Ethiopian Economics Association (EEA)

PROCEEDINGS OF THE SEVENTH INTERNATIONAL CONFERENCE ON THE ETHIOPIAN ECONOMY

Edited by
Getnet Alemu

May 2010

Volume I

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❖ ALL ACTIVITIES OF EEA ARE SPONSORED BY THE AFRICAN CAPACITY BUILDING FOUNDATION (ACBF), EMBASSY OF UK (DFID), EMBASSY OF SWEDEN (SIDA), THE NORWEGIAN CHURCH AID, EMBASSY OF NETHERLANDS, EMBASSY OF IRELAND (DCI), FRIEDRICH EBERT STIFTUNG OF GERMANY (FES), AND INTERNATIONAL DEVELOPMENT RESEARCH CENTER (IDRC) OF CANADA.

FOREWORD

The Ethiopian Economic Association (EEA) is happy to issue three volumes of the proceedings of the 7th International Conference (the 18th Annual Conference) on the Ethiopian Economy that was held from June 25 – 27, 2009 at EEA Multi-purpose Building Conference Hall. EEA has been organizing annual conferences on the Ethiopian Economy every year as part of its overall objectives to contribute to the economic advancement of Ethiopia through dissemination of economic research findings; promotion of dialogue on socio-economic issues; promotion of education in economics in higher learning institutions; enhancing national, continental and global networks of professionals and institutions; and advancement of the professional interests of its members.

Since its establishment, the Ethiopian Economic Association has been actively engaged in economic research, training, and organization of International and National conferences and round table discussions on the Ethiopian economy and the dissemination of the results of these activities through its various publications. It has also been able to provide professional opinion and advice on many issues affecting the development of the country.

As a result of these and other efforts of the Association, EEA has successfully established itself as a key player in the economic and social development process of Ethiopia and become a truly independent source of socio-economic policy options and data base in Ethiopia for the Ethiopian Government, the Ethiopian people and the International Community at large.

The 7th International Conference on the Ethiopian Economy attracted high turnout of the participants, papers presenters and session organizing institutions. The conference was attended by about 420, 238 and 252 participants during the first, second and third days of the conference, respectively. The conference officially opened by H.E. Ato Neway Gebre-Ab, Director, Ethiopian Development Research Institute and chief economic Advisor to the Prime Minister of FDRE.

All in all, 74 papers were presented in seven plenary and five parallel sessions. Of the total paper presented at the three day conference, 19 papers were presented by session organizers that include World Bank, Future Agriculture, EDRI, IFPRI, RiPPLE, Economics Department of AAU, Young Lives Study and Ethiopian Development Research Institute. The remaining 55 papers were presented by individual researchers.

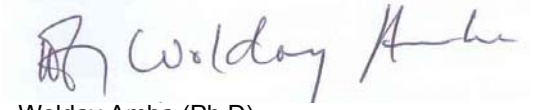
Out of the total 55 papers presented by individuals on this 7th International Conference, the editorial committee received 37 papers from authors and reviewed them. Comments and suggestions including editorial comments were communicated to authors for improvement. Among the 37 papers, the editorial committee selected 25 papers to be included in this edition. In addition to this, six papers which were presented by session organizers (IFPRI, Future Agriculture, EDRI and AAU) were edited and included in this edition. All these papers are organized into three volumes. Volume I contains Growth & Development, Volume II contains Finance and Social Sector Development and Volume III contains Agriculture and Related Development.

I would like to take this opportunity to express my heartfelt gratitude, on my own behalf and on behalf of the Ethiopian Economics Association, to the many people and organizations that made the conference a resounding success. First and foremost, I thank the authors of the papers and the audience whose active participations made the conference meaningful and dynamic. The World Bank and Commercial Bank of Ethiopia are sincerely acknowledged for sponsoring the Conference. The many professionals who dedicated their time to the conference and served as chairpersons deserve due thanks for their special contributions.

The staffs of the EEA deserve a special recognition for their enthusiasm and perseverance in managing the conference from inception to completion. I also want to extend my personal gratitude to the Organizing Committee and members of the Executive Committee of the Ethiopian Economics Association for the dedicated services and the leadership they provided to the Association.

Our special thanks go to our partners who have shared our vision and provided us with generous financial support to materialize the activities of EEA. These include; The African Capacity Building Foundation (ACBF), The Norwegian Church Aid, The Royal Netherlands Embassy, The Swedish Embassy through SIDA, The Development Cooperation of Ireland (DCI) and the Ireland Embassy, the British Embassy through DFID, the Friedrich Ebert Stiftung of Germany, and International Development Research Center (IDRC) of Canada.

Finally, I would like to extend my sincere gratitude to H.E, Ato Neway Gebre-Ab, Director, Ethiopian Development Research Institute and chief economic Advisor to the Prime Minister of FDRE, for his an insightful keynote address; and other senior government officials who spared their busy schedule and participated in the conference.



Wolday Amha (Ph.D)
President of the Ethiopian Economics Association

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Growth and Development

Growth and Development

OPTIMAL POLICY MIX IN ETHIOPIA

Emerta Asaminew Aragie[1]

Abstract

Macroeconomic policies should be harmonized with objectives in which they have the most influence. This is the main idea of Mundell's principle of Effective Market Classification (EMC). This particular paper, thus, aimed at examining this fundamental principle on the Ethiopian economy. The discussion is crucial as the country is facing with the problem of achieving both internal balance (as output is quite far from the full employment level of output) and external balance (as the country is facing with significantly increasing negative non-debt financed external balance).

Relaxing some of the assumptions of the Mundell's basic principle of EMC to fit to the Ethiopian economy, we find that social welfare is maximized if monetary policy is assigned to the external balance and fiscal policy to the internal balance. To maximize the impact of policy variables on their respective target variables, authorities should devise ways to make the policy instruments function effectively and properly. We further extended our analysis and seen that, despite the optimal mix, how the behavior of the two policy making authorities (the central bank and the fiscal authority) have been changing for the period from 1971 to 2008 to various developments in the internal and external balances. The result reveals that neither fiscal policy nor monetary policy had been changing in some systematic way in response to movements in the internal balance. On the other hand, both of the two polices had been responding significantly to deteriorations in the external balance. This implies that small open economies like Ethiopia are highly concerned with the external imbalance as it dictates the country's ability to borrow from abroad.

Key words: Effective market classification, optimal policy mix, macroeconomic policies

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1. Introduction

1.1 Background

Thinking about macroeconomic policies has transformed in the past 10 years (Kirsanova et al, 2005) and different models and techniques have been tried. Accordingly, one can find quite extensive theoretical and empirical literature regarding the effects of the interaction of monetary and fiscal policy on macroeconomic performance. This is consistent with what Lucas (2003) argued during his Presidential address to the American Economic Association. Once fixing on two policy targets-internal and external balance, he stated during his speech that "the stakes in choosing the right monetary and fiscal policies are high". Mistakes at choosing the right monetary and fiscal policies can cause or worsen the problem of achieving internal balance (stability) and balance of payments equilibrium (external balance) complicating the macroeconomic goals of countries. Internal balance is thought to be achieved when real income is considered set at the full employment level and the inflation rate is lower or non-accelerating. On the other hand, external balance is often defined as a current account position that can be sustained by capital flow on terms compatible with the growth prospect of the economy without restrictions on trade and payments[2] (Wong, 2002).

Mundell (1968) described the problem of optimum monetary and fiscal policy mix aimed to achieve the goals of internal and external balances when the policy of fixed exchange rate is implemented. He found that, assuming fixed exchange rate among others, monetary policy should be reserved for attaining balance of payments equilibrium and fiscal policy for preserving internal stability. He based his explanation on what he called the principle of Effective Market Classification (EMC). This principle states that policies should be paired with the objective on which they have the most influence. Mundell believes that if this principle is not followed, there will emerge policy assignment problem and develop a tendency either for a cyclical approach to equilibrium or for instability.

Tomski et al (2001) and Javed and Sahinoz (2005) latter adopted the principle to fit to a small open transition economy with a kind of managed floating exchange rate relaxing the initial definition of the non-debt financing external balance[3]. However, as experiment showed by these authors, the changes in the assumptions from the

[2] Recall the shortages on foreign exchange in Ethiopia even under restricted (import) trade transactions.
[3] They have defined external balance in terms of current account as indefinite foreign borrowing is not sustainable. The inclusion of capital account in the balance of payment definition implies possibility for continuous borrowing (external).

original assumptions made by Mundell did not change the relative efficiency of monetary and fiscal policy on external and internal balances.

In most of its history since 1971, the Ethiopian economy suffered from external and internal imbalances. Public finance showed a continuous increase in state budget deficit and also public debt. Thus, the issue of maintaining or at least putting the internal and external balances to their manageable limit is another concern of policy makers in Ethiopia.

Why is such a concern on achieving manageable external and internal balance? With regard to the external balance, unsustainable deficit would make (local and international) investors lose confidence in the economy's capacity to maintain the existing trends and would be reluctant to hold the national currency (birr). That may cause an exchange-rate crisis and lead to government action of imposing harsh restrictions on spending and credit, ending, inevitably, in a recession, as was seen in the Asian Financial Crisis in the late 1990's (see Stokes, 2006).

This paper also intends to describe the behavior of the central bank (National Bank of Ethiopia (NBE)) and government policies in Ethiopia for the last couple of decades. It also wishes to examine how these policies responded to the development of the internal balance and the external balance in the face of increasing openness of the economy to the external world[4].

1.2 Objective of the study

Mundell's principle of EMC dictates that policies should be paired with targets for which they have the maximum impact. Assuming maintaining internal and external balances as the two policy targets and further assuming only two policy instruments (interest rate as monetary policy instrument and government budget deficit as fiscal policy instrument), the first objective of this paper is to assign the policy instruments to the targets for which they have the best impact (i.e. solving the assignment problem). This exercise would uncover the longstanding silence in the Ethiopian economy on the optimal policy mix (section 4.1).

The paper is also aimed at describing the existing behaviors of macroeconomic policy (monetary and fiscal policies) making institutions in Ethiopia and observes how these policies responded to the developments in the internal and external balance (section 4.2). Such studies are not common and if there are, the majority of them revolve

[4] The ratio of transactions with the rest of the world to GDP reached about 42 percent.

around examining the impact of coordination of the macroeconomic policies on output and stability. To the best knowledge of the researcher, there are literarily no published works in Ethiopia on the issue.

1.3 Data and methodology

To accomplish the stated objectives and research purposes, we have adopted an analysis based on annual data. It would have been to the interest of the researcher had there been easy availability of all the relevant data on quarterly basis (most are available since 2000). The data for empirical analysis are drawn from official sources: NBE and Ministry of Finance and Economic Development (MoFED).

1.4 Structure of the study

This paper proceeds as follows. In Part II, a general discussion is presented on the Ethiopian experience on monetary and fiscal policy. In Part III, we have presented the theoretical framework of the model based on the principle of effective market classification. In the same part, we have tried to modify some assumptions of the principle of effective market classification to fit to the case of Ethiopia. On the other hand, while Part IV empirically verifies the principle to the case of Ethiopia, the final section provides the conclusion.

2. Monetary and fiscal policy in Ethiopia

2.1 Background

Before laboring into deciding how best monetary and fiscal policies should be paired with targets of achieving internal and external balances, and before exposing how have monetary and fiscal policies been reacting to inadmissible ranges of internal and external imbalances in Ethiopia, it is crucial to provide readers with a background on how these policies have been formulated.

Since 1991, Ethiopia has adopted a change in economic policy and followed a kind of pro-capitalist economic system transforming from a centrally planned one and have maintained opened-up economy, albeit not fully[5]. This economic reform was followed by some changes on the nature of macroeconomic policies followed (they being the key components of the reform itself).

[5] Foreign participation on some sectors such as banking and insurance are not allowed by law and the public sector's participation is still overwhelming on some strategic sectors such as road, telecommunication, and power.

2.2 Monetary policy

As a background for the recent monetary policy in Ethiopia, it is instructive to give an insight on the financial sector in which it is thought to operate. The efficiency of the policy largely depends on the structure of the sector apart from its linkages with the real sector of the economy. After the design of the Structural Adjustment Program (SAP) in the country, various private operators emerge in the sector which was previously fully state controlled. More than nine private banks, more than nine private insurance companies and few microfinance institutions are operating in Ethiopia today. It should be noted, however, that the sector is not of dynamic nature. The sector lacks dynamism in terms of products and services provision and differentiation. Moreover, still, public banks and insurance institutions are taking the lions share in every respect[6]. It is also highly segmented from the rest of the world with no transfer of financial technologies and innovations.

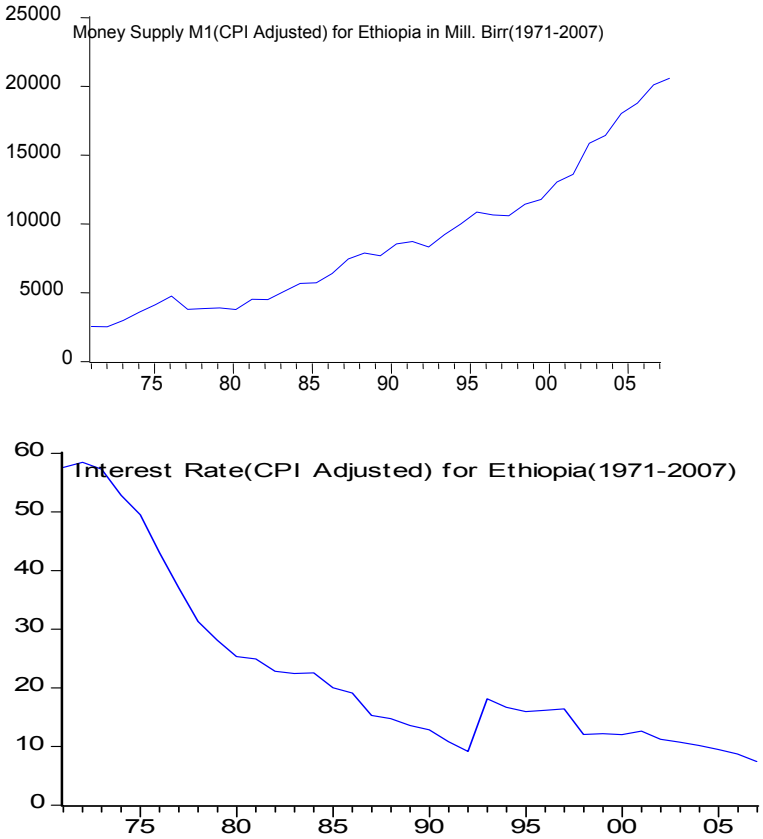
The objective of the monetary policy in Ethiopia is fostering economic growth, employment and assuring macroeconomic stability. To this end, in theory, NBE could use some monetary policy tools such as interest rates, reserve requirements, and Treasury Bills auction to control the growth and stock of money supply. Consistent with the objective of assuring macroeconomic stability expressed in terms of stable domestic price, Ethiopia implemented a tight monetary policy until recently. Under such monetary policy, money supply is required to be strictly controlled.

Despite the case that the bank was able to achieve price stability, the output growth had not been as promised for couple of years. In the last few years, the country followed a kind of expansionary monetary policy. Domestic credit increased on average by 26.6 percent for the years from 2005 to 2008. Money supply (M1) has also increased on average by about 16 percent over the same time horizon. Due to the stimulating role played by the additional money supply together with major programs introduced recently (the Poverty Reduction Strategy Papers (PRSPs)[7]), the national economy seems to be motivated and the country has registered promising growth performance. However, the objective of maintaining stable prices seems to be overlooked and thus out of track, despite the strength of the contribution of money supply is debating in the recent literature.

[6] Public banks account for 70, 60, and 64 percent of total capital, loan outstanding, and deposits. On the other hand, the single public insurance company contributes 21 percent of total insurance branches and 40 percent of total capital.

[7] The PRSPs are the country's macroeconomic, structural and social policies and programs aimed at promoting growth and reducing poverty in the medium term. The Ethiopian PRSPs so far have designed two papers: the Sustainable Development and Poverty Reduction Program (SDPRP), which run from 2002/03-2004/05, and the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) from 2005/06-2009/10. The country is not in the process of preparing the third generation of the PRSPs.

Figure 2.1: Trends in Money Supply and Interest Rate in Ethiopia



Source: Various publications of NBE

The other objective of the monetary policy of the country is to maintain adequate foreign exchange reserves. This policy objective builds on the fact that foreign exchange is a scares resource in the country. This is parly associated with the exchange rate policy of the country. In this regard, the exchange rate of Birr to other major currencies has become market determined through the interbank foreign exchange market in which commercial banks and NBE participate. The objective of an auction-based allocation of foreign exchange was to allow the exchange rate to respond to changes in the demand for and supply of foreign exchange. However, sometimes foreign exchange becomes in acute shortage and under such circumstances, banks will be forced to ration the available foreign currency under non-market criteria. This has become an identified phenomenon on quite recently due to the constrained availability of it owing to high oil price, the recent global financial

crisis and economic slow-down. In this paper, we saw the relative role of monetary and fiscal policy to improve the external balance of the country.

2.1 Fiscal policy

Similarly, the country's fiscal policy has also evolved to another phase with the economic reform. Consistent with the SAP designed for Ethiopia, the fiscal policy of the country was geared towards reducing government budget deficit, although the deficit is showing a general increasing trend. When there is pubic budget deficit, it has to be financed somehow. One way of financing deficit is foreign borrowing. There is generally a limit to foreign borrowing to any country. In this regard, the other objective of the Ethiopian fiscal policy has been to achieve sustainable public debt. Recently, consistent with the MDGs of poverty alleviation, it also aims at efficient use of highly concessional resources for poverty reduction related activities.

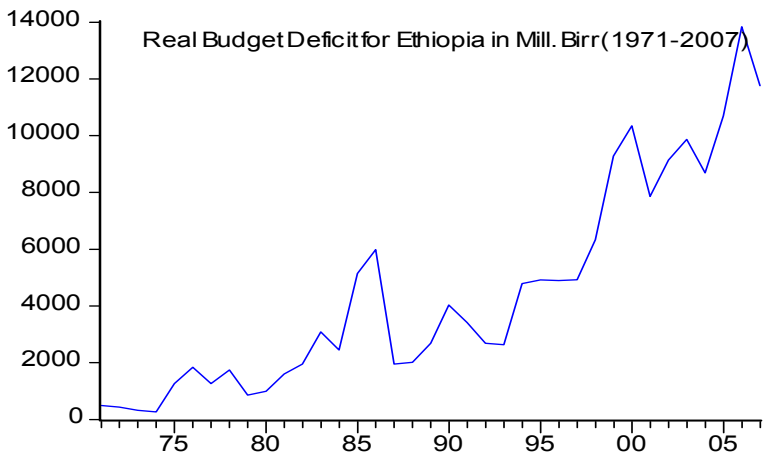
To realize the above objectives, Ethiopian fiscal policy relies on re-orientating of budgetary resources away from defense toward poverty alleviation outlays; and tax reforms aimed at improving revenue performance (AfDB, 2004). However, the public expenditure is alarmingly increasing vis-à-vis the revenue collecting ability of the economy. As a result, the budget deficit was widening except the last few years. Moreover, a significant portion of the (informal) economy is not covered by the tax scheme[8].

To promote the domestic tax revenue mobilizing capacity, the government of Ethiopia has continued to pursue several tax measures since 2002/03. The introduction of Value Added Tax (VAT) is among them. Efforts were also made to improve tax administration and collection, including the strengthening of the large taxpayer unit, which accounted for about 75 per cent of total tax revenues, and to enhance the activities of the tax reform taskforce (AfDB, 2004). On the expenditure side, the government adopted a kind of expansionary policy on selected sectors such as poverty-reducing spending on social services, especially education and health, and in other areas including roads and agriculture. Recently, real expenditure on road improvements and agriculture increased substantially.

On the trend of real (CPI adjusted) government budget deficit (excluding grants), see Figure 2.2.

[8] Literature shows that the informal sector in developing countries reached 40-70% of the official economy.

Figure 2.2: Trend in Budget Deficit in Ethiopia



Source: Computed based on MoFED data

3. Theoretical framework

3.1 Short snapshot of the principle of Effective Market Classification (EMC)

Achieving a given target requires an effective instrument[9], and achieving various independent targets needs at least an equal number of effective instruments. Mundell (1968) confirmed that if a program includes more targets than instruments, at least one target cannot be fully attained (underdetermined); whereas if it contains more instruments than targets, there will be more than one ways of achieving the combination of targets (over-determined)[10]. This is related to the case of "the assignment problem", in which case an economy can dynamically converge only under appropriate "policy-mix". It follows that a system works best if variables are assigned to markets on which they exert the most direct influence. Such understanding is proved to be of considerable help in testing the consistency of systems of economic policies.

[9] Policy targets are outcomes which policy makers opt to achieve including high output, low unemployment, price stability, and balance of payments stability. In our case, we have chosen two policy targets (high output - internal balance and balance of payments stability - external balance). We assumed two policy instruments that would help us achieve the policy targets: government expenditure (budget deficit) and interest rate.

[10] See Mundell (1968) for detailed understanding of the principle of EMC with respect to economic policy choice. This implies the need for thinking about how to increase the number of policy instruments so that real economy objectives (growth and jobs) can be prioritized within the standard policy framework formulated by Mundell. See Bradford (2005).

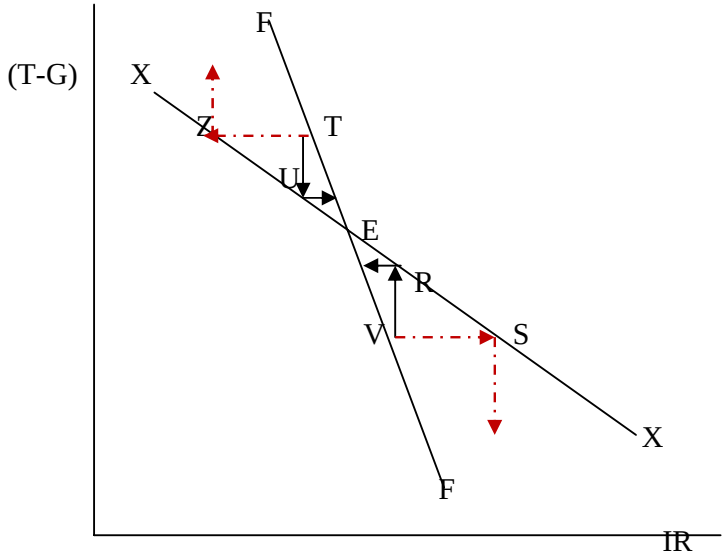
In some economies, particular policies may not be effective elsewhere except where they are naturally fit. However, we can also see in most cases that each instrument influences all target variables, although the *relative* impact of a given set of instruments on a certain pattern of targets is different. A useful guide, according to Mundell, which can be used in this connection, is the *principle of effective market classification (EMC)*, according to which an instrument should be matched with the target on which it exerts the greatest relative influence. This is taken as a prerequisite for stability and is consistent with Tinbergen's proposition[11].

Mundell provided us with a verbal and geometric interpretation of behavioral relations and equilibrium in the two policy variables, the interest rate[12] and the budget surplus. The assumptions of the model are: i) market expectations are not considered; ii) domestic and foreign assets are perfect substitutes, that is, a risk premium is not considered; iii) state budget deficits are not restricted by the amount of national debt and the balance of payments deficits are not restricted by the amount of the country's foreign debt; and iv) the side of the real economy is not developed in the model (Pilbeam, 1968; cited in Javed and Sahinoz, 2005). Under such mentality, see the principle of EMC in Figure 3.1. In this figure, the FF line is the foreign balance schedule. The schedule traces the locus of different combinations of interest rate and budget surplus along which the economy is in external balance. This schedule is with negative slope. This is because an increase in interest rate is expected to improve the balance of payments as that will reduce capital exports and domestic expenditure (and hence imports). Points above and to the right of the FF schedule represents balance-of-payments surplus, while points below and to the left of the line represents deficit.

On the other hand, the XX line represents the combination of interest rate and budget surplus that represent full employment equilibrium in the market of goods and services. The schedule is referred to as the internal-balance schedule. Along this schedule, demand for domestic goods is equal to full-employment output less exports. As an increase in interest rate is associated to decrease in budget surplus, the internal-balance line must slope downward in order to maintain domestic expenditure constant[13]. But the function of the external balance is with a larger slope than the function of the internal balance.

[11] Simply, Tinbergen's proposition is that we need as much instruments as the number of targets we have.
[12] One of the major limitations of the Mundell's model is its definition of monetary policy in terms of the change in interest rate than in terms of open market operation. The difference between the two definitions of monetary policy is fundamental since when capital is highly mobile, the monetary authority may not be able to alter the rate of interest or the supply of money.
[13] Or else, if one policy variable is increasing, the other must be decreasing in order to stabilize domestic employment.

Figure 3.1: The Principle of Effective Market Classification



Based on the theoretical model presented this way, Mundell documented the choice of monetary and fiscal policy tools in accordance with their effect on the goal to be achieved. He showed different scenarios to expose the case. If our position is e.g. at point T (i.e. external balance under parallel recession and internal imbalance), internal balance can be established at first sight by fiscal expansion as well as by monetary expansion. But if a decrease in interest rate is chosen, external balance will be destabilized relatively strongly towards its deficit. Another step will lead us to point Z. Restoration of external balance through fiscal restriction should follow. However, it has a relatively higher effect on internal balance; therefore, the restoration of external balance will cause deep recession, apparently deeper than at the original point T. The inappropriate choice of tools in a dynamic process enhances economic imbalance. A correct solution in the first step was to restore internal balance by fiscal expansion because its influence on internal balance is relatively strong and that on external balance is relatively weak. Consequently, by alternating monetary restriction and fiscal expansion (T,U,…) it is possible to arrive at the point of overall economic balance (point E) based on the policy assignment rule.

However, Mundell did not provide us with a mathematical representation to the model of EMC. However, we can find an algebraic interpretation of the model in various recent works (such as in Javed and Sahinoz, 2005; and Tomsik et al, 2001). The algebraic mechanism of the model in static form, thus, is presented as follows. We

start with the external-balance and present the internal-balance algebraic representation subsequently.

The external balance, in the model, is defined by overall balance of payments as

$$NX + NCF = 0 \quad [1]$$

where *NX* is current account balance[14] (defined as the exports *(EX)* minus the imports *(IM)* of goods and services, *NX = EX – IM,* and *NCF* [15]is net capital flow which is net receipts from sale of assets and borrowing from abroad (balance of financial account). The external balance exists when the foreign exchange reserves are unchanged, i.e., $\Delta(NX + NCF) = 0$.

The internal balance is defined by the following set of equations:

$$Y = I + C + G - IM + EX \quad [2]$$

Or $$Y - I - C - G + IM - EX = 0 \quad [3]$$

$$Y - A - NX = 0 \quad [4]$$

where *Y* is domestic product and *A* is domestic absorption, that is, the combination of investment expenditure *I*, private consumption expenditure *C* and government expenditure *G*. Internal balance exists when aggregate demand (i.e. $AD = A + NX$) equals to domestic product. Thus, internal imbalance implies when AD deviates from domestic product (Y).

Following Mundell, the functional relations can be represented in a formal notation as follows:

$$IM = f(A) \quad [5]$$

$$NCF = g(IR - IR^F) \quad [6]$$

$$A = h(IR, T - G) \quad [7]$$

Where, *IR* is the domestic interest rate, IR^F is foreign interest rate, *T-G*, that is, taxes minus government expenditure, is the balance of state budget, and A represents absorption (domestic expenditures). The function of exports *(EX)* is supposed to be

[14] We call it current account deficit if there is an excess of the spending of residents over their income, while surplus means an excess of receipts over spending.
[15] In the case of Ethiopia, capital account (also known as financial account) constitutes net movements in monetary capital. This account covers Official Long Term Capital through both the Central Government (CG) and Other Public Sector (OPS), Foreign Direct Investments (FDI), and short Term capital.

autonomous. An influence of the exchange rate is not considered because the model is defined under the fixed exchange rate regime.

3.2 Modification of the principle of effective market classification in terms of Ethiopian economy

Once putting a snapshot on the EMC principle of Mundell and seen the theoretical formulation of the internal balance (increasing output) and the external balance (balance of payments), we need to put some modifications to it so as to make it consistent to Ethiopian economy and investigate how Mundell's principle of EMC behaves in its economic activities. Mundell has used so restrictive assumptions that are not consistent for small open economies like Ethiopia. Firstly, the definition of external balance in Mundell's model, that is, balance of payments allows unlimited foreign indebtedness if the current account deficits were to be financed by foreign loans. Borrowing indefinitely is not sustainable for a small opened economy like Ethiopia. There is generally a limit to foreign borrowing for a country[16]. Besides, there are economic and political consequences of such excessive borrowings.

If we are dropping *NCF*, then definition of external balance in terms of current account component (*EX – IM)* is not suitable for a small open economy either, because inflow of foreign net factor payment is essential for such economies. For these reasons, in the case of Ethiopia, external balance should be defined in terms of the current account balance and foreign net factor payments[17] (non-debt financing of the current account deficit)-in effect defined by overall current account. Ethiopia has fairly large member of emigrants living and working abroad, and the country has been benefiting from their remittance, specially recently[18]. Finally, the model should be modified in such a way that it can reflect the fact that a kind of managed floating system is used to set the exchange rate of Birr. The expectation is that such change in assumption on the mode of exchange rate system has effect on the efficiency of monetary policy on the economy. This is documented in Tomski et al (2001), Javed and Sahinoz (2005), and Boyer and Young (2005) among others.

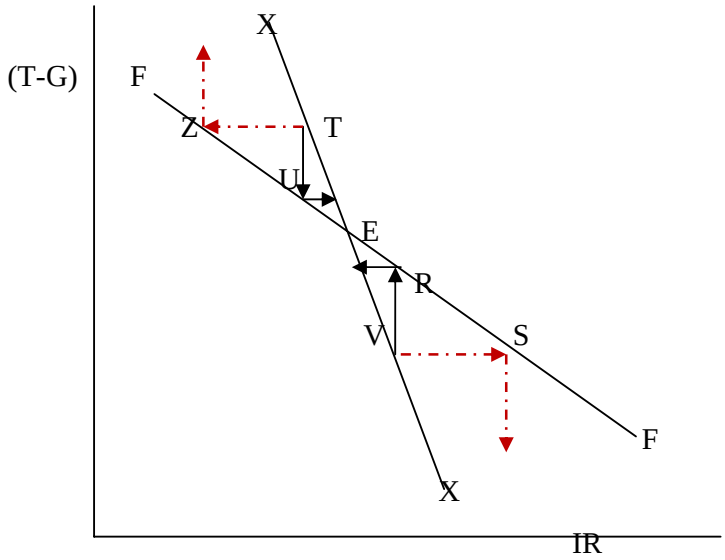
Under the managed floating exchange rate system, it is assumed that the relative sensitivity of external balance to the movement of domestic interest rates will decrease. Thus, the efficiency of monetary policy in this field will be lowered. Net

[16] This is precisely the reason for deviating from the standard definition of capital account as shown in equation [8].
[17] We would have used FDI rather, but we have only 15 years of FDI official data.
[18] The impact of the recent global financial crises on remittance flows is not yet studied and permitting another avenue for further research.

foreign payment becomes less sensitive to the change in domestic interest rate. On the other hand, the growth of domestic interest rate promotes the inflow of short-term foreign capital (unlike direct investment) and appreciation of the exchange rate of domestic currency that will also act against the inflow of foreign direct investment. It is also to anticipate that besides the direct effect of interest rate on absorption and net export the interest rate will parallelly influence net export through exchange rate. But this second channel will weaken the effect of the absorption channel (the first channel) since the growth of interest rate will lead to appreciation of the domestic currency and to a subsequent decrease in net-export.

All these changes imply that the modified external balance definition is *NX + NFP = 0*, ultimately in terms of extended current account. With the managed floating exchange rate the slope of the external balance "curve" will change against Mundell's original model. The FF curve of external balance may now happen to be more flat than the XX curve of internal balance. The implication of such change is increasing the relative efficiency of monetary policy (interest rate) vis-à-vis fiscal policy (budget deficit) on internal balance and fiscal policy vis-à-vis monetary policy on external balance (see Figure 3.2). The path to internal and external balance from point T leads through the alternation of monetary expansion and fiscal restriction.

Figure 3.2: The Modified Principle of Effective Market Classification



3.3 Theoretical specification of the modified model on the Ethiopian economy

In this part of this paper, theoretical model of the principle of EMC in terms of Ethiopian economy is specified. We are using this theoretical model for the empirical verification of the reformed principle based on the Ordinary Least Square (OLS) estimation technique.

This model is based on the conditions of the external balance (1) and the internal balance (2) below once adjustment is made on the original Mundell's EMC principle to fit to the case of Ethiopia.

1) *NX + NFP=0,*
2) *Y - A – NX = 0* [8]

The behavioral equations may be written as follows:

$$\begin{aligned} A_{CPI} &= \alpha_o + \alpha_1 (T\_G)_{CPI} + \alpha_2 IR_{CPI} + \alpha_3 M1_{CPI} + \alpha_4 ER_{CPI} + \alpha_5 Y_{CPI} \\ NX_{CPI} &= \delta_0 + \delta_1 (T-G)_{CPI} + \delta_2 IR_{CPI} + \delta_3 M1_{CPI} + \delta_4 ER_{CPI} + \delta_6 WY_{CPI} \\ NFP_{CPI} &= \beta_0 + \beta_2 IR_{CPI} + \beta_5 Y_{CPI} + \beta_7 STUDINDX \\ ER_{CPI} &= \varpi_0 + \varpi_2 IR_{CPI} \end{aligned} \quad [9]$$

where $\alpha_1, \alpha_2, \alpha_4, \delta_3, \beta_2, \varpi_2 < 0$ *and* $\alpha_3, \alpha_5, \delta_1, \delta_2, \delta_4, \delta_6, \beta_5, \beta_7 > 0$ and where IR_{CPI} is real interest rate (official lending rate - deflated by consumer price index), $M1_{CPI}$ is real money supply (money aggregate *M1*) deflated by consumer price index, ER_{CPI} is real exchange rate deflated by consumer price index, WY_{CPI} is real gross domestic product of Ethiopian major trading countries (weighted by their trade shares), *STUDINDX* is student index for capturing the labor market of the Ethiopian economy, Y_{CPI} is a real gross domestic product of Ethiopia.

3.4 The existing behavior of fiscal and monetary policies

The above was a description of how we can see which policy is more effective in achieving internal and external balance, which is largely associated with verifying the EMC of Mundell. On the other hand, to see how monetary and fiscal policies have been responding to developments in the internal and external balances in Ethiopia since 1971, we estimate the following response functions:

$$\Delta IR = \pi_0 + \pi_1 \frac{EB}{Y} + \pi_2 Y_{CPI} g$$

$$\Delta M1 = \tau_0 + \tau_1 \frac{EB}{Y} + \tau_2 Y_{CPI} g \qquad [10]$$

$$\Delta (T - G) \ = \psi_0 + \psi_1 \frac{EB}{Y} + \psi_2 Y_{CPI} g$$

where π_2, $\tau_1, \psi_2 > 0$ and $\pi_1, \tau_2, \psi_1 < 0$. In addition, the external balance is represented by the ratio $\frac{EB}{Y} = \frac{NX + NFP}{Y}$ and the internal balance is given by $Y_{CPI} g$ which is the real growth rate of GDP. It is assumed that policy authorities change their policy variable (i.e. interest rate and/or money supply in the case of monetary policy and budget balance(T-G) in the case of fiscal policy) only when the variables are thought to deviate from the equilibrium level, i.e. a situation in which both internal and external balance are not achieved. Recall that internal balance is said to be achieved when the economy reached full employment level of production and non-debt financing external balance is defined by the identity EB=*NX+NFP=0*. We use nominal policy variables as policy responses to the developments in the internal and external balances are made in nominal terms, and such presentation can make it easy for us perceive whether there was a clear policy change (movement not due to change in overall price level-inflation/deflation).

To decide how the policy makers (the two major authorities) have been changing their policy variables so as to achieve the balances, we need to precisely establish inadmissible ranges for the two imbalances for which we expect policy changes to mitigate the undesirable levels. We, thus, have attached values to the admissible ranges considering that Ethiopia needs to grow much faster to achieve internal balance (represented by real growth rate of GDP) and sustainable external debt.

Accordingly, policy makers are expected to take policy changes when the indicators of internal and external balances did not satisfy the following conditions:

1. *(NX+NFP)/Y < 10%* when negative or > 0 otherwise for external balance, and
2. Above 5% for the growth rate of real GDP (Y_{CPI}) for internal balance.

The rationale for the first condition is relied on the definition of external balance. Generally, improving the external balance is crucial when the country is facing with

negative net flows of foreign currencies[19]. However, for a small open economy like Ethiopia, non-negative non-debt financing external balance is unlikely and that lower deficit as a percentage of GDP must be the second best. Thus, we have assumed external deficit of 10% is sustainable. In the advanced world, like that in Australia, an external balance deficit of 6% is considered as "banana republic". See Stokes (2006). This is because these countries perceive a deficit of above 6% would trigger crisis. The second condition builds on the fact that Ethiopia is a poor country, and the condition decides the bottom margin of 5% real GDP growth rate. Of course, simulation results exposed that the country should grow sustainably by above 7% (Emerta, 2009 among others) to achieve the Millennium Development Goals (MDGs) and catch up (even though so slowly) with countries of at least the same steady state. We do not want to impose an upper limit to the real growth rate because the country is operating much below its potential growth.

Following the above decision rules, we have generated other sets of series by replacing zeros when the proxies for internal and external balance are around the admissible ranges and the original values otherwise. The rationale for this type of constructing new variables is because this would help us clearly see how the behavior of monetary and fiscal policy makers' change when we move from and into a certain tolerable level of the two balances. Based on these new data series, we estimate the above response functions.

4. Empirical estimation

4.1 Principle of effective market classification

In undertaking the associated empirical estimation, it is instructive to discuss the data source and variables characteristics. The data used consists of annual time series data from official sources for the period covering 1971-2008. A brief description of the data included and their sources is indicated in the annex of the paper.

Before we estimate the system that governs the relationship among our variables, we check for the order of integration of these variables to avoid the problem of spurious regression. In analyzing the univariate characteristics of the variables, Augmented Dickey-Fuller (ADF)[20] test was employed to decide the order of integration of the data series. The result of the ADF test guides the kind of estimation system we have to adopt. The ADF test was carried out with time trend and intercept and assuming a lagged difference of 1. The table reporting the outcomes of the test is Table 4.1.

[19] Currently, the external debt in Ethiopia is stood at Birr 26.7 billion, or 10.9% of GDP.
[20] See various (time series) econometrics books on the specifications of the ADF unit root test.

Table 4.1: ADF Unit Root Test Results on Data of the Ethiopian Economy

	Computed Values		Critical Values		Stationery
Series	**Level**	**1st Difference**	**1 %**	**5%**	**Order**
NX_{CPI}	0.1006	-4.1939	-4.2505	-3.5468	I(1)
NFP_{CPI}	-2.4699	-4.4769	-4.2505	-3.5468	I(1)
Y_{CPI}	1.0988	-4.5649	-4.2505	-3.5426	I(1)
A_{CPI}	1.6674	-3.8200	-4.2505	-3.5468	I(1)
$(T\text{-}G)_{CPI}$	2.7204	-7.0928	-4.2505	-3.5468	I(1)
IR_{CPI}	-2.3752	-3.3714	-4.2505	-3.5468	I(1)
$M1_{CPI}$	0.2914	-3.6646	-4.2505	-3.5468	I(1)
ER_{CPI}	-2.1530	-2.3515	-2.6321	-1.9510	I(1)
WY_{CPI}	-2.3313	-3.9643	-4.2505	-3.5468	I(1)
STUDINDX	3.2756	-4.5305	-4.2412	-3.5426	I(1)

The unit root test shows that the Ethiopian macro data series are not stationary in level. We accordingly should test for existence of cointegration. If the series are cointegrated, that means there is long-run relationship between them. We followed the 2-step Engle and Granger method which involves first estimating the multivariate equation, and then extracting the estimated residuals of the equation, and finally testing for stationarity of the estimated residuals. Results from the cointegration test based on the generated residuals of each equation showed that the residuals are stationary implying cointegration. Thus, the fundamental model was estimated by cointegration analysis, which was completed by estimating the Error Correction Models (ECM). The cointegration analysis was made by Engle-Granger´s method. For the sake of saving space in the main part of the paper, but for providing readers additional information on the short-run relationship between the variables, we have in the annex part presented the very ideal ECM. The long-run results from the cointegration method are presented below (in the parenthesis are the t-statistics of the estimated coefficients).

The cointegration equations (long-run):

A_{CPI} = -9602.000 - 0.186*$(T\_G)_{CPI}$ - 74.483*IR_{CPI} - 0.067*$M1_{CPI}$ + 198.346*ER_{CPI}+ 1.232*Y_{CPI}
(-4.831) (-0.786) (-0.821) (-0.201) (0.674) (14.644)

R^2-adjusted = 0.993, DW = 1.353, F-statistic=873.410(0.000)
T-statistics are in parenthesis

NX_{CPI} = 6569.436 - 0.424*$(T\_G)_{CPI}$ - 130.065*IR_{CPI} - 1.931*$M1_{CPI}$ + 347.184*ER_{CPI} + 0.005*WY_{CPI}
(3.215) (-1.854) (-1.217) (-7.622) (1.103) (3.287)

R^2-adjusted = 0.944, DW =0.978, F-statistic=105.102(0.000)
T-statistics are in parenthesis

NFP_{CPI} = -28.575 - 1.621*IR_{CPI} - 0.422*$STUDINDX$ + 0.008*Y_{CPI}
(-0.170) (-0.795) (-0.607) (1.324)
R^2-adjusted = 0.322, DW = 0.621, F-statistic=5.299(0.004)
T-statistics are in parenthesis

ER_{CPI}= 3.499 + 0.170*IR_{CPI}
(5.857) (7.745)
R^2-adjusted = 0.631, DW = 0.087, F-statistic=59.989(0.000)
T-statistics are in parenthesis

In the A_{CPI} equation, most of the variables are statistically insignificant. Only real GDP (Y_{CPI}) is an important explanatory variable of real absorption in the Ethiopian data. It is also consistently signed with the theory. Though insignificant in explaining real absorption in the country, budget deficit and interest rate are correctly signed. Exchange rate and money are found to be with opposite signs from expected. But are statistically insignificant and does not question our result. The exchange rate is with positive coefficient because export and import may not be responsive for exchange rate devaluation in the country implying that export and imports are not changing as hypothesized on the impact of devaluation.

In the NX_{CPI} equation, real world GDP and money supply explain net exports in the country at more than 95% significance level. These variables are also correctly signed. Other variables are insignificant. However, government budget deficit was unexpectedly signed and still significant at 90% level. This may be because when budget deficit expands, the government is crowding out the private sector through domestic borrowing and/or raising export taxes which discourage exports.

In the NFP_{CPI} equation, no variable was statistically important predictor of the dependent variable. While the interest rate and income are correct in direction, student index which is a proxy for availability of skilled labor is unexpectedly signed.

In the ER_{CPI} equation, interest rate is unexpectedly signed with statistically significant coefficient. This could be because Ethiopia is a foreign exchange scarce country and rate of exchange may not be affected by the interest rate as theoretically expected.

We have seen that most of the variables in each equation are appropriately signed. Some variables were unexpectedly signed. However, most of these variables were statistically insignificant. Once we have estimated the behavioral equations under our theoretical model for Ethiopia, it is now time to compute the slopes of the reduced forms of the functions of the internal and the external balance; which would dictate us which policy is effective where. Thus, we are computing two slopes. In computing the slopes, the coefficients of insignificant variables of interest are replaced by a value much closer to zero as the variable which is statistically insignificant implies the coefficient is not statistically significantly different from zero.

