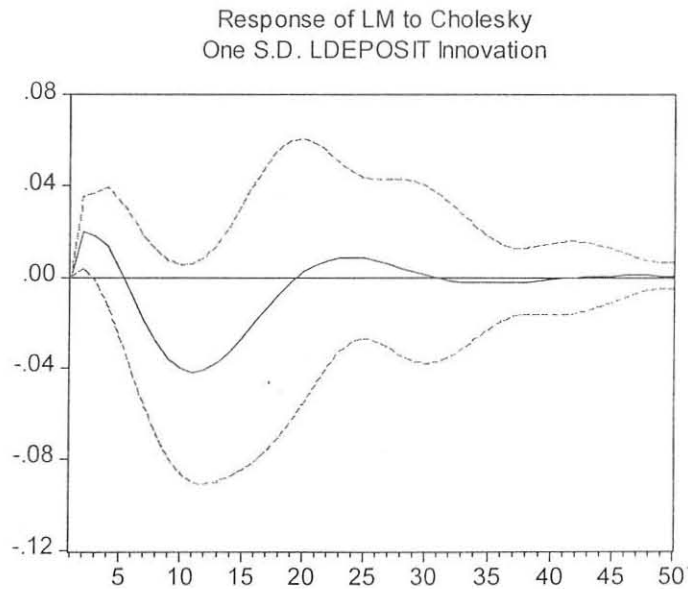
Cox N (0,1) = 0.06620 [0.9472] N (0,1) = -8.154 [0.0000]**

Ericsson IV N (0,1) = -0.06104 [0.9513] N (0,1) = 6.586 [0.0000]**

Sargan Chi²(1) = 0.0039075 [0.9502] Chi²(1) = 4.5201 [0.0335]*

Joint Model F(1,21) = 0.0037305 [0.9519] F(1,21) = 5.4303 [0.0298]*

Impulse response from VAR⁵ (2) of LM LS and DEPOSIT



⁵ Lag selection was based on sequential testing for the model with the lowest information criterion.

fig (vii)

Plotting pension expenditure against growth

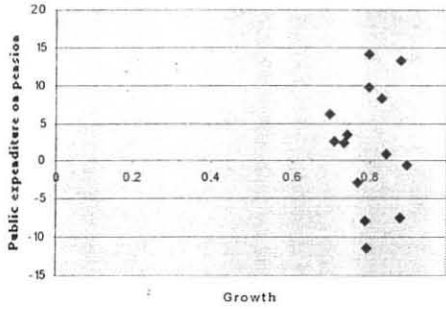


fig (viii)

Plotting Public Debt against Growth

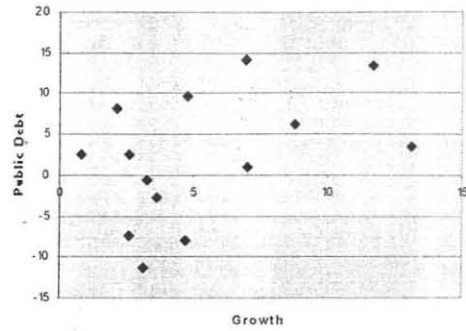


fig (ix)

Plotting Public spending on Subsidies against Growth

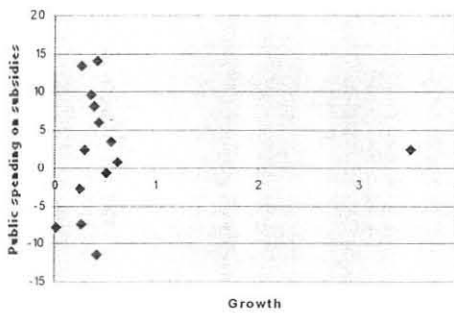


fig (x)

Plotting general public spending against growth

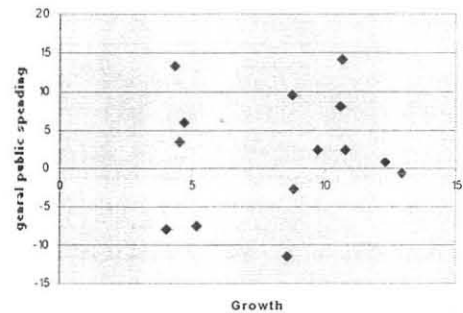
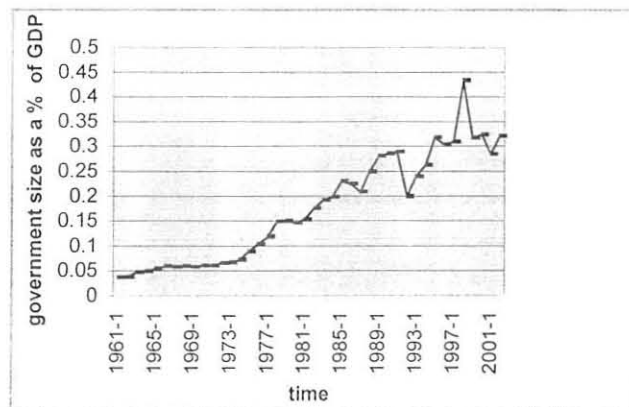


fig (xi)



Appendix V. Results reported on table 4.2

EQ(1) Modeling growth by OLS (using data from MoFED and World Bank World Development Indicators (2004)). The estimation sample is: 1985 to 2002

	Coefficient	Std.Error	t-value	t-prob
growth_2	-0.497356	0.2226	-2.23	0.044
Constant	-80.2284	94.06	-0.853	0.409
education	46.9359	58.06	0.808	0.433
educationSQ	-5.98002	8.668	-0.690	0.502
Time	-0.151758	0.5746	-0.264	0.796
Sigma	6.56231		RSS	559.830135
R ²	0.363627		F (4, 13) =	1.857 [0.178]
Log-likelihood	-56.4762		DW	2.24
No. of observations	18		no. of parameters	5
Mean (growth)	3.37873		var (growth)	48.8734

EQ(2) Modeling growth by OLS (using data from MoFED and World Bank Development Indicators). The estimation sample is: 1985 to 2002.