The slope of the reduced form of the function of the internal balance is based on:

$$(T-G)_{CPI} = \frac{\left[\alpha_2 + \delta_2\right] + \left[\left(\alpha_4 + \delta_4\right) * \omega_2\right]}{-\left(\alpha_1 + \delta_1\right)} * IR_{CPI} + A_1$$

$$(T-G)_{CPI} = \frac{\left[*0 + *0\right] + \left[\left(*0 + *0\right) * 0.17\right]}{-\left(*0 + -0.42\right)} * IR_{CPI} + A_1$$

$$(T-G)_{CPI} = 0 * IR_{CPI} + A_1$$

Thus, this is the equation of the internal balance relating $(T\text{-}G)_{CPI}$ and IR_{CPI} derived from a macroeconomic model.

The slope of the reduced form of the function of the external balance is based on:

$$(T-G)_{CPI} = \frac{-(\delta_2 + \beta_2) - (\delta_{4*}\omega_2)}{\delta_1} * IR_{CPI} + A_2$$

$$(T-G)_{CPI} = \frac{-(-130.06 + -1.62) - (*0 * 0.17)}{-0.42} * IR_{CPI} + A_2$$

$$(T-G)_{CPI} = 309.993 * IR_{CPI} + A_2$$

The last equation can be considered as the equation of the external balance when budget surplus is expressed in terms of interest rate.

The slopes derived from the macroeconomic model based on the Ethiopian macro data through the above process contradict with the hypothesis on the modified version of the principle of EMC. However, it is inline with the original hypothesis made by Mundell: the slope of the internal balance is below or less in absolute terms than the slope of the external balance despite changes in the assumptions. Thus, in Ethiopia the principle of EMC dictates that the policy assignment problem can effectively be solved and that monetary policy is effective on achieving external balance and fiscal policy is more appropriate for securing internal balance. This result contradicts with the findings by Javed and Sahinoz (2005) and Tomsik et al (2001). Relaxing some of the assumptions made by Mundell some four decades before cannot change his policy assignment in the case of Ethiopia.

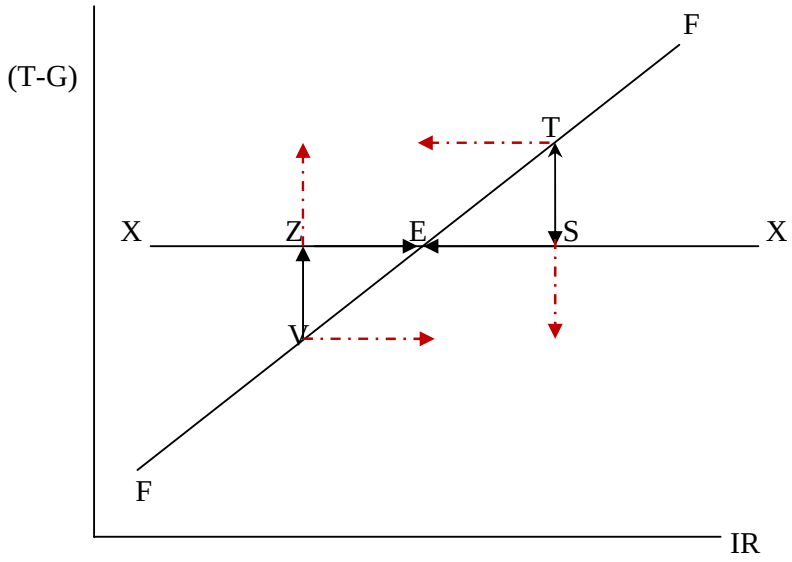
The study, however, revealed surprisingly important findings for policy makers. The internal balance is with zero slope when budget deficit is expressed as a function of interest rate. This implies that in Ethiopia, internal balance cannot be affected at all by monetary policy as represented by interest rate[21], and only fiscal policy (budget balance) can influence the level of domestic economic activity. On the other hand, only monetary policy can affect non-debt financing external balance. Fiscal policy has no statistically significant effect on external balance in Ethiopia. Effective monetary policy can instantaneously led to improvement in the external balance. Thus, monetary policy should be reserved for achieving external balance. This can be illustrated on Figure 4.1 taking some points.

Thus, unlike other countries, the issue in Ethiopia is not that of deciding which policy is more effective in achieving which balance. In the Mundell's presentation, both monetary and fiscal policy affect both internal and external balances and the challenge was deciding which policy is with the maximum effect where. In Ethiopia, the macro econometric model we have adopted does imply no such option and if internal balance (i.e. full employment level of output) is to be achieved, it can be done so only by the fiscal authority. However, external balance can be achieved by both

[21] The future task shall be assuming money supply or other open market operation tools in place of interest rate as a monetary policy instrument and try the policy assignment problem.

fiscal and monetary policies. So, there is naturally some kind of inherent policy assignment in the Ethiopian economy specifically with respect to internal balance.

Figure 4.1: The Modified Principle of Effective Market Classification Estimated for Ethiopia



So, what is the transmission mechanism through which the changes in policy variables improve the balances? With regard to the external balance, interest rate improves the external balance through the linkage from interest rate to foreign direct investment as investing in Ethiopia means a rewarding when the return for capital is large. The linkage from interest rate-exchange rate-net foreign payment or from interest rate- exchange rate - net export (or export and import separately) is not as theoretically expected as shown by ER_{CPI} equation in the cointegration results. Monetary policy is not effective in affecting the internal balance, i.e. full employment level of output because the domestic effect of monetary policy tends to be affected by its impact on exchange rate movements. Contractionary monetary policy, for instance, may bring effective exchange rate devaluations, which would shrink the trade deficit. However, such policy may end up in increasing the interest rate at the expense of local economic activity. With regard to internal balance, the transmission mechanism is budget surplus- domestic absorption. The result implies that contractionary fiscal policy can bring down aggregate demand driven inflation, and slow down the economy and vice-versa.

4.2 The existing behavior of macro-economic policy making institutions in Ethiopia

To see how fiscal and monetary authorities have been adjusting their policies to various states of the internal and external imbalances for the period from 1971 to 2008, we have estimated equations of ΔIR, $\Delta M1$ and $\Delta(T-G)$ using OLS regression technique. The results are presented below. A close investigation of the statistical significance and coefficients of variables of each equation tells us how and whether the behavior of policy makers change and in what magnitude. In all cases, we assigned ($^{\#}$) on the t-statistics if the variable is significant of at least at 5% significance level.

ΔIR = 0.105 + 1.288e-05**EB/Y* + 0.026**Y*$_{CPI}$*g*
(0.335) (0.399) (0.302)

R^2-adjusted = 0.008, DW = 2.229, F-statistic=0.136(0.873)
T-statistics are in parenthesis

$\Delta M1$ = 322.117 - 0.111**EB/Y* - 11.596**Y*$_{CPI}$*g*
(-3.491) (-11.713)$^{\#}$ (-0.461)

R^2-adjusted = 0.808, DW = 1.849, F-statistic=69.601(0.000)
T-statistics are in parenthesis

$\Delta(T-G)$ = 201.326 - 0.062**EB/Y*- 32.541**Y*$_{CPI}$*g*
(0.918) (-2.754)$^{\#}$ (-0.54z5)

R^2-adjusted = 0.198, DW = 2.092, F-statistic=4.090(0.025)
T-statistics are in parenthesis

To see how monetary and fiscal policies are behaving in Ethiopia with changes in the internal and external balance, we need to analyze the above regression results.

In the interest rate equation, there is no a single variable which was significantly related to changes in interest rate implying that there is no any systematic relationship between the developments in both the internal and external balances and changes in the interest rate structure. The monetary authority seems not to respond wisely using the interest rate as an effective policy variable from the period from 1971 on. The coefficient for the external balance is unexpectedly signed but is very

insignificant both in magnitude and statistically. The system in the equation is poorly explained by the variables included as can be inferred from the very low Adjusted R^2.

Another policy variable we used to investigate how monetary policy has been behaving in response to changes in the external balance and the internal balance is looking in to how money supply is changing over time. In the equation, external balance and money supply are significantly associated. But the change in money supply and internal balance deterioration are not systematically related. Thus, unlike the previous specification, monetary policy in the country when defined by changes in money supply has been responding to external balance deterioration.

On the other hand, fiscal policy in the country tends to change systematically in the long-run with state of external imbalance. The associated coefficient is statistically significant and is of sign consistent to the theoretical expectation. However, the coefficient of the internal imbalance is unexpectedly signed with statistically insignificant result, implying no some kind of systematic relationship between internal imbalance and fiscal policy.

In general, the result showed that interest rate has not been used by the NBE as an important monetary policy instrument, while money supply have been effectively manipulated by the monetary authority to impact on the external balance. On the other hand, fiscal policy authority tends to change its policy instrument much closely to the developments in the external balance. However, monetary policy (money supply) tends to be relatively strongly responding to the external imbalance implying that the monetary authority is highly concerned with managing the foreign exchange reserve than striving for output increment.

The above result suggests that the fiscal and monetary policy mix have not operated systematically and optimally in Ethiopia for the period considered. Moreover, unlike our finding from the verification of the principle of EMC based on the macroeconomic model estimated, we found here that in Ethiopia fiscal policy have been reacting systematically to developments in the external imbalance for which the application of the principle of EMC found fiscal policy with no effect at all. Such wrong assignment of policy to target may explain the poor impact of economic policies on the economic activities in Ethiopia.

5. Conclusion on the behavior of the macro-economic policies in Ethiopia

Using Mundell's basic principle of EMC, and adjusting it to the situation of Ethiopia, we tried to see the coordination of monetary and fiscal policies in the country. We extended our analysis to looking at how macroeconomic policy makers have been behaving in response to various developments of internal and external balances to see whether the optimal policy mix has been followed in the country.

Our verification of the principle of EMC to the Ethiopian data showed that internal balance can largely be affected by fiscal policy and external balance by monetary policy. This implies that for securing better internal balance, the fiscal authority should be responsible and design situations to make budget deficit an effective policy instrument. On the other hand, the task of achieving external balance should be exclusively left to the monetary authority, i.e. the NBE. This was more or less consistent with the original version of Mundell's principle even after relaxing some of the original assumptions. What is peculiar to Ethiopia from our finding is that the slope of the internal balance is zero implying that interest rate has no statistical role on the internal balance, while budget balance influences the external balance insignificantly. The observation may be true because the domestic economic activity is insensitive to interest rate, and the non-debt financing external balance is not influenced by budget balance.

Latter, in the paper we have seen how monetary and fiscal policies have been behaving against developments in the internal and external imbalances in Ethiopia since 1971. Interest rate (a proxy for monetary policy) has not been changing in some way to improve neither of the two imbalances. This may be because the monetary authority is not using this policy variable as an important policy tool in the country's history. On the other hand, we have seen that money supply (another proxy of monetary policy) and fiscal policy (represented by fiscal balance) responded systematically to movements in the external balance. The policies, however, showed no relevant behavior to any deterioration in the internal balance in Ethiopia for the period from 1971 to 2008. Hence, our estimation results suggest that the monetary fiscal policy mix did not operate optimally in Ethiopia over the period considered.

The overall economic activity in the country would improve to the benefit of the general public if the government and the central bank revise their policy making role consistent to the findings of this study. Unlike they have been doing, specialization of the central bank on external balance and the fiscal authority on internal balance would be welfare increasing. The researcher also hopes for a renewed interest on the policy mix issue to refine any miss-representation and confusions.

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Annexes

I. Definition and source of the data series we use for the analysis

Particulars	Definition*	Source
NX_{CPI}	Real Net Export	Data on export and import is obtained from NBE
NFP_{CPI}	Real Net Factor Payment	NBE
Y_{CPI}	Real DGP	MoFED
A_{CPI}	Real Absorption	Own computed from components of national accounts obtained from MoFED
$(T\text{-}G)_{CPI}$	Real Budget Deficit	MoFED
IR_{CPI}	Real Interest Rate	NBE
$M1_{CPI}$	Real Money Supply	NBE
WY_{CPI}	Real World GDP	Trade weights of major trading partners is obtained from NBE while countries GDP from IFS

*All real variables are CPI deflated.

II. Error correction model presentation (No lagged value included)

Dependent Variable: $D(A_{CPI})$			
Variable	**Coeff.**	**S.E.**	**t-Sta**
C	442.491	453.046	0.977
$D(T\_G_{CPI})$	-0.448	0.211	-2.121
$D(IR_{CPI})$	-116.40	158.025	-0.737
$D(M1_{CPI})$	-0.518	0.539	-0.960
$D(ER_{CPI})$	779.777	533.760	1.461
$D(Y_{CPI})$	1.228	0.104	11.778
ECM01(-1)	-0.677	0.193	-3.506
R2	0.880	F-stat	35.392
Adjusted R2	0.855	Prob(F.st)	0.000
Log likelihood	-313.79	DW	1.736

Dependent Variable: $D(NX_{CPI})$			
Variable	**Coeff.**	**S.E.**	**t-Sta**
C	109.446	381.217	0.287
$D(T\_G_{CPI})$	-0.291	0.141	-2.065
$D(IR_{CPI})$	-130.11	105.563	-1.233
$D(M1_{CPI})$	-0.939	0.346	-2.713
$D(ER_{CPI})$	193.674	354.442	0.546
$D(WY_{CPI})$	-0.004	0.003	-1.331
ECM02(-1)	-0.262	0.153	-1.712
R2	0.434	F-stat	3.711
Adjusted R2	0.317	Prob(F.st)	0.007
Log likelihood	-300.50	DW	1.364

Dependent Variable: $D(NFP_{CPI})$			
Variable	**Coeff.**	**S.E.**	**t-Sta**
C	35.648	17.924	1.988
$D(IR_{CPI})$	18.660	5.311	3.512
D(STUDINDX)	0.912	0.650	1.401
$D(Y_{CPI})$	-0.012	0.005	-1.987
ECM03(-1)	-0.252	0.111	-2.258
R2	0.386	F-stat	4.879
Adjusted R2	0.307	Prob(F.st)	0.004
Log likelihood	-204.61	DW	2.236

Dependent Variable: $D(ER_{CPI})$			
Variable	**Coeff.**	**S.E.**	**t-Sta**
C	-0.005	0.111	-0.047
$D(IR_{CPI})$	0.204	0.038	5.334
ECM04(-1)	-0.076	0.050	-1.540
R2	0.473	F-stat	14.836
Adjusted R2	0.442	Prob(F.st)	0.000
Log likelihood	-30.109	DW	1.152

THE EFFECT OF DROUGHT ON URBAN POVERTY: THE CASE OF ADDIS ABABA

Esubalew Alehegn[1] and Mastewal Dessalew[2]

Abstract

The objective of the study was to analyze the effects of drought, measured by rainfall variability, on urban poverty taking Addis Ababa as a case. To this time series data, consisting three different periods, were used and estimated stepwise in three equations. The first equation, with years 1980-2005, estimated the amount of agricultural productivity using rainfall variability, fertilizer utilization, and agricultural expenditure by government as explanatory parameters. The second equation, years 1973-2003, examined impacts of the country's agricultural output, population growth, food aid, food import, and food export, on food price. The third equation, spanned in 1976-1978 and 1990-1999, computed the effects of change in food price on the number of the poor in the city. Addis Ababa, the only metropolitan city, was taken for a case with the assumption that the city would reflect real picture of urban centers and, hence, is better representative of all other urban areas in the country. The Dickey Fuller and Augmented Dickey Fuller unit root tests were used to verify the stationarity of data while the Johansen maximum likelihood cointegration test was employed to check existence of long run relationship among variables.

The result indicated that agricultural output in Ethiopia was directly proportional to and determined by the amount of rainfall variability. In the first equation we found that rainfall variability has significantly affected agricultural output at 5% level while fertilizer, expenditure on agriculture, and land have each impacted productivity at 1%,5%,and 10% level respectively. The food price in Addis Ababa was inversely proportional to the agricultural output and was found robust at 1% level. The current period and second period lag value of the food price in the city was also found significant in affecting the number of the poor in the city at 5% level. On the other hand, long run food price in the city was found highly responsive to factors that affect food demand (population growth and income) than variables that impacted food supply (agricultural production, food aid, and food import).Of the variables envisaged to affect food price, domestic agricultural production brought the highest elasticity coefficient. This suggests the need that interventions geared to improve food supply and, hence, food price in the city ought to focus on improving domestic agricultural production than increasing food import.

Key Words: Effect, Drought, Urban Poor, Addis Ababa, Ethiopia

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1. Introduction

Ethiopia, by any measurement, has remained one of the poorest nations on earth. It hosts about 77 million citizens whose some 40% of the population is living below absolute poverty while 80% or even more of this is anchored on traditional agriculture a fact that characterizes the true subsistence economy of the country. It is a nature dependent nation whose bulk of the economy comes from rain fed agriculture making life usually vulnerable to drought and other natural and man-made calamities (CSA, 2007).

Drought has, since the 1960s, become a regular and persistent phenomenon of Ethiopia and is taking the lives of many who sometimes, in the past, could have been the creams of the nation's development endeavor. It used to visit the country every 10-15 years and quite recently is coming in every five years or less. The droughts that occurred in 1984/85, 1987-1988, 1991/92, 1993/94, 1999, and 2003 were, for instance, some evidences which took the lives of most rural populace, mainly, children and the old who, at any cost, didn't have the power to migrate (Stefan, 2004). In 2003 the failure of the two rainy seasons: the '*Belg'* and the *'Meher'*, which came in February and June respectively, withered over 70 % of the maize and sorghum crops thus decimating grain production altogether in the country. In the same year the country produced 25 % less cereals and pulses than the previous year which led to the life of about 15 million people to depend on international food assistance (Middlebrook, 2005).

Recurring droughts in the country left poor farmers with no food crops leading, usually, to periodic famines. The persistent lack of rainfall was a major factor in rural poverty and in this case food aid was and remains to serve a life saver for millions who chronically were/are food insecure or affected by drought (Rural Poverty Portal, 2007). Erratic rainfall and instability of commodity prices for exports have also played significant in weakening the overall economy of the country and thus rural poverty (USAID, 2004).

Drought, a result of chiefly rainfall shortfall, has complicated the food insecurity problem in the country. Fifty-four percent of the food insecure households were in the 25% of the poorest districts while 46 % of them being in the other. Regional differences were characterized by market access as they are also by rainfall differences (ibid). Grigg (1996) has, in this circumstance, identified the considerable role drought might have on poverty and classified it into three parts. The first is seen as a meteorological F:\wiki\Meteorology drought which emerges when there is a prolonged period with less than average precipitation. This drought precedes others

and is, usually, a cause for agricultural drought. The agricultural droughts do affect crop production or the ecology of the range and aroused independently from any change in precipitation levels when soil conditions and erosion triggered by poorly planned agricultural endeavors causes shortfall in water availability to crops. It could, traditionally, be caused by an extended period of below average precipitation. The third one is a hydrological drought which is brought about when the water reserves available in sources such as aquifers, lakes, and reservoirs falls below the statistical range. Like agricultural drought the hydrological drought can be triggered by more than just a loss of rainfall. All the three forms of droughts, albeit with complex behaviors and sometimes difficult to differentiate; have reinforcing effects of one over the other and on poverty (Joachim *et al*, 2009).

Drought, certainly, aggravates both rural and urban poverty. By reducing agricultural productivity and making the rural economy fragile it induces poverty driven rural-urban migration and then raises the cost of living to the urban poor. The 1974 and 1984-1985 severe droughts that occurred in the country had, for instance, substantially plummeted the agricultural output of the nation. The reduction in the output had also caused a sharp rise in the price of food in urban areas, in turn, forcing the urban poor to change their consumption (Mulugeta, 1986). Drought in the 1990s also created waves of immigration from the countryside into towns and cities further complicating urban unemployment. The effect forced about four million migrants to settle in makeshift shanty towns (Vadala, 2008)

In spite of these factual recordings in the country, interventions that try to link the impacts of drought on the rain fed agricultural productivity, subsistence economy, national poverty and, in particular, on the livelihoods of the urban dwellers remained the least researched. This study, therefore, was intended to bridge this gap by analyzing the effects of drought on urban poverty in Addis Ababa. It, specifically, examined the effect of drought (measured in rainfall variability), impact of cultivated land, amount of chemical fertilizer, and agricultural expenditure on the agricultural output in Ethiopia. It also estimated the amount of total agricultural output, the effect of population growth, incomes of households, food aid, net food import and export, on food price in Addis Ababa. Finally, it looked at the effects of change in food price on the number of poor in the city. The rest of the paper is sketched as follows. Section two consists of literature that holds theoretical and empirical. The third section presents methodology and data. It gives the sources of the study on which the research was based, provides model specifications and estimation techniques to determine the effects of drought on urban poverty. Section four brings results of the survey and finally conclusion and policy implications are made.

2. Literature

2.1 Theoretical orientations

The rural and urban economies have always been interlinked and a failure to keep strong relationships is likely to result a failure of the national economy. A shock or boost in the rural economy could, if mainly traditional, affect poverty substantially in urban areas despite with cautions that urban poverty has beyond the causes of rural anomalies and with its intricate nature should be seen differently from the rural setup. The urban economy and thus poverty is a manifestation of the various demographics, socioeconomic, and geopolitical setups which differ quite considerably from that of the rural landscape. The urban poverty is heterogeneous, individualistic, and more commercialized/commoditized than the rural poverty which is relatively more homogenous and communal. The commoditization nature of the urban poverty will, thus, affect the lives of the urban poor by affecting their needs for subsistence in: health, housing, education etc. Increases in the prices of food, house rent, fees on educational, and health expenditure will put pressure more on the urban poor and reduces real income (UNCHS, 2000). Real income of urban households is affected by the price of agricultural products through change in their consumer price index. Urban areas have also varieties of more attractive consumer goods and services that result in significant substitution of nonfood for food items in consumption patterns with the effect of lowering income elasticity of demand in urban areas compared to rural areas even at the same per capita income levels (Mellor, 1966).

Food consumption increases with per-capita income the magnitude determined by income elasticity of demand for food. There is also the corollary that distribution of income influences food consumption. On the other hand, urban food consumption varies from rural food consumption in a number of ways. First, consumer behavior is influenced by the greater varieties of food items in urban markets. Second, the opportunity cost of doing household chores and for using women's time in general is high in urban areas. Thirdly, urban food markets are highly affected by food pricing policy of the government than rural markets do (UNECA, 1992).

Considerable debates exist concerning the causes of urban poverty. Some point to the adaptations of mal structural adjustment programs (SAP) [3], in the very little practice of customizing to the local environments, which have been started in the 1980s in emerging countries. Much of the operations were found in African and other Latin American countries. The argument is that the structural adjustment programs

[3] The structural adjustment program that has been started since 1980s affected the economies of most emerging countries

have made numerous people to suffer from increases in food price and service charges, restrictions on wage levels, reduction in employment and declines in urban infrastructure expenditure (Amis and Rakodi, 1994 cited in UNCHS, 2000).

This approach, which emphasis on macro issues, has the tendency to neglect other factors that explain the impoverishment of individuals, families, or social groups at micro level. The micro level poverty is a manifestation of the livelihood that most often resulted in a particular point in time by sudden shocks and migratory status (such as poverty driven and without skill etc). Looking at the micro level causes of poverty Vanderschueren (*et al,* 1996) in UNCHS (2000) contend that the loss of the breadwinner income in the family, the confiscation of individual street traders stock, the demolishing of housing because of illegality, the high cost of illness in family, civil war, and drought etc are the major factors for considerable poverty. This is particularly true when it comes to the case of African nations. Rural impoverishment also initiates rural-urban exodus ultimately fueling to, juvenile delinquency, unemployment, and urban poverty in cities (Tegegn, 2000).

The macro or micro level causes of poverty would, on varying degrees, bring about malnutrition and the fact that the incomes of the poor are fragile and sometimes difficult to predict large number will remain malnourished for decades to come. Policies and strategies that aim to reduce malnutrition or food vulnerability substantially, in this case, needs craft and come-up with prudent approaches that ranges from raising the incomes of the poor to and reducing the shock. Such policies should be participatory and long term. Famines and marginal increase in incomes may, of course, have important effects on the quantity of food consumed. In the same vein harsh hungry season or unanticipated employment shock may increase household calorie income elasticity. Nevertheless, the behavior of households in famines or following shocks may notably differ from that of households in chronic poverty (Alderman, 1993).

Household's short term response to shocks may vary from long-tem response typically measured with cross-sectional data partly because credit constraints and asymmetries in savings and dis-savings possibilities are likely to be more pronounced among low income households. Consequently, such households may be less able to maintain their level of calorie consumption in the face of transitory shocks than when there is a permanent change in the level of income as indicated by average returns to physical or human capital or similar instrumental variables.

Over the long term or over a cross-sectional increased income will be associated with occupations and perhaps workdays that tend to reduce the demand for energy, thus,

making the calorie income curve somehow flatter. In the short term, however, a reduction in, say, real wages or crop yields are unlikely to affect the energy intensity of work. In such situations an income transfer or food subsidy might well have large effect on the individual and household food intake than a similar increment to income stemming from, say, a move from manual to managerial work.

The marginal propensity to consume food is relatively large for low income households. Income elasticity for food is high for households at income levels at which the risk of energy and protein deficiencies is high. The income elasticity for quantity of food expressed in energy is considerably lower, often, about one half of the expenditure elasticity (Andersen, 1993).The consumption characteristics of the urban population, usually, conforms to the Engel's law of income elasticity where demand elasticity of the low income group is less than one, on average, and it declines to lower levels for higher income consumers because of the desire for variety and higher quality food in the diet (Stefan, 2004).

2.2 Empirical literature

Urban poverty has increasingly become a pervasive problem in Ethiopia. From about 8.1 million urban populations in the country in 1994 more than 4.9 million (60 %) were below poverty line (Tegegn, 2000). The Household Income and Expenditure Survey made by Central Statistical Authority in 1995/96 revealed that 41.5 % of the households in Addis Ababa earn income less than 4199 Birr [4]per year or less than 350 Birr per month. Further 19.6 % earn yearly income between 4,200-6,599 Birr or monthly income between 350 Birr and 550 Birr making 61 % of the households earning income less than 550 Birr per month. The expenditure category also revealed that those spending below 550 Birr per month account for a little over one-third or 34.5 % of the households (UNCHS, 2000).

Bigsten and Workneh (2004) estimated total household income, income per capita, and income per consumption unit for Addis Ababa and other towns using data from 1994 Ethiopian Urban Socioeconomic Survey. The result disclosed that 45.5 % of the sample households had monthly income of less than 300 Birr almost 33 % with a monthly income of 300-800 Birr and only 21.7 % had monthly income of 800 Birr or above. The distribution showed that a large number of people in Addis Ababa have had low income.

[4] Birr is the legal tender of the Ethiopian currency. In May 2009 it was equivalent to 0.088 USD.

A calibration of the number of the poor by the Ministry of Finance and Economic Development of the Federal Democratic Republic of Ethiopia (MoFED ,2002) using the 1999/2000 Household Income and Consumption Expenditure Survey indicated that in 1999/2000 about 51.6 % of the population in Addis Ababa live below moderate poverty line. In the same period, poverty gap (p_1) in the city from moderate poverty line was 16.6 % and the squared proportional shortfall from the moderate poverty line (p_2) was also about 0.071 %.

Table 1: Poverty indices for Addis Ababa city in 1999/2000

	Absolute poverty indices	Moderate poverty indices	Extreme poverty indices
P_0 (Head count)	0.362	0.516	0.186
P_1 (Poverty gap)	0.097	0.166	0.038
P_2 (Severity)	0.036	0.071	0.012

Source: MoFED (2002)

Mekonen (1997) made a study on food consumption and poverty in urban Ethiopia. His finding showed that 49.5 % of the population in Addis Ababa was below the food poverty line in 1997 lacking sufficient income to purchase the minimum food necessary to provide essential energy for a healthy life. About 51.4% of the population in the city was found below total poverty line making them unable to afford the minimum food basket and basic non-food items. The absolute number of people lying below total poverty line was, therefore, increased from 1,131,570 to 1,175,004 between 1995 and 1997. The poverty gap among the dwellers in the city was also 21 % in 1997 (Bereket, Abebe and Mekonnen, 2005). The implication is that there existed widespread poverty in the area in which the study was made with its likely effect into vulnerability, social exclusion, and raise in urban crimes.

The above studies have proven the widespread nature of poverty in urban Ethiopia yet it could be said from the findings that the efforts made so far did not give comprehensive pictures if drought and famine are kept aside. This is because given the fact that the country is nature dependent whose bulk of the economy is anchored on agriculture and the occurrence of shocks which happened many times and most likely will happen anytime in the future, such as drought, would certainly disturb the nation's economy further leading to rising poverty. Depth analysis such as scrutinizing the historical records of drought and famine are, therefore, central in poverty explanations. Famines of the 19th century, for instance 1888-1892[5], devastated the

[5] The period is popularly known as Great Famine of Ethiopia, which a result of rinderpest, has taken the lives of many Ethiopians. The rinderpest, which got a foothold through an Ethiopian seaport in 1887, decimated the cattle of northern Ethiopia and traveled to the rest of Ethiopia and Africa by 1897. Like so many of the other droughts that Ethiopia has suffered, the country could have survived the drought of the late 1880's at much lower loss of lives if it had not been for the rinderpest plague(Pankhurst 1964, Zewde 2001).

socioeconomic of the country, thus, of mass poverty and malnutrition. The twentieth century famines of Ethiopia, which occurred since 1960s, also took the lives of many and significantly deterred the development of the nation. Besides, the level at which it appeared the frequency increased tremendously leading future into rising and multi-layered poverty among communities and further to structural inequalities and lack of entitlements (Sen, 1985 and Mesfin, 1984 cited in Alula and Ayalew, 2003). The records made since 1960s should, therefore, be given central in poverty discourse.

The harvest failures as a result of drought that occurred in the 1990s, in particular in 1994 and 1998/1999, had considerably affected about 10 millions most of who left their origin and settled in new areas. This created land and other natural resource conflicts between migrants and the originals. The effect resulted in little room for recovery in 2000-2001 before the situation in 2002 became disastrous in many areas after insufficient rainfall in April and May and the long rains stopped a month short in many lowland areas in September. In the year 2003 around 11.3 million people were affected. A famine, on the scale of the 1984/5 year famine, was predicted by government and the Prime Minister himself suggested that the number of people seeking food aid could rise to 15 million.

Careful analysis of the evolution of poverty between 1989 and 1995 by World Bank among households in six villages of Ethiopia indicated that while overall poverty declined by about 29 % it would have declined by about 39 % in the absence of rainfall shocks. Indeed, about 79 % of the households in the Ethiopian Rural Household Survey (ERHS) reported harvest failure more often caused by rainfall failure as the most common type of hardship. Other ways in which drought risks were experienced include loss of livestock (including oxen), food, and water insecurity. Empirical evidence further suggested that in addition to the immediate negative impacts of shocks on consumption, the detrimental effects can be long lasting. Among households by ERHS data it was shown that lowering rainfall by 10 % led to reduction in growth rates by 1 % even after 4 to 5 years. More strikingly, the impact of the 1984/85 drought was found to affect consumption growth of the 1990's substantially. Households that faced 75 % consumption loss during the 1984/5 famine experienced, on average, 16 points less growth during the 1990s than those at the 25^{th} percentile. Clearly not only household's livelihoods were exposed to drought shocks but they were also often unable to cope with ex-post leaving them in more vulnerability (World Bank, 2005).

The same study by World Bank using the ERHS panel data between 1994 and 1997 showed that a 10 % increase in rainfall resulted in a 10 % increase in agricultural output. Further, analysis of the same panel data showed that a 10 % increase in rainfall raises total income including agricultural and nonagricultural by about 5 %

between 1989 and 1995 and consumption expenditure by about 4 %. It was also found that a 10 % crop damage relative to the mean reduced consumption by about 0.4 % whereas a 10 % livestock disease resulted in a 1.5 % reduction in consumption (World Bank, 2005 and Peter *et al*, 2006).

The social consequences of famine and peasant survival strategies were intimately related to poverty and inequality. Reduction of consumption distress sales of assets, the collapse of exchange and the drop of livestock prices distress migration, which in turn led into dispersal of families and dependence on food aid. Survival and rebuilding households and livelihoods and longer term effects of famine shocks and dependence on aid have exacerbated the burden of poverty (Alula and Ayalew, 2003). Pandey and Bhandari (2006) have in a study of *Coping Drought in Rice Farming in* India showed that about 13 million people who live perilously just above the poverty line fall back below it due to drought induced income loss and others already below the poverty line in non-drought years were pushed further down.

Looking the urban consumption behavior of Ethiopia one finds its conformity to Bennett's law which asserted that increase in average income level is likely to bring about a change in household diets). This was observed during the two major droughts of 1974/75 and 1984/85 where the supply of food for urban population drastically plummeted and the prices for major staple food crops and substitutes surged to 250 % more than the price after normal harvests. As a result the low income group shifted to relatively low price maize while the average income groups shifted to wheat, sorghum, and maize mixed with a proportional quantity of *teff*[6]. In the good harvest situation of 1985/86 the situation was, however, reversed. The average income groups shifted to *teff* while the low income group shifted to wheat and *teff* mixture. In 1984/ 85 the high quality foods, such as, meat, fish, and all the diary products were greatly substituted by pulses, legumes, root crops and vegetables. However, with an increase in income the demand for these quality food items increased proportionately. The general level of consumption of the above food items, on average, was as low as 1-4 % of income varying with income levels (Timmer *et al*, 1983 cited in Mulugeta, 1986).

A survey conducted by the then Central Statistics Organization of Ethiopia in 1980 showed that the vulnerable and/or low income groups earn less than Birr 249 spent 40%- 60 % of their income on food. In the works of Mulugeta such high expenditure level, however, didn't provide the minimum required amount of calories due to the

[6] Teff is believed to have originated in Ethiopia between 4000 BC and 1000 BC. Teff accounts for about a quarter of total cereal production in Ethiopia. The grain has a high concentration of different nutrients, a very high calcium content, and high levels of phosphorus, iron, copper, aluminum, barium, and thiamin.

relatively exorbitant price of food. The same author also found that the consumption characteristics of the urban population of Ethiopia changed significantly with a shift in income: a 10%- 20 % downward shift in the price of major cereals significantly improving the nutritional status of the urban society by same proportion.

Goitom (1996) studied aspects of poverty in Addis Ababa. His finding showed that the proportion of total population of the city who live below poverty line had increased from 45.4 % in 1990 to 63 % in 1992 in the same period and that the share of the people who live in a state of primary poverty (food poverty) had increased from 35 .3 % to 48.4 %. His study also disclosed that food consumption took about 77 % of the total household expenditure in the stated period in the city. A computation by MoFED (2002) using household Income and Consumption Expenditure Survey also revealed that about 55 % and 51 % of total household expenditure in Addis Ababa was spent on food in 1994/5 and 1999/00 respectively.

The poor in rural economies of much of Asia and, increasingly, in sub-Saharan Africa derive a large share of their income from wage employment in food grain production. Higher grain prices will probably lead to higher agricultural wage rates with the possibility of mitigating adverse effects on the poor (Ravallion, 1992).A study conducted by the same author in Bangladesh using dynamic econometric model confirmed that an increase in the price of rice benefited the rural non-poor whereas the rural and the urban poor tend to loose from the rise in price. But in the long run the effect of the increase in the price of rice on the rural poor tends to be positive or neutral.

Fan, Fang, and Zhang (2001) analyzed the effect of total agricultural production on food price in China using a time series econometric approach. The study, *citrus paribus*, found out that a percent increase in agricultural production led to a 0.43 % decline in food price in urban China and this was found significant at 5% level. The same study also proved that the number of poor in urban China was directly related with urban food price at 5% level of significance. Further, a percent increment in food price in urban China led to a 1.69 % and a 1.41 % increase in the number of urban people who live below $1.5 and $2 per day respectively.

Using panel data Fan (2002) examined the factors of agricultural production: rainfall, land and others on total agricultural production and then on food price and the number of urban poor in India. His result showed that, keeping other variables constant, an increase in rainfall in India by one percent led to an improvement in total agricultural productivity by 0.272 % at 5 % level of significance and a percent increase in agricultural productivity led to a 0.231 % decline in food price in urban India. For every one percent decline (increase) in food prices urban poverty was observed to reduce (increase) by 0.35 percent.

A study by UNECA (1992) on food gap in Egypt showed that population growth together with change in per capita income and income elasticity of food items led to a change in food demand. The study obtained that, population growth, per capita income and the estimated expenditure elasticity of food demand from the year 1992 up to 2000, on aggregate, led food consumption to increase by 40.9 % as a lower limit and by 46.36 % as an upper limit for wheat, between 40.48% and 44.7 % for rice and between 41.75 and 45.12 % for maize. The same study also found that expenditure elasticity of food items of wheat, meat, and rice have positive expenditure elasticity whereas a food item of sorghum has negative expenditure elasticity. On the other hand, comparison of expenditure elasticity of cereals and fresh meat among urban and rural areas of Egypt indicated that both areas do have positive expenditure elasticity with respect to meat and urban areas have slightly higher expenditure elasticity for meat whereas expenditure elasticity of cereals was higher for rural than urban areas of the country.

3. Methodology & data

3.1 Model specification

In the efforts of analyzing drought effects on urban poverty, in Addis Ababa, we adopted a time series econometric model. The adoption of the model was in consultation with other empirical studies which popularly employed in the study of agricultural productivity factors and the effects of the amounts of agricultural production on urban poverty and, in this case, the contributions of Fan *et al* (2001), who did similar to our study, were intensively used. The model consists of three separate equations which were then determined stepwise. This is because many poverty determinants such as production or productivity growth and prices were generated from the same economic process as poverty and, hence, must be specified as endogenous to avoid estimation biases. In addition, since drought affects poverty through change in food price it was difficult to capture this link using a single equation model. These are indicated below as:

Agricultural production= f (land, rainfall, fertilizer, expenditure on agriculture, μ). **(1)**

Food price= f (agricultural production, population, GDP, NFIE, FA, μ) **(2)**

Urban poverty= f (food price, μ) **(3)**

Equation (1) is an agricultural production (AP) function. In Ethiopia, where rain fed agriculture is dominant, drought caused by rainfall variability was expected to result significant impact on total agricultural production and, in this case, to capture the

effect of rainfall variability on agricultural output, rainfall (RF), was taken as one of the determinants for agricultural output in the equation. The relationships between rainfall distribution and agricultural produce are functional [7],and to this purpose, the impacts of other determinants of agricultural output such as the amount of cultivated land (LAND), fertilizer (FERT), total expenditure on the agricultural sector (AE) by government, were included in equation (1). In addition, μ, which is a white noise term, was included to capture the impact of other omitted variables.

Equation (2) set out determinants of food prices (FP). A decline in agricultural production was expected to decrease supply of agricultural products and, hence, would increase food prices. Gross Domestic Product (GDP) and population size (POP) were used to capture demand side factors in the food market. Since there was a substantial amount of food that enter into the country as an import or as aid, NFIE (Net food import and export) and international food aid (FA) were included in Equation (2) as determinants of food price.Net food import was taken to determine the values of food import- export on food price as net values because in the years used for the data showed that the country exported very small or zero amount of food. To capture the effect of other omitted variables as usual the variable μ was included.

Equation (3) models determinants of urban poverty (UP).Even though many factors could, certainly, determine urban poverty the study would only see the effect of a change in food price on urban poverty and to this food price was taken as explanatory variable by keeping the effect of all other omitted variables via μ. Moreover, an important characteristic of Addis Ababa residents was that they spent more than half of their expenditure on food. During the 1970s and 1980s, for example, about 60 % of the total household expenditure in the city was on food and, in the first half of the 1990s, it raised to 77 % (Goitom, 1996). Similarly, during the second half of the 1990s the percentage share of expenditure on food from total household expenditure declined from 55 % in 1995 to 51 % in 1999 (MoFED, 2002).In all periods expenditure on food took the lion's share of the total household expenditure.

The above explanations can be specified in lin-log form as follows:

$$Log\ ^{AP} = \beta_0 + \beta \log\ ^{Land} + \beta_2 \log\ ^{Rf} + \beta_3 \log\ ^{Fert} + \beta_4 \log\ ^{Ae} + \mu_i \qquad \textbf{(4)}$$

(+) (?) (+) (+)

$$Log\ ^{FP} = \mu_0 + \mu_1 \log\ ^{AP} + \mu_2 \log\ ^{POP} + \mu_3 \log\ ^{RGDP} + \mu_4 \log\ ^{NFIE} + \mu_5 \log\ ^{FA} + \mu_i \qquad \textbf{(5)}$$

(-) (+) (+) (-) (-)

[7] In economic analysis, such as looking the effect of factors of production on agricultural produce, we cannot exhaustively list all determinants and find their amounts on the dependent variables as there is usually some hidden we call them stochastic parameters that help as simplify our assumptions. The assumptions are always functional and not deterministic like pure/hard science.

$$Log^{UP} = \delta_0 + \underset{(+)}{\delta_1 \log^{FP}} + \mu_i \ldots \quad \textbf{(6)}$$

The signs below each variable show the expected directions of the coefficients and it was given (+) if the anticipated sign was positive, (-) if the expected sign was negative, and (?) if the expected sign was indeterminate.

Since agricultural production increases with an increase in the amount of cultivated land, fertilizer used and, expenditure on the sector, all the three variables were expected to have positive coefficients. On the other hand, rainfall scarcity leads to production loss, similarly too much rainfall will have a devastating impact on crop production, thus, it was difficult to assign either positive or negative expected sign for the variable rainfall. We, therefore, hypothesized rainfall to have indeterminate (?).

In equation 2, an increase in agricultural production could reduce the price of food. This variable was expected to have negative sign. Since population growth and GDP growth (via income growth), increases demand for food, they were expected to increase food price and they, therefore, were assigned positive. Ethiopia is one of the countries in the world that get high amount of international food aid. Since food aid increases food supply it was expected to reduce food price in the market. Food import to the country was substantial whereas it exported negligible amount. Various data from Central Statistics Authority of Ethiopia, for various years, showed that there were even some years which record zero or negative food exports and the net effect was that food import exceeded food export. Our expectation was that increase in import foods will tend to reduce food price and thus with negative relationship.

In the third equation urban poverty was expected to positively correlate with food price because increase in food price would tend to reduce real income of the urban poor and then raising the number of the poor in the city.

3.2 The data

In order to estimate the effects of the explanatory variables on the dependent variable(s) a time series data that consists of different periods for the three equations were used. In the AP equation, 26 years (1980-2005) annual time series data were used while in the FP model a 31 years (1973-2003) annual time series data were analyzed. Yet, in the third model, dearth of data limited us to use only 13 years (1976-1978 and 1990-1999) annual time series. Data on total agricultural production, cultivated land, fertilizer, GDP, population size, food aid, size of imported and

exported food, and food price were extracted from the Ethiopian Economic Association/ Ethiopian Economic Policy Research Institute (EEA/EEPRI) data base CD -ROM of the year 2006. Food price for recent years, which were not available on EEA/EEPRI CD-ROM, were obtained from National Bank of Ethiopia. To obtain the number of urban poor in the city, set by MoFED (2002), the moderate poverty line was used after converting it to the 1995/96 constant prices (annex 4 contains the derivation of poverty line). Based on the 1995/96 and 1999/00 Household Income and Consumption Expenditure Surveys, based on the 1994 manpower and demographic surveys of Central Statistics Authority and the study by Goitom(1996), the number of poor in the city was calculated.

Food price was measured as the food procurement price in the city at the 1995/96 constant prices. The Gross Domestic Product was measured in constant prices and since the size of the total population of the country had effect on food price in the city it was the whole population in the country that was taken to represent one of the variables in the second equation.

Agricultural production inputs were measured in terms of total amount of cultivated land, fertilizer, total expenditure on agriculture by government and average annual rainfall. All the four variables were aggregates of the whole country. This was because most food supplies to Addis Ababa came from, almost, all parts of the country. In addition to the EEA/ EEPRI CD-ROM and CSA publications, data were gathered from published and unpublished official documents.

The collected data were estimated and analyzed after checking stationarity and cointegration of variables. Data are stationary if and when error terms have zero mean, have constant variance, and the covariance between any two periods depends only on the distance or lag between the two periods and not on the actual time at which it is computed (Gujarati, 2006). The unit root tests of the Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) were used to check stationarity of the data (annex 1). If data, however, contain unit roots before differencing cointegration test is needed and if and when sets of I(1) variables are cointegrated then regressing one on the other should produce residuals that are I(0) (Kennedy, 2000).To this purpose a cointegration test of Engle Granger two step procedure and Johansen maximum likelihood approaches were used.

4. Results and discussion

The result of the DF and ADF tests showed that the null of a unit root was not rejected for all the natural logarithmic variables in agricultural production and food

price equations. However, the DF and ADF statistics of the natural logarithmic first difference of the variables were significantly low for both equations thereby rejecting the null hypothesis that the first difference was non-stationary either at 5 % or 1 % level of significance. Therefore, the variables in the AP and FP equations were I (1)[8] series. As can be seen from appendix 1(a) and (b), the null hypothesis was rejected for both with the constant and with trend in both equations. On the other hand, variables in the urban poverty equation were found stationary at level and the result of the test is reported in appendix 1(c).

4.1 The long run estimation

a) Lag determination

Determining the appropriate lag length in a time series data is essential and the applications of the Johansen technique in this case was based on the assumption of white noise errors. The issue of setting appropriate lag length is that there are variables that only affect the short run behavior of the model and if they are omitted will become part of the error term and leading to residuals misspecification (Harris, 1995). Thus, the level systems were estimated with initial choice of lag 2 and the long run result was estimated for the agricultural production and food price equations. The sample size was small to increase the lag length to three or more and, therefore, the additional lags were not tested. On the other hand, in the UP equation the sample size was too small to use the second lag and lag length one was used to analyze the model. As shown (appendix 2) the null hypothesis of the information at period t-i was not significant in determining the current period value of the dependent variable based on the F-test. The result of the F-test indicated that the second period lag was significant [appendix 2 (a) and (b)] for the AP and FP equations. The same test was also conducted for the UP equation and the result showed that the first period lag of food price was significant in determining the number of urban poor. Therefore, significant information in the AP and FP models was contained principally at the second lag and in the case of UP model the first lag contained significant information. Since cointegration analysis requires the model to have common lag length, lag length two was used in the AP and FP equations whereas in the UP equation lag length one was used for cointegration analysis.

[8] I (1) means integrated of order one (stationary after being differenced once). If a time series is differenced d- times before it becomes stationary, then it is integrated of order –d or I (d).

b) Estimation of the cointegration

Determining the number of cointegrating vectors using trace test is essential after fixing the lag length. The test statistics used are summarized in appendix 3. For the AP equation the trace test rejected the null hypothesis that there were no cointegrating vectors (r = 0) against the alternative one ($r \geq 1$) at 1 % level of significance because the test statistic (85.757) was greater than the 99 % critical value which implies that there was at least one cointegrating vector. The null hypothesis of $r \leq 1$ against $r \geq 2$, $r \leq 2$ against $r \geq 3$, $r \leq 3$ against $r \geq 4$, and $r \leq 4$ against $r \geq 5$ were all accepted. This implies that there was only one cointegrated vector among the variables included in the model or among the variables of agricultural production(land, agricultural expenditure, and rainfall variability) there was only one cointegration vector and then only one long run relationship [appendix 3(a)].

Similarly, in the FP equation since the test statistic of the null hypothesis(101.85) was greater than the 95 % critical value, the null hypothesis that there were no cointegrating vectors (r=0) against the alternative that there is at least one cointegrating vector ($r \geq 1$) was rejected at 5% level of significance. The null hypothesis of $r \leq 1$ against $r \geq 2$, $r \leq 2$ against $r \geq 3$, $r \leq 3$ against $r \geq 4$, $r \leq 4$ against $r \geq 5$ and $r \leq 5$ against $r \geq 6$ were all accepted with the implication that among the variables of the FP model there was only one cointegration vector and then one long run relationship. On the other hand, in the UP equation both variables were stationary at level and then we did not conduct further cointegration test.

Table 2a: Cointegration results for agricultural production equation with standard β' eigenvectors

LnAP	LnLAND	LnFERT	LnAE	LnRF
1.0000	-0.37107	-0.056576	-0.11130	-0.31559

Table 2b: Cointegration results for food price equation with standard β' eigenvectors

LnFP	LnAP	LnPOPL	LnNFIE	LnRGDP	LnFA
1.00	0.15888	-5.8645	0.030428	3.2169	0.09691

Table 2c: Cointegration results of urban poverty equation with standard β' eigenvectors

LnUP	LnFP
1.00	-0.49203

Sources: 2a-2c (EEA/EEPRI, 2006)

After proving that there was only one cointegrating vector the following procedure was to impose restriction on the first column of the α- matrix to identify which entries

of the first column of α– matrix was statistically zero. This helps identify weakly exogenous variables in the systems that enter the right hand side of VAR. We found no loss of information by modeling weak exogenous variables (Harris, 1995).Efficient estimation of parameters requires that no information on these parameters is lost by conditioning on the explanatory variables. In other words, the explanatory variables may be treated as though they are fixed in repeated samples even though they may be generated by a stochastic mechanism in the same way as the dependent variables. If this condition is satisfied, the explanatory variables are said to be weakly exogenous (Harvey, 1990).

Table 3a: Tests for zero restriction on α- coefficients for Agricultural production equation (Weak exogeneity test)

Variable	LnAP	LnLAND	LnFERT	LnAE	LnRF
α - Coefficients	-1.2298	-0.18285	5.2450	-0.31375	0.26382
LR-test χ^2 (1)	14.123	0.62845	1.8391	0.60620	0.81697
P-value	[0.0002]**	[0.4279]	[0.1751]	[0.4362]	[0.3661]

Table 3b: Tests for zero restriction on α- coefficients for food price equation (weak exogeneity test)

Variable	LnFP	LnAP	LnPOPL	LnNFIE	LnRGDP	LnFA
α - Coefficients	-0.45044	0.13255	0.15002	-0.81239	0.14590	-0.57739
LR-test χ^2 (1)	15.465	0.059295	2.2712	1.8555	1.6359	1.2443
P-value	[0.0001]**	[0.8076]	[0.1318]	[0.1731]	[0.2009]	[0.2646]

Table 3c: Tests for zero restriction on α- coefficients for urban poverty equation (weak exogeneity test)

Variable	LnUP	LnFP
α - Coefficients	-1.2559	-0.62153
LR-test χ^2 (1)	4.7026	0.44422
P-value	[0.0301]*	[0.5051]

** and * denotes rejection at 1 % and 5% level of significance in order.

It is clear from the above table that the null hypothesis of weak exogeneity was rejected for the variables: agricultural production for the AP equation, food price for the FP equation and urban poverty for the UP equation which strengthens the results we have obtained above using trace test. Then the normalized long run equations of the model were formed by taking the opposite sign of standardized β' coefficients as follows:

LnAP = 8.29895 + 0.37107LnLAND + 0.056576 LnFERT + 0.1113LnAE + 0.31559 LnRF **(2a)**

LnFP= 9.81696 -0.15888 LnAP + 5.8645 LnPOPL - 0.030428 LnNFIE- 3.2169 LnRGDP - 0.09691 Ln FA **(2b)**

LnUP= 5.07261 + 0.49203LnFP **(2c)**

The coefficients of the above equations have the natural interpretation as the long run effect of the independent variables on the dependent in which the coefficient of the independent variables indicate the elasticity of the dependent variables for a unit change in the respective independent variable. In the AP equation, for instance, the coefficient of lnRF (=0.3155) implies that, *citrus paribus*, a percent increase in the total amount of rainfall received in the country increases total agricultural output by 0.3155 %. Similarly, in the FP equation lnAP's coefficient (-0.15888) indicates, keeping other things constant, a percent reduction in total agricultural output in the country leads to a 0.15888 % increment in food price in Addis Ababa. In the UP equation also the coefficient of FP (=0.49203) showed that, *citrus paribus*, a percent increase in food price in Addis Ababa results in a 0.49203 % increase in the number of poor in the city. The result subscribed to the works of Fan *et al* (2001) and Fan (2002) who respectively conducted in China and India with the coefficients of the other variables having the same interpretation.

The result indicated that agricultural production in Ethiopia was directly related to the amount of rainfall in the country. An increase /a decrease in the amount of rainfall in the country led to an increase/ a decrease in the agricultural production. This perhaps is the reason for why the country suffered crop failure and hunger in low rainfall years. It is also evident from the result that agricultural production was inversely related to food price or a decrease /increase in agricultural production in Ethiopia leads to an increment /decline in food price in Addis Ababa and food price in the city were directly related with the number of poor in the city. In other words, an increment /decline in food price in the city was found to raise /reduce the number of poor in the city. Our result satisfied the hypothesis set out earlier. The significance of the long run beta coefficients was also tested and the results of the test are shown in Table 4a below.

Table 4a: Tests for zero restrictions of the long run coefficients for agricultural production (AP) equation (test of the significance of long run beta coefficient)

Variable	LnAP	LnLAND	LnFERT	LnAE	LnRF
β_Coefficients	1.00	-0.37107	-0.056576	-0.11130	-0.31559
[4]LR -test on χ^2 (1)	15.933	3.0252	7.5259	5.1949	3.8934
P-value	[0.0001]**	[0.0820]	[0.0061]**	[0.0227]*	[0.0485]

Table 4b: Tests for zero restrictions of the long run coefficients for food price (FP) equation (test of the significance of long run beta coefficient)

Variable	LnFP	LnAP	LnPOPL	LnNFIE	LnRGDP	LnFA
β_Coefficients	1.00	0.15888	-5.8645	0.030428	3.2169	0.09691
LR -test on χ^2 (1)	19.357	5.6744	15.331	0.15103	9.4384	1.9919
P-value	[0.0000]**	[0.0172]*	[0.0001]**	[0.6976]	[0.0021]**	[0.1581]

Table 4c: Tests for zero restrictions on the long run coefficients for urban poverty (UP) equation (i.e. Test of the significance of long run beta coefficient)

Variable	LnUP	LnFP
β_Coefficients	1.00	- 0.49203
LR -test on χ^2 (1)	4.8915	4.0020
P-value	[0.0270]*	[0.0454]*

* and ** denotes significant at 5 % and 1 % levels of significance respectively

In the AP equation, rainfall and agricultural expenditure were significant in determining agricultural production at 5 % level. Similarly, fertilizer and land were robust in affecting food price at 1 % and 10 % level of significance respectively. As expected, all exogenous variables, in the equation, brought positive and inelastic beta coefficients.

In the long run a percent reduction in the total amount of rainfall in the country leads to a 0.31559 % decline in the total amount of agricultural production in the country at 5% level. This conforms to the theoretical underpinnings that drought can have a substantial impact on the ecosystem and agriculture of the affected region and even a

[4] The likelihood Ratio (LR) test used to test zero restrictions on αcoefficients takes the form $\lambda trace = -T\sum_{i=1}^{n}\log(1-\hat{\lambda_i})$ where T is the number of observations, λ_i are eigen values as defined earlier (Harris, 1995).

short yet intense drought can cause significant damage and harm to the local economy. The reduction in agricultural production, due to drought, has vicious effect in reducing agricultural production by depleting the assets, including, livestock and natural resources of the affected locality.

In the long run fertilizer use has direct relationship with agricultural production at 1 % level of significance. An increase (decrease) in the amount of fertilizer use in Ethiopia leads to an increase (decrease) in the agricultural production of the country. On the other hand, inelastic beta coefficient of fertilizer (0.056756) shows that in the long run agricultural production increases at a lower rate than fertilizer use.

Expenditure on agriculture has also direct relationship with agricultural production of the country. An increase (decrease) of total government expenditure on the agriculture sector by 10 % leads to an increase (a decrease) in the country's agricultural production by 1.113 % at 5% level of significance. This implies that expenditures by the government on the agricultural sector for training, research, introduction of new techniques, and for other purposes, helped to improve agricultural productivity of the country.

In the FP equation, all variables except net food import and export and international food aid, were significant either at 5% or 1% level of significance in affecting food price in Addis Ababa. In this equation, all explanatory variables, except population, brought negative elasticity coefficients and variables that affected food price via demand (population and real gross domestic product) have elastic beta coefficients whereas variables that affected food price via food supply(food import, food aid and domestic agricultural production) have inelastic coefficients in determining food price. Put differently, food price in the city was more responsive to change in factors that affect food demand than food supply.

The food price equation, except real gross domestic product, brought the expected sign of beta coefficient. Through raising income and then food demand an increase in real gross domestic product was expected to increase food price but the result was the reverse. This might be partly because, in the long run, an increase in income might be saved and then spent on other high priced luxury commodities such as car or invested on other needs including housing than buying more food. In the long run, an increase in income might also induce people to save more money even by curtailing their level of consumption before the rise of income in anticipation of long run investment on capital goods.

Significant elastic coefficient of population on prices of food staffs in Addis Ababa revealed how population growth had impacted consumption patterns of dwellers and

life worlds. It is very likely that this pattern will repeat in future unless otherwise sustainable means are created. A percent increase in the total population of the country leads to a 5.8645 % increment in food price in the city at 1% level of significance with the implication that unless population growth of the country is checked today, with its current growth rate (2.85 %), it can trigger the rise in food price and then the cost of living in urban centers.

In the same model, FP equation, agricultural production was found significant at 5 % level in the extent to which it affected food price of the city of Addis Ababa whereas food aid and food import were insignificant vectors. This is because food aid that comes to the country during drought times was, mainly, distributed to rural people who were directly affected by famine than in urban areas with the implication that food aid has had higher effect in rural food supply and food price than the urban one. Put differently, even during drought times urban areas, including Addis Ababa, were more dependent on domestic food production than food aid. Moreover, food import to the country was actually too small when compared to overall food consumption of the nation in general and Addis Ababa in particular. The overall impact was, thus, little on food supply and food price in Addis Ababa.

In the UP equation, food price in Addis Ababa brought substantial in affecting the number of the poor in the city at 5% level. The positive beta coefficient of food price (0.49203) showed that food price, keeping other variables constant, resulted in expected direct relationship. Therefore, given the highest share of expenditure on food from total expenditure of households in the city such direct and significant relationship with food price and the number of poor in the city imply that food price was crucial in determining the welfare of most in the city.

4.2 Error correction model

Once the long run relationships among variables were quantified the next step was to determine the short run correction between them and, hence, their coefficient(s) of short run dynamics. Accordingly, the short run dynamics was estimated using Hendry's general to specific model selection technique. The technique involved simplifying the model into a more interpretable characterization of the data by reducing sequentially insignificant variables based on t-value and their constituents with the generally accepted theories.

When the short run dynamic model was estimated by a two period auto-regressive distributed lag of all variables except the error term was saved in case of all the three equations, the error term was saved at its first lag. Then using Hendry's general to

specific procedure the error correction model was calibrated. In applying the technique at each reduction the F-test and diagnostic test were carried out in order to verify the justifiability of the reduction.

The significances of the results of the three equations were verified using various diagnostic tests as shown in appendix 3. The diagnostic test of residuals indicated that the models have the desired properties of OLS estimation. The LM test for serial autocorrelation, heteroscedasticity test, the Jarque-Bera test of skewness and kurtosis showed that all the three mentioned desired properties of OLS estimation were satisfied and Ramsey's RESET test indicated the non-existence of model specification problem. Besides, in all the three models one period lagged value of residuals (the coefficient of vector error correction term) had the theoretically expected negative coefficient. The F test also showed that variables in each of the three equations were jointly significant either at five or one percent significance level. Further, coefficient of determination (R^2) was fairly higher in all the three cases: 73 % in the AP model, 84 % in the FP model and 91 % in the UP model. The results of the short run dynamics equation for the AP, FP and UP equations from PC-Give are presented in Table 5 below**.**

Table 5a: Short run dynamic model (Error correction modeling) for Agricultural production equation

Variable	Coefficient	Std.Error	t-value	t-prob	Part.R^2
$DLnAP_{t\_2}$	-0.359502	0.1723	-2.09	0.056	0.2373
$DLnLAND_t$	0.540340	0.3238	1.67	0.117	0.1659
$DLnLAND_{t\_1}$	0.497384	0.3132	1.59	0.135	0.1527
$DLnFERT_{t\_2}$	0.0370614	0.01477	2.51	0.025	0.3103
$DLnAE_{t\_1}$	0.0352962	0.1256	0.281	0.783	0.0056
$DLnRF_{t-1}$	0.355064	0.2084	1.70	0.111	0.1717
$residuals_{t\_1}$	-0.443924	0.2970	-1.49	0.157	0.1376
Constant	0.0037166	0.02828	0.131	0.897	0.0012

RSS = 0.184362133
R^2 = 0.733951
Adjusted R^2 = 0.631
F(7,14) = 5.517 [0.003]**
DW = 2.69

Δ : denotes first order difference, $residuals_{t-1}$ denotes error correction term at its first lag,
* denotes significant at 5 % level, and ** denotes rejection at 1 % level of significance.

In the Agricultural production Vector Error Correction Model (VECM) residual at its first lag had negative coefficient and all other explanatory variables were found to

increase agricultural production. Land, which presents at its first lag and at current period has positive coefficients in both cases. Similarly, fertilizer got at its second period lag, agricultural expenditure at its first lag, and rainfall at current period were found to increase agricultural production in the short run. In the short run, fertilizer was significant in affecting agricultural production at 5% level of significance. On the other hand, as expected, all explanatory variables in the model got positive relationship on agricultural production. For instance, *citrus paribus*, a percent increase in the total amount of cultivated land in Ethiopia before a year leads to a 0.497384 % increment in the country's total agricultural production at current period. Likewise, a percent increase in the total amount of rainfall in the country and total agricultural expenditure by the government before a year leads respectively to a 0.355064 % and 0.0352962 % rise in the total agricultural production of the country.

Table 5b: Short run dynamic modeling (Error correction modeling) for the food price equation

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
$DLFP_{t\_1}$	0.491651	0.2096	2.35	0.037	0.3143
Constant	0.0422410	0.02456	1.72	0.111	0.1978
$DLAP_t$	-0.106883	0.03433	-3.11	0.009	0.4468
$DLPOPL_t$	0.762231	0.3268	2.33	0.038	0.3120
$DLPOPL_{t\_1}$	0.574486	0.2863	2.01	0.068	0.2512
$DLPOPL_{t\_2}$	0.602012	0.3344	1.80	0.097	0.2126
$DLNIFIE_{t\_1}$	-0.0610867	0.04095	-1.49	0.162	0.1564
$DLNIFIE_{t\_2}$	-0.0345023	0.03390	-1.02	0.329	0.0795
$DLRGDP_t$	-0.880987	0.3346	-2.63	0.022	0.3662
$DLRGDP_{t\_1}$	-0.496888	0.2966	-1.68	0.120	0.1896
$DLRGDP_{t\_2}$	-0.538485	0.2725	-1.98	0.072	0.2455
DLFA	0.0785133	0.02900	2.71	0.019	0.3791
$DLFA_{t\_1}$	-0.0636377	0.03811	-1.67	0.121	0.1885
$DLFA_{t\_2}$	-0.0491143	0.03253	-1.51	0.157	0.1596
$residuals_{t\_1}$	-0.469792	0.3544	-1.33	0.210	0.1277

RSS = 0.0393457398
R^2 = 0.846978
Adjusted R^2 = 0.70
F(14,12) = 4.744 [0.005]**
DW = 2.67

In the food price VECM the current period agricultural production was significant at 1%t level in determining food price. A percent reduction in agricultural production of Ethiopia, c*itrus paribus*, leads to a 0.106883 % increment in food price in Addis Ababa. In addition, the current period values of food aid, RGDP, and population were significant at 5 % level in determining food price in the city. As can be seen from the above table, both the first and second period lag values of food aid have negative relationship with food price in the city. A percent increase in food aid before a year and two years leads to a 0.0636377% and a 0.0491143 % reduction in food price in Addis Ababa which implies that, like the long run, short run food price in the city was less responsive to food aid. This may be because mostly substantial amount of food aid to the country comes during times of severe drought and famine which was likely to take more time in distribution for recipients. The rise in food price due to drought, thus, remained higher until aid was distributed to recipients and then affected food supply and food price in the country in subsequent periods.

In all the three periods (current, first lag, and second lag), population growth in the country leads to a rise in food price in Addis Ababa. Citrus paribus, a percent increase in the total number of population in the country before a year leads to a 0.574486 % increment in food price in the city after a year. Similarly, a percent increment in the population of the country at a current period leads to a 0.762231 % rise in food price in the same period. Moreover, as expected, NIFIE brought negative impact with food price in Addis Ababa and that the relationship holds for both the first and second period lag values (Table 5b). This is because food import of Ethiopia exceeds its food export by substantial amount in the years used for analysis. Finally, the current, first period and second period lag values of RGDP have negative relationship with food price in the city.

The result that an increase in real GDP leads to a decline in food price may, however, seem strange. This might be due to the fact that if and when the income of the people rises they may shift their food demand to high quality food than raising their total demand for food. This, in turn, is likely to lead a reduction in the price of inferior food items that actually were consumed by the bulk of the population in the city and then more than offset the increase in the price of high quality food items that was consumed by relatively small proportion of the population. This result is consistent with Bennett's law which states that an increase in average income level brings about a change in household diets and that of Mulugeta's (1986) contributions whose conclusion was that the consumption characteristics of the urban population conform to Engel's law of income elasticity that the demand elasticity of the low income group is less than one on average and it declines to lower levels for higher income consumers due to the desire for varieties and high quality foods. The same author also found that the consumption characteristics of the urban population of Ethiopia

changes significantly with a shift in income by about 10%- 20 % downward shift in the price of major cereals which is equivalent to an increase in real income can significantly improve the nutritional status of the urban society by the same proportion. The improvement was, however, not due to an increase in total food consumption instead due to a shift towards highly nutritious and/or quality food items.

In the urban poverty vector error correction model the second period lag and current period values of food price in Addis Ababa was significant in determining the number of the poor at 5% level. Similarly, the one period lag value of food price was significant at 10% level in determining the number of poor in the city. As expected, an increment in food price in the city leads to a rise in the number of poor in the city. The current period, first period lag, and second period lag values of food price, were directly related with the number of poor in the city. The result showed that a percent increase in food price before two years leads to an increase in the number of poor in the city by 0.341539 % at current period. Likewise, *citrus paribus*, a percent increase in food price at the current period leads to a 0.291125 % increment in the number of the poor in the city at the same period with the implication that the welfare of the poor in the city at a given period was not only affected by food price in that period only but also by the price of food before years.

Table 5c: Short run dynamic modeling (Error correction modeling) for the urban poverty equation

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
$DLnUP_{t\_2}$	-0.375675	0.1816	-2.07	0.107	0.5170
Constant	-0.0310614	0.02426	-1.28	0.270	0.2908
$DLnFP_t$	0.291125	0.09398	3.10	0.036	0.7058
$DLnFP_{t\_1}$	0.240018	0.09242	2.60	0.060	0.6277
$DLnFP_{t\_2}$	0.341539	0.1067	3.20	0.033	0.7192
$residuals_{t\_1}$	-0.561893	0.2185	-2.57	0.062	0.6231

RSS = 0.010361954
R^2 = 0.913045
Adjusted R^2 = 0.851
F(5, 4) = 8.4 [0.030]*
DW = 2.78

5. Conclusion and policy implications

5.1 Conclusions

Using time series data the study analyzed the effect of drought, measured by amount of rainfall variability, on urban poverty in Addis Ababa. Three models (equations) were used to meet the objective with the first model holding determinants of agricultural production which include rainfall, land, agricultural expenditure and fertilizer. The second equation set out determinants of food price in Addis Ababa: agricultural production, population, Real GDP, food aid, food import and the third equation estimating food price as a determinant of the number of poor in the city. Stationarity of the data using Dickey Fuller and Augmented Dickey Fuller methods of unit root were tested and the Johansen cointegration test were used to check the presence of long run relationship among variables included in the model. Weak exogeneity test and vector error correction model were also calibrated using Hendry's general to specific model selection technique.

> *The result showed that drought, due to reduction in total rainfall amount, brought significant impact in reducing agricultural production of the country which, in turn, raised food price and the number of poor in Addis Ababa. In the long run, rainfall variability was found to have direct relationship with agricultural production. An increase (decrease), citrus paribus, in the amount of rainfall in Ethiopia by 1% has led to its agricultural production to increase (decrease) by 0.31559% at 5 % level. Fertilizer, agricultural expenditure, and land were found significant at 1 %, 5%, and 10% level respectively in determining agricultural production. In addition, all explanatory variables have inelastic coefficients in the extent to which they determine agricultural production.*

In the second equation (determinants of food price) agricultural productivity and, thus, production of Ethiopia was significant in determining food price of Addis Ababa in the long run. A 10 % increase (decrease) in the agricultural production of Ethiopia leads to a 1.5888 % reduction (increase) in food price in the city at 1% level. On the other hand, the result showed that among its determinants food price in the city was found substantially responsive to variables that affect the demand side of food market (population and RGDP of the country) than variables that affect the supply side of food market (agricultural production, food aid and food import). Both variables that affected the demand side of food market have elastic coefficients in determining food price whereas all the three variables that affected the supply side of the market have inelastic coefficient. In addition, among its entire explanatory variables food price in

Addis Ababa was highly responsive to population growth of the country. A percent increase (decrease) in the total population of the country leads to a rise (decrease) in food price of the city by 5.8645 % at 1 % level of significance. Moreover, in the long run food price in the city was less responsive to food import and food aid and that both variables were found insignificant in determining food price.

In the third model, which set out food price as determinant of the number of poor, food price in Addis Ababa was found to have direct relationship with the number of poor in the city. *Citrus paribus*, a percent increase (decrease) in food price of Addis Ababa city leads to a 0.49203% increase (decrease) in the number of poor in the city in the long run.

In the short run we found a direct relationship between rainfall and agricultural production of Ethiopia. A percent increase in the total amount of rainfall in the country before one year leads to a 0.355064 % rise in its agricultural production at current period with the result being significant at 10% level. On the other hand, the current period agricultural production of Ethiopia was significant at 1% level in affecting food price in the city. *Citrus paribus,* a 1% reduction in agricultural production of Ethiopia at current period leads to a 0.106883 % increment in food price in Addis Ababa in the same period. Like the long run, food price in the city, was less responsive to food aid and food import in the short run because even during drought years the city depended more on domestic food production than food aid and food import.

In the short run, current period and second period lag value of food price in the city was significant in determining the number of poor in the city at 5% level. As anticipated, there was a direct relationship between food price and the number of poor in the city. A percent increase in food price before two years, assuming other things remain constant, leads to an increase in the number of poor in the city by 0.341539 % at current period. Similarly, a percent increase in food price at the current period leads to a 0.291125 % increment in the number of poor in the city in the same period.

Summing up, both in the long run and in the short run agricultural production of Ethiopia was found to have direct relationship with the amount of rainfall in the country. Whenever drought came in, the country substantially suffered a decline in agricultural production and the decline in the production led to a rise in food price in Addis Ababa which, finally, led raise in the number of poor in the city by squeezing the real income of consumers.

5.2 Policy implications

The inelastic coefficient of rainfall on agricultural production of the country both in the long and short run implies that unless new agricultural systems, such as irrigation, new technologies or inputs are introduced properly, the country cannot, certainly, increase its agricultural production by principally depending on rain fed agriculture. Similarly, highly inelastic long run coefficient of fertilizer on agricultural production implies the need for using a mixture of organic and chemical fertilizers that maintain long term soil fertility and then sustain the improvement of productivity. Direct relationship between government expenditure on agricultural sector and agricultural productivity, though inelastic, entails that government spending on the sector is vital and for further improvement of agricultural productivity the role of government need to be more harnessed.

Long run elastic coefficient of population with respect to food price indicates that if the current population growth rate, estimated at 2.85% per annum, continues it will lead to high level of food price and then cost of living in Addis Ababa. On the other hand, elastic and inverse relationship between RGDP and food price in the long run implies that the rise in income will lead to a decrease in general price level of food. This result may seem eccentric for the reason that a rise in income will induce those whose income has increased to shift their consumption habit to high quality food items and then lead to a decrease in the price of cheap food items. The decrease in the price of cheap food items, which are consumed by the majority of the people, will then more than offset the increase in the price of high quality food items that were consumed by relatively small proportion of the population. The consumption characteristic of the urban population of Ethiopia conforms to Bennett's law: an increase in income leads to a shift towards the consumption of high quality food items than raising total demand for food. It is, therefore, imperative to note that instead of leading to a rise in the cost of living in the city the increase in income, due to economic growth, will lead to an improvement in the standard of living of residents in the city by enabling them to eat nutritious food items as well as by inducing them to save and invest in items including housing, car, and other expensive commodities.

Inverse relationship between agricultural production of the country and food price in Addis Ababa both in the long run and in the short run implies that drought that leads to a shock in the agricultural production of the country induces to a rise in food price in the city and then plummets real income of consumers. This informs the fact that policies of the country, such as agricultural development led industrialization (ADLI), aimed to improve agricultural production in rural areas of Ethiopia benefits not only the rural farmers but also consumers in urban areas who get their food supply mostly

from domestic production. Inelastic coefficients of food aid and food import on food price in the city indicate that food aid and food import have little effect on food price in Addis Ababa. In the long run, lower elasticity coefficient of food import compared with domestic agricultural production in determining food price implies that policies that aim to improve food supply and then food price to the city is more effective if it focuses on improving domestic agricultural production than increasing food import.

The positive coefficient of food price on the number of poor in the city both in the long and short run entails that policies and factors that affect food price will have robust impact in affecting poverty in Addis Ababa. At the same time domestic agricultural production was found an important factor in affecting food supply to the city and domestic agricultural production, per se, was also affected by rainfall variability, in which the decline in agricultural production of Ethiopia, due to drought, will transcend into urban food price and ultimately to urban poverty in the city. It is, therefore, essential that drought resistant crops, irrigation, and other drought coping mechanisms in rural areas are to be introduced so as to help tackle both rural and urban poverty at the same time.

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Appendix 1

Unit Root Test

(a) Unit root test using DF and ADF Test for the Agricultural production equation

Variable	Unit root tests					
	Dickey fuller test		Augmented Dickey fuller test			
	Lag zero		Lag one		Lag two	
	With constant	With constant and trend	With constant	With constant and trend	With constant	With constant and trend
Log (AP)	-1.025	-3.006*	-1.527	-4.461**	-0.4067	-2.931
Log (LAND)	-0.5187	-2.829	-0.7012	-2.923	-0.5768	-2.624
Log (FERT)	-3.090*	-3.417*	-2.758	-3.204*	-2.266	-2.799
Log (AE)	-1.127	-2.682	-0.3953	-1.835	-0.07899	-1.481
Log(RF)	-3.067*	-3.428*	-2.018	-2.335	-1.562	-1.841
DLog (AP)	-4.046**	-4.018**	-5.176**	-5.215**	-3.371*	-3.470*
DLog (LAND)	-4.287**	-4.206**	-3.496*	-3.477*	-3.908**	-3.918**
DLog (FERT)	-5.819**	-5.678**	-4.648**	-4.535**	-3.925**	-3.824**
DLog (AE)	-10.47**	-9.839**	-5.369**	-5.063**	-3.688*	-3.595*
DLog (RF)	-7.280**	-7.093**	-4.956**	-4.807**	-3.635*	-3.494*

(b) Unit root test by using DF and ADF Test for the food price equation

Variable	Unit root tests					
	Dickey fuller test		Augmented Dickey fuller test			
	Lag zero		Lag one		Lag two	
	With constant	With constant and trend	With constant	With constant and trend	With constant	With constant and trend
Log (FP)	-1.547	-1.973	-1.363	-2.687	-1.644	-2.329
Log (AP)	-2.540	-2.239	-2.578	-2.524	-2.494	-2.427
Log (POPL)	-1.093	-5.433**	-0.4921	-4.001**	-0.1885	-3.447*
Log (NFIE)	-2.589	-4.146**	-1.332	-2.629	-0.8957	-2.114
Log (RGDP)	-0.9661	-4.945**	-0.07270	-3.509*	0.6083	-2.729
Log (FA)	-2.830	-2.737	-2.448	-1.881	-1.539	-2.542
DLog(FP)	-4.181**	-4.186**	-3.944**	-4.067**	-3.085*	-3.579*
DLog(AP)	-4.458**	-4.603**	-3.510*	-3.711**	-3.321*	-3.590*
DLog(POPL)	-8.676**	-8.509**	-6.023**	-5.913**	-5.184**	-5.192**
DLog(NIFIE)	-8.477**	-8.355**	-5.644**	-5.550**	-3.455*	-3.384*
DLog(RGDP)	-8.365**	-8.321**	-5.785**	-5.946**	-3.358*	-3.510*
DLog(FA)	-7.997**	-8.276**	-5.043**	-5.764**	-3.085*	-3.872**

(c) Unit root test using DF and ADF Test for the urban poverty equation

Variable	Unit root tests	
	Dickey fuller test Lag zero With constant	Augmented Dickey fuller test Lag one With constant
Log (UP)	-4.858**	-5.489**
Log (FP)	-6.998**	-6.830**

Note Dlog = First difference of natural logarithm, * Denotes rejection at 5 percent level of significance

** Denotes rejection at 1 percent level of significance

Appendix 2

Cointgeration Test

(a) Test for number of cointegration vectors based on Trace test statistics for the Agricultural production equation

Ho: Rank=r	H_1	n-r	Eigen value	Trace Test statistic	P-value
r = 0	r ≥ 1	5	0.83999	**85.757**	**[0.001] ** **
r ≤ 1	r ≥ 2	4	0.63845	43.610	[0.118]
r ≤ 2	r ≥ 3	3	0.44790	20.211	[0.420]
r ≤ 3	r ≥ 4	2	0.24659	6.5480	[0.636]
r ≤ 4	r ≥ 5	1	0.0015450	0.035562	[0.850]

(b) **Test for number of cointegration vectors based on Trace test statistics for the food price equation**

Ho: Rank=r	H_1	n-r	Eigen value	Trace Test statistic	P-value
r = 0	r ≥ 1	6	0.77638	**101.85**	**[0.016] ***
r ≤ 1	r ≥ 2	5	0.53673	58.412	[0.289]
r ≤ 2	r ≥ 3	4	0.47662	36.098	[0.396]
r ≤ 3	r ≥ 4	3	0.30923	17.321	[0.625]
r ≤ 4	r ≥ 5	2	0.20238	6.5927	[0.631]
r ≤ 5	r ≥ 6	1	0.0012138	0.035222	[0.851]

Note: r denotes the number of cointegration vectors,** Denotes rejection at 1 percent level of significance

* Denotes rejection at 5 percent level of significance

Appendix 3

Diagnostic Test

(a) Test statistics for Diagnostic Test for the Agricultural Production error correction model

Test	Statistic
AR 1-2 test:	F(2,12) = 3.231 [0.0916]
ARCH 1-1 test	F(1,12) = 0.054443 [0.8194]
Normality test	Chi^2(2) = 0.51462 [0.7731]
Hetero test:	Chi^2(14)= 9.9747 [0.7640]
RESET test:	F(1,13) = 3.2930 [0.0927]

(b) Test statistics for Diagnostic Test for the Food Price error correction model

Test	Statistic
AR 1-2 test	F(2,10) = 3.1268 [0.0882]
ARCH 1-1 test	F(1,10) = 0.43382 [0.5250]
Normality test:	Chi^2(2) = 1.0251 [0.5990]
RESET test:	F(1,11) = 0.23157 [0.6398]

(c) Test statistics for Diagnostic Test for the Urban Poverty error correction model

Test	Statistic
AR 1-1 test	F(1,3) = 2.1360 [0.2400]
ARCH 1-1 test:	F(1,2) = 0.013069 [0.9194]
Normality test:	Chi^2(2) = 1.2477 [0.5359]
RESET test:	F(1,3) = 0.83993 [0.4270]

** Denotes rejection at 1 percent level of significance

Appendix 4

Poverty Line

The poverty line used for analysis was obtained from MoFED (2002). MoFED calculated poverty indices based on minimum calorie required for subsistence 2200 kcal and calls these indices absolute poverty indices. Moderate poverty indices are based on food poverty line of 2750 kcal (which is 125 percent of the 2200 kcal) and extreme poverty indices are food poverty line based on 1650 kcal. In all the three alternative poverty indices, the poverty lines are adjusted for the non- food expenditure in the table below.

Table 6: Alternative poverty lines

Alternative poverty lines	Food poverty line per adult equivalent per annum(Birr)	Kcal per adult equivalent per day	Total poverty line per adult equivalent per annum(Birr)
Poverty line	647.81	2200	1075.03
Moderate poverty line	809.76	2750	1343.78
Extreme poverty line	485.86	1650	806.27

Source: MoFED (2002)

In order to calculate poverty lines the following procedures were followed: First, a common bundle of national food items meeting the predetermined minimum nutritional requirement (2200kcal per day per adult) was defined. A combination of many food bundles can provide the minimum caloric requirement. The relative share of the food items in the poverty line depend on the caloric share of the items in the consumption of the poorest quartile. Second, the cost of this representative food items were estimated. To do this, the quantity of each item in the bundle was multiplied by its national average price of food item, which was the quantity weighted average of regional prices. Third, a reasonable allowance for non food consumption was estimated. To do this, the food poverty line was divided by the food share of the poorest quartile. Since the poverty line was based on the national average price, the per capita consumption expenditure used for calculation of poverty was deflated by the relative (to national average) price index.

In order to take account of the temporal variation in price, the 1995/96 Laspeyre's consumers' price index was used to take account of the temporal variation in price. The CSA constructed the Laspeyres consumer price index (CPI) for food and nonfood items separately and the formula was as follows:

$$\text{LPI} = \sum_{i=1}^{n} W_i^{baseyear} \left(\frac{P_i^{givenyear}}{P_i^{baseyear}} x100\right), i = 1,2,.....n$$

$$W_i^{baseyear} = \frac{P_i^{baseyear} x Q_i^{baseyear}}{\sum_{i=1}^{n} P_i^{baseyear} x Q_i^{baseyear}} \quad \text{For food items}$$

$W_i^{baseyear} = \frac{V_i^{baseyear}}{\sum_{i=1}^{n} V_i^{baseyear}}$ For non food items, V_i is the national aggregate expenditure of item i in base year.

THE CONTRIBUTION OF MAJOR EXPORT COMMODITIES OF ETHIOPIA TO THE VOLATILITY OF THE COUNTRY'S EXPORT EARNINGS

Fitsum Zewdu Mulugeta[1]

Abstract

Ethiopian export, like many other developing countries, is limited to few primary products, which are mainly agricultural. Studies show that such commodity concentration could result in volatility of export earnings, which in turn will affect capital formation and growth. This is due to high dependence of developing countries on earnings from the export sector to satisfy their import requirements. It is argued that volatility of such proceeds will significantly influence output by constraining input and production planning. The present study analyzes Ethiopia's export earnings instability by employing country-specific models which will take advantage of the sufficiently large sample period, from 1962 to 2008. The study identifies the contributions of major agricultural export commodities, namely coffee, hides and skins, oilseeds, pulses and fruits and vegetables. Attempts have also been made to make comparisons between the sub-periods of the Imperial, Derg and Post-Derg periods, since these sub-periods experienced distinct trade and foreign policies. The study finds that the post-Derg period is characterized by higher level of instability and diversification of exports. This calls for the reconsideration of the direction of the diversification policy towards commodities that are negatively correlated with the traditional export commodities of the country.

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1. Introduction

Like many other developing countries, Ethiopia's export is limited to few primary products, which are mainly agricultural. Besides commodity, the export is also geographically concentrated into few destination countries as well. According to Abebe (1991) there has been a widely held view that such commodity and geographic concentrations are the major cause for volatility in the export earnings. Belay (1998) noted that the problem caused by instability of earnings from commodity export has received considerable attention, especially in the North-South dialog. According to him, instability in export earnings has been major concern for policy-makers in many developing countries.

Heavy and sudden fluctuations in quantity and price of exports could create a serious problem in balance-of-payments (BOP), national income, investment as well as the overall growth of less developed countries. The severe consequences of export instability at the various fronts of the economy have ratchet effect on wages and manufactured products in industrialized countries, especially during the period after boom, and the higher import prices, hence inflationary consequences on least developed countries (LDCs), (Devkota 2004).

According to Gyimah-Brempong (1991), empirical researches on the relationship between export earnings instability and economic growth in less developed countries have yielded mixed results. Some studies found positive relationship while others found a negative one. There is also a third group which found non-significant relationships to exist between export earnings instability and economic growth. These groups gave their own explanation for their respective results. The "negative impact" groups explained their findings using the uncertainties caused by the instability, which makes planning and production decisions of the export sector difficult. In addition, the instability will also constrain the country's ability to import goods that are deemed essential for the growth of the country.

On the other hand those who obtained positive relation between fluctuations of export earnings and economic growth used uncertainty itself to explain their findings. They argue that uncertainty among the stakeholders of the export sector will encourage more saving. This saving, which is made with the intention of mitigating the impacts of earnings fluctuations, will then becomes investment in the subsequent periods. This in turn contributes to the growth of the economy (Gyimah-Brempong, 1991).

The present study extends the work of Belay (1998) with the objective of identifying the contributions of major export commodities to the volatility of the Ethiopian export

proceeds. The results are expected to help policy-makers in making decisions regarding export diversification or any other policy interventions. The sample time period for this study is from 1962 to 2008, which is sub-divided into three different sub-periods, i.e. the Imperial (1962-1973), the Derg[2] (1974-1991) and post-Derg (1991-2008) periods.

The methodology we are using to address the above-mentioned objectives is first to identify the most appropriate measure of instability index with respect to the three sub-periods and as well as the entire period (1962-2008). The analysis of these periods separately is important since each has distinct characteristics with respect to their political, economic and foreign relation policies.

The other comparisons to be made are between the relative contributions of commodities in the instability. How important a commodity is to the overall instability will be assessed by comparing its share in the instability with its share in the total export earnings.

This study attempts to identify the stability and instability of five major export commodities, namely coffee, oilseeds, hides and skins, pulses, and fruits and vegetables based on secondary data. Other export commodities than the ones mentioned here are taken as one commodity under the name 'others'. This is done due to the fact that these five commodities contribute to the larger share (about 80% on average) of the export income of the country.

The rest of the paper is organized as follows: The literatures reviewed are summarized in section II. Section III describes the export sector of the country. This will be followed by Section IV, which presents the analytical framework and the discussion of the main findings of the study. Finally Section V will conclude the study by summary of the main conclusions, policy-implication, and listing some issues for further studies.

2. Literature review

2.1. Theoretical literature

Adam Smith proposes that two nations trade with each other voluntarily if both nations gain. This gain is possible based on the theory of absolute advantage, i.e.

[2]The Derg (or Dergue) was a communist military junta that came to power in Ethiopia, following the ousting of Haileselassie I (From Wikipedia, the free encyclopedia). This period is named after this committee that ruled the country during the years 1974 to 1991.

one nation is more efficient than (or has absolute advantage over) another in the production of one commodity but is less efficient (or has absolute disadvantage with respect to) the other nation in producing a second commodity. If that is the case both nations gain by each specializing in the production of the commodity of its absolute advantage, under the assumptions of classical trade theory (Salvatore 1998).

According to David Ricardo's law of comparative advantage, a country should specialize in the production and export of the commodity in which its absolute disadvantage is smaller (this is the commodity of its comparative advantage) and import the commodity in which its absolute disadvantage is greater (this is the commodity of its comparative disadvantage) than the foreign country in order for both countries to gain from trade. In this case one country could have absolute advantage in the production of both goods but it could benefit if it produce the one in which it is most efficient and import the other good from the foreign source, hence a base for trade (Salvatore 1998).