	Coefficient	Std.Error	t-value	t-prob
growth_2	-0.432006	0.2339	-1.85	0.088
Constant	-49.0315	51.75	-0.948	0.361
health	94.3706	100.3	0.941	0.364
healthSQ	-34.4622	43.16	-0.798	0.439
Time	-0.434062	0.7493	-0.579	0.572
Sigma	6.55416		RSS	558.440572
R ²	0.365207		F (4, 13) =	1.87 [0.176]
Log-likelihood	-56.4539		DW	1.97
No. of observations	18		no. of parameters	5
Mean (growth)	3.37873		var (growth)	48.8734

EQ(3) Modeling growth by OLS (using data from MoFED and World Bank World Development Indicators(2004)). The estimation sample is: 1984 to 1995

	Coefficient	Std.Error	t-value	t-prob
growth_2	-0.550304	0.2746	-2.00	0.085
Constant	-68.8459	75.88	-0.907	0.394
tre	5.25721	7.795	0.674	0.522
treSQ	-0.104539	0.2068	-0.505	0.629
Time	1.46003	0.8942	1.63	0.147
Sigma	7.30189		RSS	373.223314
R ²	0.502782		F (4, 7) =	1.77 [0.239]
Log-likelihood	-37.6509		DW	2.38
No. of observations	12		no. of parameters	5
Mean (growth)	1.67059		var (growth)	62.5519

EQ (4) Modeling growth by OLS (using data from MoFED and World Bank World Development Indicators (2004)). The estimation sample is: 1984 to 1995

	Coefficient	Std.Error	t-value	t-prob
growth_2	-0.490783	0.2626	-1.87	0.104
Constant	-84.5987	107.1	-0.790	0.455
es	126.812	175.6	0.722	0.494
esSQ	-37.1660	69.72	-0.533	0.610
Time	-1.18652	1.071	-1.11	0.305
Sigma	7.23722		RSS	366.64121
R ²	0.511551		F(4, 7) =	1.833 [0.227]
Log-likelihood	-37.5441		DW	2.52
No. of observations	12		no. of parameters	5
Mean (growth)	1.67059		var (growth)	62.5519

EQ(5) Modelling growth by OLS (using data from MoFED and World Bank World Development Indicators(2004)). The estimation sample is: 1984 to 1995

	Coefficient	Std.Error	t-value	t-prob
growth_2	-0.588912	0.2622	-2.25	0.060
Constant	-98.8483	77.50	-1.28	0.243
j	1736.36	1363.	1.27	0.243
jSQ	-6577.97	5733.	-1.15	0.289
Time	-0.388022	0.9039	-0.429	0.681
sigma	6.96454		RSS	339.533665
R ²	0.547664		F(4,7) =	2.119 [0.182]
log-likelihood	-37.0833		DW	1.99
no. of observations	12		no. of parameters	5
mean(growth)	1.67059		var(growth)	62.5519

EQ(6) Modelling growth by OLS (using data from MoFED and World Bank World Development Indicators (2004)). The estimation sample is: 1984 to 1995

	Coefficient	Std.Error	t-value	t-prob
growth_2	-0.397222	0.2998	-1.33	0.227
Constant	-51.8903	39.42	-1.32	0.229
pub debt	40.1155	31.76	1.26	0.247
pub debtSQ	-6.78932	6.454	-1.05	0.328
Time	0.0365204	0.8222	0.0444	0.966
sigma	7.02875		RSS	345.82297
R ²	0.539286		F(4,7) =	2.048 [0.192]
log-likelihood	-37.1934		DW	2.23
no. of observations	12		no. of parameters	5
mean(growth)	1.67059		var(growth)	62.5519

EQ(7) Modelling growth by OLS (using data from MoFED and World Bank World Development Indicators (2004)). The estimation sample is: 1984 to 1995

	Coefficient	Std.Error	t-value	t-prob
growth_2	-0.628779	0.2877	-2.19	0.065
Constant	-45.5976	39.38	-1.16	0.285
gps	6.57208	7.789	0.844	0.427
gpsSQ	-0.277646	0.4407	-0.630	0.549
Time	1.94231	1.214	1.60	0.154
sigma	7.19902		RSS	362.781305
R ²	0.516693		F(4,7) =	1.871 [0.220]
log-likelihood	-37.4806		DW	2.07
no. of observations	12		no. of parameters	5
mean(growth)	1.67059		var(growth)	62.5519

THE THESIS MY ORIGINAL WORK, HAS NOT BEEN PRESENTED FOR A DEGREE IN ONLY OTHER UNIVERSITY AND THAT ALL SOURCES OF MATERIAL USED FOR THE THESIS HAVE BEEN DULY ACKNOWLEDGED.

CANDIDATE

A handwritten signature in blue ink, appearing to read 'Dawit Birhanu Tessema', written over a horizontal line.

DAWIT BIRHANU TESSEMA