Mulugeta (2007) argues that most underdeveloped countries ought to concentrate in exporting raw materials because it is here that they have comparative advantage over developed nations. Developed nations on the other hand are apt to have greater comparative advantage in manufactured goods.

There is also another reason for developing countries to concentrate on the export of few unprocessed products, which is explained by the Heckscher-Ohlin (HO) theorem. The theorem states that a nation exports the commodity whose production requires intensive use of the nation's relatively abundant and cheep factors and imports the commodity that is produced by intensive use of a nations relatively scares and expensive factors (Salvatore 1998).

Now let us apply the above theorem to Ethiopia[3], where its large rural population provides the 'abundant' supply of labor for the agricultural production. Since most farmers and farm workers in Ethiopia work in their own and/or their families' farm, and farm employment doesn't pay much due to the large supply of labor, it is reasonable to consider that labor is a cheap and abundant factor. According to the HO theorem, the Ethiopian 'specialization' in exporting agricultural products and importing more capital intensive manufactured goods is in line with the theory. This is because Ethiopia is capital scarce and labor abundant and agriculture is labor intensive in developing countries unlike that of developed where it is rather capital intensive.

[3] Ethiopia has one of the largest populations in Africa (about 74 million according to the 2007 national population and housing census) of which about 83.83 percent is living in rural area

Accordingly less developed countries are expected to specialize in the production of more labor intensive primary products. In line with this argument Ethiopia has 'specialized' on few agricultural commodities. But this commodity concentration could have consequences in terms of earnings instability according to the empirical arguments in section 2.3 below.

3.4 Measurement of export instability

Naya (1973) defined export earnings as the receipts from several products that the country exports. These products have a varying composition in the export of the country and may face different prices based on demand, supply and market conditions. Fluctuations in export proceeds are thus induced by changes in individual products' proceeds and by the interaction of such changes among the different export commodities. Such variations could be caused by economic, natural and other forces which could be internal or external. Some examples of such shocks are crop failure, cyclical decline in economic conditions, and changes in commercial policies.

The general agreement in defining instability is that it is the deviation of the observed outcome from its natural (expected) value. In the context of export earnings, export is expected to grow positively, negatively or stay flat following some pattern. The instability is then the deviation of the actual outcomes of the earnings from this expected pattern, commonly called the trend. To measure this fluctuation several authors developed and used several indices.

Massell (1964) and Massell (1970) stressed that the measurement of instability chosen will be influenced by the type of trend fitted. He chose to use linear trend in the former and exponential trends in the latter, due to their best fit to their respective dataset. He specified the instability index using the formula:

$$I_m = \frac{1}{\log \bar{y}} \sqrt{\frac{\sum (\log y - \log \hat{y})^2}{N}} \qquad (2.1)$$

Where the fitted value is estimated using either $y = a + bt + \varepsilon_t$ or $\log y = \log a + bt + \varepsilon_t$.

Cuddy and Valle (1978) criticizes the above approach for its *ad hoc* nature, reasonable but not founded on any clear theoretical foundation. They suggested what

they called “A General Approach”, which was based on the coefficient of multiple determination to give it a solid statistical foundation. Following some mathematical manipulation they arrived at:

$$I_{CV} = 100\frac{SSE}{\bar{y}} = CV\sqrt{(1-R^2)\left(\frac{N-1}{N-k}\right)} \qquad (2.2)$$

Where $SSE^2 = \frac{\sum(y-\hat{y})^2}{N-k}$ is the Sum of Squares of deviation of the estimated from the actual value, and k being the number of independent explanatory variables, including the constant, in the model. I_{CV} is a corrected coefficient of variation (CV)[4] bounded by zero and CV.

Love (1985) measured instability as the percentage deviation of export earnings from its trend, which could be expressed as:

$$u_t = \frac{\left(x_t - \bar{x}_t\right)}{\bar{x}_t} \qquad (2.3)$$

Where x_t is total earning and $\bar{x}_t$ is the trend value. The choice of the appropriate trend correction is central for the estimation of u_t. Among the available choices of trend are moving averages, linear, and exponential[5] trends.

Glezakos (1973), Savvides (1984) and Glezakos (1984) used the arithmetic mean of the absolute value of the yearly changes in a time series corrected for the trend and expressed as percentage of the average of all observations. The above definition is expressed symbolically as:

[4] $CV = \frac{S.e}{\bar{X}}$, i.e. the ratio of the standard error to the mean.

[5] The preference of the study was the moving average one, as it is assumed to be more likely by the author.

$$I_G = \frac{100}{\bar{y}} \frac{\sum_{t=2}^{N} | y_t - y_{t-1} - b |}{N-1} \quad (2.4)$$

Where, *b* is the slope of the linear trend $y_t = a + bt + \varepsilon_t$ fitted by ordinary least square (OLS) method. The logical economic explanation of this index is that part of the change in earnings could be expected on the basis of the positive or negative trend experienced in the past while the remaining part, $|y_t - y_{t-1} - b|$, being the unexpected change.

The methods used by Murray (1978) to measure instability were MacBean Index (MBI) and the Log Trend Index (LTI). The MBI measures deviations from a 5-year moving average of the observed values having the form:

$$MBI = \left(\frac{100}{n-4}\right) \sum_{t=3}^{n-2} \left(|x_t - MA_t| / MA_t \right) \quad (2.5)$$

Where, MA_t is the five year moving average of the earnings, x_t. The LTI, which measures deviation from a constant growth rate trend line, has the form:

$$LTI = \left(\frac{1}{n}\right) \sum_{t=1}^{n} \left(x_t - ae^{bt}\right)^2 \times 100 / \bar{x} \quad (2.6)$$

Where, *a* and *b* are estimates derived from the least square fitting of $\log x_t = \log a + bt + \varepsilon_t$, where x_t is the export proceed.

Belay (1998) used the Average Absolute Deviation (AAD) instability index, having the form:

$$AAD = \frac{100}{n} \frac{\sum_{t=1}^{n} \left| x_t - \hat{x}_t \right|}{\hat{x}_t} \quad (2.7)$$

Where x_t are observed export earnings while $\hat{x}_t$ are the estimated (trend) export earnings.

The above review of the different specifications of the instability indices shows that the central agreement rests on the need to eliminate the trend from the series. Other

than this, researchers used different approaches and explanations for their choice of a particular specification and method of eliminating the trend. For the purpose of this study we adapted a version of (2.7) as specified by:

$$I = 100 \times \sum_{i=1}^{T} \frac{\left| x_i - \hat{x}_i \right|}{\hat{x}_t} \qquad (2.8)$$

With x_i being the export earning in year $t = 1,2,...,T$ and $\hat{x}_i$ being the estimated trend value of earnings, estimated by regressing either the level or the logarithm of the earnings on year (the time variable) using ordinary least square (OLS).

2.3 Empirical literature

Several studies have been conducted regarding export earnings instability using a sample of both developed and developing countries. The first six studies are either analysis of export instability or its relation with commodity and geographic concentrations. The remaining ones studied export instability's role in growth and capital formation.

Based on a sample of twenty-nine African countries over the period 1960-1982, Abebe (1991) tried to assess the relation of commodity concentration and export earnings fluctuation. His results showed that major export commodities contribute to the instability of earnings more than proportionately in seventeen of the sampled twenty-nine countries. No strong association was found between concentration and instability of export proceeds in the remaining twelve.

The study by Murray (1978) analyzed instability of export earnings with the objective of examining the patterns of instability in export prices and volumes, and the relative importance of supply and demand fluctuations in determining earnings instability. It considered a large number of countries from both developed and underdeveloped over the period 1952-1971. The results showed that instability of export earnings, prices and quantities are higher for underdeveloped countries than developed. The findings also showed that earnings instability in the case of developing countries is strongly associated with quantity instability than price.

Belay's (1998) analysis of the contributions of agricultural commodities on the Ethiopian export earnings fluctuation used a twenty-nine year time-series data

covering the period 1962 to 1990. The major agricultural commodities the study considered were coffee, hides and skin, vegetables and fruits, and oilseeds.

The statistical results of Belay (1998) are as follows. Hides and skins and coffee contributed to the instability less than their share in the total export earnings. On the other hand the contribution of vegetables and fruits, and oilseeds to the instability were greater than their share in total export proceeds. In analyzing the contribution of price and quantity fluctuations on the instability of export revenue, the study found that with the exception of coffee, fluctuations in export quantities were the dominant causes of instability in export earnings. This means that the supply factors are more important in causing the fluctuations of the proceeds. The study tried to explain this by the fact that, Ethiopia heavily depends on few agricultural products for its export earnings and agricultural products in turn heavily depend on weather conditions. Another supply factor is domestic consumption. In the case of coffee, whose fluctuation has significant impact due to its share in total export earnings, it suffers wide fluctuation in earnings owing mostly to instability in the world market price where Ethiopia has no control.

Massell (1964) used a sample of thirty-six countries when estimating his linear regression model in which export instability, the dependent variable, was function of commodity concentration and geographic concentration of exports. The results gave significant results for both commodity and geographic concentration of exports. Regarding the sign, the former was positively related to instability while the latter being negatively. The study suggested the insulating effect of strong bilateral trade relations for the negative sign of geographic concentration on instability.

In another, more extensive study of fifty-five countries over the period 1950-66, Massell (1970) fit exponential model to control for trend effects on instability. The cross-country regression resulted in significant result for commodity concentration and food share of exports in explaining instability in earnings of export. A second model, which was the same model after deleting geographic concentration, per capital income, export market share and raw material share, resulted in the improvement of the power of the model (R^2) and the significance of the variables; concentration index, food ratio of export and value of total export. In both estimations commodity concentration was positive while food ratio and export volume were negative in terms of their direction of impact on instability of proceeds.

According to Love (1985), the typical statistical techniques used for the investigation of causes of export earnings instability were cross-country regressions. These regressions used some measure of instability as dependent variables and tried to explain it with structural variables such as commodity and geographic concentration,

share of raw materials, food and manufactures in total export and the domestic consumption ratio (see Massell (1964) and Massell (1970) for instance). The empirical results obtained from such models were found to be insignificant. Love (1985) explained the causes of this limited power of explanation of these typical models as being untenable inherent assumptions of cross-country regressions, i.e. the assumption of single, unique relationship between a given explanatory variable and the degree of instability. Another possible cause of insignificant results form the model is the use of different method of estimating the dependent and the explanatory variables, by mixing cross section with time series.

Love (1985) based on the distinction between external and internal causes of instability, used country specific time-series models. Using market instability and production instability as independent variables, he found that there is a considerable gain in the explanatory power of the new country-specific time series model as compared to the typical cross-country regressions.

Naya (1973), on his study of fluctuations in export earnings and economic patterns of Asian countries, found results that confirmed with the findings by Murray (1978), i.e. the average instability index of LDCs are greater than that of DCs. The regression results showed that large exporters tend to have relatively stable earnings and countries with much of their exports directed to neighboring countries faced higher instability.

When we come to the studies, which analyzed the role of instability on economic growth, we find Gyimah-Brempong (1991) making Sub-Saharan Africa (SSA) the center of attention. According to the study, SSA countries have relatively homogeneous economies, hence expected similar responses to volatility of earnings from export[6]. The analysis tried to identify the impact of earnings instability on growth over the period 1960 to 1986. The study used specification and estimation of a more general form of neoclassical growth models in which earnings instability index was included as explanatory variable. The main finding of this study was that the instability indices had significant and negative impact on growth rate, and the significant improvement of the neoclassical growth model's explanatory power (adjusted R^2) when including the indices into the model.

Akpokodje (2000) analyzed the case of Nigeria to study the impact of export earnings fluctuation on capital formation, inline with the above studies; instability index was constructed and used as explanatory variable in a model where logarithm of change in capital stock was the dependent one. Using data from international publications by

[6] This is one of the points on which Love(1985) criticized cross-country regressions

International Monetary Fund (IMF) and World Bank, the study tried to answer the effect of export earnings instability on capital formation. The short run models confirmed the hypotheses that export earnings instability and logarithm of changes in capital stock are significantly and inversely related.

Sinha (1999) looked at the relationship between export stability, investment and economic growth in nine Asian countries using time series data. The study particularly paid attention to stationarity and cointegration issues, on which previous time series studies in this area have not. The study found that, in most cases, the variables are non-stationary in their levels and not cointegrated. These findings raise serious doubts about the results of the previous studies. The results were not uniform across countries; casting doubts about the validity of the numerous cross-section studies. For Japan, Malaysia, Philippines and Sri Lanka, it was found that a negative relationship between export instability and economic growth to exist. For (South) Korea, Myanmar, Pakistan and Thailand, a positive relationship between the two variables was found. For India, the results were mixed.

Glezakos (1973) covered the period 1953-66 and both least developed (LDCs) and developed ones countries (DCs) were included in the sample. Basically the study used a cross-country regression but relied on time series analysis to compute the indices. One of the findings of the study was that the average export earnings instability for LDCs was twice as much as that of DCs. The regression results of income growth rate on export instability showed that instability to have a significantly negative impact on real per capital income growth rate in the case of LDCs.

Savvides (1984) tried to test Glezakos's (1973) hypothesis that export instability is a factor detrimental to the growth of LDCs. The study used identical method of estimation as Glezakos (1973) by extending the study to take account of recent data, 1967-77. Surprisingly, it was found that the cross-section regressions do not confirm the hypothesis in question; in fact these results directly contradicted that of Glezakos (1973), given the application of identical technique in both cases. Omission of important variables, measurement errors and endogenity of export instability and growth were suggested as possible cause for this contradiction.

In a response study (Glezakos 1984), Constantine Glezakos agreed with Savvies's remark on the insufficiency of single equation cross-country models. The first critique this study identified on Savvies's (1984) was that the relatively high per capital growth rate, despite the economic downturn of the early 1970s following the first oil shock. Another point of critique was the trend elimination technique. The study argues that the data 1953-66 exhibited either a liner or no-trend in export proceeds, while that of 1967-77 showed exponential trends. Savvides (1984) ignored this fact in order to

make his analysis using identical method like that of Glezakos (1973). The Glezakos (1984) regressions were run by giving considerations for the above critiques, after correcting per capital incomes and choosing the 'best' index, linear or exponential based on goodness of fit. Export instability in Glezakos (1984) has still shown to have a significant negative impact on income growth of LDCs like that of Glezakos (1973). It was also found that export growth is more significant factor in determining the income growth of LDCs than DCs based on the regression coefficients, which is in direct contrast with Savvides's (1984).

The literatures above show that countries like Ethiopia have comparative advantage in production and export of commodities which are labor (which is the country's abundant resource) intensive than capital (which is the country's scares resource) intensive. It is theoretically reasonable to expect for such countries to specialize in primary sectors like agriculture, one of the most labor intensive sectors in a developing country context. Empirical results on the other hand suggest that export concentration on few products has a danger of earnings instability. Therefore, each developing country should study the impact of commodity concentration on instability while making-policy decisions

The knowledge gap this study is anticipating to fill is to make a country specific analysis of the issue, using more comprehensive dataset of forty-five years. Analyzing the current situation will inform policy-makers where the country stand with regard to the research question.

3. Performance of the Ethiopian export sector

3.1 Data

The data on export earnings, price and quantity of Ethiopia used in this study is gathered from various issues of the annual reports of the National Bank of Ethiopia (NBE). The period under consideration is between the years 1963 to 2008[7]. Of the forty-five years under consideration, the years 1963 to 1974 is the imperial sub-period under the rule of Hailesilassie I[8], followed by the period 1974 to 1991,which is the period of the Derg while the remaining period of 1991 to 2008 is the post-Derg period. The first annual report of NBE was published in 1964 with data from the year 1963 where detailed export earnings were reported only for coffee, hides and skins, oilseeds and pulses. The remaining components of Ethiopian export commodities were reported in aggregate form as 'all others'. Since the data for the years 1964 to

[7] For the purpose of the descriptive statistics we used the period 1963 to 2007 only.
[8] Emperor Hailesilasie I ruled Ethiopia from 1930 to 1974 (Beharu 2002). The imperial rule was then replaced by the military council of Derg, which over throw the king in a military coup.

1970 was reported in the Gregorian calendar, we took the average of the two consecutive years to make it compatible with the rest of the series, which is in Ethiopian/Julian calendar[9].

Several issues of Ethiopian Statistical Abstracts of the Central Statistical Agency (CSA) are used to obtain data on Gross Domestic Product (GDP) at current market prices to represent national production, gross capital formation (investment) and forecasts of population size. Such data is available since 1961 as the publication of these abstracts has started in 1963.

3.2 Performance of the export sector during the Imperial period

According to Berhanu (2005), this period is characterized by relatively free market oriented policies with the private, mainly foreign capital, taking the lion's share of both import and export trade. The dominant trade strategy of the time was import substitution even though export diversification was explicitly stated on the First-Five-Year Development plan (Berhanu 2005).

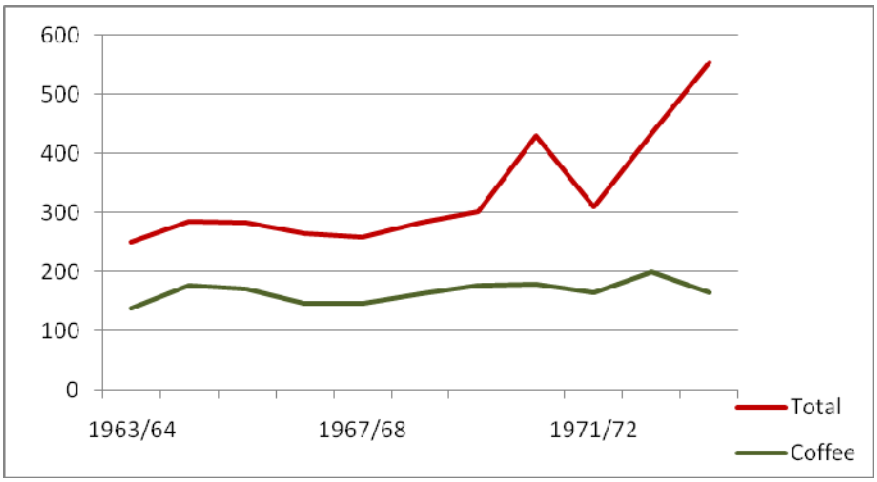
The trend of export earnings in the imperial period is increasing in general, with some fluctuations here and there. Coffee takes a major share of the earnings as can be seen from the graph in Figure 3.1. The remaining three, oilseed, hides and skins and pulses, share more or less the same trend; with hides and skins falling and pulses rising towards the end of the sub-period (see panel (a.2) of Figure 3.1).

The shares of these major export commodities in export earnings is dominated by coffee, which declined towards the end of the sub-period (see panel (b) of Figure 3.1), while total proceeds from export of coffee remains, more or less, flat (panel a.1) during the sub-period. On the other hand, the other commodities experienced a fluctuated in share from time to time (panel (b) of Figure 3.1).

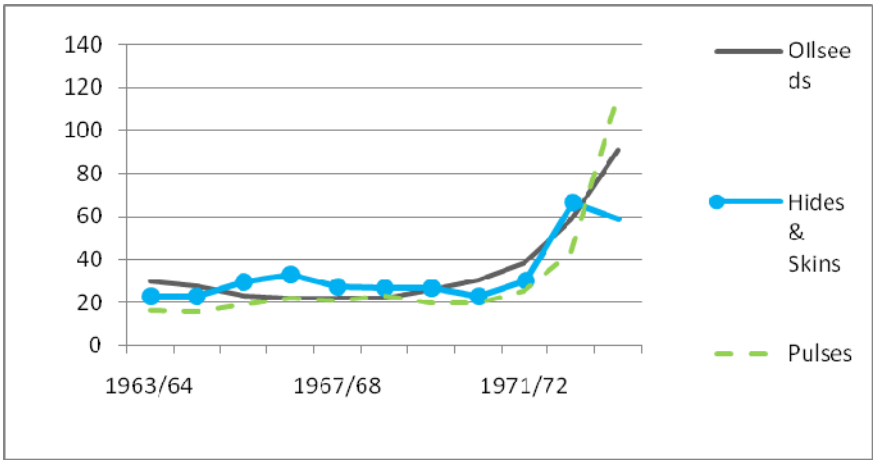
[9] In this calendar a year starts on September 11 (and 12 in every leap year) and the Ethiopian fiscal year starts on 8th of July.

Figure 3.1: Trend of export earning and share in earnings by commodity during 1963-74

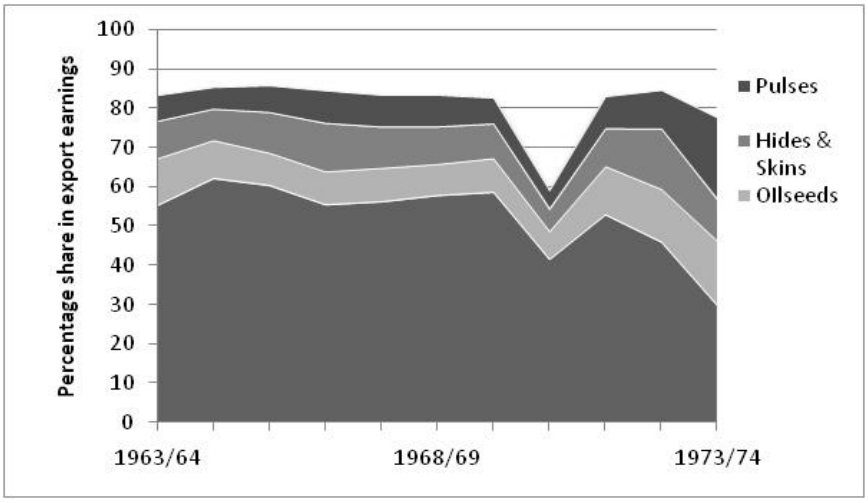
(a.1) Earnings



(a.2) Earnings



(b) Share in earnings



Source: Own analysis based on NBE data

The growth rates of export earnings of the country as well as earnings from the individual major export commodities show that the growth has suffered from fluctuations, indicated by the positive and negative signs of these rates in Table 3.1. Negative growth rates indicate decline in earnings as compared to its previous year, while the positive ones showing increase in earnings, even though these increases are not uniform or constant. This means that there is a fluctuation even in the growth rates of the proceeds.

Table 3.1: Growth rates of export proceeds by commodity over the imperial period

Year in G.C.	1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74
Year in E.C.	**1957**	**1958**	**1959**	**1960**	**1961**	**1962**	**1963**	**1964**	**1965**	**1966**
Coffee	27.54	-3.03	-14.20	-0.81	11.86	8.55	1.13	-8.30	21.50	-16.98
Oilseeds	-7.89	-14.91	-4.72	-0.68	1.13	15.59	18.18	24.80	53.02	55.89
Hides & Skins	-4.00	28.84	10.64	-16.49	-1.10	-0.77	-9.67	23.63	123.18	-12.50
Pulses	-4.96	22.45	14.14	-4.50	8.25	-12.77	-0.09	27.81	68.49	169.62
Others	-0.44	-3.16	1.80	5.12	8.88	11.88	-84.55	-29.97	-35.79	1583.23
Total	13.55	-0.19	-6.65	-2.14	8.80	7.02	42.53	-27.92	39.89	27.81

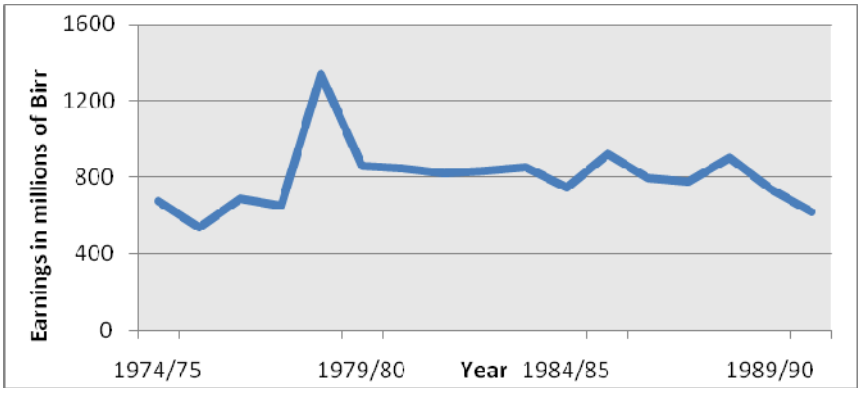
Source: Computed based on NBE data

3.3 Performance of the export sector during the Derg Period

Alemayehu (2007) outlined the economic characteristics of the period 1974-1991, which we termed as the Derg sub-period, as:

- Strengthening the state's role in external trade by attempting to control participation of private capital in the sector
- Close monitoring of price, quantity and distribution of goods, to the extent of direct distribution of goods
- Especial emphasis was given to external trade sectors deemed essential for economic growth and in the trading of medical equipment and goods that ensure the health and security of the population
- Diversification attempts were also made in terms of commodity and destination of exports, especially to divert trade towards its socialist partners.

Figure 3.2: Trend of export earnings in the Derg period



Source: Own computation based on NBE data.

The share of export[39] as defined by the ratio of exports to gross domestic product[40] (GDP) averaged at 10.36% for the years 1974 to 1991. On the other hand the share of imports in Ethiopian GDP averages at 16.94%[41] for the same period. This indicates that the country's trade was running in deficit with the export earnings being unable to cover the country's import requirements. During the Derg sub-period the earnings form export remained more or less between 500 million and a billion Birr. The major agricultural

[39] Share of export in the country's GDP is calculated using $SoE_t = \frac{X_t}{GDP_t}$ where X_t is the export earnings in year t.

[40] GDP used for this computation is based on GDP at current prices reported by MEDaC/MoFED and published by CSA on its annual statistical abstracts.

[41] Import data is obtained from the 2007 Database of the Ethiopian Economics Association/Ethiopian Economic Policy Research Institute (EEA/EEPRI)

products, namely coffee, hides and skin, fruits and vegetable, pulses, and oilseeds, all taken together, accounted for 82.46% of the national export earnings, on average.

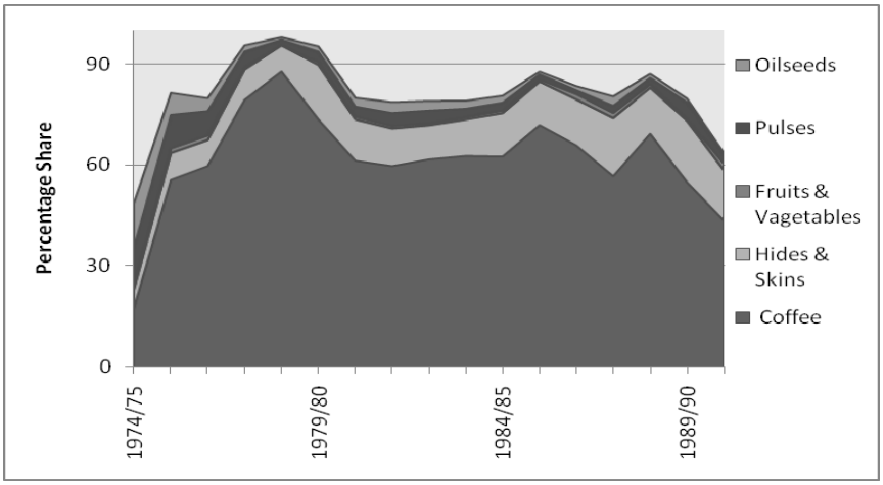
Table 3.2: Percentage share of agricultural products in total export earnings in the Derg period

	Average share	Minimum	Maximum	S.D. of shares
Coffee	61.47	17.51	87.90	15.26
Hides & Skins	11.87	5.55	18.19	3.60
Fruits & Vegetables	0.98	0.20	1.95	0.47
Pulses	3.87	1.07	10.96	2.90
Oilseeds	2.89	0.59	13.23	3.05
Live Animals	2.35	0.00	7.62	2.30
Chat	1.60	0.49	3.61	1.16

Source: Own computation based on NBE data

In this period coffee alone took 61.47% of the earnings followed by hides and skin with 11.87%, pulses with 3.87% oilseeds with 2.89%, and fruits and vegetables with 0.98%.

Figure 3.3: Share of the major agricultural commodities in export earnings in the Derg period



Source: Own computation based on NBE data

The pattern of the shares in earnings of the major export commodities of the country remained being dominated by coffee in the Derg period as well. The share of coffee started to rise from its decline towards the end of the imperial period and suffered several mild ups and downs during the course of the Derg period.

3.4 Performance of the export sector during the post-Derg period

Following the fall of the Derg, the objectives of the government changed towards ensuring participation of the private sector, promoting export by providing incentives, replacing quantitative trade restrictions with *ad valorem* rates, increase diversification, minimize illicit trade and restructuring state owned trade enterprises (Alemayehu 2007).

According to Alemayehu (2007) and the Ethiopian investment and licensing policies and procedures of the Ethiopian Investment Agency, the government took the following measures to meet the above objectives:

- Liberalize the foreign exchange market into an auction system between banks, in order to provide foreign currency for both public and private sectors
- Devaluation of the Birr in order to make Ethiopian products cheaper in the world market versus the products of the rest of the world
- Simplification of licensing procedure
- Supportive services to private exporters were designed in areas of transport, packaging training, overseas market research, etc.
- Introduction of simple tariff structure and foreign exchange retention schemes

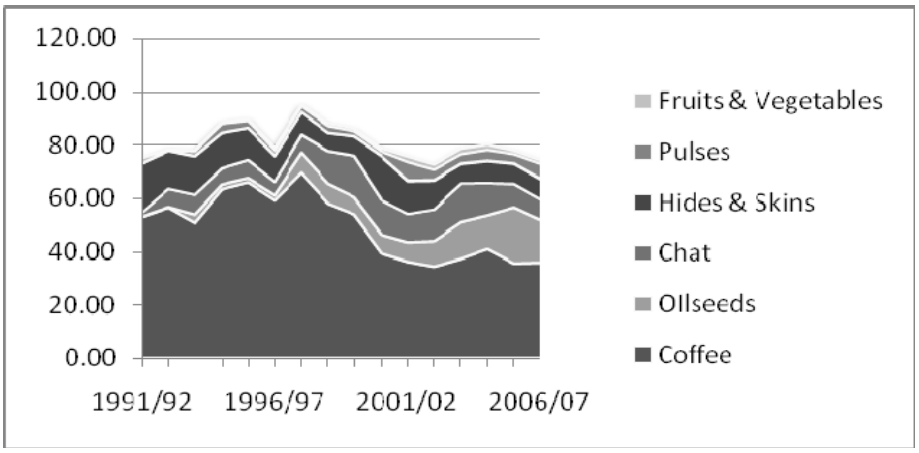
According to the Ethiopian investment and licensing policies and procedures of the Ethiopian Investment Agency, exporters are totally exempted from import duties of capital goods. Such privileges also extend to raw materials used as an input for export commodities. Ethiopian products and services destined for export are exempted from the payment of any export tax and other taxes levied on exports. The sector also enjoys other incentive privileges extended to private investors, including income tax holidays, loss carry forward and investment guarantees, in order to encourage their active participation in the economy.

As per the present study, the Post-Derg period covers the period 1991 to 2008. In this period the five major export commodities, coffee, hides and skins, fruits and vegetable, oilseeds and pulses, account for about 71.91% of the total export earnings on average. The one product which gained importance in terms of average share in earnings, as compared to the previous two periods, is *chat* with a share of 0.84%, 1.78% and 9.26% in the imperial, Derg and post-Derg periods respectively.

The share of oilseeds increased with significant amount in this period from nearly 2% to about 20%. This increase in share is mainly attributed by the increase in export volume of the commodity, from nearly 176 metric tons in 1992 to 234,976 metric ton

in 2007, while its price increased from nearly 2 Birr/kg to 7 Birr/kg, which is not much as compared to its increase in volume. Coffee's share dropped dramatically despite increase in its export volume and a net increase in its price between the years 1992 and 2007. The possible explanation for the drop in coffee's share is again the diversification of Ethiopian exports.

Figure 3.4: Share of major export commodities during the post-Derg Period



Source: based on NBE data

Despite the efforts of the government, the share of the export sector in the national economy as represented by the share of export in GDP is only 6.62%, which is less than that of the same ratio for the Derg period by 3.8 percentage points. This accounts for the increase in GDP of the country, which is the de-numerator of the ratio, at a faster rate than its numerator, the export proceeds. This indicates one of the weaknesses of the ratio, i.e. not accounting for faster GDP growth as compared to earnings. This conclusion is in direct contradiction with the situation on the ground. According to the ratio, the country is more 'closed' to international market than it was during the Derg but in reality it is more open.

With the exception of *chat* and oilseeds, all the other commodities listed on Table 3.3 experienced declined from their relative share in the Derg period, as compared to their shares in the post-Derg period. This could be an indicator for either shrink in volume and/or price of the commodities, or diversification away from these commodities.

Table 3.3: Average shares of commodities in export earnings over the three periods

Average shares	Imperial period	Derg	Post Derg
Coffee	52.53	59.54	49.35
Hides & Skins	10.06	11.42	10.86
Fruits & Vegetables	9.55	5.07	1.27
Pulses	8.56	3.69	3.10
Oilseeds	10.19	2.74	7.32
Chat	0.84	1.78	9.26

Source: Computed based on NBE data

4. Econometric analysis

In this section we try to present the empirical approach employed to address the thesis of the study. Prior to the discussion of the results of the study, the framework with which the analysis is conducted is outlined. In addition to the description of the framework, we also presented them using their symbolic representations or formulas. Following the outline of the analysis, there is a section dedicated to discuss the major findings of the study.

4.1 Specification of instability indices

A number of indicators have been developed to measure instability. The present study has also attempted to review some of them in the literature review section. As can be seen from the indices used by several authors (see for example Massell 1964 and 1970, Murray 1978, Love 1985), the only consensus in defining instability indices is the need for the elimination of the trend in export growth. This study follows the average absolute deviation instability index as outlined by Xin and Liu (2007)[42]. This specification of instability index is chosen due to its ease of computation, for it does not impose the condition of the same trend, and due to its similarity with the one used by Belay (1998); so that comparisons could be made by incorporating the data for the seventeen years period that followed his analysis.

[42] Xin and Liu (2007) studied the impact of geographic concentration on instability of China's agricultural export earnings

Following Xin and Liu (2007), the instability index can be specified as:

$$I_t = 100 \times \frac{\left| x_t - \hat{x}_t \right|}{\hat{x}_t} \quad (4.1)$$

Where x_t is the actual export earnings from time t, $\hat{x}_t$ is the trend value of earnings and I_t being the value of the instability index for time t. $\hat{x}_t$ in equation (4.1) is estimated using the regression of export earnings on time, as specified by (4.2) and (4.3) below[43], to define the trend growth of export earnings.

$$x_t = \alpha + \beta.t + \varepsilon_t \quad (4.2)$$

Or

$$\log x_t = \log \alpha + \beta.t + \varepsilon_t \quad (4.3)$$

Where x_t is the export earnings, t being the time variable and ε_t is the stochastic error term.

We made the choice between the linear and the exponential models of (4.2) and (4.3) using the regression specification test (RESET)[44], adapted from Wooldridge (2000). We first estimated (4.2) and (4.3) to obtain $\hat{x}$ and $\log \hat{x}$. Then we computed the differences

$$d_1 = \hat{x} - e^{\log \hat{x}} \quad (4.4)$$

and

$$d_2 = \log(\hat{x}) - \log \hat{x} \quad (4.5)$$

[43] Please see table 4.1 for estimated results

[44] Davidson and MacKinnon called this method the J-test as it estimates β and δ or γ (for (4.6) or (4.7) respectively) jointly (Maddala 1992)

Table 4.1: Estimation of the trend (equations (4.2) and 4.3))

Commodity	Over all period		Imperial Period		Derg period		Post-Derg period	
	Constant	Time trend (s.e)	Constant	Time trend (s.e)	Constant	Time trend (s.e)	Constant	Time trend (s.e)
Total	-141	0.078541*** (0.006045)††	-113	0.064119*** (0.014868)	Lin -2.97x10^6	1909.063 (8934.32)	Lin -1.14x10^9	574830.6*** (90640.97)†
Coffee	-131	0.073097*** (0.005931)††	-20.8	0.016726* (0.00912)	Lin -1.04x10^6	784.0404 (12852.65)‡	Lin -3.62 x10^8	182582.8*** (42829.95)†
Oilseed	Lin -4.30x10^7	21859.67** (9359.751)††	-183	0.098622* (0.044091)†	206	-0.0994*** (0.030464)‡	-828.52	0.4218979*** (.0830241)†
Hides and Skins	-145	0.079438*** (0.003533)†	-135	0.074227** (0.026398)‡	Lin -873x10^6	4470.102*** (1320.983)†	Lin -7.92 x10^7	39971.88*** (5196.692)‡
Pulses	Lin -1.70x10^7	8644.542** (3863.255)†	Lin -1.10x10^7	5623.041 (3099.235)‡	160	-0.07608*** (0.023778)‡	-613.12	0.3135134*** (0.0810417)†
Fruits and vegetables	-139.105	0.075096*** (0.021967 ††	1545.459	-0.78174 -0.551481	-30.59	0.019955 (0.021267)	Lin -1.79 x10^7	9040.598*** (742.6772)‡
Others	-185	0.099596*** (0.00741)†	-110	0.061823* (0.031564)‡	-65	0.038809 (0.037933)‡	Lin -3.64 x10^8	183519.9*** (19763.85)‡

Source: Own calculation based on NBE data

Lin = Estimated using linear trend, * significant at 10% significance level, ** significant at 5% significance level and *** significant at 1%.

‡ Newy-West standard error at zero lags, † Newy-West standard error at one period lag, †† Newy-West standard error at two periods lag and ††† Newy-West standard error at three periods lag

Then we estimated:

$$x_t = \alpha + \beta.t + \delta.d_1 + \varepsilon_t \qquad (4.6)$$

$$\log x_t = \log \alpha + \beta.t + \gamma.d_2 + \varepsilon_t \qquad (4.7)$$

If we accept the hypothesis of $\delta = 0$ from equation (4.6), then we chose the linear model. On the other hand the acceptance of the hypothesis $\gamma = 0$ from (4.7) will accept the exponential model. In the cases where both models are acceptable, we choose the one with the highest power of acceptance. Significance of the trend is also considered as a criterion of choosing a model in the event when both specifications are acceptable. In the few cases where both models were rejected by the RESET test, we base our choice on significance of the trend and graphical inspection of the earnings.

In case of the overall period, from 1963 to 2008, all the models[45] with the exception of the one for oilseeds and pulses turned out to be best fitted by the exponential trend of equation (4.3). The models for total earnings, fruits and vegetable, and other exports were chosen by graphical inspection of the trends. Those earnings that increase at a faster rate over time are fitted using exponential trend. To avoid the bias of using linear and logarithmic scales, we transformed the estimates from the linear model by taking their natural logarithm in all cases of our analysis.

During the imperial sub-period, the exponential model performed well in representing the data, with the exception of the case for pulses. The exceptions from exponential trend during the Derg period are total earnings, coffee and hides and skins.

When it comes to the Post-Derg period, linear trend dominates exponential with the exception of the case for oilseeds and pulses.

Following the fitting of the appropriate trend for each time period, we computed shares of each agricultural commodity in the instability. The first step is to summarize the instability indices by commodity, using arithmetic mean of the index computed using (4.1):

$$I_i = \frac{\sum_{t=1}^{T} I_t}{T} \qquad (4.8)$$

Where I_i is the average instability index of commodity i in the time period [1, T]. Following this, we computed the weighted instability index of each commodity in the sample. To do so we multiplied the average instability indices (I_i) of each commodity by their share in the export earnings (i.e. their weights), which is symbolically represented as:

$$I = \sum_i S_i \times I_i \qquad (4.9)$$

Where, S_i stand for commodity i's (i = Coffee, Oilseeds, Hides and Skins, Pulses, Fruits and Vegetable and Others) share in export earnings and I_i being the average instability index as given by equation 4.8 for commodity i. Then the weighted share in the instability of commodity i is computed using:

[45] Model for total export earnings includes earnings from Coffee, Oilseeds, Hides and Skins, Pulses, Fruits and Vegetables, and Other exports.

$$Ish_i = \left(I_i \times S_i\right) / I \qquad (4.10)$$

4.2 Findings of the study

The results of this analysis are summarized on Table 4.2 below. The reported total instability indices on the table are the average non-weighted indices, computed using equation (4.8). The commodity wise shares are generated by (4.10) using shares in export earnings as weights. In doing so the exponential model of (4.3) and the linear model of (4.2) are used, based on the results of the J-test (RESET-test), to estimate the trend growth of export earnings. To make the periods comparable with each other, we transformed the index values computed using level values (linear models) to natural logarithms and reported them in Table 4.2.

The comparison of the values of the instability index across the sub-periods show that the instability in the imperial and Derg periods are lesser than the instability in the entire period (see the last row of Table 4.2), while that of the post-Derg are greater than the total by 50% of the total instability. Based on this, the imperial period is the least in terms of export earnings instability, followed by the Derg and post-Derg respectively.

When we take a look at the contribution of the major export commodities of the entire period of 1963-2008, we find that coffee, and hides and skins contribute less (45.74% and 7.17% respectively) to the instability than their shares in export earnings, which on average stood at 54.52% and 10.98% respectively. The remaining, oilseeds, pulses, and fruits and vegetables contribute 9.53%, 7.02% and 4.45% respectively to the instability, which are more than their respective average shares in export proceeds of 6.56%, 4.91% and 2.01%. These findings are similar with that of Belay (1998) with the exception of the case of pulses, even though his study does not include the post-Derg period.

Table 4.2: Estimation Results for Instability Indices

	Total 1963-1991			*Imperial 1963-1974*			*Derg 1974-1991*			*Post Derg 1991-2008*[46]		
	Instability index	*Share in instability*	*Share in earnings*	*Instability index*	*Share in instability*	*Share in earnings*	*Instability index*	*Share in instability*	*Share in earnings*	*Instability index*	*Share in instability*	Share in earnings
Coffee	2.64	45.74	54.52	0.66	16.94	52.53	2.56	53.97	61.47	3.11	42.31	48.87
Oilseeds	4.58	9.53	6.56	2.53	12.54	10.19	4.24	4.19	2.89	7.67	16.88	7.90
Hides and Skins	2.06	7.17	10.98	2.00	9.78	10.06	2.52	10.26	11.87	2.67	7.96	10.68
Pulses	4.51	7.02	4.91	3.80	15.81	8.56	2.99	3.96	3.87	7.34	7.33	3.58
Fruits and Vegetables	7.00	4.45	2.01	7.48	34.69	9.55	3.90	1.31	0.98	2.77	0.97	1.26
Others	3.86	26.09	21.33	1.39	10.24	15.19	4.06	26.31	18.93	3.18	24.55	27.71
Total[47]	**2.16**			**1.00**			**2.26**			**3.24**		

Source: Own analysis based on NBE

[46] The estimation for this period is based on fitting of linear trend
[47] This index stand for the instability index of the total export earnings computed using (4.8)

In the imperial period it was only coffee and hides and skins which contributed less in the instability than their share in earnings. Coffee contributed only 16.94% while its average share for the period was 52.53%. The contribution of hides and skins[1] to the instability was 9.78% while its share in earnings was 10.06. Out of the eleven years covered for this period, only four observations were found for fruits and vegetable, therefore it is left out of our analysis for this period. For the remaining products, oilseeds, and pulses, the contributions to instability were 12.54% and 15.81% respectively while their respective contribution to the total export earnings was 10.19% and 8.56%, which again is inline with the findings of Belay (1998).

In the Derg period; coffee and hides and skins were stable, once again, in terms of their contribution to the instability as compared to their export share (53,97% versus 61.47% for coffee, and 10.26% versus 11.87% for hides and skins). The remaining commodities contributed more to the instability than what they contributed to the proceeds of exports. Coffee in our case has a stabilizing impact (since its share in instability is less than its share in earnings) in contrast with that of Belay (1998) that found proportional contribution of coffee in the instability to be almost equal to its share in earnings. The particular interest on this commodity is due to its major share in earnings. Its stability will have a strong implication for the mitigation of instabilities of many commodities and its slight instability is likely to cause major distortion in the export earnings due to the fact that it is a big player in the export sector of the country.

The post-Derg period is facing higher shares of coffee, hides and skins, and fruits and vegetable in earnings as compared to their share in causing the instability. The shares in earnings of these commodities are 48.87%, 10.68% and 1.26%, while their shares in the fluctuation are 42.31%, 7.96% and 0.97% respectively. During the same period oilseeds and pulses contributed more to the instability than they do to the proceeds from their export.

In summary coffee and hides and skins consistently contributed to the stability of the earnings in all the four cases, the entire period, imperial, Derg and post-Derg periods. Oilseeds and pulses mostly contributed to the instability more than what they are contributing to the earnings while fruits and vegetables marginally improve in the case of the post-Derg period.

Table 4.3 below shows the total instability index and the weighted total instability index for each period. The total instability index is computed using the formula (4.8)

[1] For the case of hides and skins the share in earnings is only marginally greater than the share in the instability.

following the regression of the total export earnings on time and the computation of the index I_t of equation (4.1) for the total export earnings. On the other hand the weighted total index is the sum of the instability indexes of the constituent commodities of the export earnings weighted by their share in the total export earnings.

Table 4.3: Total and weighted total instability indexes

Period	Total Instability Index	Weighted Total Instability Index
Imperial	1.00	2.06
Derg	1.04	2.92
Post-Derg	3.24	3.59
Total	2.16	3.15

Source: Own computation based on NBE data

The weighted total index is greater than that of the simple total index in periods. The weighted total's being greater is an expected result as it is the sum of the instability from the individual commodities. The instability index of total export earnings on the other hand does not reflect the fluctuation of individual commodities, rather the net-fluctuation of the total export earnings of the country. Since instability of one commodity could be offset by the stability of the other, the index of the total earnings is expected to be lesser than that of the weighted. In the case of Ethiopia, even if most of the commodities fluctuate more wildly, the relative stability of the major commodity, i.e. coffee, offsets the impact of the fluctuation of the total earnings.

In order to explain the higher instability index for the post-Derg period, we took a look at the difference between the share of coffee in earnings and its share in the instability over the periods under consideration. In doing so it is found that the gap between coffee's share in earnings and its share in the instability of earnings range from around 36 percentage points in the imperial era to 6.5 in the post-Derg period.

This means that the share of coffee in export proceeds was much higher than its share in the instability during the imperial period and it is the least now. Following this we can suggest that the coffee has lost its power to stabilize the volatility in earnings caused by the other commodities since it only marginally qualifies for stabilization.

According to the framework of Abebe (1991), the instability of each export commodity is a function of its share in earnings and the correlation between the trend-corrected export earnings of the commodities. Negative correlation indicates the offsetting movements of the major (coffee in our case) and the minor (the remaining) export

commodities. On the other hand positive correlations indicate that the major and the minor commodities are moving in phase, i.e. in a way that reinforces their impact on the instability.

Taking coffee as major export and the remaining as minor, we computed the correlations between the trend-corrected (de-trended)[2] earnings of the major the minor commodities. The findings suggest that the movement of coffee in the three periods, over-all, imperial and Derg is offsetting. On the other hand the movement of the 'major' and the 'minor' export commodities in the period that followed the Derg is in phases as indicated by the positive correlation on Table 4.4 below.

Table 4.4: Correlation between de-trended major and minor commodities

Period	Total	Imperial	Derg	Post-Derg
Correlation	-0.6364	-0.3041	-0.9259	0.5550

Source: Own computation on NBE data

The reason for coffee to move from its role as stabilizer of the export earnings to marginally qualify as stable could be due to the fact that its share dropped at a faster rate than its share in the instability. One of attributes to the loss in share of the coffee is the diversification of the country's export into other products. For example flower, which was never on the list of Ethiopian export balance few years back, is gaining increasing share in the export earnings account of the country. Another immerging commodity is Chat, whose share increased from below one percent in the imperial and below 2% in the Derg to more than 9% during the post-Derg period.

In order to test the hypothesis that the post-Derg period is the most diversified than the others, we computed the Gini-Hirschman concentration index as employed by Abebe (1991), Xin and Liu (2007), Malik (2007) and others.

The formula used to generate the Gini-Hirschman concentration index in above mentioned studies as well as in the present study is:

$$G_t = 100 \times \sqrt{\sum_{i=1}^{n} \left(X_{it} \Big/ X_t \right)^2} \qquad (4.11)$$

[2] We computed the de-trend series by taking the difference between the observed value of the export earnings and that of the estimated trend (i.e. the de-trended series= $X_i - \hat{X}_i$, where $\hat{X}_i$ is as estimated by either equation 4.2 or 4.3)

Where X_{it} represent the export earnings from commodity i in year t while X_t represent the total export proceeds of the year t. We then computed the mean values for each period to find a summary statistic that best describe the period in terms of its export diversification/concentration.

Table 4.5: Average Index of Export Concentration/Diversification

Period	Total	Imperial	Derg	Post-Derg
Gini-Hirschman index	57.29	56.69	63.34	51.62

Source: Own computation using NBE data

The likely values of this index are between 0 and 100. According to Malik (2007) the highest likely value, i.e. 100, indicates that the total agricultural exports are comprised of only one commodity. When the number, and value of goods exported increases, the value of G_t will decline. This means that when the value of G_t gets lower, it indicates that export diversification has increased.

Based on this definition, the Derg is the period where export is concentrated into fewer commodities. The imperial period is the second, following the Derg, in terms of high export commodity concentration. The post-Derg period is the least, among the three, with regard to export commodity concentration. In other words, the post-Derg period faced the highest degree of export commodity diversification as compared to the remaining two. When compared to the level of concentration over the total period, that of the imperial and post-Derg sub-periods performed better than the overall period while that of the Derg is below the entire period. Even in some years in the Derg sub-period, the values of G_t reached as high as 88%, meaning that this much percent of the export income is generated by a single commodity.

5. Conclusion and policy implication

5.1 Conclusion

Based on our findings we conclude that the market-economy's economic policies performed well in attaining export diversification, which is one of the recommended remedial of export earnings volatility, as the imperial and the post-Derg periods performed better than that of the Derg in this regard. Despite the fact that the post-Derg period is the most diversified as compared to the remaining two, it performed badly when it comes to stabilizing the fluctuations from the export income. This is in direct contradiction with the policy recommendation by most literatures to attain stability.

The source of this contradiction could be the positive correlation between the traditional exports, i.e. coffee, oilseeds, hides and skins, pulses, and fruits and vegetable, with the newly emerging export commodities, such as flower and chat. This means that all the major export commodities fluctuate in a similar manner, in terms of their export proceeds. This could be explained by the fact that most of these commodities are agricultural, and it is a known fact that agricultural outputs in Ethiopia are highly dependent on the level of rainfall. Therefore, when output (volume) falls due to climatic conditions, earnings from export will also fall since earning is a function of both supply (volume) and price of export commodities.

The above analysis shows that for export to be stable, diversification should be directed towards commodities that could be negatively correlated with the traditional exports. In other words, diversification efforts should give attention to diversifying into non-agricultural exports, such as manufactured goods and other non-traditional sectors as hydro-electric power.

5.2 Policy implication

The policy lessons to be taken from this study is that diversification by itself does not solve the problem of export earnings volatility. Diversification should be a means not an end. And when diversifying, if we diversify with more unstable commodities or into commodities that fluctuate in the same direction as the traditional exports, this may result in more distortion than otherwise. The country should consider to diversifying into commodities on which it has comparative advantage and a sustainable demand. Production of commodities that have domestic demand is advantageous, especially to sustain production at early stages and motivate investors to enter that particular industry. Eventually it could increase its foreign market and grow through time.

The policy conclusion of this study is to supplement the diversification efforts of the export commodities with an effort to reduce the instability. And most importantly to diversify into sectors that does not rely on rainfall, such as manufacturing and service sectors.

Stability in earnings is a function of stability of both price and volume of exports. Since Ethiopia is a ‘small open economy’, which does not have influence in the world commodity price, our primary focus should be in stabilizing export volume, i.e. sustainable, weather independent production. Another risk minimizing factor is geographic diversification, which insulates the export market from fluctuations caused by shifts and/or fluctuation in demand for our exports in a particular country or group of countries.

One additional solution to reduce the fluctuation in earnings is to enter into trading agreements (regional trading agreements (RTA), free trade areas (FTA), custom unions etc) with countries with which the country is trade compatible. This means to remove trade barriers through a mutually negotiated agreement with countries that are not producing and exporting similar products as Ethiopia. This is because trade compatible countries have demand for each others' products and the RTAs facilitate freer trade among the partners.

Joining the World Trade Organization (WTO) could also have similar advantage as a multilateral trading platform, if Ethiopia manages to negotiate and inter the organization without having to give up much of its advantages at the current status quo. But joining only is not a solution by itself; the country should be able to increase its trading partners in the WTO for its exports.

5.3 Important issues for further studies

The present study attempted to identify which and by how much important export commodities contribute to the instability. Determinants of the instability are beyond the scope of this study. Other issues such as the impacts of instability on the economic growth of the country, its capital formation and future investments, the pressure it puts on the foreign currency reserve, the nation's ability to import both capital and consumption goods, etc. are left for other parallel and future studies.

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DETERMINANTS OF URBAN POVERTY: EVIDENCE FROM ETHIOPIAN URBAN HOUSEHOLD SURVEY 1994-2004

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Abstract

The paper investigates the impact of various household characteristics on consumption thereby on poverty in Ethiopia by analyzing the panel data covering 1994-2004. The descriptive analysis of poverty using headcount, poverty gap and squared poverty gap measures shows that poverty has decreased over the period under consideration owing to various policies related implementations. The paper also identifies some important household characteristics that determine poverty. Finally, it addresses some poverty simulations with regard to the impact of a change in certain characteristics of households on the level of poverty.

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1. Introduction

Currently, Ethiopia is a home for about 73.92 million people of which about 16 percent live in urban areas. (CSA, 2008). Yet, it is one amongst the extremely poor countries of the world. During 2006, for instance, 78% of the people lived on less than $2 a day compared with 74% of the sub-Saharan average. In addition, its GNI PPP per capita in 2008 is only US$ 870 compared with US$ 1950 of the sub-Saharan average. (World population data sheet, 2009).The same source depicts that the people's average life expectancy at birth is limited at 53 years in the same year. However, for the past consecutive five years (2003/4-2007/8) the nation registered an average real GDP growth rate of more than 11% (NBE Annual Report, 2007/8). This growth may be a sign of success in poverty reduction programs in Ethiopia which are at the center of policy makers.

> *"The improvement in Ethiopia's growth performance over the past decade has led to a reduction in income poverty reduction. However, poverty reduction has not been fast and deep enough. During the 1995-2000 periods, the incidence of poverty in Ethiopia, as measured by the head count poverty index, declined marginally from 46 to 44 percent. According to the recent Household, Income, Consumption and Expenditure Survey (2004/05) the incidence of poverty has further declined over the past five years. The proportion of the population living below the absolute poverty line fell from 44 percent in 1999/00 to 36 percent in 2004/05. The slow pace in income poverty reduction in Ethiopia is attributed to a number of factors. Firstly, Ethiopia's high population growth (2.4 percent) has limited per capita income growth. Over the past five years, per capita GDP growth rate has averaged 2.4 percent, which is hardly sufficient to generate significant reductions in poverty reduction. The high degree of volatility in growth and food insecurity has made poverty reduction even more challenging. Another factor is the slow progress in structural transformation and diversification of sources of growth. For decades, the poor in Ethiopia have been entrapped into subsistence agriculture, which is characterized by low investment, low productivity and low returns. The poor are also characterized by very low human capital which limits income-earning opportunities."* (See African Development Bank, 2006-2009 country strategy paper).

The literature dealing with urban poverty profile in Ethiopia during earlier periods is limited, reflecting the fact that urban poverty is not sufficiently studied in Ethiopia (Tesfaye, 2005; Kedir, 2005). When looking at urban poverty trends in Ethiopia, the recent work of Bigsten and Abebe (2008), as can be seen in the subsequent table, reveals that subjective measure of headcount poverty has decreased from 53 in 1994

to 47 in 2004 while consumption based head count has increased from 33 to 37 respectively. However, when taking both subjective and objective measures, their analysis shows that poverty level in the year 2004 remained same when compared with the situation a decade ago. What could be the possible reasons for this? This needs for a call to closely look at the various 'determinants' of poverty. In fact, analysis on the determinants of poverty goes beyond a mere poverty profiling with an attempt of inferring certain causality of some specific household characteristics on household welfare (IFPRI, 2001).

Table1: Trends in poverty based on objective and subjective measure in urban Ethiopia

	1994	1995	1997	2000	2004
Subjective measure headcount	53	56	53	49	47
Consumption based headcount	33	32	27	38	37
Headcount by both subjective and objective measures	24	24	20	26	24

Source: Bigsten and Abebe (2008)

The regression model used in assessing the determinants of poverty in this paper might permit inferences to be made as to the direction of causality between an independent and a dependent variable. This is achieved by controlling for the effect on the dependent variable of the other relevant independent variables in the equation. That is, one holds the effects of other independent variables constant while isolating the effect of one independent (explanatory) variable on the dependent variable (IFPRI, 2001).

Being a deeply rooted and complex phenomenon, poverty cannot easily be eradicated. One may not find quick and easy solutions unless the factors that are associated with being poor or the so-called determinants of poverty in Ethiopia are identified. Thus, the outcome of the paper might be of interest to policy makers since it provides a means to assess the likely impact of different household characteristics on the incidence of poverty in Ethiopia where certain government policies are aimed at reducing poverty (equivalent to say in improving the welfare of the peoples).

The paper is organized as follows: section two deals with some concepts related to poverty and its measurement while section three discusses about the descriptive analysis employed. Section four explains the data and econometric approach used to estimate the consumption. Section five presents the results of regression analysis whereas section six looks into the poverty simulations. The last section concludes the outcome of the paper.

2. Poverty: Some concepts and measurement

Poverty is a multi-dimensional problem. The definition of poverty extends beyond material deprivation. Poverty might be defined as a level of deprivation such that a person is unable to meet minimum standards of well-being with well-being defined in terms of acquiring adequate resources for attaining the basic necessities, access to acceptable levels of health and education, accountability from state institutions and civil society; and freedom from excessive vulnerability to adverse shocks (AusAID, 2002). However, the focus of the quantitative analysis will be on income poverty (material deprivation) usually depicted by consumption expenditures which are more readily quantifiable. Though the relevance of qualitative measure of poverty cannot be ignored, it seems the case that quantitative approach of measuring poverty creates some sort of convenience to the researcher to easily quantify the expressions used to illustrate the impact of certain policy issues at reducing poverty.

As noted by Dercon (2005), one has to consider three relevant components to compute measure of poverty. First, a choice of dimension to explain the wellbeing of the peoples is needed. Second, choosing a means of discriminating those who are poor from the non poor by setting a poverty line i.e., minimum threshold below which an individual is said to be poor. Finally, one has to select a poverty measure to be used for reporting for the population as whole or part of it.

In my analysis, I have chosen consumption (expenditure) rather than income as welfare indicator due to the fact that consumption reflects the actual living standard of the household and the ability to meet the basic needs. In addition, consumption is less prone to under reporting than income. That is, households are often more willing to truthfully report their consumption and expenditure than their income, particularly when dealing with government enumerators. More clearly, consumption and expenditure can be viewed as realized welfare, whereas income is more a measure of potential welfare (IFPRI, 2001). Thus, since not all income is consumed, nor is all consumption financed out of income, the two measures typically differ. Consumption is arguably a more appropriate indicator if we are concerned with realized, rather than potential, welfare (Simler et al, 2004**).** Even more, more than any other dimensions of poverty, such as education or child mortality, it tends to be most closely related to changing economic opportunities. It is also the type of poverty that is suspected to be the most lagging in Ethiopia (Dercon, Hoddinott and Tassew, 2007).

A constructed poverty line based on the cost of basic needs approach from the works of Bigsten et al (2002) is used for the analysis in this paper. And the poverty index

developed by Foster, Greer and Thorbecke (FGT) family of measures (1984) is used for the computation of poverty, whose formula is shown below.

$$P_{\alpha} = 1/n\sum_{i=1}^{q}(z-c)/z^{\alpha}$$

Where, n stands for the total population size; z for the poverty line; q for the number of poor persons; α for a parameter reflecting the weight placed on the very poorest.

When the parameter α is set to zero, we have the head-count index P_0 which gives the proportion of the population with a standard of living below the poverty line. The head-count index (also called the poverty incidence or poverty rate among persons) does not indicate how poor the poor are. However, its advantage relies in enabling to assess the overall progress in reducing poverty right away (Fitsum and Holden, 2003). When α is equal to one, we have the poverty gap index P_1 which shows the average depth of poverty. However, this is not sensitive to the distribution of living standards among the poor. But when α is set equal to two, we have the poverty severity index P_2, which is highly sensitive to the distribution of income among the poor. The higher the value of this index, the more unequal is the distribution of income. All the above three measures are used for the analysis of poverty in this paper. The reason for choosing the FGT P_{α} measures of poverty is due to their simplicity and popularity, especially the head count index. Yet no single measure has toppled the headcount index from public attention (Ravallion, 1996)

3. Descriptive analysis

One can look at the trend of average consumption per capita in relation to the measure(s) of poverty to examine if a kind of correlation exists between the two or not.

Table 2: Average real per capita consumption and poverty indices1994-2004

Round	Mean real Consumption Per capita	poverty Headcount (α=0)	Poverty gap (α=1)	Poverty Severity (α=2)
1994	116.75	0.37	0.14	0.07
1995	117.16	0.38	0.14	0.07
1996	128.52	0.36	0.14	0.07
2000	150.05	0.30	0.11	0.05
2004	150.94	0.32	0.10	0.04

Source: Calculated from the Ethiopian Urban Household Survey. Poverty index based on real consumption per capita in 1994 prices per month.

As can be seen from the above table, it can be generally said that poverty has reduced substantially taking all the three measures of poverty. However, poverty gap and poverty severity measures indicate that poverty status has been constant for the years 94-97 while the percentage of poor people has increased from 37% to 38% from 94 to 95 and declined to 36% at the year 97. Considering the years 97 to 2004 one can say that poverty has reasonably decreased. In addition, mean real consumption per capita has increased slightly at early stages of the years and then showed a remarkably higher increase in 2000 though it shows almost no change in the year 2004 as compared to the year 2000. In general, comparing poverty level in 2004 and before ten years, it is clearly observed that there is a considerable reduction in poverty with an increase in the average real consumption per capita. This might be attributed to the poverty reduction strategy being followed by the government with its implication on the effectiveness of the policy at reducing poverty.

Furthermore, the following table can show the movement of peoples towards and outwards of poverty.

Table 2: Poverty transitions 1994-2004 in percentage.

	Poverty status in 2004		
Poverty status in 94	**Not poor**	**Poor**	**Total**
Not poor	45.41	60.44	66.28
Poor	**15.02**	**20.87**	18.69
Total	39.56	33.72	100.00

Source: Own calculation using EUHS

The above table depicts the fact that the percentage of people who remained to be out of poverty in both years (45.41%) is substantially higher than the percentage of people who remained to be poor (18.69%) in both years. In addition, the percentage of poor people who exited from poverty (20.87%) is higher than the percentage of non-poor people who entered into poverty status (15.02%). In general, the total percentage of non-poor people has increased from 60.44 in 1994 to 66.28 in 2004. By the same token, the total percentage of poor people has decreased from 39.56 in 1994 to 33.72 in 2004. From this, one can conclude that there is improvement in reduction of poverty over the trend of 1994 to 2004.

4. Model specification, data and estimation issues

4.1 Model specification

Poverty can be modeled in a number of ways. As cited in the works of Fagernäs and Wallace (2007), the first method is to regress per capita consumption against a series

of independent variables. A second approach is to run a probit, or logit regression, where the dependent variable is a binary variable with 1 representing the individual being poor and 0 the non-poor. However, there are a number of weaknesses in the second type of model. Specifically, as the probit/logit approach uses an artificial construct of the dependent variable, information about the actual relationship between the level of consumption and the dependent variables is lost.

Easily preferred approach is to model the determinants of poverty using a two-step procedure. In the first step, I model determinants of the Ln of consumption at the household level. The simplest form of such a model is presented below.

$$\text{Ln } C_{it} = \beta X_{it} + u_i + u_{it} \qquad (1)$$

Where C_{it} is real per capita consumption of household i at time t,
X_{jt} is a set of time-varying household characteristics,
u_i is the time-invariant fixed characteristics of the household and other unobserved fixed determinant of the real consumption per capita, and
u_{it} is a random error term varying both across individuals and time.

The second step defines poverty as a function of the household's predicted consumption level. Here I decided to use the Foster-Greer-Thorbecke class of $P\alpha$ poverty measures (Foster, Greer, and Thorbecke, 1984).This approach may contrast with directly modeling household-level poverty measures as

$$P_{\alpha j} = \beta x_j + u \qquad (2)$$

Despite the fact that many scholars have used this approach i.e., directly modeling household-level poverty measures against the household level characteristics, there are several reasons for the need to leave this approach (equation 2 above) and use to predict poverty based on the regression results found from equation (1) above(see: Datt and Joliffe, 1999; IFPRI, 2001). In this study, consumption is modeled as in equation (1) above and then use the estimated consumption regression to explore the impact on predicted poverty of changes in certain characteristics. Consumption is expressed in terms of real per capita in 94 prices.

4.2 Data and estimation issues

4.2.1 The data

The study is based on panel data extracted from Ethiopian Urban Household Survey 1994-2004. The survey covers 1500 households in each round, with the intention to resurveying the same households in subsequent rounds. And in each round, household information had been collected over a period of four successive weeks during a month considered to represent average conditions of the given year. The data were collected by the department of Economics, Addis Ababa University, in collaboration with Economics department of Goteborg University and Michigan State University. The survey constitutes seven major towns of the nation- Addis Ababa (the capital city), Dire Dawa, Awassa, Bahir Dar, Dessie, Jimma and Mekele. The samples of households were taken to be representative of the urban towns of Ethiopia.

4.2.2 Estimation issues

Unfortunately, data of certain variables (for example related to infrastructure, unemployment etc) are not either fully available or lack consistency. For this reason, some potentially crucial variables are missing in the analysis. However, to overcome such problems I tried to minimize the omitted variable bias using the fixed effect model. This is because for one thing, time constant unobserved heterogeneity is not a problem for FE-estimator. Secondly, even tough time varying unobserved heterogeneity is a problem for the FE-estimator; most omitted variables are time constant especially when T is relatively small. (See Wooldridge, 2002 and Brüderl, 2005). In addition, a Hausman test has been conducted and the null hypothesis that differences in coefficients are not systematic was rejected and hence FE- estimator was employed.

Another crucial assumption where one should look for when employing the FE-estimator is that it rests on the basic assumption of (strict) exogeneity i.e.

$\text{Cov}\ (X_{it,}\ u_{it}) = 0.$

For this reason, only variables which are assumed to be exogenous in determining the Ln of real per capita consumption (current welfare indicator) are carefully selected. For instance, it seems the case that education of household head is related to the welfare of the household.

> *"However, the educational level of the head of household is an exogenous variable when examining household welfare, since it is determined by actions*

that are unrelated to the welfare level of the current household of which he or she is the head. The education level of the household head is likely to be an outcome of the past welfare status of his or her parent's household rather than of the current welfare status of the household."(See IFPRI, 2001).

Although efforts have been made to exclude the endogenous variables as explanatory variables, in some cases, however, the exogeneity of the selected variables is debatable. For instance, variables such as the number of persons who completed primary school, number of persons who completed secondary school & number of persons who completed university level are highly suspected to be determined by the current welfare of the household. However, it might seem somehow that these variables are not purely endogenous as the completion of these levels of education is more influenced by the past economic status of the family than actually the current real consumption expenditure. That is, for a person to complete say primary school, what matters more, I think, is his parents previous welfare than the current welfare during the year s/he completed her/his primary school. On top of that it is extremely difficult to find suitable instruments for those suspected endogenous variables which force someone to treat them as exogenous.

With regard to the dependency ratio, it can be said that households with higher income/consumption might have more dependents especially young individuals as they will be considered as form of assets which guarantee parent's future welfare during the time of old age. But this is mostly true for rural Ethiopia. In the case of urban Ethiopia more income/consumption, on the other hand, may even lead to have less young dependents owing to awareness of the society of family planning or probably due to strong desire to enjoy life among few. Even more, current welfare of the household will determine more of future dependency than actually the current level of dependency. In other words, current level of dependency might have also been determined more by previous welfare of the household than by this period's welfare. That is, households may think and tend to have more dependents today considering more to their past trend of income and/or consumption levels than the current income status as addition of more dependents to the household is not such onetime phenomenon-cannot actually be practical overnight.

Considering the variable of number of adults employed in the household, I do not think that it will be highly influenced by the current welfare of the household. It would Rather make a strong sense to argue that current welfare of the household can be influenced by the number of adults employed in the household.

Despite the presence of certain problems illustrated above, I took the under explained dependent and explanatory variables.

The dependent variable: to state the variables used for this model, let me begin with that of the dependent variable which has been taken as the welfare indicator of the household. As stated earlier, this is the natural log of the total monthly real per capita consumption as reported from the household.

Independent variables: the set of explanatory variables chosen for the model are explained below.

Demographic variables:

- Age of household head in years
- Sex of the household head (female dummy=1)
- Dependency ratio computed as the number of sum of persons below 15 and above 64 years of age [dependents] divided by the number of persons who are in economically active age groups [15 to 64 years of old]
- Household size

I also considered age squared and household size squared to capture the non-linear relationship of these explanatory variables with the dependent variable. That is, the marginal effect on household's consumption per capita of one additional year of age or one more person may not necessarily be linear, but dependent on existing age years of head or household size.

Education: I include some measures to capture the educational attainments.

- Maximum educational level attained by the head of the household. This is a categorical variable where the categories are labeled below.
  1-illiterate (cannot read and write)
  2-litterate (read and writes only)
  3-completed primary school
  4-completed secondary school
  5-completed university
- Number of persons in the household who are illiterate
- Number of persons in the household who are literate
- Number of persons in the household who completed primary school
- Number of persons in the household who completed secondary school
- Number of persons in the household who completed university level

Employment condition:

- Number of employed adult persons in the household

City dummy variable: city dummy=0 for the capital Addis & 1 otherwise.[2]

[2] The city dummy is not used for the FE-estimator

5. Regression results for the determinants of poverty

The regression results found, depicted in the following table, reveals that many of the variables are significant with expected signs taking the fixed effect model.

Table 4: Regression results using the fixed effects models

Dependent variable: ln of real per capita consumption per month

Number of obs	= 2994	F (13, 1287)	=	13.05
R-sq: within	= 0.1165	Prob > F	=	0.0000
between	= 0.1231			
overall	= 0.1282			

Indt. Variables	Descriptions	Coef.	t-stat
Age	Age of household head	-.0213828 (.012)*	-1.71
age2	Age of household head squared	.0002061 (.000)*	1.77
Hhsize	Household size	-.1852947 (.023)***	-8.07
hhsize2	Household size squared	.0042326 (.001)***	3.74
Sex	Female dummy=1	-.1146552 (.046)**	-2.48
highestlev~c	Highest level of education of the household head	.0577965 (.024)**	2.38
Illiterate	Number of illiterate persons in the household	.004183 (.018)	0.23
Literate	Number of literate persons in the household	.0146313 (.031)	0.47
Primary	Number of persons who completed primary school	.0382293 (.009)***	3.90
secondary	Number of persons who completed secondary school	.0641491 (.013)***	5.12
University	Number of persons who completed university level	.082531 (.024)***	3.39
dependency~o	Dependency ratio	-.0045897 (.041)	-0.11
noemployed	Number of adults employed	.0084716 (.019)	0.43
_cons	Constant term	5.864083 (.360)***	16.27

Standard errors in parenthesis; * p<0.10, **p<0.05, ***p<0.01

As shown in Table 4, the age of household head is significant with a negative coefficient. This implies that households headed by older individuals, holding other variables constant, will tend to be poorer than those headed by younger individuals. However, the estimated coefficient on the quadratic term for age of household head is positive and significant, suggesting a U-shaped relationship between age of household head and consumption per capita. This might be due to the fact that very

younger heads of the family may not be as productive as relatively older heads attributing to various reasons such as experience and better education which substantially helps towards improving the income of the household.

Coming to the household size, households with larger size consume less per capita; depending on model specification, one additional member lowered real consumption per capita by approximately 0.19. However, household size squared is shown to be significant and positive. This result might indicate that there may be economies of scale of household welfare derived from increasing household size.

Turning to the gender of the head of household, I find an expected result in that the marginal effect of a female-headed household is great [approximately -0.115] and negative as compared to male-headed household and it is statistically significant. This is due to the fact that female heads of households were not given as equal opportunity as that of males towards education, freedom of work and good perception by the society, especially during the earlier regimes. This will then negatively affect the welfare of the households headed by females.

When looking the highest level of education of the head, it reveals that, on average, when education of the head increases by one stage (say from illiterate to literate or primary to secondary), real per capita consumption increases by 0.058.This implies, undoubtedly, increasing that the educational status of the head will increase the welfare of the household.

The coefficients of the number of illiterate & literate people in the household, unfortunately, were not found to be significant variables. The other variable of interest is the number of primary school completed persons. Its coefficient implies that, on average, holding other things constant, with one more person primary school completed consumption per capita increases by 0.038.

In addition, the coefficient of the number of secondary school completed persons is positive and significant revealing the positive impact on real per capita consumption of the addition of one more individual who completed secondary school. In a similar fashion, if we look for the number of persons completed university level the coefficient is statically highly significant and positive. This shows that with one more university completed person in a given household, on average, real consumption per capita increases by about 0.083.

The last two variables, dependency ratio and number of adult persons employed, have expected signs though they are not statistically significant.

6. Poverty reduction simulations

Using the parameter estimates from the regression models, I simulate the effects of changes in policy-related exogenous variables. The results of these simulations are presented in Table 4 below. The brief methodology used to obtain the simulation results are discussed in subsequent paragraphs.

Table 4: Simulation results using predictions from the urban household model

		%age change in		
No. Simulation description	**real con pc**	**P_0**	**P_1**	**P_2**
1. Increase household size by 20%	-0.20	0.69	1.31	1.90
2. Increase by one stage the highest Level of education of head	0.12	0.46	-0.56	-0.76
3. Increase one person completed Primary school	0.07	-0.46	-0.46	-0.66
4. Increase one person completed Secondary school	0.07	-0.12	-0.31	-0.40
5. Increase one person completed University level	0.02	0.00	-0.04	-0.05
6. When Dependency ratio doubles	-0.003	0.00	0.023	0.035
7. Increase one adult person employed	0.009	0.00	-0.05	-0.07

Having estimated a consumption model, I generated simulations to predict the reductions or increases in general poverty levels that result from certain changes in selected aggregate household characteristics. Using the estimated parameters of the model (β hat), I generated predictions of consumption per capita (C_i estimated) for every household *i* by changing the level of the independent variable (X_i). That is, I calculated the C_i predicted which are equal to $e^{\beta xi}$ for every household. Then, poverty rate is calculated from the predicted consumption. The poverty rate is computed using the "p_α" poverty measure developed by Foster, Greer and Thorbecke (1984).

The purpose of these simulations is to illustrate the impact that changes in the levels of the determinants of poverty have on poverty levels.

As can be seen easily above, the percentage change in real per capita consumption and poverty measures (of all the three classes of measures of poverty) as a result of a certain change in independent variables (explanatory variables used for simulation) is depicted.

To begin with, the first simulation reveals the impact of a 20 percent more increase in the size of the household. That is, it shows the impact of adding one more person to the existing 5 members in the measure of poverty. And it is seen that the poverty head count increases by about 0.69 percent while the real per capita consumption per month has decreased by about 0.20 percent for each additional one person out of five members in the household. Even worse, the measures of poverty depth (P_1) and poverty severity (P_2) have increased by 1.31 and 1.90 percent respectively. These imply that as size of the household expands, the household tends to be poorer and poorer as the share of consumption going to each individual declines unless the expansion of the size of the household is coupled with higher return and productivity of additional person to offset the burden, which is most unlikely in LDCs like Ethiopia.

The education simulation displays the fact that education is one of the tools of alleviating poverty. Increasing educational status of the head of the family by one step (say from illiterate to literate, from primary to secondary, or from secondary to university level), increases real per capita consumption by 0.12 percent while it reduces poverty head count by about 0.46 percent. Similarly, it reduces the other two measures of poverty by a considerable amount.

In addition, adding one more person with primary school reduces poverty by around 0.46 percent taking both the head count and poverty gap indices. And the severity of poverty declined by 0.66 percent. On the other hand, real per capita consumption improved by 0.07 percent.

Looking into yet another two educational variables i.e., secondary and university levels reveals an increment of real per capita consumption by 0.07 and 0.02 percent respectively. In a similar context, poverty has declined substantially as a result of adding one more people who completed secondary and university levels of education in the household.

Considering the dependency ratio simulation, it's clear that when dependency ratio doubles, poverty has increased with parallel decrease in real per capita consumption. This is depicted by an increase in the poverty gap and poverty gap squared measures though it resulted in no change of the head count measure.

The last simulation shows the impact of adding one more employed person in the household on real per capita consumption and poverty measures. It shows that real per capita consumption increased by 0.009 percent for each additional one person employed in the household while the poverty indices, measured by poverty depth and poverty severity, have decreased by 0.05 and 0.07 percent respectively.

7. Conclusions

This paper tried to examine the impact of various time varying household characteristics on poverty-measured in terms of material deprivation, taking the Ethiopian Urban Household Survey of the years 1994-2004. The fixed effect estimator was used for the regression analysis and some policy simulations have been tried as a means of poverty alleviating strategies.

In the analysis, many of the variables such as age of household head, age of household head squared, household size, household size squared & female dummy (with negative coefficients); and highest level of education of the head, number of persons completed primary school, number of persons completed secondary school & number of persons completed university level (with positive coefficients) were found to be significant determinants of the real per capita consumption. On the other hand, some of the variables such as number of illiterate and literate persons, dependency ratio and number of adults employed in the household were found to be such insignificant in terms of explaining the dependent variable.

The result of poverty simulation approach depicts some important concepts:
First, a household with larger family size tends to be poorer than the household with smaller family size. Secondly, education can no doubt serve as the major tool towards alleviation of poverty. Finally, increasing dependency ratio is associated with increasing poverty whereas increasing number of employed persons in the household will help in reducing poverty.

Therefore, the various strategies that the government is currently employing; mainly concentrating on family planning, increasing enrollment of primary, secondary and tertiary levels of education (of course not at the expense of quality) in order to reduce poverty should be supported. In addition, the policy implementation by the government in empowering women is something to be emphasized more than what actually is being done as it was found that female headed households were highly associated with poverty as compared to male headed households. Moreover, creating employment opportunities to the urban people in particular and to the society at large can serve as one of the tools towards combating poverty.

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HOW SENSITIVE ARE POVERTY MEASURES TO THE CHOICE OF EQUIVALENCE SCALE AND UNIT OF ANALYSIS? EVIDENCE FROM URBAN ETHIOPIA

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Abstract

The paper studies the effect of the choice of equivalence scale and unit of analysis on poverty measures using data from urban Ethiopia. Four types of equivalence scales and three different units of analysis were considered. The three commonly used FGT indices namely P_0, P_1 and P_2 were computed for the whole sample and for different sub-samples based on geography and socio-economic characteristics of household heads. We found an important effect of the choice of equivalence scale on the poverty measures for the whole sample and for the sub- samples. The magnitude of the effect varies across sub-samples and in some cases rank reversal was observed. This suggests that maximum care should be done while choosing the appropriate equivalence scale. It is also advisable to consider more than one method of equivalence scale to check the robustness of poverty measures to the choice of equivalence scale. Using households as units of analysis consistently understates the level of poverty while the choice between individuals and equivalent individuals does not change the result much. Households should not be used as units of analysis as this could give a misleading result. In general, P_0 which is the most widely used poverty index by policy makers and international organizations is found to be the most sensitive one.

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1. Introduction

Poverty studies involve many methodological issues that require some kind of decision by the researcher. The first step is to choose a variable or dimension by which poverty will be defined. The two commonly used variables are consumption and income. The first one is referred to as a direct measure in the sense that it deals with the actual consumption of commodities considered to be necessary to be out of poverty while the latter is an indirect method which is based on the amount of money required to command the necessities. Consumption is more commonly used partly because it is believed to be less volatile than income. What is more, collecting reliable information on consumption is by far easier than collecting information on income at least in developing countries (Deaton, 1997).

Once the dimension of poverty is determined, the next step is to set the poverty line. In connection with the task of setting the poverty line, there is disagreement on whether poverty should be treated as a relative or an absolute phenomenon. In general, relative poverty is more common among rich societies while absolute poverty is common in the developing world.[2] For relative poverty, the line is set as a fixed proportion of the mean or median income of the population. But, for absolute poverty which is the subject of this paper setting the poverty line is a difficult task and involves high degree of arbitrariness. The cost-of-basic-needs (CBN) and the food-energy-intake (FEI) are two commonly used approaches (Ravallion and Bidani, 1994).

After the poverty line is set the next question is how to make the aggregation of poverty measure; how to report it as a single index so that it can be compared across time and space. Many poverty indices have been used to summarize the level of poverty in a particular area. The head count ratio which is simply a measure of the proportion of poor people has been used for such a long period of time albeit with serious criticisms. Other common poverty indices include the poverty gap ratio and the Foster-Greer-Thorbecke (*FGT*) indices.

Another methodological issue that needs to be addressed is that information on income and consumption is very often available at household level. This raises the issue of comparing the needs of different households. A crude adjustment could be made by taking household size as a deflator so that households with the same consumption/income per capita will be considered to be equally well-off. In the literature, there are a bunch of works on the choice of the appropriate equivalence

[2] For a detailed discussion in support of absolute poverty refer to Amartya Sen (1979, 1983 and 1985) and for relative poverty refer to Peter Towsend (1962 and 1985).

scale under different settings. Most works so far consider age and size as important dimensions to set the equivalence scale.

The assumptions and choices made on the different measurement issues may affect poverty measures. More importantly, they may affect the profile of poverty across regions and socio-economic groups. They may also affect the trend of poverty across time. As such, it will affect policies directed at reducing poverty (Ravallion 1996, Lanjouw and Ravallion 1995). Specific policies that could be affected include national poverty reduction policies, pro-poor growth policies and international poverty reduction policies.

Deaton (2003) argues that the choice of the poverty line could affect the trend of poverty across time thereby affecting countries' performance in light of the global campaign of poverty reduction. Ravallion (1996) also stresses that the method of setting the poverty line could affect poverty profile and hence whether poverty studies guide policies in the right direction depend on the assumptions made. Assumptions related with equivalence scale have similar effect. Specifically, the assumption made about the relative cost of children vis-à-vis adults and the allowance made for economies of scale in consumption will affect the level and profile of poverty. It will also affect the correlation of poverty with different demographic variables notably household size (Lanjouw and Ravallion 1995, Ravallion 1996).

The issue of equivalence scale has recently become an interesting research area in the literature of poverty studies and the available studies so far suggest that poverty measures are sensitive to the choice of equivalence scale (Buhman et al 1988, Coulter et al 1992, Lanjouw and Ravallion 1995, Creedy and Sleeman 2005). None the less, researchers usually do not give sufficient motivation for their choice of equivalence scale implicitly assuming that their result is robust to their choice. In relation to the issue of equivalence scale the choice of unit of analysis (method of weighting) is also an important issue. For a given equivalence scale, the unit of analysis will affect the level, profile and trend of poverty as far as the distribution of poverty is different across different household types. For instance, if there is more poverty among large households, a shift from households to individuals as units of analysis will increase poverty. Though the issue of unit of analysis is hardly raised in poverty studies, studies on inequality suggest that it matters (Ebert 1996, Lambert 2001, Decoster and Ooghe 2002; and Ebert and Moyes 2003).

The paper studies the sensitivity of poverty levels and profile of poverty across sub-populations to the choice of equivalence scale using urban household survey from Ethiopia. As such, it will add up to the empirical evidence on the topic. The paper also

shows the sensitivity of poverty measures to the choice of unit of analysis which is a new contribution to poverty studies.

The rest of the paper is organized as follows. Section two discusses the most common types of poverty indices including the head count ratio, the poverty gap ratio and the set of *FGT* indices. Discussion on equivalence scales and their effect on poverty measures is presented in section three. Section four discusses the different units of analysis and their implication to poverty measures. The data used is presented in section five. Empirical evidence on the sensitivity of poverty measures to the choice of equivalence scale and unit of analysis is presented in section six. Section seven concludes the paper.

2. Poverty indices

The choice of an index to aggregate the level of poverty has been an important point of discussion and many poverty indices have been developed. A number of axioms that should be satisfied by poverty indices have also been developed by different economists. The most common ones include monotonicity, transfer, focus, transfer sensitivity, and decomposability (for discussion on these and other poverty axioms see Hagennars; 1987). There seems to be a universal agreement about the requirement of monotonicity and transfer axioms. The focus axiom is also satisfied by many poverty indices. In this section, the head count ratio, the poverty gap ratio, and the *FGT* indices are discussed. For a survey of these and other poverty indices refer to Lambert (2001).

The Head Count Ratio (H)

The head count ratio (*H*) which simply is the measure of the ratio of people living in poverty is probably the oldest and the most widely used poverty index. If poverty is measured by income denoted by *y* where *z* is the poverty line, and *F(y)* is the cumulative distribution of income in the population of interest, with a density function of *f*(y), *H* will be given as follows:

$$H(F \mid z) = \int_0^z f(y)dy = F(z) \qquad (1)$$

For a discrete population of *n* people with incomes: $y_1, y_2, \ldots, y_q, \ldots, y_n$, arranged in ascending order such that: $y_1 \leq y_2 \leq \ldots \leq y_q < z \leq y_{q+1} \leq y_{q+2} \ldots \leq y_n$ we will have:

$$H(y|z) = \frac{q}{n} \qquad (2)$$

As argued by many economists the head count measure does not take in to account how poor the poor are. It implicitly assumes that poverty is entirely a discrete concept in the sense that it does not matter how much you have as far as you remain poor. Once people fall short of the poverty line they become poor whether the shortage is small or huge. In other words, the head count ratio is not sensitive to the degree of poverty and does not satisfy the monotonicity and transfer axioms (Deaton 1997). The fact that poverty will not increase (may even decrease) as a result of a pure transfer from a poor person to a better-off person is also a serious weakness of the head count measure as is clearly discussed by Sen (1979). Nonetheless, its simplicity for computation and conceptualization makes it very popular among policy makers and international organizations alike.

The Poverty Gap Ratio (I)

Another common measure of poverty is the poverty gap ratio (*I*) which is the average consumption/income deficit of the poor measured as a percentage of the poverty line. Under a continuous income distribution it will be:

$$I = \frac{1}{q}\int_0^z n\left(1-\frac{y}{z}\right) f(y)dy = \frac{1}{q}\int_0^z n\frac{g}{z} f(y)dy, \qquad \textbf{(3)}$$

where *g* is the poverty gap given by *z-y* and *z, y, n, F* and *f* are defined as in equation (1) above. And for a discrete distribution of income we will have:

$$I = \frac{1}{q}\sum_{i=1}^{q}(1-\frac{y_i}{z}) = \frac{1}{q}\sum_{i=1}^{q}\frac{g_i}{z} \qquad \textbf{(4)}$$

Where $g_i = z - y_i$ is the poverty gap for the i^{th} individual and *q* is the number of poor people as before.

The poverty gap ratio improves some of the problems of the head count ratio. Unlike the head count ratio, the poverty gap ratio is not insensitive to the level of poverty. In other words, it considers poverty as continuous measure in the sense that a person contributes more to poverty as he gets further below the poverty line.

But, it suffers from the problem of lack of sensitivity to transfers like the head count ratio. If money is transferred from a poor person to another poor without anyone crossing the poverty line the poverty gap ratio will be the same implying that poverty is not sensitive to transfers among the poor. It is also not sensitive to the number or proportion of people under the poverty line (See Sen 1979 for the critiques of the poverty gap ratio and the head count ratio).

The FGT index

James Foster et al (1984) developed a more sophisticated index which solves the problems of both the head count ratio and the poverty gap ratio. Like the poverty gap ratio, the *FGT* index is based on the individual poverty gap (*g*) but allows having higher weight for the poorest of the poor and takes in to account the proportion of poor people unlike the average poverty gap ratio. It is given as follows both for the continuous and discrete income distributions respectively:

$$P_\alpha = P = \int_0^z \left(1 - \frac{y}{z}\right)^\alpha f(y)dy = \int_0^z (\frac{g}{z})^\alpha f(y)dy$$

$$P_\alpha = \frac{1}{n}\sum_{i=0}^{q} (\frac{g_i}{z})^\alpha, \text{ where } \alpha \geq 0 \qquad \textbf{(5)}$$

P_0 will simply be the head count ratio and P_1 will be the product of the head count ratio and the poverty gap ratio and measures the average poverty gap for the whole population where the non-poor contribute nothing. In general, the parameter α can be considered as a measure of poverty aversion and a larger α gives higher emphasis to the poorest of the poor. [3]

P_α satisfies the monotonicity Axiom for $\alpha > 0$, the transfer axiom for $\alpha > 1$ and the transfer sensitivity axiom for $\alpha > 2$. And for any value of α, P_α satisfies the decomposability axiom and the weaker sub-group monotonicity axiom. The decomposability axiom is a desirable property for regional comparison of poverty levels and policy intervention. This is partly the reason why the *FGT* index is very common.

[3] In the literature P_0, P_1 and P_2 are respectively termed as measures of incidence, intensity, and severity of poverty.

For a population that is divided in to *m* collections of households *j = 1,…, m* with ordered income vectors of $y^{(j)}$ and population size n_j, the *FGT* index will be given as follows:

$$P_\alpha(y;z) = \sum_{i=0}^{m} (\frac{n_j}{n}) P_\alpha(y^{(j)};z) \qquad \textbf{(6)}$$

The overall poverty measure will be given as a weighted average of the poverty measures of the groups where the weights are the population shares of each group. What is more, a rise (fall) in poverty in a particular group will lead to a rise (fall) in the overall poverty level at a rate equal to the population share of the group.

3. Equivalence scales and poverty measures

One of the practical challenges on poverty studies is that data on consumption/income is very often available at household level while poverty is defined at individual level. One crude way is to divide the household consumption/income by the number of people in the household, i.e., to consider the household as a group of people with the average household consumption/income. This method has serious weakness because it fails to take the variation in demographic composition of households in to account. As a result, various sophisticated methods of equivalence scale have been developed. But, the focus has mainly been on size (scale) effect and age composition.

The purpose of equivalence scales is to make households with different size and age composition comparable in their consumption/income. Usually, the reference is a single adult and consumption/income of households with more than one member will be deflated by their equivalence scales to get their equalized (adjusted) consumption/income. The equivalence scale could be computed using utility theories or normative (arbitrary) methods.

The usual approach in the first method is to compare the expenditures or incomes required to achieve some reference utility level by different households. If the minimum standard of life (poverty line) is associated with a particular utility level for a reference household type, the equivalence scale for another household will then be given by the ratio of expenditure/income needed by the household to the expenditure/income needed by the reference household to achieve the minimum level of utility (for a detailed discussion refer to Deaton 1997, Deaton and Muellbauer 1986, Balisacan 1992 and Beston 2004). This method has various practical problems as a result of which the normative method of equivalence scale which does not directly

depend on utility theory is more common. There are different normative equivalence scale methods and some are parametric while others discontinuously attach weights for different household members. They all depend on demographic characteristics of households' notably household size and age composition.

The parametric methods are based on the intuition that children have lower need than adults and there is economies of scale in consumption because there are some public goods in the household consumption (for a detailed discussion refer Creedy and Sleeman 2005, Coulter et al 1992, Deaton and Zaidi 1998 and Betson 2004). Thus, the equivalence scale for a household i with A_i adults and K_i children will be given as follows:

$$s_i = s(A_i, K_i) \quad \textbf{(9)}$$

The reference household has just one adult and hence S_r = 1. Household income/consumption, y_i is adjusted to obtain the equivalent living standard, defined by:

$$y_i^a = \frac{y_i}{s_i} \quad \textbf{(10)}$$

Thus, the living standard of a household with a total income of y_i, A_i adults, and K_i children will be equivalent with a one adult household with y_i/S_i. There are various ways of defining the function S and following is one common functional form.

$$s(A_i, K_i) = (A_i + \alpha K_i)^{\theta}, \; 0 \le \theta \le 1, \; 0 < \alpha \le 1 \quad \textbf{(11)}$$

The parameter, α, measures the cost of a child relative to an adult while θ reflects economies of scale in consumption. $(A_i+\alpha K_i)$ could be considered as the adult equivalence scale which does not take economies of scale in to account. Normally, both parameters will be less than one. θ is inversely related with economies of scale. In the absence of any economies of scale where every item consumed by the household is private, θ will be one and in the other special case of full economies of scale where all the commodities are public, θ will be zero. If both parameters are one, the equivalence scale will boil down to household size and the adjusted level of consumption/income will simply be per capita consumption/income. The parameters are determined based on some theory or estimation but often times they are subject to some degree of arbitrariness.[4]

[4] Cutler and Katz (1992) set α and θ to be 0.5 and 0.4 respectively in their study of poverty and inequality

In general, the degree of economies of scale is believed to be low in poor countries since households do not share a lot of public goods and spend much of their income on food which essentially is a private good. The cost of children is also low since households do not expend much on children's education and entrainment unlike households in rich countries. This calls for a smaller α and a bigger θ in poor countries compared to rich countries (Deaton and Zaidi, 1998). Along this line, Kedir and Disney (2004) set $\alpha = 0.5$ and $\theta = 0.95$ in their study of poverty in Ethiopia. There are also other methods that discontinuously assign values for each household member.[5]

The choice of the two parameters will affect the poverty level and it may also affect the rank among different socio-economic and geographic groups. A change in the weight attached to children, α, affects the equivalence scale for households with children thereby affecting their equivalent consumption/income which in turn will affect poverty levels. Households with no children will not be affected. Thus, a rise in α will increase poverty for the group with children and hence the overall poverty will also rise and the effect will be stronger the larger the proportion of households with children is. The effect on P_0 will mainly result from some households crossing the poverty line from top (some households become poor now) while there is an additional effect for P_1 and P_2 which comes from the rise in the poverty gap of the initially poor households. The value of α may also affect the relative poverty of different socio-economic groups and regions as far as there is difference in the distribution of household types within the groups and rank reversal is also possible. Change in the economies of scale parameter, θ, affects households with more than one member and the effect on poverty measures is similar to that of α.

There have been some studies that show the effect of equivalence scales on poverty measures. Creedy and Sleeman (2005) studied the effect of equivalence scales on poverty and inequality using data from New Zealand. They showed the change on the two special cases of the *FGT* indices namely P_0 and P_1 as the parameters θ and α change using data from New Zealand. They found that poverty strictly increases as α for all values of θ. Similarly, poverty substantially increases as θ increases, keeping α constant.

[5] Lambert (2001) discussed one such method that attaches 0.61 for the first adult, 0.39 for the second adult (spouse of the first adult), 0.46 for a third adult, 0.36 for subsequent adults, and values ranging from 0.09 to 0.0.27 for each additional child less than 16 years old. In their poverty studies using data from Ethiopia, Stafen and Krishnan (1998) and Gebremedhin (2006) have used another discontinuous method which is based on the calorie intake requirement and remarkably attaches a weight of more than one to men in the age range of 14-30 and a weight of less than one to women of all ages.

Coulter et al (1992) showed the effect of variation in economies of scale, θ and implicitly assumed that children cost as much as adult (α = 1) to show the effect of changes in the equivalence scale (in this case due to change in θ) on poverty. They considered the *FGT* class of decomposable indices where P_0 and P_1 can be derived as special cases. They found that the impact of change in equivalence scale relativities on poverty measure is not negligible using data from the UK which is consistent with their theoretical discussion.

Buhman et al (1988) studied the sensitivity of poverty measures to equivalence scales using data from ten industrialized countries. Their focus is relative poverty as is witnessed by their choice of poverty line which is the median income. They used a special case of the standard equivalence scale function with α =1 and four different values of θ namely 0.25, 0.36, 0.55 and 0.72. They found that poverty measures significantly change with the choice of θ and the change systematically varies across different demographic groups and countries.

Lanjouw and Ravallion (1995) showed that the relationship between poverty and household size depends on the assumed economies of scale (θ) using data from Pakistan. They particularly showed that there is positive correlation between poverty and household size for big values of θ which becomes negative for smaller values of θ.

4. Unit of analysis and poverty measures

Once adjustment is made to demographic variation among households, the next issue will be to decide the unit of analysis (method of weighting). Three cases could be considered viz., (i) households: the same weight being given for all types of households irrespective of their size and composition (no weighting) (ii) individuals: weight equals household size (every person will be counted as one irrespective of his age and whether he belongs to small or big household) and (iii) equivalent individuals: a weight equal to the number of equivalent individuals will be used[6].

Let us reconsider the decomposable poverty index presented by equation (6) in section three with m groups based on household composition where h_j denotes the number of households in group j, while I_j and S_j respectively represent the number of

[6] We could also use children as units of analysis. I.e, the weight attached to each household will be equal to the number of children. Such a method was used by Creedy and Sleeman (2005) and could be preferred if child poverty is the focus of the study though it has a serious weakness of not taking the impoverishment of adult in to account. Alternately, equivalent adults could be used as units of analysis in which case the weights will be the number of equivalent adults without taking the effect of economies of scale.

individuals and equivalent individuals in each household in group *j*. The overall poverty measure will then be given as follows for the three cases.

i) $$P_\alpha(y;z)=\sum_{i=0}^{m}(\frac{n_j}{n})P_\alpha(y^{(j)};z)=\sum_{i=0}^{m}(\frac{h_j}{n})P_\alpha(y^{(j)};z), \text{ where } n=\sum_{j=1}^{m}h_j \quad \textbf{(11)}$$

ii) $$P_\alpha(y;z)=\sum_{i=0}^{m}(\frac{n_j}{n})P_\alpha(y^{(j)};z)=\sum_{i=0}^{m}(\frac{h_jI_j}{n})P_\alpha(y^{(j)};z), \text{ where } n=\sum_{j=1}^{m}h_jI_j \quad \textbf{(12)}$$

iii) $$P_\alpha(y;z)=\sum_{i=0}^{m}(\frac{n_j}{n})P_\alpha(y^{(j)};z)=\sum_{i=0}^{m}(\frac{h_jS_j}{n})P_\alpha(y^{(j)};z), \text{ where } n=\sum_{j=1}^{m}h_jS_j \quad \textbf{(13)}$$

Under the first alternative, a single person's deprivation and suffering is considered the same way as that of a family of more than one member which is a serious drawback. But, the choice between the second and third alternatives is not an easy one as either has its weaknesses and strengths. The second alternative which counts every individual equally irrespective of the size and composition of the household they belong has the advantage of considering sufferings of individuals equally, i.e, it satisfies the property of anonymity. But, this method has the problem that it does not satisfy the transfer principle. Poverty may decrease if money is transferred from a small poor household to a less poor bigger household (Creedy and Sleeman, 2005). The third alternative, on the other hand, satisfies the transfer principle but has the weakness that the deprivation of two individuals is not weighted equally for the mere reason that they belong to different households. Particularly, it does not satisfy the anonymity principle. Sen (1979) seriously criticizes this method on account of its failure to satisfy the anonymity principle and goes for the second option.

If poverty differs across different groups which also differ in terms of household composition, the overall poverty will be affected by the unit of analysis. For example, if there is more poverty among large households compared to small households, the overall poverty will be the highest if individuals are used as units of analysis and the least if households are used instead. If we consider three types of households namely singles (one person households), couples without children and couples with children; each of the three groups of households will respectively get the highest relative weight when households, equivalent individuals and individuals are used as units of analysis. While it is clear that overall poverty depends on the choice of unit of analysis the practical importance of the effect depends on the joint distribution of demographic composition and poverty in the population. It is worth noting that the

distribution of poverty and hence the effect of the choice of unit of analysis depends on the choice of equivalence scale.

The choice of unit of analysis is hardly raised in poverty literature. But, there is some evidence that the choice matters for welfare and inequality measures (For a detailed discussion on the effect of the choice of unit of analysis on inequality and welfare measures see Ebert 1996, Lambert 2001, Decoster and Ooghe 2002; and Ebert and Moyes 2003).

5. Data

The data source for the study is the 2004 Ethiopian Urban Households Survey conducted by the Department of Economics, Addis Ababa University (in collaboration with Gothenburg University). Seven major urban centers which are believed to constitute a representative sample of the urban population were included in the survey. These include the capital city, Addis Ababa, and six other towns from different regions of the country namely Awassa, Bahir Dar, Dessie, Dire Dawa, Jimma and Mekelle. The sample is about 1,500 households and it was allotted to the seven urban centers proportional to their population size. Accordingly, 900 households were drawn from Addis Ababa which has a population of around three million and the rest 600 were distributed among the six towns proportional to their population size. Households were then drawn randomly from each urban center. The data includes information about income and consumption of households among other things. For the simple reason that consumption is likely to have been measured more precisely than income and following the common practice in the literature, poverty is determined based on consumption.[7]

The poverty lines set by Gebremedhin and Whelan (2007) for each region using the 2000 round of the same survey were used. The poverty lines were set based on the cost of basic needs approach. They first constructed the food poverty line by estimating the value of a basket of food items that meets a stipulated minimum calorie requirement for a healthy life (2,200 kcal per person per day). The food basket was determined by earlier studies based on the consumption pattern of the bottom 50% of the urban population ranked according to expenditure per capita using the first round of the Ethiopian Urban Household Survey collected in 1994 (Tadesse 1999). The same food basket was used for all the regions assuming that there is no

[7] Other poverty studies in Ethiopia that used consumption as a measure of poverty include Tadesse (1999), Kedir and Disney (2004), Gebremedhin (2006); and Gebremedhin and Whelan (2007) among others.

significant difference in the consumption behaviour across regions.[8] The cost for the whole basket was computed based on the vector of prices of food items they constructed from the survey. The non-food component of the poverty line was estimated taking in to account the share of food consumption expenditure of households. Accordingly, the total poverty lines (per adult per month) for the seven urban centers were respectively 91.21, 84.59, 75.80, 85.47.96.26.77.55 and 92.95 Birr.[9]

Given that the underlying food basket is the same for all regions, the poverty lines themselves reflect the difference in cost of life among the regions. Accordingly, Dire Dawa is the most expensive city followed by Mekelle and Addis Ababa while Bahir Dar is the cheapest city followed by Jimma. These variations in cost of life as reflected by the difference in the poverty lines of the regions are used to compute the relative cost of life of the regions taking the capital, Addis Ababa as a reference. Accordingly, both the poverty lines and consumptions of households are deflated by the ratio of the poverty line of each region to that of Addis Ababa. Gebremedhin and Whelen (2007) have found supporting evidence that such method of adjusting for price variation across regions gives similar result as the ideal method of adjustment based on relative price indices of the regions. Finally, the national inflation rate was used to adjust for price changes between 2000 and 2004. Accordingly, the poverty line in Addis is 100.24 Birr per person per month. This makes an implicit assumption that there were the same price variations in all the regions. This may not be a correct assumption and was used mainly due to lack of data on regional inflation rates. But, given the short period of time we hope that the result will not be affected much.

6. Result and discussion

The three *FGT* indices (P_0, P_1 and P_2) are estimated for the whole sample and sub-samples based on region and socio-economic groups. Four different methods of equivalence scale were used. The first one (*ES1*) is simply the household size with no regard to age composition and size effect (i.e., both α and θ are set to be one in the parametric equivalence scale given under equation 11 in section three). The second method (*ES2*) is based on calorie requirement estimates by the World Health Organization and discontinuously attaches weight for members of households based on age and sex and is given in appendix A. It has been used inter alia by Dercon and Krishnan (1998); and Gebremedhin (2006). The fact that this method is based on the

[8] The assumption of no difference in consumption behaviour across the different regions may be unrealistic and is mainly used for simplicity. But, considering the fairly similar consumption behaviour in urban Ethiopia we hope that the results of the study will not be affected much.
[9] The exchange rate in 2004 was about $ = 8.7 Birr

calorie requirement of individuals which is consistent with the way the poverty line is set is a virtue. It is also more flexible than the parametric method which divides individuals in to adult and children with no regard to age and sex. But, it has a serious weakness of not taking the effect of size. The third method (*ES3*) is a modification of the second one. In order to take account for economies of scale in consumption we powered the sum of individual weights by 0.95 (we set θ =.95). The fourth one (*ES4*) is based on the parametric method with α = 0.5 and θ = 0.95 following Kedir and Disney (2004). This implies that children cost half of adults and there is no much economies of scale in consumption. Though this may seem an underestimation of the relative cost of children, given that poor households do not spend much on children's education and entertainments as discussed by Deaton and Zaid (1998), we believe this will not be far from the actual cost of children.[10] The three different methods of weighting are also considered. Before we go to the poverty estimates let us see the summary of variables by region and socio-economic groups.

Table 1 below presents the summary of household composition, equivalence scales and equivalized consumptions across regions. There is big difference in terms of household composition across regions as reflected by the mean values. Awassa has the largest average number of adults and equivalent scales while Jimma has the largest mean number of children. Dessie has the lowest number of adults, children and equivalence scales on average. This may lead to varying effect on poverty measures as we change the equivalence scale and unit of analysis. Based on all equivalence scales, Bahir Dar has the highest mean consumption followed by Awassa and Addis Ababa while Dessie has the lowest mean consumption followed by Dire Dawa and Mekelle. As can be read from the standard deviation of the mean consumption given in parenthesis Bahir Dar has the highest volatility of mean consumption followed by Dire Dawa and Addis Ababa while Mekelle has the lowest volatility.

A summary of the same variables across different socio-economic groups is given in appendix B. Male headed households have on average higher number of children, adults, equivalent individuals and mean consumptions. Similarly, households with married heads are on average larger than households with single heads as reflected by the mean values of children, adults and the four equivalence scales. But, they also have lower mean consumptions relative to single headed households. When it comes to religion, orthodox Christians have bigger number of adults and smaller number of children compared to the non-orthodox group which includes Christians of other denominations and Muslims. They also have slightly lower average equivalence scales (with the exception of *ES4*) and mean equivalized consumptions. Households

[10] The common practice in the literature is to consider the parametric equivalence scale method and see how poverty measures respond to changes in the parameters as is discussed in section three

headed by pensioners have the largest number of adults and equivalent scales and the lowest number of children. Households with heads employed by the formal sector have the largest mean consumptions followed by pensioners while households with heads working in the informal sector have the lowest mean consumptions. In terms of education of head, households headed by people with high school education have the lowest mean number of adults, children and equivalence scales. They also have the highest average mean consumptions followed by those with some formal education.

Table 1: Summary of household composition, equivalence scales and monthly equivalized consumptions by region

Variable	*Addis Abeba*	*Awassa*	*Bahirdar*	*Dessie*	*Dire Dawa*	*Jimma*	*Mekelle*	*Total*
Adults	4.50 (2.17)	4.51 (2.22)	3.78 (1.64)	3.03 (1.72)	3.99 (2.40)	4.06 (1.75)	3.56 (1.87)	4.24 (2.12)
Children	1.25 (1.25)	1.57 (1.29)	1.44 (1.30)	1.30 (1.26)	1.56 (1.55)	1.80 (1.59)	1.43 (1.37)	1.36 (1.32)
ES1(Household size)	5.76 (2.60)	6.07 (2.67)	5.22 (2.15)	4.61 (2.31)	5.55 (3.34)	5.86 (2.28)	4.99 (2.58)	5.60 (2.62)
ES2(Sum of individual weights)	5.61 (2.56)	5.93 (2.67)	5.04 (2.09)	4.38 (2.21)	5.31 (3.13)	5.59 (2.14)	4.77 (2.50)	5.42 (2.55)
ES3(ES2 with e = 0.95)	5.12 (2.23)	5.40 (2.32)	4.63 (1.83)	4.04 (1.95)	4.84 (2.73)	5.11 (1.86)	4.38 (2.19)	4.95 (2.22)
ES4(α = 0.5 and e = 0.95)	4.70 (2.02)	4.84 (2.07)	4.16 (1.58)	3.67 (1.72)	4.37 (2.46)	4.56 (1.63)	3.95 (1.89)	4.52 (2.00)
Consumption per ES1	161.98 (179.03)	189.19 (183.36)	201.21 (206.56)	130.70 (141.29)	138.40 (194.72)	145.61 (126.93)	137.69 (86.91)	160.43 (173.50)
Consumption per ES2	166.12 (182.95)	193.45 (183.01)	208.54 (214.21)	136.43 (147.20)	145.54 (219.50)	150.93 (127.69)	145.31 (93.55)	165.41 (178.94)
Consumption per ES3	178.57 (193.46)	208.29 (191.85)	224.02 (228.72)	145.32 (155.67)	152.47 (218.60)	163.39 (137.79)	154.86 (96.58)	177.45 (188.37)
Consumption per ES4	191.38 (201.12)	226.97 (199.03)	249.91 (278.94)	161.01 (174.21)	165.99 (219.88)	181.61 (148.64)	165.88 (95.96)	192.12 (200.07)
Sample size	**855**	**99**	**99**	**99**	**97**	**100**	**98**	**1452**

Note: Standard deviations are given in brackets

Table 2 shows the three *FGT* indices (P_0, P_1 and P_2) under the different equivalence scales and units of analysis for the whole sample. All the three indices fall as we move from *ES1* towards *ES4*. Movement from *ES1* to *ES2* is associated with a modest rise in the poverty indices. And, as we move from *ES2* to *ES3* (which is simply *ES2* powered by 0.95) poverty falls by a reasonably big margin. This shows the importance of economies of scale (even if it is small). Finally, movement from

ES3 to *ES4* which takes the effect of both age composition and size leads to further fall in poverty. This is consistent with the result from other studies (Creedy and Sleeman 2005, Coulter et al 1992 and Buhman et al 1988). When it comes to the unit of analysis poverty invariably increases as we use individuals instead of households implying that poverty is more pervasive among larger households on average. However, when we move from individuals to equivalent individuals there is no difference for *ES1* (because it is the same as household size). For the other three equivalence scales, poverty slightly falls (with the exception of P_2 under *ES2* in which case it remains the same). In general, the choice of equivalence scale and unit of analysis matters a lot for poverty measures. But, using individuals or equivalent individuals as units of analysis does not matter much.

Table 2: Overall poverty levels (P_0, P_1 and P_2) under different equivalence scales and units of analysis

Poverty index	Unit of analysis	ES1	ES2	ES3	ES4
P_0	households (hhs)	.4305(.0188)	.4133(.0177)	.3680(.0188)	.3349(.0190)
	individuals (inds)	.4875(.0209)	.4693(.0196)	.4176(.0208)	.3823(.0219)
	equivalent inds	.4875(.0209)	.4679(.0197)	.4144(.0209)	.3781(.0219)
P_1	households	.1623(.0099)	.1518(.0096)	.1310(.0090)	.1090(.0085)
	Individuals	.1905(.0116)	.1792(.0114)	.1534(.0106)	.1268(.0100)
	equivalent inds	.1905(.0116)	.1790(.0115)	.1522(.0106)	.1261(.0578)
P_2	Households	.0813(.0060)	.0749(.0059)	.0622(.0053)	.0502(.0048)
	Individuals	.0967(.0071)	.0894(.0070)	.0731(.0061)	.0580(.0054)
	equivalent inds	.0967(.0071)	.0894(.0071)	.0725(.0061)	.0578(.0054)

Note: standard errors are given in brackets

Now, let's turn to the distribution of poverty across regions. Table 3 shows the changes in P_0 across regions as the equivalence scale and unit of analysis changes. As we move from *ES1* to *ES2* P_0 falls for all regions except Bahir Dar for which it remains the same. Similarly, movement from *ES2* to *ES3* and from *ES3* to *ES4* leads to a lower poverty for all regions. But, the magnitude of the change in poverty varies from region to region consistent with the result Buhman et al (1988) found in Europe. As we shift from households to individuals as units of analysis P_0 increases substantially in all regions under all equivalence scale methods. The magnitude of the change varies across regions and the largest change is observed in Dire Dawa which also happens to be the poorest region in any case. When we use equivalence scales as units instead of individuals P_0 slightly falls in all regions but Dire Dawa (in which case it slightly rises). We do not see any change in rank for the three poorest regions (Dire Dawa, Dessie and Addis Ababa) while the ranks for the other regions change as

we change the equivalence scale and unit of analysis. But, the choice of unit of analysis between individuals and equivalent individuals does not affect the rank which is not surprising given that the choice does not have big effect on the regional poverty levels to begin with. For *ES4* there is no rank reversal even when we move from households to individuals implying that it is robust to the choice of unit of analysis.

To see how significant the difference in P_0 is for different pairs of regions statistical test is in order.[11] To the extent that changes in equivalence scale and units of analysis affect the regional poverty levels differently as shown above we would expect variation in the significance of the difference in P_0 as we change the equivalence scale and units of analysis. The significance level for each pair of regions under the four methods of equivalence scales and three units of analysis is given in Table 4.[12]

[11] Suppose $\hat{p}^1_\beta$ and $\hat{p}^2_\beta$ are the poverty estimates for two independently distributed samples with estimated standard errors $SE(\hat{p}^1_\beta)$ and $SE(\hat{p}^2_\beta)$. The estimate for the difference in poverty between the two sub-samples will be given as $\hat{p}^1_\beta - \hat{p}^2_\beta$ with a standard error, $SE(\hat{p}^1_\beta - \hat{p}^2_\beta)$. Then, following Kakwani (1993), the t-statistic for testing the null hypothesis that poverty is equal between the two sub-samples will be given by: $t = \dfrac{\hat{p}^1_\beta - \hat{p}^2_\beta}{SE(\hat{p}^1_\beta - \hat{p}^2_\beta)} = \dfrac{\hat{p}^1_\beta - \hat{p}^2_\beta}{\sqrt{SE(\hat{p}^1_\beta)^2 + SE(\hat{p}^2_\beta)^2}}$

[12] A test could also be made about the equality of poverty across all regions. But, such test will not show the sensitivity test we are looking for as it will merge the effects on the seven sub-samples together in one test.

Table 3: P_0 in the seven urban centres under different equivalence scales and units of analysis

Urban centre	*hhs*	*ES1*	*hhs*	*ES2*		*hhs*	*ES3*		*hhs*	*ES4*	
		*inds/einds**		*inds*	*einds*		*inds*	*einds*		*inds*	*einds*
Addis Ababa	.4444[3]	.4987[3]	.4292[3]	.4798[3]	.4793[3]	.3918[3]	.4404[3]	.4378[3]	.3626[3]	.4093[3]	.4039[3]
	(.0234)	(.0268)	(.0219)	(.0247)	(.0248)	(.0242)	(.0261)	(.0262)	(.0225)	(.0263)	(.0262)
Awassa	.28[7]	.3511[7]	.29[7]	.3611[6]	.3558[6]	.21[7]	.2529[7]	.2481[7]	.17[7]	.213[7]	.209[7]
	(.0181)	(.0369)	(.0241)	(.0422)	(.0417)	(.0211)	(.0342)	(.0317)	(.0141)	(.0296)	(.0293)
Bahir Dar	.3[6]	.352[6]	.3[6]	.352[7]	.347[7]	.26[6]	.294[6]	.29[6]	.19[6]	.2186[6]	.2131[6]
	(.0471)	(.0553)	(.0471)	(.0553)	(.051)	(.0118)	(.0267)	(.0263)	(.0211)	(.0261)	(.0241)
Dessie	.53[2]	.5702[2]	.5[2]	.5526[2]	.5489[2]	.44[2]	.4781[2]	.4716[2]	.42[2]	.4518[2]	.4489[2]
	(.0492)	(.0533)	(.0365)	(.0468)	(.0431)	(.0357)	(.039)	(.0349)	(.0421)	(.0447)	(.0429)
Dire Dawa	.5859[1]	.6914[1]	.5455[1]	.6617[1]	.6655[1]	.5152[1]	.6264[1]	.6276[1]	.495[1]	.6115[1]	.619[1]
	(.0636)	(.0509)	(.0648)	(.0552)	(.0557)	(.0638)	(.0527)	(.0537)	(.057)	(.0501)	(.0514)
Jimma	.4[4]	.4249[5]	.36[4]	.3805[5]	.3763[5]	.29[4]	.3106[5]	.3048[5]	.27[4]	.2918[4]	.2817[4]
	(.0658)	(.0458)	(.0803)	(.0592)	(.0603)	(.0808)	(.0651)	(.0665)	(.0976)	(.0801)	(.0843)
Mekelle	*.37*[5]	*.4601*[4]	*.35*[5]	*.4376*[4]	*.4374*[4]	*.29*[4]	*.364*[4]	*.3591*[4]	*.23*[5]	*.2843*[5]	*.2772*[5]
	(.0207)	*(.0347)*	*(.0158)*	*(.0342)*	*(.0308)*	*(.0345)*	*(.0575)*	*(.0541)*	*(.0238)*	*(.0324)*	*(.0341)*
Total	***.4305***	***.4875***	***.4133***	***.4693***	***.4679***	***.3680***	***.4176***	***.4144***	***.3349***	***.3823***	***.3781***
	(.0188)	***(.0209)***	***(.0177)***	***(.0196)***	***(.0197)***	***(.0188)***	***(.0208)***	***(.0209)***	***(.0190)***	***(.0219)***	***(.0219)***

Note: Standard errors are given in brackets and regional ranks are given as superscripts

*For *ES1* which is simply the household size with no adjustment for age composition and economies of scale, the number of individuals (inds) and the number of equivalent individuals (einds) are the same

Table 4: Test of equality of P_0 between regions based on different equivalence scales and units of analysis

	Addis Ababa	Awassa	Bahir Dar	Dessie	Dire Dawa	Jimma
Households as units of analysis						
Awassa	(3,3,3,3)					
Bahir Dar	(3,2,3,3)	(0,0,2,0)				
Dessie	(0,1,0,0)	(3,3,3,3)	(3,3,3,3)			
Dire Dawa	(2,1,1,2)	(3,3,3,3)	(3,3,3,3)	(0,0,0,0)		
Jimma	(0,0,0,0)	(1,0,0,1)	(0,0,0,0)	(0,0,1,0)	(2,1,2,2)	
Mekelle	(2,3,2,3)	(3,2,2,2)	(0,0,0,0)	(3,3,3,3)	(3,3,3,3)	(0,0,0,0)
Individuals as units of analysis						
Awassa	(3,2,3,3)					
Bahir Dar	(2,2,3,3)	(0,0,0,0)				
Dessie	(0,0,0,0)	(3,3,3,3)	(3,3,3,3)			
Dire Dawa	(3,3,3,3)	(3,3,3,3)	(3,3,3,3)	(1,0,2,2)		
Jimma	(0,0,1,0)	(0,0,0,0)	(0,0,0,0)	(2,2,2,1)	(3,3,3,3)	
Mekelle	(0,0,0,3)	(2,0,1,0)	(1,0,0,0)	(1,2,1,3)	(3,3,3,3)	(0,0,0,0)
Equivalent individuals as units of analysis						
Awassa	(3,2,3,3)					
Bahir Dar	(2,2,3,3)	(0,0,0,0)				
Dessie	(0,0,0,0)	(3,3,3,3)	(3,3,3,3)			
Dire Dawa	(3,3,3,3)	(3,3,3,3)	(3,3,3,3)	(1,1,2,2)		
Jimma	(0,0,1,0)	(0,0,0,0)	(0,0,0,0)	(2,2,2,1)	(3,3,3,3)	
Mekelle	(0,0,0,3)	(2,0,1,0)	(1,0,0,0)	(1,2,1,3)	(3,3,3,3)	(0,0,0,0)

Note : the statistical significances of the difference of poverty between all pairs of urban centres using ES1, ES2, ES3 and ES4 is given in order where numbers 1, 2 and 3 are associated with significance levels at 10%, 5% and 1% respectively while 0 implies that the difference is not significant at all.

When households are used as units of analysis there is discrepancy in the statistical significance of the difference in poverty for three pairs of regions out of the total 21 pairs associated with change in the equivalence scale. The difference between Dire Dawa and Addis Ababa is significant at 5% level when *ES1* and *ES4* are used but when *ES2* and *ES3* are used the difference is significant only at 10%. For Bahir Dar and Awassa, the difference is significant only when *ES3* is used while for Dire Dawa and Jimma the difference is significant in all equivalence scales except *ES2* in which case it is significant only at 10%. When individuals are used as units of analysis there

is difference along the dimension of equivalence scale for pairs Dire Dawa and Dessie; Jimma and Dessie; Mekelle and Addis Ababa; Mekelle and Awassa; and Mekelle and Dessie. We get similar result when equivalent individuals are used. When households are used as units of analysis the significance of the difference between regions does not change much as we change the equivalence scale compared to the result when individuals/equivalent individuals are used as units of analysis. This shows that the difference is more robust to the choice of equivalence scale when households are used as units of analysis. There is also difference when we change the units of analysis from households to individuals or equivalent individuals keeping the equivalence scale the same. Examples of pairs of regions for which there is difference include Mekelle and Addis Ababa; Mekelle and Awassa; Dire Dawa and Dessie; and Jimma and Dessie among others. A shift from individuals to equivalent individuals does not however change the result.

The regional changes in P_1 are given in Table 5 and we observe similar result. Movement from *ES1* towards *ES2* leads to a fall in P_1 for all regions. As we change the unit of analysis from households to individuals P_0 decreases under all equivalence scales for all regions though the magnitude of the change varies from region to region; the highest change being observed for Dire Dawa and the lowest for Jimma. Movement from individuals to equivalent individuals does not change P_1 much. In general, the rank of the regions does not change either with equivalence scale or unit of analysis implying that regional rank is not sensitive for P_1 unlike for P_0.

Table 5: P_1 in the seven urban centres under different equivalence scales and units of analysis

Urban centre	*hhs*	*ES1*	*hhs*	*ES2*		*hhs*	*ES3*		*hhs*	*ES4*	
		*inds/einds**		*inds*	*einds*		*inds*	*einds*		*inds*	*einds*
Addis Ababa	.1658[3]	.1944[3]	.1572[3]	.1852[3]	.1852[3]	.1346[3]	.158[3]	.1569[3]	.1117[3]	.1311[3]	.1295[3]
	(.0119)	(.0143)	(.0116)	(.014)	(.0143)	(.0107)	(.013)	(.0132)	(.01)	(.0122)	(.0122)
Awassa	.0945[6]	.1165[6]	.0847[6]	.1059[6]	.105[6]	.0685[6]	.0843[6]	.0832[6]	.0529[6]	.0645[6]	.0639[6]
	(.0022)	(.0048)	(.0021)	(.0046)	(.0045)	(.0008)	(.001)	(.0015)	(.0051)	(.0058)	(.0064)
Bahir Dar	.0912[7]	.11[7]	.0814[7]	.0976[7]	.0964[7]	.0654[7]	.0781[7]	.0764[7]	.0454 [7]	.0537[7]	.0527[7]
	(.0067)	(.0131)	(.0069)	(.014)	(.0143)	(.0061)	(.0123)	(.0121)	(.0045)	(.0095)	(.0091)
Dessie	.2234[2]	.2415[2]	.2033[2]	.2215[2]	.2206[2]	.1844[2]	.1969[2]	.1952[2]	.1666[2]	.1703[2]	.1742[2]
	(.0328)	(.0357)	(.0339)	(.0367)	(.0357)	(.0352)	(.0376)	(.0364)	(.0387)	(.041)	(.0406)
Dire Dawa	.2627[1]	.3455[1]	.2497[1]	.331[1]	.3343[1]	.2256[1]	.2998[1]	.3[1]	.1998[1]	.2693[1]	.2717[1]
	(.0387)	(.0373)	(.0371)	(.0361)	(.036)	(.0352)	(.0343)	(.0339)	(.0306)	(.0301)	(.0304)
Jimma	.1502[4]	.1583[4]	.1388[4]	.1448[4]	.1421[4]	.1224[4]	.1259[4]	.1234[4]	.1029[4]	.1009[4]	.1006[4]
	(.0521)	(.0431)	(.0519)	(.045)	(.0446)	(.0491)	(.0433)	(.0431)	(.0457)	(.0417)	(.0413)
Mekelle	.1219[5]	.1481[5]	.108[5]	.1303[5]	.1306[5]	.089[5]	.1035[5]	.1034[5]	.0643[5]	.0708[5]	.0704[5]
	(.0153)	(.0243)	(.0176)	(.0235)	(.0233)	(.0163)	(.0195)	(.0197)	(.0169)	(.0174)	(.0185)
Total	.1623	.1905	.1518	.1792	.1790	.1310	.1534	.1522	.1090	.1268	.1261
	(.0099)	(.0116)	(.0096)	(.0114)	(.0115)	(.0090)	(.0106)	(.0106)	(.0085)	(.0100)	(.0578)

Not: Standard errors are given in brackets and regional ranks are given as superscripts

The statistical significance of difference in P_1 between regions hardly changes with equivalence scale when households are used as units of analysis as can be read from Table 6 below. We get similar result when individuals/equivalent individuals are used as units of analysis with the exception of two pairs namely Mekelle and Addis Ababa; and Dessie and Dire Dawa. Movement from households to individuals/equivalent individuals leads to change in the statistical significance for two pairs (Dire Dawa and Dessie; and Dire Dawa and Jimma). Difference in equivalence scale does not make any difference when households are used as units and there is little change when individuals and equivalent individuals are used. In general, the difference in P_1 across regions is not affected much by the choice of equivalence scale and units of analysis which is consistent with the result reported in Table 5 above.

Table 6: Test of Equality of P_1 between regions based on different equivalence scales and units of analysis

	Addis Ababa	Awassa	Bahir Dar	Dessie	Dire Dawa	Jimma
Households as units of analysis						
Awassa	(3,3,3,3)					
Bahir Dar	(3,3,3,3)	(0,0,0,0)				
Dessie	(1,0,0,0)	(3,3,3,3)	(3,3,3,3)			
Dire Dawa	(2,2,2,3)	(3,3,3,3)	(3,3,3,3)	(0,0,0,0)		
Jimma	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(1,1,1,1)	
Mekelle	(2,2,2,2)	(1,0,0,0)	(1,0,0,0)	(3,2,2,2)	(3,3,3,3)	(0,0,0,0)
Individuals as units of analysis						
Awassa	(3,3,3,3)					
Bahir Dar	(3,3,3,3)	(0,0,0,0)				
Dessie	(0,0, 0,0)	(3,3,3,2)	(3,3,3,3)			
Dire Dawa	(3,3,3,3)	(3,3,3,3)	(3,3,3,3)	(2,2,2,1)		
Jimma	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(3,3,3,3)	
Mekelle	(1,2,2,3)	(0,0,0,0)	(0,0, 0,0)	(2,2,2,2)	(3,3,3,3)	(0,0,0,0)
Equivalent individuals as units of analysis						
Awassa	(3,3,3,3)					
Bahir Dar	(3,3,3,3)	(0,0,0,0)				
Dessie	(0,0, 0,0)	(3,3,3,3)	(3,3,3,3)			
Dire Dawa	(3,3,3,3)	(3,3,3,3)	(3,3,3,3)	(2,2,2,1)		
Jimma	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(3,3,3,3)	
Mekelle	(1,2,2,3)	(0,0,0,0)	(0,0,0,0)	(2,2,2,2)	(3,3,3,3)	(0,0,0,0)

Note: The statistical significances of the difference of poverty between all pairs of urban centres using ES1, ES2, ES3 and ES4 is given in order where numbers 1, 2 and 3 are associated with significance levels at 10%, 5% and 1% respectively while 0 implies that the difference is not significant at all.

The result for P_2 is also similar and is given by Table 7. Like P_1, the rank for P_2 does not change with equivalence scales. But, when we change the unit of analysis from households to individuals (or equivalent individuals) the rank for Addis Ababa and Jimma gets reversed. Addis Ababa becomes poorer than Jimma if households are used as units of analysis and the vice versa if individuals (or equivalent individuals) are used instead. Thus, the rank of P_2 is more sensitive than that of P_1 while P_0 is the most sensitive. The statistical test for the difference across regions also shows similar result and is presented in appendix C.

It is also interesting to see the changes in the poverty measures across different socio-economic groups. The movement in P_0 across different socio-economic groups is provided in Table 8. As expected, P_0 falls as we move from *ES1* towards *ES4*. The same is true when we move from households to individuals (equivalent individuals) as units of analysis. The magnitude of the change varies across groups. For example, movement from *ES1* towards *ES2* does not change P_0 much for female headed households (as opposed to male headed households) and singe headed households (as opposed to married headed households). A shift from individuals to equivalent individuals does not affect P_0 much. For *ES3* and *ES4*, P_0 falls slightly for all socio-economic groups while for *ES2* the effect is mixed. In general, households headed by females and orthodox Christians have higher P_0. The group with married heads has larger P_0 under *ES1* and *ES4*. They also have higher P_0 under *ES2* and *ES3* when households are used as units of analysis. Under *ES2* and *ES3* with individuals or equivalent individuals used as units of analysis, single households have higher P_0. In terms of employment, P_0 is the least for those with formal employment; while informal workers have the highest P_0 followed by the unemployed. In terms of education, those with high school education have the lowest P_0 followed by those with some formal education. The rank of P_0 changes only for the groups based on marital status of head (for other groups it remains the same).

Table 7: P_2 in the seven urban centres under different equivalence scales and units of analysis

Urban centre	*ES1*		*hhs*	*ES2*		*hhs*	*ES3*		*hhs*	*ES4*	
	Unit of analysis			*Unit of analysis*			*Unit of analysis*			*Unit of analysis*	
	hhs	*inds/einds*		*inds*	*einds*		*inds*	*einds*		*inds*	*einds*
Addis Ababa	.0803[4]	.0963[3]	.075[4]	.0903[3]	.0904[3]	.0612[4]	.0728[3]	.0723[3]	.0486[4]	.0573[3]	.0567[3]
	(.0068)	(.0087)	(.0067)	(.0086)	(.0088)	(.0059)	(.0075)	(.0075)	(.0052)	(.0065)	(.0065)
Awassa	.0446[6]	.0546[6]	.0392[6]	.049[6]	.0491[6]	.0314[6]	.0387[6]	.0386[6]	.0238[6]	.0292[6]	.0292[6]
	(.0030)	(.0022)	(.0036)	(.0033)	(.0042)	(.0043)	(.0041)	(.0049)	(.0051)	(.0058)	(.0059)
Bahir Dar	.0394[7]	.0471[7]	.0333[7]	.0402[7]	.0397[7]	.0259[7]	.0305[7]	.0298[7]	.0177[7]	.0199[7]	.0199[7]
	(.0045)	(.0076)	(.0062)	(.0085)	(.0087)	(.0054)	(.0067)	(.0067)	(.0048)	(.0052)	(.0055)
Dessie	.1254[2]	.1312[2]	.1123[2]	.1173[2]	.1174[2]	.0997[2]	.1002[2]	.1[2]	.0886[2]	.0834[2]	.0871[2]
	(.0318)	(.0306)	(.0326)	(.0315)	(.0309)	(.0324)	(.0306)	(.0299)	(.0336)	(.0307)	(.0309)
Dire Dawa	.1454[1]	.2038[1]	.1375[1]	.1931[1]	.1952[1]	.1184[1]	.1661[1]	.1659[1]	.0996[1]	.1419[1]	.1425[1]
	(.0241)	(.024)	(.0228)	(.0229)	(.0225)	(.0205)	(.0204)	(.0199)	(.0163)	(.0162)	(.0166)
Jimma	.0856[3]	.088[4]	.0772[3]	.0782[4]	.0767[4]	.0673[3]	.0666[4]	.0654[4]	.0561[3]	.0534[4]	.0532[4]
	(.0344)	(.0298)	(.0327)	(.0295)	(.0288)	(.0299)	(.0275)	(.0269)	(.0264)	(.0246)	(.024)
Mekelle	.0558[5]	.0645[5]	.0487[5]	.0556[5]	.0559[5]	.0397[5]	.0432[5]	.0434[5]	.0293[5]	.0297[5]	.0301[5]
	(.0120)	(.0157)	(.0131)	(.0153)	(.0155)	(.0122)	(.0134)	(.0138)	(.0114)	(.0118)	(.0124)
Total	**.0813**	**.0967**	**.0749**	**.0894**	**.0894**	**.0622**	**.0731**	**.0725**	**.0502**	**.0580**	**.0578**
	(.0060)	**(.0071)**	**(.0059)**	**(.0070)**	**(.0071)**	**(.0053)**	**(.0061)**	**(.0061)**	**(.0048)**	**(.0054)**	**(.0054)**

Note: Standard errors are given in brackets

Table 8: P_0 by socio-economic groups under different adult equivalence scales and units of analysis

Socio-economic group		ES1		ES2			ES3			ES4		
		hhs	inds/einds	hhs	inds	einds	hhs	inds	einds	hhs	inds	einds
Gender	M	.4136(.023)	.4744(.0255)	.3846(.0223)	.4436(.0248)	.4434(.0249)	.3443(.023)	.3992(.0258)	.3969(.0259)	.3228(.0228)	.3759(.0258)	.3733(.0259)
	F	.4553(.0218)	.5071(.0248)	.4537(.0214)	.5102(.024)	.507(.024)	4003(.0216)	.4461(.0252)	.4411(.025)	.3564(.0216)	.3958(.0261)	.3887(.0258)
marriage	M	.4397(.0241)	.4892(.0257)	.4159(.0241)	.4644(.0255)	.4648(.0257)	.3669(.0248)	.4133(.0264)	.4118(.0266)	.343(.0246)	.3885(.0265)	.3872(.0266)
	S	.4193(.0204)	.4816(.0248)	.4103(.0192)	.4753(.0234)	.471(.0233)	.3665(.0193)	.4203(.0248)	.4141(.0243)	.3273(.0194)	.3725(.0258)	.3638(.0251)
religion	O	.443(.0195)	.5019(.0224)	.4314(.019)	.4899(.0217)	.4885(.0218)	.3832(.0203)	.4373(.023)	.4341(.0231)	.3485(.0199)	.399(.0236)	.3944(.0236)
	N	.3861(.0334)	.4342(.0349)	.3498(.0319)	.3975(.034)	.3949(.0334)	.3102(.034)	.3464(.0383)	.3414(.0374)	.2937(.0347)	.3291(.0397)	.3237(.0381)
Employment	F	.3156(.0261)	.3743(.0284)	.2997(.025)	.3524(.0276)	.3501(.0273)	.2467(.0245)	.2938(.0268)	.2907(.0266)	.2175(.024)	.2621(.0274)	.2568(.0268)
	I	.5221(.0226)	.5692(.0257)	.5035(.0217)	.5519(.0242)	.5507(.0244)	.4569(.02181)	.4992(.0256)	.4965(.0255)	.4172(.0249)	.4617(.0296)	.4584(.0305)
	P	.4138(.0314)	.4735(.0383)	.3892(.0305)	.4547(.0392)	.456(.039)	.3547(.0343)	.4196(.0436)	.4173(.0431)	.3448(.0312)	.4033(.0392)	.3985(.038)
	U	.4499(.0301)	.5135(.0353)	.4377(.029)	.5011(.0331)	.4991(.0336)	.3936(.0328)	.448(.0379)	.4435(.0379)	.3594(.0294)	.4062(.0389)	.4012(.0384)
Education	H	.228(.0273)	.2616(.0338)	.1978(.0264)	.2273(.0322)	.2279(.0321)	.1703(.0248)	.1982(.0297)	.1975(.0295)	.1511(.0249)	.1792(.0305)	.1778(.0302)
	S	.4398(.027)	.5035(.0273)	.4191(.0286)	.4832(.0292)	.4814(.0291)	.3693(.0272)	.4284(.0283)	.424(.0282)	.334(.0238)	.3905(.0253)	.3851(.0254)
	N	.554(.0261)	.6056(.0278)	.5469(.0247)	.5998(.026)	.5985(.0262)	.493(.0256)	.5366(.028)	.5342(.0282)	.4554(.026)	.4926(.0286)	.4878(.0288)

Note: Standard errors are given in brackets

***** For gender *m* and *f* respectively denote male and female, for marriage *m* and *s* respectively denote married and single, for religion *o* and *n* denote Orthodox Christian and non-orthodox Christian, for employment *f*, *i*, *p* and *u* respectively denote formal , informal, pensioner and unemployed and for education *h*, *s* and *n* respectively denote high school, some formal and no formal education.

The effect on P_1 is similar and is given in appendix D, Table 13. While movement from *ES1* towards *ES4* and from households to individuals as units of analysis makes P_1 higher for all groups, movement from individuals to equivalent individuals makes P_1 higher in some cases and lower in others though the effect is not big. As is the case for P_0, Orthodox Christians have higher poverty in all cases. The rank for the three groups based on education of heads does not change. Households with married heads are also poorer in all cases which is not the case for P_0. Interestingly enough, there is also rank reversal between pensioners and unemployed heads as well as between male and female headed households.

We observe similar result for P_2. Like for P_0 and P_1, there is no big difference between male headed and female headed households. When households are used as units of analysis female headed households are slightly poorer than male headed households for all equivalence scales. The opposite is true when we use individuals/equivalent individuals as units of analysis. In all cases, households with married and orthodox heads are poorer. In terms of type of employment, the rank of P_2 for the four types of employment are the same as for P_1 except for *ES2* with individuals and equivalent individuals as units of analysis in which case the ranks of pensioners and unemployed are reversed. The rank based on educational level of heads does not change with equivalence scale and units of analysis as is the case for P_0 and P_1. For the detailed result see Table 14 in appendix D.

Statistical test for the difference in the three poverty indices across pairs of socio-economic groups was also made. The result reveals that for some pairs there is change in statistical significance of the difference as we change the equivalence scale and unit of analysis. For P_0, the difference between male and female headed households is significantly different from zero when *ES2* and *ES3* are used (but, for *ES3* the difference is significant only at 10% when households are used as units of analysis). For *ES1* and *ES2*, the difference is insignificant irrespective of the unit of analysis used. There is no significance difference in P_1 and P_2 under all cases (equivalence scales and units of analysis). The difference between married and single heads is insignificant in all cases for the three poverty indices (even at 10% level of significance). The difference between groups based on educational level of heads is on the other hand significant in all cases. The difference between Orthodox Christians and non-orthodox Christians is also not significant for P_1 and P_2 under all equivalence scales and units of analysis. For P_0, the difference is significant when *ES2* and *ES3* are used (but, for *ES3* the difference is significant only at 10% when households are used as units of analysis). For *ES1* and *ES2*, the difference is insignificant irrespective of the unit of analysis used. When it comes to the difference in poverty measures between the pairs of groups based on employment type some changes are observed as shown in Table 9 below.

Table 9: Test of Equality of the three poverty indices across groups based on employment type of heads

	Households as units of analysis			Individuals as units of analysis			Equivalent Individuals analysis		
	Formal	**Informal**	**Pensioner**	**Formal**	**Informal**	**Pensioner**	**Formal**	**Informal**	**Pensioner**
P_0									
Informal	(3,3,3,3)			(3,3,3,3)			(3,3,3,3)		
Pensioner	(2,3,3,2)	(3,3,1,2)		(2,2,3,2)	(2,2,0,0)		(2,2,3,2)	(2,2,0,0)	
Unemployed	(3,3,3,3)	(1,1,0,0)	(0,0,0,0)	(3,3,3,3)	(0,0,0,0)	(0,0,0,0)	(3,3,3,3)	(0,0,0,0)	(0,0,0,0)
P_1									
Informal	(3,3,3,3)			(3,3,3,3)			(3,3,3,3)		
Pensioner	(2,2,3,2)	(3,2,0,2)		(2,2,3,2)	(1,0,0,0)		(2,2,3,2)	(1,0,0,0)	
Unemployed	(3,3,3,3)	(1,1,0,0)	(0,0,0,0)	(3,3,3,3)	(0,0,0,0)	(0,0,0,0)	(3,3,3,3)	(0,0,0,0)	(0,0,0,0)
P_2									
Informal	(3,3,3,3)			(3,3,3,3)			(3,2,3,3)		
Pensioner	(2,2,3,2)	(2,2,1,2)		(2,2,3,2)	(0,0,0,0)		(2,2,3,2)	(0,0,0,0)	
Unemployed	(3,3,3,3)	(0,0,0,0)	(0,0,0,0)	(2,2,3,2)	(0,0,0,0)	(0,0,0,0)	(2,2,3,2)	(0,0,0,0)	(0,0,0,0)

Note: the statistical significances of the difference of poverty between all pairs of employment types of household heads using ES1, ES2, ES3 and ES4 is given in order where numbers 1, 2 and 3 are associated with significance levels at 10%, 5% and 1% respectively while 0 implies that the difference is not significant at all.

7. Conclusion

The paper studies the effect of the choice of equivalence scale and unit of analysis on poverty measures using data from urban Ethiopia collected in 2004 by Addis Ababa University. The sample includes about 1500 households drawn from seven major urban centers including the capital, Addis Ababa. Consumption was used as a measure of poverty and an absolute poverty line based on the minimum calorie intake with a corresponding allowance for non-food expenditure was used. Adjustment for regional price variations was made using difference in poverty lines as proxy for difference in cost of life.

Four different types of equivalence scales were considered following similar studies in Ethiopia along with three different units of analysis (method of weighting). The three commonly used *FGT* indices namely P_0, P_1 and P_2 were computed for the whole sample, for the seven urban centers and different socio-economic groups. The effect on the overall poverty of the choice of equivalence scale and unity of analysis is important. As we change the equivalence scale, poverty changes significantly under the three units of analysis. Similarly, changing the unit of analysis from households to individuals/equivalent individuals increases poverty under all equivalence scales implying that poverty increase with household size. Choice between individuals and equivalent individuals as units of analysis does not affect the poverty levels much.

There is also similar effect on regional poverty levels and the magnitude of the effect varies across regions. Different regions are affected differently when we change the method of equivalence scale and the unit of analysis. As a result, reversal of rank among some regions was observed. Of the three indices, P_0 was found to be very sensitive relative to P_1 and P_2. Given that P_1 and P_2 are believed to be better measures of poverty, this could be considered as good news. But, it is also worth noting that governmental offices and international organizations heavily depend on P_0 and hardly report P_1 and P_2. The effect on the different socio-economic groups is similar except that the poverty measures are more sensitive at least for some socio-economic groups.

With regard to equivalence scales, the findings in this paper add to the available evidence from other studies that poverty measures are not insensitive to the choice of equivalence scales. Thus, poverty researchers should try to get the appropriate equivalence scale taking in to account the particular settings of the data they use and the assumption they make about other measurement issues like on the dimension of poverty and the way the poverty line is set. Needless to say, getting an appropriate equivalence scale is not easy, but this is not reason enough to totally disregard the

issue of equivalence scale. It is also imperative to consider more than one type of equivalence scale as a robustness check.

This study also found that for a given equivalence scale, the choice of unit of analysis matters even though most (if not all) poverty studies do not mention what unit of analysis they use and if they do they do not sufficiently motivate their choices. Taking households as units of analysis consistently underestimates poverty compared to individuals and equivalent individuals while there is no big difference whether individuals or equivalent individuals are used. Thus, using households as units of analysis which does not also have strong theoretical support is not recommended as it may give misleading results. More empirical studies are required to check if the choice between individuals and equivalent individuals do not matter as is found in this paper. When there is difference between the two the choice should be motivated in consideration of theory and policy implications. The theoretical works in inequality studies could be useful in this regard.

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Appendix A

Table 10: Calorie based equivalence scales

age	≤1	(1, 2]	(2, 3]	(3, 5]	(5, 7]	(7, 10]	(10, 12]	(12,14]	(14,16]	(16, 18]	(18, 30]	(30, 60]	>60
male	.33	.46	.54	.62	.74	.84	.88	.96	1.06	1.14	1.04	1	.84
famale	.33	.46	.54	.62	.70	.72	.78	.84	.86	.86	.80	.82	.74

Source: Dercon and Krishnan (1998)

Appendix B

Table 11: Summary of household composition, equivalence scales and monthly equivalized consumptions by socio-economic groups

Variable	*Gender*		*Marital Status*		*Religion*		*Employment*				*Education*			*Total*
	Male	*Female*	*Married*	*Single*	*Orthodox*	*Other*	*Formal*	*Informal*	*Pensioner*	*Unemployed*	*High school*	*Some Formal*	*No formal*	
Adults	4.63(2.17)	3.78(1.95)	4.75(2.11)	3.68(1.97)	4.31(2.13)	4.06(2.03)	4.15(1.96)	4.08(2.06)	5.04(2.32)	4.17(2.13)	4.07(2.01)	4.35(2.20)	4.43(2.13)	4.24(2.12)
Children	1.48(1.39)	1.22(1.22)	1.62(1.37)	1.08(1.22)	1.28(1.27)	1.68(1.49)	1.55(1.32)	1.57(1.46)	.99(1.06)	1.18(1.24)	1.29(1.23)	1.55(1.43)	1.30(1.30)	1.36(1.32)
ES1	6.11(2.62)	5.00(2.47)	6.37(2.44)	4.76(2.54)	5.59(2.59)	5.74(2.67)	5.69(2.41)	5.65(2.60)	6.03(2.69)	5.35(2.74)	5.37(2.38)	5.89(2.69)	5.73(2.71)	5.60(2.62)
ES2	5.91(2.57)	4.84(2.40)	6.14(2.41)	4.63(2.46)	5.43(2.54)	5.49(2.56)	5.50(2.34)	5.45(2.52)	5.90(2.68)	5.19(2.66)	5.20(2.33)	5.71(2.62)	5.55(2.65)	5.42(2.55)
ES3	5.39(2.23)	4.45(2.10)	5.59(2.09)	4.26(2.15)	4.96(2.22)	5.01(2.23)	5.03(2.04)	4.98(2.19)	5.38(2.33)	4.75(2.33)	4.77(2.04)	5.20(2.28)	5.06(2.31)	4.95(2.22)
ES4	4.91(2.01)	4.05(1.88)	5.08(1.89)	3.90(1.93)	4.54(2.00)	4.50(1.97)	4.52(1.83)	4.47(1.95)	5.06(2.14)	4.37(2.08)	4.35(1.85)	4.69(2.06)	4.66(2.05)	4.52(2.00)
Consumption per *ES1*	168.88 (187.65)	150.29 (155.48)	152.15(17 5.52)	170.50(17 1.84)	158.12 (175.97)	168.81 (164.87)	190.52 (188.13)	143.67(17 9.76)	153.03 (147.56)	153.29 (163.01)	229.93 (234.84)	146.18 (138.17)	123.84 (120.57)	160.43 (173.50)
Consumption per *ES2*	173.68 (187.65)	155.59 (166.39)	158.03 (178.95)	174.61 (179.81)	162.51 (180.09)	176.16 (175.53)	195.33 (188.00)	148.47 (182.58)	156.99 (150.22)	159.46 (178.74)	235.47 (236.37)	150.67 (143.38)	129.02 (127.88)	165.41 (178.94)
Consumption per *ES3*	187.22 (201.26)	165.87 (172.49)	171.26 (190.86)	185.37 (186.32)	174.37 (190.24)	188.96 (181.63)	209.95 (198.43)	159.36 (193.74)	169.38 (159.56)	170.26 (184.78)	252.37 (250.35)	162.27 (151.33)	138.59 (134.12)	177.45 (188.37)
Consumption per *ES4*	202.62 (210.81)	179.69 (187.43)	187.36 (202.89)	198.53 (197.76)	188.52 (204.93)	205.65(18 1.04)	229.88 (213.00)	175.22 (204.65)	176.62 (160.34)	182.69 (198.38)	273.29 (260.66)	178.94 (173.39)	146.81 (134.14)	192.12 (200.07)
Sample size	**793**	**640**	**755**	**666**	**1224**	**304**	**378**	**430**	**203**	**409**	**364**	**486**	**425**	**1452**

Note: Standard deviations are given in brackets

Appendix C

Table 12: Test of Equality of P_2 between regions based on different ESs and units of analysis

	Addis Ababa	Awassa	Bahir Dar	Dessie	Dire Dawa	Jimma
Households as units of analysis						
Awassa	(3,3,3,3)					
Bahir Dar	(3,3,3,3)	(0,0,0,0)				
Dessie	(0,0,0,0)	(2,2,2,1)	(3,2,2,2)			
Dire Dawa	(3,3,3,3)	(3,3,3,3)	(3,3,3,3)	(0,0,0,0)		
Jimma	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	
Mekelle	(1,1,0,0)	(0,0,0,0)	(0,0,0,0)	(2,1,1,1)	(3,3,3,3)	(0,0,0,0)
Individuals as units of analysis						
Awassa	(3,3,3,3)					
Bahir Dar	(3,3,3,3)	(0,3,0,0)				
Dessie	(0,0,0,0)	(2,2,2,1)	(3,2,2,2)			
Dire Dawa	(3,3,3,3)	(3,3,3,3)	(3,3,3,3)	(1,1,1,1)		
Jimma	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(3,3,3,3)	
Mekelle	(1,2,1,2)	(0,0,0,0)	(0,0,0,0)	(1,1,1,1)	(3,3,3,3)	(0,0,0,0)
Equivalent individuals as units of analysis						
Awassa	(3,3,3,3)					
Bahir Dar	(3,3,3,3)	(0,0,0,0)				
Dessie	(0,0, 0,0)	(2,2,2,1)	(3,2,2,2)			
Dire Dawa	(3,3,3,3)	(3,3,3,3)	(3,3,3,3)	(1,2,1,0)		
Jimma	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(0,0,0,0)	(3,3,3,3)	
Mekelle	(1,2,1,1)	(0,0,0,0)	(0,0,0,0)	(1,1,1,1)	(3,3,3,3)	(0,0,0,0)

Note: the statistical significances of the difference of poverty between all pairs of urban centres using ES1, ES2,

ES3 and ES4 is given in order where numbers 1, 2 and 3 are associated with signficance levels at 10%,

5% and 1% respectively while 0 implies that the difference is not significant at all.

Appendix D

Table 13: P_1 by socio-economic groups under different adult equivalence scales and units of analysis

Socio* economic group		ES1		ES2			ES3			ES4		
		hhs	inds/einds	hhs	inds	einds	hhs	inds	einds	hhs	inds	einds
gender	M	.1561(.0125)	.1877(.0147)	.1465(.0124)	.1776(.0147)	.178(.0148)	.1259(.023)	.1528(.0138)	.1519(.0138)	.1058(.011)	.1284(.0131)	.1281(.0131)
	F	.1715(.0104)	.1949(.0122)	.16(.0101)	.1821(.0118)	.1808(.012)	.1384(.0095)	.1546(.0108)	.1527(.0109)	.1138(.0088)	.1243(.0096)	.1228(.0096)
marriage	M	..1678(.0136)	.1945(.015)	.1572(.0134)	.1837(.0149)	.1843(.0151)	.1348(.0125)	.1577(.0140)	.157(.0141)	1125(.0116)	.1319(.0132)	.1322(.0132)
	S	.1551(.0090)	.1819(.0115)	.1449(.0088)	.1698(.011)	.1682(.0111)	.1255(.0081)	.1442(.0099)	.142(.0099)	.1039(.0078)	.1162(.009)	.1142(.0089)
religion	O	.1667(.0103)	.1966(.012)	.1569(.0102)	.186(.0118)	.1858(.012)	.1349(.0095)	.1588(.0109)	.1575(.011)	.1123(.009)	.1314(.0102)	.1305(.0103)
	N	.1479(.0175)	.1692(.0222)	.1351(.0165)	.1559(.0213)	.1547(.021)	.1179(.0154)	.1348(.0201)	.133(.0196)	.0981(.0137)	.1103(.018)	.1095(.0174)
Employment	F	.107(.0114)	.1327(.0139)	.0976(.0108)	.122(.0133)	.1218(.0133)	.0815(.0098)	.1024(.0123)	.1014(.0122)	.062(.0087)	.079(.0113)	.0777(.0112)
	I	.2073(.0117)	.2347(.0141)	.1937(.0119)	.2201(.0143)	.2201(.0145)	.1685(.0114)	.1904(.0137)	.1897(.0137)	.1371(.0117)	.1542(.0138)	.1552(.0138)
	P	.1527(.0166)	.1902(.0222)	.1463(.0166)	.1849(.0217)	.1851(.0216)	.1256(.0153)	.1586(.02)	.1569(.0197)	.1126(.0142)	.1411(.0188)	.1384(.0185)
	U	.1733(.0143)	.1992(.0205)	.1631(.0141)	.1878(.0201)	.1869(.004)	.1417(.013)	.1603(.0185)	.1584(.0185)	.1227(.0118)	.1356(.0166)	.1342(.0163)
Education	H	.0681(.0107)	.081(.0136)	.0625(.0101)	.0749(.0129)	.075(.0128)	.0518(.009)	.0613(.0114)	.0607(.0112)	.0405(.0077)	.0478(.0099)	.0466(.0095)
	S	.159(.0119)	.1938(.0134)	.1481(.0114)	.1819(.0131)	.1818(.0133))	.1254(.0103)	.1542(.0122)	.1527(.0122)	.0996(.0095)	.1235(.0116)	.1232(.0117)
	N	.2274(.0136)	.2518(.0148)	.2142(.0135)	.2382(.0144)	.2384(.0147)	.1879(.0126)	.2066(.0134)	.206(.0135)	.1615(.0114)	.1753(.0122)	.1747(.0125)

Note: Standard errors are given in brackets

* For gender *m* and *f* respectively denote male and female, for marriage *m* and *s* respectively denote married and single, for religion *o* and *n* denote orthodox Christian and non-orthodox Christian, for employment *f*, *i*, *p* and *u* respectively denote formal , informal, pensioner and unemployed and for education *h*, *s* and *n* respectively denote high school, some formal and no formal education.

Appendix E

Table 14: P_2 by socio-economic groups under different equivalence scales and units of analysis

Socio* economic group		ES1		ES2			ES3			ES4		
		Hhs	inds/einds	hhs	inds	einds	hhs	inds	einds	hhs	inds	einds
gender	M	.0791(.008)	.0971(.0095)	.0734(.0078)	.0907(.0094)	.0911(.0095)	.0603(.007)	.074(.0084)	.0737(.0083)	.0489(.0062)	.0595(.0074)	.0596(.0073)
	F	.0846(.0065))	.0959(.0073)	.0772(.0064)	.0875(.0071)	.0868(.0072)	.0649(.006)	.0715(.0062)	.0706(.0063)	.052(.0055)	.0553(.0053)	.0547(.0053)
marriage	M	.0849(.0084)	.1005(.0096)	.0782(.0082)	.0935(.0094)	.094(.0096)	.0641(.0072)	.0763(.0084)	.076(.0084)	.0514(.0064)	.0612(.0074)	.0614(.0074)
	S	.0766(.0057)	.0889(.0066)	.0704(.0057)	.0813(.0063)	.0805(.0064)	.0593(.0054)	.0664(.0054)	.0653(.0055)	.0481(.0052)	.0513(.0047)	.0507(.0047)
religion	O	.0825(.0063)	.0987(.0072)	.0767(.0063)	.0921(.0071)	.0921(.0073)	.0634(.0057)	.075(.0062)	.0744(.0063)	.0512(.0051)	.0596(.0055)	.0593(.0055)
	N	.078(.011)	.0895(.0148)	.0695(.0102)	.0801(.0138)	.0797(.0136)	.0587(.0092)	.0663(.0123)	.0657(.012)	.0471(.0079)	.0518(.0104)	.0517(.0101)
Employment	F	.0496(.0065)	.0634(.0085)	.0447(.0062)	.0577(.0082)	.0578(.0082)	.0356(.0054)	.046(.0073)	.0455(.0072)	.0256(.0047)	.0333(.0064)	.0328(.0063)
	I	.1055(.0078)	.1215(.0095)	.0966(.008)	.1117(.0096)	.112(.0097)	.0807(.0074)	.0923(.0088)	.0922(.0088)	.0633(.0071)	.0719(.0082)	.0726(.0082)
	P	.0756(.0101)	.0985(.0139)	.0712(.0099)	.094(.0133)	.0941(.0134)	.058(.0086)	.0761(.0115)	.0754(.0115)	.05(.0076)	.065(.0104)	.0638(.0103)
	U	.0895(.0086)	.1011(.0127)	.083(.0083)	.0937(.0121)	.0931(.0123)	.0704(.0074)	.0767(.0103)	.0757(.0103)	.0599(.0069)	.0627(.0086)	.0623(.0085)
Education	H	.0302(.0058)	.0365(.0077)	.0279(.0055)	.0336(.0072)	.0335(.0071)	.0223(.0048)	.0264(.0062)	.026(.006)	.017(.004)	.0199(.0052)	.0191(.0049)
	S	.076(.0066)	.0965(.0083)	.0691(.0063)	.0887(.0081)	.0889(.0082)	.0556(.0055)	.0711(.0072)	.0706(.0072)	.0418(.0049)	.0541(.0064)	.0542(.0065)
	N	.1195(.0089)	.1315(.0095)	.1111(.0089)	.1226(.0092)	.1229(.0094)	.0942(.0082)	.1016(.0082)	.1015(.0083)	.0786(.0077)	.0828(.0074)	.0829(.0075)

Note: Standard errors are given in brackets

* For gender *m* and *f* respectively denote male and female, for marriage *m* and *s* respectively denote married and single, for religion *o* and *n* denote orthodox Christian and non-orthodox Christian, for employment *f*, *i*, *p* and *u* respectively denote formal , informal, pensioner and unemployed and for education *h*, *s* and *n* respectively denote high school, some formal and no formal education.

REMITTANCES AND HOUSEHOLD WELFARE: LONGITUDINAL EVIDENCE FROM URBAN ETHIOPIA

Bizuayehu Getachew[1]

Abstract

Two views are raised on the impact of remittances at the household level. The first view contends that remittances directly augment the income of recipient households and provide financial resources, increased household investments in education, entrepreneurship, and health. However, the second view states that remittances might have negative incentive effect which results in an increased in reservation wage and reduction in labor supply. This study examined the impact of remittances on household welfare, selectivity bias with regards to migration and remittances, and how households allocate the remittances they received from different sources.

Using the Ethiopian Urban Socio-Economic Survey, descriptive and econometric methodologies are adopted. The main findings include: the amount of receipt from domestic and international sources increased during the study period, remittances are primarily used for consumption followed by expenditure for schooling. It is found that there is no selectivity bias with regards to migration and recipient of remittances. The result also confirmed that the predicted per capita annual expenditure of remittance recipient households is higher than households that do not receive remittance in both the including remittances and no remittance scenarios. Finally, panel data model is estimated and the result materializes the welfare improving impact of remittances on the welfare of recipient households.

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1. Introduction

In the context of developing countries people migrate from rural to urban areas and to other developed countries looking for better economic opportunities for them and for their families. The United Nations estimates that migrants account for some 3 percent of the world's population, or about 175 million persons. The stock of immigrants to high income countries increased at about 3 percent per year from 1980 to 2000, up from the 2.4 percent pace in the 1970s (Global Economic Prospects, 2006).

Both internal and international migrants are the source of finance for families back home in the developing world. For many developing economies, international remittances constitute the single largest source of foreign exchange, exceeding export revenues, FDI, and other private capital inflows (World Economic Outlook, 2005). Over the past decade they have emerged as the second largest source of net financial flows to developing countries. The total volume of remittances to developing countries in 2001 was $72.3 billion, nearly one and half times net ODA in that year ($52 billion) and almost half net private flows (FDI plus debt flows) of nearly $153 billion(Kapur, 2004). Total remittance inflows grew five-fold between 1980 and 2003 to reach $91 billion, or 1.6 percent of developing countries' GDP—an amount not far short of total inward FDI, and larger than all other private capital inflows (world economic outlook, 2005:72). In 2006, recorded remittances sent home by migrants from developing countries reached $206 billion, up from $193 billion in 2005 and more than double 2001's level (Ratha, 2007).

According to Global Economic Prospectus (2006), recorded remittance receipts were equivalent to about 6.7 percent of developing countries' imports and 7.5 percent of their domestic investment. They were also larger than official flows and private equity (non-FDI) flows in 2004.

At a regional level, the Western Hemisphere and developing Asia in particular have experienced a major increase in remittance inflows, and currently account for the bulk of total remittance receipts (World economic outlook, 2005). Among developing countries, China, India, Mexico, and the Philippines were among the top recipients (Global Economic Prospects, 2006).

The inflow of remittance to Sub-Saharan Africa (SSA) has been part of the increasing global trend. Remittances to SSA have increased by over 55 percent in U.S. dollar terms since 2000, while they increased for developing countries as a group by 81 percent. However, the recorded remittances are only a small fraction of total remittances to SSA. In 2005, remittances to the 34 SSA countries were

estimated to be about US $6.5 billion. Remittance flows to SSA are relatively small, 4 percent of total remittances to developing countries and just 33 percent of those to India, which received the most. In contrast, countries in Latin America and the Caribbean received 25 percent of all remittances, as did the countries of the East Asia and Pacific region (Gupta et al., 2007).

Gupta et al. (2007) also states that remittances to SSA are about 2.5 percent of GDP compared to almost 5 percent for other developing countries. However, there are striking exceptions in SSA. In particular, remittances were almost 28 percent of GDP in Lesotho, and more than 5 percent in Cape Verde, Guinea-Bissau, and Senegal. The largest recipients of remittances in the region are Kenya, Nigeria, and Senegal.

In Ethiopia people relocate their residence from rural to urban areas looking for better living conditions like better wage and facilities in towns and cities. International migration in the Ethiopian context is increasing starting from the late 1970's, which is the result of the political instability at that time. Nowadays, so many Ethiopians, skilled and unskilled, cross border to different countries legally and illegally looking for better economic opportunities. The main destinations for Ethiopians are North America, Europe, and the Middle East (Aredo, 2005).

The inflow of international remittances to Ethiopia exhibits an increasing trend. According to the data from National Bank of Ethiopia, the amounts of remittances recorded in 1996/97 were around 855 million Ethiopian Birr. This figure increased to 9.3 billion Ethiopian Birr in 2006/07 fiscal year. This figure only shows the official transfer. However, there is unofficial transfer that may increase the figure by more than double.

There are different views about the impact of remittances on a given economy at micro and macro level. At the household level remittances directly augment the income of recipient households. Ratha (2007) states that in addition to providing financial resources for poor households, they affect poverty and welfare through indirect multiplier effects. Remittances are associated with increased household investments in education, entrepreneurship, and health—all of which have a high social return in most circumstances. Studies based on household surveys in El Salvador and Sri Lanka find that children of remittance-receiving households have a lower school dropout ratio and that these households spend more on private tuition for their children. In Sri Lanka, the children in remittance-receiving households have higher birth weight, reflecting that remittances enable households to afford better health care. Several studies also show that remittances provide capital to small entrepreneurs, reduce credit constraints, and increase entrepreneurship.

The positive effects of remittances at the household level are clear, although not always undisputed. Unlike government to government aid, most remittances go directly to the family budget and are often used for basic subsistence needs and better housing. They thus contribute to family welfare and higher levels of living. Increased expenditure on food and housing and rising levels of living, combined with better knowledge on health and hygiene, often lead to improved productivity and development of human capital, as was found for example in Pakistan and the Pacific Islands (Ghosh,2006).

Unlike foreign aid, remittance flows do not put any burden on taxpayers in rich countries. Nonetheless, they occur only to the extent that emigrants from poor countries can work in richer countries. The critical difference between foreign aid and remittances is that the former consists of transfers from public entities in the donor country to public agencies in receiving countries and even when it is directed to civil society actors such as NGOs, it goes to organized entities. Remittances of course, simply go directly to households and in that sense their immediate poverty alleviation impact, through increased consumption, can be greater than traditional foreign aid, depending on the income characteristics of the receiving household. The transaction costs are lower and there is less leakage to rent seeking bureaucracies and consultants (Kapur, 2004).

However, remittances are not an unmixed blessing; they also have their downside. The positive effects of remittances on household welfare and foreign exchange can be somewhat neutralized when remittances lead to ostentatious consumption in remittance-receiving households, and encourage imports of luxury goods adding to pressure on the country's import bill (Ghosh, 2006). In communities heavily dependent on remittances, a culture of dependency often sets in. In a variety of contexts it has been observed that household members simply stop working and wait from month to month for the overseas remittance. Such negative incentive effects, a form of moral hazard, also results in an increase in the reservation wage. Young men and women prefer to remain unemployed and wait for the possibility that they themselves will migrate, rather than take up jobs at the local market-clearing wage. That remittances increase consumption much faster than production, raises issues of long-term sustainability, given an inevitable decline as migrants settle in new communities and links with their home communities gradually erode (Kapur, 2004).

There are also important costs associated with the act of migrating if it possible that migrants do not come from the lowest quintiles of the income distribution and therefore remittances do not flow towards the poorest (Acosta et al., 2007).

Therefore, this study tries to answer the following research questions. How households allocate the remittances they received from their family members? What is the impact of internal and international remittances on household's welfare in the context of urban Ethiopia? To what extent remittances improve the wellbeing of the poor in urban Ethiopia? To identify which group of households receives remittance and to check whether there is selectivity biases with regards to migration and recipient of remittances.

2. Literature review

2.1 Conceptual framework

Migrant remittances are defined broadly as the monetary transfers that a migrant makes to the country of origin, i.e., financial flows associated with migration. Most of the time, remittances are personal, cash transfers from a migrant worker or immigrant to relatives in the country of origin. They can also be funds invested, deposited or donated by the migrant to the country of origin. The definition could possibly be altered to include in-kind personal transfers and donations. Some scholars go further to include transfers of skills and technology as well as social remittances (Baruah, 2006).

There are different microeconomic theories of remittance that justifies the motivation to remit by migrants to families back home. These include altruism, insurance/risk sharing, portfolio/investment, strategic behavior, exchange and self interest.

Migrants can be seen as acting altruistically, sending money and other forms of support to increase the welfare of family members: spouse, children, parents and members of large kinship and social circles (Vanwey, 2004).

According to Rapoport and Docquier (2006) the altruism motive to remit shows us that the amount of transfer increases with the migrant's income and the degree of altruism of the migrant, and it is negatively related to the household's income and the degree of altruism of the household. Another prediction of the altruism model is that an increase in the income of the migrant, coupled with a one dollar drop in the recipient's income, should raise the amount transferred exactly by one dollar. The implication of this hypothesis is that the distribution of consumption should be independent of the distribution of income.

The existence of uncertainty in third world countries like Ethiopia forced migrants and families back home to enter in to informal coinsurance arrangement. Families living abroad and in towns and cities would ensure their families against drops in incomes

with the exact terms of insurance depend on the bargaining power of the families and the migrant.

As Rapoport and Docquier (2006) stated this arrangement achieved because a sufficient degree of altruism prevails within the family, that is, families detain reliable information on individual types and may be good in selecting the right migrant. If a migrant fail to remit families use retaliation strategies to enforce him/her. Default to remit may be sanctioned by denying the migrant rights to future family solidarity, inheritance, or return to the village for retirement. Therefore, the insurance motive to remit predicts that remittances are positively related to period one income and the probability of the bad state and negatively related to second period income.

The exchange motive to remit is sending money for families who provide service for the migrants. The range of services provided by families includes taking care of migrant's assets like land or relatives, most of the time children. Another way of exchange may be where remittance is a repayment of loans used to finance the migrant's education or cost incurred in the course of migration. The amount transferred depends on the market price of the service and the opportunity cost of the families who provide the service.

Cox (1987) and Rapoport and Docquier (2006) stated that the amount of remittance increases with the quantity of service provided but ambiguously reacts to the change in the household's pre transfer income. The main prediction of this motive unlike the altruistic motive is that an increase in the recipient's income may raise the amount transferred.

Another self interest to remit is to invest in assets in their home area and the migrant wants to be part of the family inheritance. Migrants prefer to invest in their home area because of the existence of careful selection and purchase of assets by families and even families are trust worthy in maintaining the assets. This implies the larger is the remittance the large will be the inheritance. Generally, if the migrant sends remittances to invest in inheritance, she will send more when the parent's income and assets are higher if she is not too risk averse. She will also transfer more if the probability of inheritance is higher, and if she is richer, wealthier, and less risk averse (B. de la Baière et al., 2002).

The strategic motive is specific to the context of migration since remittances may be both the cause and the consequence of migration. This allows us to treat those two interdependent decisions in an encompassing framework. Among the various approaches stated above it is suggested that remittances may be the outcome and

part of strategic interaction aiming at positive selection among migrants. Rapoport and Docquier(2006) justifies that when migrants are heterogeneous in skills and individual productivity is not perfectly observable on the labor market of the host country, employers apply statistical discrimination so that migrant workers are paid the average productivity of the minority group to which they belong. In such a context, there is a room for cooperative arrangements between skilled and unskilled migrants: the former can act cohesively and "bribe" the latter in order to maintain them home; in addition, the community of those left behind must also control potential free riders.

2.2 Empirical review of literature

There is a proposition that remittances from migrants to households reduce poverty. This proposition is examined by different authors using data from different countries. One of the studies by Gupta et al. (2007*)* confirm that a 10 percent rise in the remittances- to-GDP ratio is associated with a fall of a little more than 1 percent in the percentage of people living on less than $1 a day. Further, they find that even taking into account the impact of poverty on remittances, in a model in which both poverty and remittances are simultaneously and endogenously determined, the poverty-reducing effect of remittances remains.

A study by Fajnzylber and López (2007) from 11 Latin American countries find that the average estimated impact of remittances on poverty headcounts is such that a 1 percentage point increase in the remittances to GDP ratio reduces moderate and extreme poverty by respectively 0.37 percent and 0.29 percent. On the other hand, a study by Adams and Page (2005) shows that remittances reduce the level, depth, and severity of poverty in LDCs. Similarly, a paper by Adams (2004) using data from a survey of 7276 households in urban and rural Guatemala finds that the receipt of international remittances reduces the poverty headcount index by 1.6 percent and the more sensitive poverty gap index by 12.6 percent. Generally, the studies revised here confirm the poverty reducing effect of remittances even if the magnitude varies among countries.

Remittances may increase or decrease income inequality based on the situation of a given country or region. Contradicting empirical findings are there on the impact of remittances on inequality. A paper by Barham and Boucher (1998) in Bluefield's, Nicaragua confirm that when the observed income distribution is compared with two no-migration counterfactuals, where migration and remittances are treated as a substitute for home earnings, income inequality was found to be lower in the no-migration counterfactuals. In other words, the potential home earnings of migrants in Bluefield's have a more equalizing effect than do remittances on income distribution.

However, Jones (1998) in his study in Mexico argued that two factors help to explain the divergence of views on labor migration and inequality: a place's stage of migration and the geographic scale (interregional, interurban, rural-urban, and interfamilial) at which inequalities are measured. With regard to stage of migration, evidence from central Zacatecas, Mexico, supports the proposition that interfamilial inequalities decrease with migration experience up to a point, after which they increase. With regard to geographic scale, he found that at family scale, better-off families improve their status at the expense of poorer families, with advanced stages of U.S. migration. At the rural-urban scale, by contrast, advanced stages of migration result in rural places improving their income position vis-à-vis in urban places.

In contrary to the above findings, another study in Egypt by Adams (1989) shows that the remittance earnings of migrants from abroad had a negative impact on rural income distribution. The data indicate that remittances from abroad worsened rural household income distribution- both in gross terms and in per capita terms because they were earned mainly by upper income villagers.

However, a study by Acosta et al. (2007) using household surveys data for 10 Latin American and Caribbean countries stated cross-country regressions suggest that while in Latin America remittances generally have the effect of reducing inequality, the corresponding changes are generally small in magnitude. A study by Rapoport and Mckenzie (2007) using data from Mexico found that international migration is a cost at the beginning of migration because only individuals on the middle class of wealth distribution may have the opportunity to migrate which increases inequality in the sending country. But after the migration networks are formed the cost for future migration will reduce so that inequality will be lower. They find that the overall impact of migration is to reduce inequality across communities with relatively high levels of past migration.

People argue that remittance income has a negative impact on labor market participation of recipients and also are the cause for high reservation wage. Kim (2007) in his study in Jamaica examines the effect of remittance income on the labor supply of households and some evidence was found to confirm that remittances contribute to high real wages while high unemployment persists. The cross-sectional analysis suggests that remittances have some impact on labor participation but little or none on the weekly working hours of employees. The pseudo-panel data analysis confirms the result that remittances have a strong impact on labor participation but not on weekly working hours. Households with a remittance income have a higher reservation wage and reduce labor supply by moving out of the labor force. Another study by Bussolo and Medvedev (2007) also confirm the negative relationship between labor supply and remittances in Jamaica.

A study by Airola (2005) using household income and expenditure data from Mexico attempts to understand to what degree labor patterns are affected by the receipt of remittances and analyze the effect of remittance income on labor supply decisions. The finding shows that household labor supply in response to remittance income is consistent with findings which measure labor supply behavior in the presence of other forms of unearned income in different settings. That is, remittance receipts are associated with fewer hours of work.

Migrants transfer affects the schooling decisions of households back home. It is expected that as the amount of remittance increases school attendance of children in the origin families will improve. Cox and Ureta (2003) examine this hypothesis using data from El Salvador. They adopted the Cox proportional hazard model to examine the determinants of school attendance. Measuring income from a source that is uncorrelated with parental schooling remittances they found that remittances have a large and significant effect on school retention. They also estimate that while household income net of remittances has a small, though significant, impact on the hazard of leaving school in rural and urban areas, remittances have a much larger impact on the hazard of leaving school. In urban areas, the effect of remittances is, at its smallest, 10 times the size of the effect of other income. In rural areas, the effect of remittance is about 2.6 times that of other income.

3. Data and methodology of the study

3.1 Data source

The data for this study was obtained from the socioeconomic survey of urban household's collected by the Department of Economics, Addis Ababa University in collaboration with Institute of Development Research (1994),the then Ethiopian Ministry of Economic Development and Cooperation and Michigan State University (1995) and University of Gothenburg in all the rounds. The data was collected for five waves i.e. 1994, 1995, 1997, 2000, and 2004. The urban centers covered by the survey include Addis Ababa, Awassa, Bahir Dar, Dessie, Dire Dawa, Jimma, and Mekele. The sample size was 1500 households in each round. The sample size for Addis Ababa, Awassa and Dire Dawa were 900,125 and 75, respectively. However, Bahir Dar, Dessie, Jimma, and Mekelle contributed 100 households (Kedir, 2005)

The data includes information on local and international remittances, educational status of households, migration, household demographics, expenditure, employment and income, vulnerability, credit and savings. In addition, information on the frequency, and amount of remittances was considered.[2]

[2] The questions included in the survey related to remittances are: how many times did you receive remittances in the last 12 months? Type of receipt: This includes remittances from abroad, remittances

3.2 Analytical framework

To measure a household's welfare, the standard utility theory was applied by assuming that the household wants to maximize his/her utility given a budget constraint. Utility is representing household's welfare but it is not observable. Thus, a proxy for indicator of household welfare should be used. A good indicator of household welfare that can be used as a proxy for household welfare is household consumption expenditure. According to Deaton and Zaidi (1999), and Glewwee (1991) ,based on duality theory, it is possible to express consumer decisions in terms of expenditure functions, which specify the amount of money needed by a utility maximizing household to reach a given level of utility. Then the determinants of expenditure $\left(x^h\right)$ includes prices of consumer goods and services $\left(p_1,...,p_n\right)$, characteristics of household members, such as their age and sex $\left(b_1,...,b_m\right)$ and the utility level (U) that the household wishes to obtain.
This can be stated as follows:

$$x^h = E\left(U; p_1,..., p_n; b_1^h,..., b_m^h\right) \qquad \textbf{[1]}$$

Where x^h stands for households expenditure and h denotes a particular household. Prices don't contain the superscript h because it is assumed that all households face the same prices. This assumption will be relaxed later. To use expenditure levels (x^h) to measure unobservable utility (U) impose a restriction on the functional form of E (.) so that household characteristics can be put into a distinct functional form which becomes a multiplicative term to the rest of the expenditure function.

$$\begin{aligned} x^h &= E\left(U; p_1,..., p_n; b_1^h,..., b_m^h\right), \\ &= m\left(b_1^h,..., b_m^h; p_1,..., p_n\right) E_1\left(U; p_1,..., p_n\right) \end{aligned} \qquad \textbf{[2]}$$

This states that there exists a per capita expenditure function $\left(E_1\right)$ which can be scaled up or down by a distinct multiplicative factor (m) to accommodate a difference in household's composition.

from domestic, pension, gift, inheritance, dowry, and others. Who sent you the remittances or gave you the gift? How long has the remitter being there? Remitter's marital status (included only in the 2004 survey). Amount received in the last 12 months. What was this income used for?

To compare the utility level across households with different compositions we can divide both sides of equation (2) by m (.):

$$x^h \Big/ m\left(b_1^h,...,b_m^h; p_1,..., p_n\right) = E_1\left(U; p_1,..., p_n\right) \quad \textbf{[3]}$$

The left hand side of equation (3) is money metric measure of utility for a give set of prices.

However, households do not always face the same prices. Therefore, the model can be extended to incorporate and compare the difference in price in different regions. This can be done by defining the true cost of living index[3] as ratio of two expenditure functions. Utility levels of households living in different regions with different price[4] structures can be compared as follows (Glewwe, 1991):

$$\frac{x_B^h \Big/ \left[m(.)s_B\right]}{p_r\left(U^B,..,\right)} = \frac{E_1\left(U^B; p_1^B,..., p_n^B\right)}{p_r\left(U^B,...,\right)}$$
$$= E_1\left(U^B; p_1^A,..., p_n^A\right) \le or \ge E_1\left(U^A; p_1^A,..., p_n^A\right) \quad \textbf{[4]}$$
$$= \frac{x_A^s \Big/ s_A}{m(.)} as U^B \ge or \le U^A$$

s_j is the scaling factor.[5] Where j=A,B. $s_j = \exp\left[\sum_{i=1}^{n} w_i \log\left(p_i^j \Big/ \overline{p_i}\right)\right]$

To examine the determinants of household welfare we can regress $x^h \Big/ \left[m(.)s_j\right]$ on various explanatory variables assumed to be exogenous. This is the reduced form estimate of various structural relationships which affect welfare. The explanatory

[3] True cost of living index= $\frac{E_1\left(U; p_1^B,..., p_n^B\right)}{E_1\left(U; p_1^A,..., p_n^A\right)} = p\left(U; p_1^B,..., p_n^B; p_1^A,..., p_n^A\right)$ where A and B stands for regions.

[4] $\overline{p_j} = \exp\left[\sum_{i=1}^{n} w_i \log\left(p_i^j \Big/ \overline{p_i}\right)\right] \overline{p} = s_j \overline{p}, w_i$ is expenditure share of good i.

[5] See Glewwee(1991) for detail derivation of scaling factor.

variables can be categorized as follows:
a) Household composition variables (b^h); b) location dummy variables (R^h);
(c) Physical assets owned by the household $\left(K^h\right)$; d) human capital variables such as education and experience of the household $\left(E^h\right)$; and e) community characteristics $\left(C^h\right)$[6]. We can generalize equation [4] for several regions. Our function to be estimated is:

$$\frac{x^h}{m\left(b_1^h,...,b_m^h;\, p_1^j,...,\, p_n^j\right)s_j} = F\left(b_1^h,...,b_m^h;R_1^h,...,R_r^h;K_1^h,...,K_k^h;E_1^h,...,E_e^h;C_1^h,...,C_c^h\right).\varepsilon \quad \textbf{[5]}$$

Where ε is a multiplicative term accounting for random (unobserved) effects. If we multiply both sides of equation [5] by m (.)7 , and take the logarithm of both sides and assumes a linear form of the logarithms of F (.) and m (.) we obtain:

$$\log\left(x^h/s_j\right) = \sum_{j=1}^{r}\sum_{i=1}^{m}\alpha_i b_i^h + \sum_{i=1}^{m}\beta_{bi}b_i^h + \sum_{i=1}^{r}\beta_{ri}R_i^h + \sum_{i=1}^{k}\beta_{ki}K_i^h + \sum_{i=1}^{e}\beta_{ei}E_i^h + \sum_{i=1}^{c}\beta_{ci}C_i^h + e \quad \textbf{[6]}$$

The $\alpha's$ are the parameters of m (.), the β's are parameters of F (.) and e=log (ε).By estimating (16) we can identify $\left(\alpha ij + \beta_{bi}\right)$ within any region j, not $\alpha ij \;\; or \;\; \beta_{bi}$ separately. That means we can measure the impact of household composition on the observed level of household expenditures, but not relate this to unobservable household utility.

3.3 Econometric model

The econometric methodology applied for the study is presented in this section. Based on Adams (2004, 2006), and Cameron and Trivedi (2005), Barham and

[6] We will not include community characteristics in our regression because the survey doesn't cover community level characteristics.
[7] Using an incorrect estimate of m (.) will be problematic. So we can never estimate m (.) without making certain assumptions. Incorrect estimates of m (.) will affect the parameter estimates on $b_1^h,...,b_m^h$ in the function F(.), so the consequence of not knowing the function m(.) is that one cannot determine whether particular types of households are likely to have higher or lower levels of household welfare. Given this we might not estimate the function m (.) at all but instead allow a broader estimation to work this out.

Boucher (1998), Acosta et al. (2007) three equations are used to address the objective of the research. The first equation is the selectivity equation where we are going to check whether there is a selectivity bias with regards to migration and recipient of remittance. The second equation is designed to predict the expenditure of households in the case of no remittance and then to use the parameters to predict household expenditure in the case of remittances. This helps to see the contribution of migrants to expenditure/income of families if they stay and work at home. Finally we will have the third model which helps us to explain the impact of remittances on household welfare.

3.4 Econometric model of household's expenditure with selection control

The main problem with comparing household's expenditure excluding remittance is that we cannot know the income of the households had those migrants stayed in home land. According to Acosta et al. (2007), these comparisons suffer from one important shortcoming, namely that remittance are not likely to be an exogenous transfer but rather a substitute for the home earnings that migrants would have had if they had not decided to leave their countries to work abroad. In fact, the non-remittances income reported by households with migrants cannot be considered a good representation of the situation of the family prior to migration. If the migrant had positive earnings before leaving the household, it is likely that the household's total non-remittances income is lower after migration. Thus, estimating the effect of migration and remittances on poverty/welfare would require taking into consideration the counterfactual per capita expenditure that the household would have had if the migrant had stayed at home, otherwise we would be overstating the true impact of migration and remittances on welfare of households.

It is possible to overcome this problem by predicting income in the case of no migration and remittances. This can be done by treating households with no remittances as a random draw from the population and estimating the mean regression of incomes for these no remittance households. After estimating this we use the parameters to predict the expenditure of households with remittances (Adams, 2006).

This approach may be problematic if households with and without remittances differ systematically in their unobserved characteristics. There is a proposition that households differ systematically in their skill and ability which is not observed. This leads to selection biases in generating migrant and remittances. Therefore, the main

purpose of the selection equation is to investigate whether migration is systematic or not.

The first equation is the selection equation. In this case we will have the choice equation and the expenditure function which may be determined by migration and remittances.

$$\mathrm{R}_{\mathrm{r}}^{*} = \gamma_r + \beta_r z_r + \varepsilon_r \qquad \textbf{[7]}$$

The dependent variable $\left[R_r^* \right]$ is remittance, where R is not observable if $R^* \leq 0$ (if the individual get no remittances), R=R*, $R^* > 0$ if the individual get remittances. Where Z_r is a vector of explanatory variables in group r, β_r is coefficient of group r, whereas ε_r is assumed independent of all the component Z_r of for all i, i=1… R and that $\varepsilon \square N(0,1)$.

Equation [7] is estimated for all observations and stand for the household choice decision to send migrant and receive transfer. The household chooses a certain group if and only if the household gain higher income from that activity than any other activities i.e. $R_{ri}^* > \max\left(R_{ji}^*\right); j \neq r$.

Expenditure function:

$$y_r = \gamma_i + \alpha_r x_r + \theta\lambda_i + \mu_r \qquad \textbf{[8]}$$

Where y_r is logarithm of per capital expenditure, x_r is a vector of explanatory variables in group r, α_r is a coefficient of group r, whereas μ_r is assumed independent of all the component of, x_r for all i, i=1,…,R, and that $\mu_r \square N(0,1)$

Here we will include lambda from equation [7] and the equation is estimated by OLS. The term λ (lambda) is the inverse Mill's ratio defined as

$$\lambda_i = \frac{\phi\left(\alpha_r + \beta z_r\right)}{1 - \Phi\left(\alpha_r + \beta z_r\right)} \qquad \textbf{[9]}$$

The objective of expenditure equation [8] is to see whether expenditure is determined by remittances (Or the determination of household expenditure conditional up on the receipt of remittances). Unlike the choice equation the dependent variable (expenditure) is continuous and observable. The procedure of estimating these two equations (choice equation and the expenditure equation) is the Hekman procedure.

The model is identifiable if there is at least one independent variable which is in equation [7] but it is not in equation [8]. This is an exclusion restriction. This means variables that affect remittances but that do not affect household expenditure. Age of the household head is the variable that identifies the model. It is proposed that age of household head will positively affect household migration and remittance if the migrant is not the household head because households in the older age category will have children in the age 15-30 that enable them to produce migrant. But age of the head negatively related to household income (Adams, 2006). In the context of Ethiopia, older household heads are expected to earn lesser income because their educational level is low which has an implication on income generating potential.

The following explanatory variables are used in the model. The rationale of choosing the explanatory variables (in both the choice equation and expenditure equation) is:

Household characteristics which include age of household, family size, number of children under five and number of household members above 15 will affect the probability of migration and remittances. The probability of migration and remittance is expected to be higher for households with older age, more household members above 15 and fewer children under 5. The sign of age of household and number of household members above 15 is expected to be positive whereas the sign of number of children under 5 is expected to be negative.

Human capital variables are expected to affect the probability of migration and remittances positively. As the educational level of individual's increases, the opportunity of securing employment and earning better income in destination areas is also increases.

Migration network are expected to affect the probability of migration and remittance positively. Some societies and nationalities have traditional village networks which increase the probability of migration. The proxy for migration network is ethnic dummy.

The location of residents also affects the probability of migration and remittance. Those who live in big cities like Addis Ababa will have better opportunity and information about destination areas than other urban centers.

3.5 Econometric model of estimating predicted household's expenditure

$$Y = \beta X + \varepsilon \quad \textbf{[10]}$$

Where Y stands for per capita household expenditure, X is a vector of explanatory variables, β represents vector of coefficients and ε is random error term.

This equation [10] is meant to predict per capita expenditure in the case of no migration/remittances. Based on the methodology adopted by Acosta et al. (2007), Barham and Boucher (1998) and Adams (2004, 2006) in a cross sectional data the counterfactual income is predicted. In this case, we can see the expenditure of households if migrants stayed and work at home. We can predict expenditure in the case no remittances, internal remittances and international remittance. This can be done following three steps. First, we will estimate the parameters predicting household's expenditure using households which don't receive remittances. Then, the parameters estimated will be used on the households which receive internal remittances. The same parameters estimated above will also be used to predict expenditure of households which receive international remittances.

We can see here the change in expenditure due to the inflow of remittance after considering the counterfactual income. After predicting the expenditure in the case of no migration and remittances we can get the expenditure in the case of remittance. To calculate the expenditure in the case of remittances we will add the actual remittances on the predicted expenditure in the case of no remittances, internal remittances and international remittances (Adams, 1991).

The justification to use these variables as explanatory variables in equation [10] is explained as follows. The impact of educational variables on expenditure is expected to be positive. But the age of household head, number of children under age 5 and household size are expected to be negatively related to expenditure. Whereas number of children above15 is expected to have positive impact on expenditure. Location also affects the level of household's expenditure (Adams, 2006).

3.6 Measuring the impact of remittances on household welfare-panel data model

The purpose of this equation is to see the impact of remittance on household welfare/poverty status. Household's expenditure is used as a proxy for household welfare. This model is based on Quartey (2006), and Glewwe (1991).

The formal derivation of the equation is as follows:

$$y_{it} = \alpha_i + \beta x_{it}^{'} + \varepsilon_{it}, \varepsilon_{it} \sim IID\left(0, \delta^2\right) \quad \textbf{[11]}$$

$$\operatorname{cov}\left(x_{it}, \varepsilon_{it}\right) = 0$$

.

Where Y_{it} is the logarithmic of household i per capita consumption expenditure at time t, x_{it} represents a vector of explanatory variables including remittances, ε_{it} is an identically and independently distributed idiosyncratic random term, and α_i is the individual effect that doesn't vary over time (Wooldrige, 2002).

To remove the impact of individual effects we transform the model. To do that averaging equation (11) over time for each i, will give as

$$\overline{y_i} = \beta \overline{x_i} + \alpha_i + \overline{\varepsilon_i} \quad \textbf{[12]}$$

Subtracting [12] from [11] gives

$$\left(y_{it} - \overline{y_i}\right) = \beta\left(x_{it}^{'} - \overline{x_i}^{'}\right) + \left(\alpha_{it} - \overline{\alpha_i}\right), t = 1, 2, ..., T \quad \textbf{[13]}$$

This is the fixed effect model. In this case we are interested more on individual difference. Another class of model is the random effect model where we treat $\alpha_i + \varepsilon_{it}$ as an error term consisting of an individual specific component $\left(\alpha_i\right)$ and a remainder component $\left(\varepsilon_{it}\right)$.

Then, our model will be

$$y_{it} = \beta x_{it} + \upsilon_{it}, \upsilon_{it} = \alpha_i + \varepsilon_{it} \quad \textbf{[14]}$$

Assuming, $\operatorname{cov}\left(x_{it}, \alpha_i\right) = 0$ .The random effect estimator combine the information from the between and within dimensions in an efficient way. We can get the within estimator if we regress [13] and the between estimator from [12].

Based on this specification the choice between the random effect and fixed effect model is based on different factors. If we are interested on individual effect we prefer fixed effect model, which makes sense if the number of units is relatively small and of specific nature. But this is not always the case. Even if we have large population of individual units fixed effect may be preferred if the explanatory variables are correlated with the individual effect $\left[\operatorname{cov}\left(x_{it}, \alpha_i\right) \neq 0\right]$ (Wooldridge, 2002).

Hausman specification test is conducted to check whether fixed or random effect is appropriate. The null hypothesis is $\alpha_i \; and \quad x_{it}$ are uncorrelated. Since the key consideration in choosing between a random effects and fixed effects approach is whether $\alpha_i \; and \quad x_{it}$ are correlated, it is important to have a method for testing this assumption. Hausman (1978) proposed a test based on the difference between the random effects $\left(\beta_{RE}\right)$ and fixed effects $\left(\beta_{FE}\right)$ estimates. Since Fixed Effect model is consistent when $\alpha_i \; and \quad x_{it}$ are correlated, but Random Effect model is inconsistent, a statistically significant difference is interpreted as evidence against the random effects assumption. The Hausman test statistics is:

$$\xi_H = \left(\beta_{FE} - \beta_{RE}\right)' \left[\hat{v}\left\{\beta_{FE}\right\} - \hat{v}\left\{\beta_{RE}\right\}\right]^{-1} \left(\beta_{FE} - \beta_{RE}\right) \qquad \textbf{[15]}$$

(Verbeek, 2002)

Reasons to choose the explanatory variables are explained as follows:

Expenditure is used as an indicator of household welfare and poverty status. The reason to use expenditure instead of income is that expenditure provides more accurate measure of welfare over time. Another reason is that households in LDCs like Ethiopia under report their income so that income suffers from measurement error (Adams, 2006). Consumption is less variable over the period of a year, much more stable than income in agricultural economies and makes it more reasonable to extrapolate from two weeks to a year for a survey household (Deaton and Zaidi, 1999).

There are other reasons why it is more practical to gather consumption than income data in most developing countries. Where self-employment, including small business and agriculture, is common, it is difficult to gather accurate income data, or indeed to separate business transactions from consumption transactions (ibid).Expenditure in this study includes expenditure for food, and expenditure for non food items. The non

food expenditure includes expenditure for transport, education, health, clothes, electric and water bills, and furniture's and equipments, etc.

Household characteristics are expected to affect the welfare/poverty status of the family because the composition of households has an implication on the income of the family. The life cycle hypothesis proposes that members of the family which are in the labor force will have a positive contribution to family income. Elderly and young family members are net consumers of the family income. Therefore family composition variables like age and sex of head of household and family size will have an impact on welfare.

Human capital variables are expected to have positive impact on the welfare of households. The number of years of education of the family member affects the income generating potential of the family. Households with more educated family members are expected to be better off.

Remittances are expected to improve the welfare of the family by smoothing the household's consumption. This depends on the way families use the transfers. Poor families may use to smooth consumption and to satisfy their basic needs whereas rich families may invest in productive activities or non productive activities (Quarety, 2006). In this study we expect migrants remittances will improve the welfare of household's i.e. the sign of this variable will be positive.

Location also explains welfare. Area of residence varies in different aspects like availability of infrastructure and other geographical differences which has its own implication on household welfare.

4. Remittances and households welfare: Results and discussion

4.1 Remittances and households welfare: Descriptive analysis

As explained in the methodology section, household is the unit of analysis in the study. Therefore, the demographic characteristic of sample household heads is analyzed here. On average out of the total households in the survey, 60% of them are male headed while 40% are female headed. The average age of the heads of household was 49 years and the average household size was 7 for the panel period (Table 1).

Table 1: Demographic Characteristics of Households

Variables		1994	1995	1997	2000	2004	average
average age of head of households		8	49	51	49	50	49
Sex of households head	Male	933	933	836	826	803	886
	Female	554	554	522	647	648	592
Average households size		7	6	6	7	7	7

Source: Author's calculation from EUSES

With regards to educational status of household heads almost one third (31%) of the household heads has primary education, 28% of them been Illiterate, and 18% had secondary education throughout the period (annex 3).

Out of the total households covered in this survey and used for the regression analysis the number of households who received remittance from abroad and/or from domestic sources were 918 in 1994, 894 in 1995, 1263 in 1997, 1020 in 2000, and 1023 in 2004. According to the data from the survey the total amount of remittances received by households in real terms were 8703.5 Birr in 1994, 8666 Birr in 1995, 13450 Birr in 1997, 13733 Birr in 2000, and 26038.5 Birr in 2004.

The mean value of transfer in cash exhibited an increasing trend. Transfer in kind did not have predictable pattern. It had declined in 1995 and increased in 1997 and 2000, again significantly declines in 2004 (Annex 1). Meanwhile the maximum amount of transfer in real terms reaches its highest level in the first round and the lowest being recorded in the fourth round. The highest level of mean value in real terms was Birr 36 in 2004 and the lowest being Birr 15 in 1995 (Table 2).

Table 2: Descriptive Statistics of Net Remittances (internal and international) in Nominal and Real Terms in Birr (1994-2004)

	1994		1995		1997		2000		2004	
	nominal	real	Nominal	real	nominal	real	nominal	real	nominal	real
Max	79000	785	67060	661	58000	695	40000	387	92500	759
Min	1	0	5	0	1.8	0	1	0	2	0
Median	5000	8	347	8	360	8	600	10	1752	20
mean	1192	18	986	15	1148	20	1517	21	3104	36

Source: Author's calculation from EUSES

According to the data the main source of remittances include remittance from abroad, domestic transfer, pension, and gift (Table 3). There was no significant change in the number of individuals who received remittances from abroad for the period 1994, 1995, and 1997. It had slightly increased from that of 20% in 2000 to 22% in 2004.

On the other hand, the proportion of households who received remittance from domestic relatives and friends was 22% in1994, 26% in 1995, 19% in 1997, 16% in 2000, and 22% in 2004. Furthermore, among those who received remittances gift constituted 11% in 1994, 22% in 1995, 31% in 1997, and 16% in 2000, 13% in 2004. The proportion of households who received remittances in the form of dowry, inheritance, house rent, and food aid combined were about 19% for 1994 and the lowest being in 1995 which was 2%. Overall, the main sources of transfer for the majority of households were remittances from abroad and from domestic during the panel period.

Table 3: Percent of sample households receiving remittances from different sources

Type of receipt	1994	1995	1997	2000	2004
Remittances from abroad	17	18	17	20	22
Remittances from domestic	22	26	19	16	22
Pension	31	32	21	30	27
Gift	11	22	31	16	13
Others	19	2	13	18	16
Total	100	100	100	100	100

Source: Author's calculation from EUSES

Interestingly, the total amount of real remittance received by households in the panel from abroad exhibited an increasing trend (Annex 7). The highest percentage of receipt, 38% of receipt from abroad recorded in 2000.This might be related to the Ethio-Eritrean war where remittances are used to smooth consumption in times of shocks. Remittance from domestic sources, on the other hand fluctuates throughout the study period. Government transfer in the form of pension was also contributes 32% of the total receipt on average for the whole period (Annex 4).

With regard to remittance senders' non-resident and relative household members account for the major source of remittance followed by government transfers. The remittance from relatives was 28% in 1994 and it increased to 41% of the total remitters in the 1995 but decreased to 27 % in2004 (Table 4). Government transfer exhibits a decreasing trend where the highest proportion recorded in 1994 and the lowest being in 1997. On the other hand, transfers from friends constituted less than 10% of the total sources of remittances throughout the period.

Table 4: Remittances by sources in percent

Remitters	1994	1995	1997	2000	2004
Non-resident household members	17	13	12	18	32
Relative of household member	28	41	36	31	27
Friends	6	6	6	5	3
Government organization	42	34	23	32	28
Non-government organization	4	3	10	6	5
Others	3	3	13	8	5
Total	100	100	100	100	100

Source: Author's calculation from EUSES

Households included in the survey were asked to state the primary, secondary and third use of remittances. Consistent with the theoretical background stated in chapter two data from the survey confirm that 88% in 1994, 83.7% in 1995, 83% in 1997, 84% in 2000 and 92 % in 2004 of the total households primarily used the remittances for consumption expenditure. This is inline with the altruism motive where relatives and friends send remittance to support consumption of their families. The proportion of remittance used for investment in assets and in private businesses is less than 5% in all the observation periods. This implies remittance is an important source of income used to smooth consumption (Table 5). In fact, Gupta et al. (2007) states that remittances reduce poverty, smooth consumption, affect labor supply, provide working capital, and have multiplier effects through increased household spending.

Table 5: Main use of remittances by households (percentage of total receipt)

Used for	1994	1995	1997	2000	2004
Consumption	88	84	83.4	84	92
Investment in land/house	3	1	1.5	1	1
Others	9	15	15.5	15	7

Source: Author's calculation from EUSES

Paying for children schooling was reported to be a second important purpose of remittances. For instance, the proportion of households which used the remittance for schooling was 13% in 1994, 12% in 1995, 10% in 1997, 15% in 2000, and 46% in 2004. Educational expenditure was found to be higher than the consumption expenditure for the year 2004 (Annex 2).

In general, we observe that remittances are primarily used for consumption expenditure followed by schooling and medical expenses implying, strong welfare improving impact of remittances in urban Ethiopia

4.2 Remittances and households welfare: Econometrics analysis

In this section, the results of the econometric models are presented. The first two models are estimated using only the 2004 survey data. However, the last model is estimated using the panel data. The results are presented accordingly.

4.3 Estimated results of econometric model with selection control

After correcting the data for possible outliers by substituting the median, the selectivity model is estimated using the Heckman two step estimation procedures. It is tried to estimate the model using both total annual expenditure and logarithm of per capita annual expenditure as a dependent variable for the expenditure function. However, the result of the logarithm of per capita expenditure is better in terms of the coefficients, p values and standard errors. Therefore, the reported results are using logarithm of per capita expenditure as a dependent variable for the expenditure function.

The results from the selectivity equation shows that λ (inverse mills ratio) is found to be insignificant. This implies that there is no selectivity bias with regards to migration and remittance. In other words, migrants and recipients of remittances are randomly selected from a pool of population in the context of urban Ethiopia (annex 9). This finding is consistent with a study by Adams (2006) in Ghana and Barham and Boucher (1998) in Nicaragua. However, it is not consistent with a study by Acosta et al. (2007) from their examination of Latin American countries.

This result is contrary to the proposition that migrants are from a selected group with respect to income, skill, and education. However, according to Adams (2006) one of the possible reasons is that from the choice function families with the most educated members do not have higher tendency towards receiving remittances. This can be seen from annex 8 that the two human capital variables-secondary and university-are insignificant. Another possible reason could be related to the data used in this study as it incorporates both legal and illegal migrants and the respective transfer of remittances. This implies that especially the illegal migrants come from economically poor and less educated families, which is considerable in poor countries like Ethiopia.

Some of the results in the choice function are unexpected. For instance, all migration network variables turn out insignificant. The dummy for sex of the head is found positive and significant at 1%. That is the probability of receiving remittance for female headed households is higher than male headed households.

Age of household head is positive and significant at 1% level as expected in the choice equation. This means older household heads do produce more migrants and receive more remittances. While number of household members under age five is insignificant, number of household members above age 15 is positive and significant at 5% level. This means as the number of household members above age 15 increases the probability of migration and receiving remittances also increases. Household size and location are found insignificant.

The magnitude of the coefficients in the choice equation cannot be directly explained as it only shows the direction and cumulative probability. The figures reported in second column of annex 8 are the marginal effects. But the results are the same as the estimates of the expenditure function so that it is not analyzed here.

The results of the expenditure equation can be directly analyzed like any OLS estimates. From annex 9 the result shows that two educational status variables are positive and significant. That means as the number of household members with secondary and university increases by one the per capita consumption expenditure of households increases by 7% and 18%, respectively. The contribution of having technical and vocational study to consumption expenditure is insignificant. Likewise, the other educational variables namely literate and no education are negative. No education even becomes negative and significant at 5% level. Location dummy is positive and significant. This implies the per capita expenditure of households living in Addis is higher by 14% compared to households in other urban centers. Female dummy is negative and significant at 10% level implying the per capita income of female headed households is lower by 10.8% as compared to the male headed households.

The sign of other demographic variables such as household size, number of household members under 5 and number of household members above 15 found as expected. Household size is negative and significant implying an increase in household size by 1unit leads to a decrease in per capita consumption by 14%. This confirms the welfare reducing impact of large household size which might be related to the tradition of considering children as an asset. On the other hand, an increase in the number of household members above 15 by one leads to a 5.8% increase in per capita consumption though households in this age category are in the productive age group. The estimated result for the variable age of household head in the expenditure equation is negative as expected and it is excluded from the expenditure equation and it identified the model.

4.4 Estimates of predicted per capita annual expenditure

The results of OLS estimates that are used to predict per capita annual expenditure are presented in annex 10. The purpose of this regression is to predict the per capita annual expenditure in the case of no remittance and including remittances. It makes possible to see the contribution of migrants if they stay and work at home.

Even if the objective of this regression is to predict per capita annual consumption expenditure in the case of internal and international remittances using the coefficients, the regression result which is computed using logarithm of per capita annual expenditure is reported for the sake of comparison. In both cases the robust standard errors are reported. However, the coefficients of the regression that are estimated using per capita annual expenditure is used to find predict per capita expenditure. In addition, the magnitudes of the respective variables from this regression are analyzed.

From the four household composition variables two of them namely household size and female dummy are found to be significant as expected. The number of household members under 5 found insignificant. The sign of the other three is as expected. The female dummy variable is negative and significant that the per capita consumption expenditure of female headed households is lower than the other category male headed families.

Only one of the human capital variables is found to be positive and significant. On the other hand, the number of household members with no education is negatively related to per capita consumption expenditure and it is also significant at 5% level. All ethnic dummies that are used as proxy for migration network are found to be insignificant except the dummy for Gurage.

Using the coefficients of column one of annex 10 per capita annual expenditure excluding remittances is predicted for all the three groups namely for households with no remittances, internal remittance, and international remittances. Based on this result, the per capita expenditure in the case of including remittances is calculated by adding the actual remittance on the predicted per capita annual expenditure for households. The average annual per capita remittances received in 2004 by households from internal sources was 293.5 birr and 508.8 birr from international sources.

Unlike the finding of Adams (2006) the result confirms that households who receive remittance from both domestic and international sources are better off otherwise (Table 6). Households who receive remittance from domestic sources (i.e. 132.3 Birr)

have higher predicted per capita expenditure than the other two. Households without remittance are found to be the poorest. The predicted average annual per capita expenditure for households who receive remittance from relatives and friends in Ethiopia was 7.5% higher than households that do not receive remittances. But the average predicted annual per capita expenditure for households that receive remittance from abroad was 3% higher than households with no remittances.

The predicted per capita annual expenditure for households which receive remittance from domestic sources is 246% larger than households with no remittance. On the other hand, the predicted per capita expenditure of households which receive remittances from international sources is five times higher than households that do not receive remittances. We can see that households that produce migrant are able to improve their living condition and are better off than households that do not have migrant family members.

Table 6: Predicted annual per capita expenditure in birr for non-remittance and remittance receiving households in urban Ethiopia (2004)

	Receive no remittance	Receive internal remittances	Receive international remittances	Percentage change(internal Vs no remittance)	Percentage change (international Vs no remittance)
Predicted mean annual per capita expenditure(excluding remittances)	123	132.3	126.7	7.56	3
Predicted mean annual per capita expenditure(including remittances)	123	425.8	635.5	246	416.7
Number of observations	725	178	184	-	-

4.5 The Impact of remittances on household's welfare: Panel evidence

In this part of the paper it is tried to check the impact of remittances on household's welfare based on the data from the urban socio economic survey. For this model the data used includes all the five rounds. The total number of observation is 6302 after data cleaning and correcting for possible outliers and missing values. The regression is based on unbalanced panel. Attrition is one of the problems of the data. But the sample size after data cleaning is large so that it is possible to get efficient results.

The panel data used for regression was also corrected for inflation using consumer price indexes (CPI) of respective years. The consumers price index used in this study was taken from the Central Statistics Agency and rebased to 1994 to handle the variation in price. Logarithm of real per capita expenditure is used as a dependent variable. To avoid the problem of endogeneity remittances were instrumented using one year lag real remittances.

After the data is prepared for regression the model specified in equation [13] i.e. the fixed effect and then the random effect model of equation [14] are estimated. The Hausman specification test was conducted to choose the appropriate model from the fixed and random effect models. The test rejects the null hypothesis[8] indicating that the difference in coefficients is not systematic. That means the fixed effect model is consistent but the random effect model is not so. The F statistics is also confirmed the overall significance of the model.

Therefore, the results of the fixed effect model are used for further analysis (annex 11). The contribution of households head education for household welfare is positive and significant for three human capital variables. Heads educational levels primary, and secondary found positive and significant at 5% level whereas university education is significant at 1% level. That means the per capita expenditure of households with primary, secondary and university level education heads is higher than the base category no education. Moreover, primary education emerges significant at 5% level. However, technical and vocational education is found to be insignificant.

The household composition variables are found as expected. Household size is significant and negatively correlated with household welfare. An increase in household size by one unit leads to a 9.5% reduction in real per capita annual expenditure. This result explains the downward pressure of family size on welfare especially if the majority of household members are children. Age of household head is positive and significant at 1% level. The dummy for sex is insignificant.

Consistent with the finding of Quartey (2006) in his study in Ghana, one year lag real remittance found positive and significant as expected at 10% level. This implies that remittances improve household's welfare in the context of urban Ethiopia.

In addition to the panel regression, simple pooled OLS regression is conducted and results are reported in the fourth column of annex 11. This is to see whether the panel regression is robust as compared to the pooled OLS. Test for hetroskedsticity and

[8] See annex 12 for details of the results of the Hausman test.

omitted variable is conducted .The Ramsey RESET test reject the null of no omitted variable. The test for hetroskedasticity is also rejects the null of homoskedasticity. To solve this problem of hetroskedasticity robust regression carried out. Test for multicolinearity, VIF[9] confirm that there is no problem of multicollinearity.

All human capital variables found positive and significant at 1% level in the pooled OLS regression. Age of household head found positive and significant. Unexpectedly male dummy turns out insignificant unlike the finding in the panel framework. However household size is negative and significant at 1% level as expected. That means the larger the size of household the lower the welfare of the family will be. Three regional dummies namely Mekele, Awassa and Dire Dawa found positive and significant as compared to the base category dummy for Addis Ababa.

5. Conclusion and recommendations

Remittances at the household level directly supplement the income of recipient household's and provide financial resources for poor households and also affect poverty and welfare through indirect multiplier effects. Remittances are also associated with increased household investments in education, entrepreneurship, and health. However, remittances do have their own downside. For instance, household members might stop working and wait from month to month for remittances. Such negative incentive effects, a form of moral hazard, also results in an increase in the reservation wage. In addition to this, remittances might lead to ostentatious consumption in remittance receiving households, and encourage imports of luxury goods adding pressure on the country's import bill.

This study used representative urban socio economic household survey conducted in seven major urban centers in Ethiopia. The study examines the impact of remittances on household welfare, checks whether there exists selectivity bias with regards to migration and remittances, investigates how households allocate the remittances they received from different sources, and the type and sources of remittances. The study also revised different theoretical and empirical works related to the study topic.
The data set used for the study was conducted for five rounds covering 1500 households in each round. It was collated in 1994, 1995, 1997, 2000, and 2004. To address the objectives of this paper descriptive and econometric methodologies are adopted.

[9] Variance inflation factor, $VIF = \frac{1}{1-R^2}$

The result from the descriptive analysis of the study reveals that the amount of remittances exhibits increasing trend in the study period. The main sources of remittances were international remittance, internal remittances and government transfers. In terms of the amount of receipt the highest proportion of remittances comes from abroad and from government transfer followed by domestic private transfers. Relatives of households were the primary source of transfer.

The study is also found that remittances are primarily used for food and non food consumption expenditure followed by expenditure for schooling and expense for medical services. In the study period, more than 80% of the recipients primarily used the remittance income for consumption.

Three separate regressions were conducted and the results emerged as follows. A selectivity analysis was employed to assess whether there is systematic difference among households that produce migrant with regards to skill, and ability which is not observed. A two step Heckman estimation procedure was adopted and it is found that there is no selectivity bias with regards to migration and remittance recipients.

It is found that even without remittances, the predicted per capita expenditure of households who receive remittance from local sources were 7.5% higher than households that do not receive remittances. Similarly, the average predicted per capita expenditure of remittance recipient from abroad was 3% higher than those households that do not receive remittances. Obviously, with remittances the predicted per capita expenditure of remittance recipient households was significantly larger than households that do not receive remittances.

The random and fixed effect panel data models are estimated and Hausman specification test was conducted to select the appropriate model. The test rejects the null hypothesis indicating that the fixed effect model is consistent and hence results of this estimate are used for further analysis. Welfare improving impact of remittances for urban households in Ethiopia is supported by the result from the fixed effect regression. One year lag real remittance is found positive and significantly improve the living conditions of urban dwellers. This has an implication on school attendance, improved health care facilities or improvement in the nutritional intake of the family members. Secondary and university education are found to enhance welfare. Dummy for sex and age of household head found positive but household size emerge negative and significant.

The study provides strong evidence on welfare enhancing impact of remittances. Therefore, it is important to exploit the welfare enhancing potential of remittances by designing and improving policies which increase the flow of internal and international

remittances. Policies that improve the operation and efficiency of financial institutions like banks are important. Devising regulatory policies that amalgamate formal and informal remittance channels will enhance the flow of both internal and international remittances. In addition, improving the quality of service given by remittance service providers and reducing the cost and inconvenience of transferring remittance will increase the amount of remittance received. Government can effectively affect the cost, efficiency and quality of remittance services by enhancing competition in the market place through stimulating greater private sector interest in providing remittance services.

Moreover, strengthening the capacity of secondary deposit taking institutions, such as credit cooperatives, agriculture banks, and community banks, to offer remittance services will facilitate the flow of internal remittances.

On the other hand, devising incentives for the use of remittances can motivate recipients to invest their remittance income which has a trickledown effect to the poor. The most prominent type of incentive is special bank accounts that give emigrants a premium interest rate on their deposits. In some cases, interest from such accounts is fully or partly exempted from taxation.

Government could develop appropriate training/education programs to assist remittance receipts in making effective investment decision. Promoting financial literacy among remittance receivers can increase the poverty reducing effect of remittances and enhance the capacity of remittance receivers to use remittances for creating sustainable livelihoods.

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Annexes

Annex 1: Mean value of transfer in kind and cash in birr

Type	1994	1995	1997	2000	2004
In cash	500	512	884	1848	1402
In kind	227	115	136	392	92
Total	727	627	1020	2240	1494

Source: author's calculation from EUSES

Annex 2: Secondary use of remittances by households in percent of the total receipt

Remittance used for	1994	1995	1997	2000	2004
Consumption	76	73	69	59	13
Pay for children/relative schooling	13	12	10	15	46
Medical expenses	1	4	3	2	22
Investment in land/house	2	1	2	1	5
Investment in off-farm activity/business	2	2	1	2	3
Marriage/other ceremonies	0		2	4	8
Pay back debts	3	2	1	1	1
Saved	1	1	1	2	2
Other	1	4	11	14	0
Total	100	100	100	100	100

Source: author's calculation from EUSES

Annex 3: Educational status of household heads in percent (1994-2004)

Educational status	1994	1995	1997	2000	2004	average
Illiterate	24	24	24	34	33	28
Literate	14	14	14	10	8	12
Primary	33	33	33	27	27	31
Secondary	18	18	18	17	20	18
Technical and vocational	2	2	2	2	2	2
University	9	9	9	10	10	9
Total	100	100	100	100	100	100

Source: Author's calculation from EUSES

Annex 4: Amount received in Ethiopian Birr, number of recipients and percent of total receipt and recipients.

Type of receipt	1994				1995			
	No. of recipients	Percent of total	Amount received	Percent of total	No. of recipients	Percent of total	Amount received	Percent of total
Remittance from abroad	159	17	242249	27	159	17.8	302794	34
Remittance fromdomestic	205	22	178844	20	235	26.3	145467	17
Pension	282	31	327201	37	282	31.5	325557	37
Gift	99	11	54169	6	196	21.9	63208	7
Inheritance	3	0	952	0	1	0.1	23500	3
Dowry	24	3	12944	1	-	-	-	-
House rent	21	2	35804	4	-	-	-	-
Food aid	119	13	29075	3	-	-	-	-
Other	6	1	2169	0	21	2.3	19106	2
Total	918	100	883407	100	894	100	879632	100

Source: author's calculation from EUSES

Amount received in Ethiopian Birr, number of recipients and percent of total receipt and recipients. (Cont'd)

Type of receipt	1997				2000			
	No. of recipients	Percent of total	Amount received	Percent of total	No. of recipients	Percent of total	Amount received	Percent of total
Remittance from abroad	211	17	446931	31	201	20	587624	38
Remittance fromdomestic	237	19	139426	10	167	16	217090	14
Pension	259	21	328215	23	305	30	407482	26
Gift	386	31	147618	10	164	16	99352	6
Inheritance	-	-	-	-	8	1	13980	1
Dowry	-	-	-	-	1	0	208	0
House rent	132	10	270962	19	101	10	200523	13
Food aid	17	1	3579	0	53	5	7063	0
Other	21	2	86205	6	20	2	4801	0
Total	1263	100	1422966	100	1020	100	1538123	100

Amount received in Ethiopian Birr, number of recipients and percent of total receipt and recipients. (Cont'd)

Type of receipt	2004			
	No. of recipients	**Percent of total**	**Amount received**	**Percent of total**
Remittance from abroad	230	22.5	919918	29
Remittance from domestic	221	21.6	385544	12
Pension	275	26.9	1235725	39
Gift	130	12.7	144775	5
Inheritance	6	0.6	45075	1
Dowry	3	0.3	10100	0
House rent	118	11.5	418054	13
Food aid	30	2.9	11559	0
Other	10	1	5952	0
Total	1023	100	3176702	100

Source: author's calculation from EUSES

Annex 5: Use of remittances by households as a percent of total receipts-third

Remittance used for	**1994**	**1995**	**1997**	**2000**	**2004**
Consumption	16	15	12	18	6
Investment in land/house	7	8	2	2	1
Investment in off-farm activity/business	3	5	7	3	2
Marriage/other ceremonies		1	5	3	10
Pay for children/relative schooling	43	44	26	28	27
Medical expenses	13	15	9	9	37
Pay back debts	6	5	3	2	3
Saved	8	4	4	7	11
Other	5	4	31	29	4
Total	100	100	100	100	100

Source: author's calculation from EUSE

Annex 6: definition and description of variables- used in the panel data model

Variables	Description
lnpccons	Logarithm of real per capita annual consumption expenditure
Age	Age of household head in years
maledum	Dummy for sex and equals one if the head of household is male,0 otherwise
Illiterate	Dummy=1,if the household head is illiterate, 0 otherwise
literate	Dummy=1,if the household head is literate, 0 otherwise
Primary	Dummy=1,if the household head has primary education, 0 otherwise
Secondary	Dummy=1,if the household head has secondary education, 0 otherwise
Techvoc	Dummy=1,if the household head has technical and vocational education, 0 otherwise
University	Dummy=1,if the household head has university education, 0 otherwise
Remit_1	One year lag real remittances
Addis	Dummy=1, if the city is Addis Ababa, 0 otherwise
Awassa	Dummy=1, if the city is Awassa, 0 otherwise
Bahirdar	Dummy=1, if the city is Bahir Dar, 0 otherwise
Dessie	Dummy=1, if the city is Dessie, 0 otherwise
Diredawa	Dummy=1, if the city is Dire Dawa,0 otherwise
Jimma	Dummy=1, if the city is Jimma, 0 otherwise
Mekele	Dummy=1, if the city is Mekele, 0 otherwise

Annex 7: Annual real remittances received in Birr and percent of total receipts

	1994		1995		1997		2000		2004	
Type of receipt	Amount received	Percent of total	Amount Received	Percent of total	Amount received	Percent of total	Amount received	of total	Amount received	Percent of total
remittance from abroad	2387	27	2983	34	4224	31	5247	38	7540	29
Remittance from domestic	1762	20	1433	17	1318	10	1938	14	3160	12
Pension	3224	37	3207	37	3102	23	3638	26	10129	39
Gift	534	6	623	7	1395	10	887	6	1187	5
Inheritance	9	0	231	3	-	-	125	1	369	1
Dowry	127	1	-	-	-	-	2	0	83	0
House rent	353	4	-	-	2561	19	1790	13	3427	13
Food aid	286	3	-	-	34	0	63	0	95	0
Other	21	0	188	2	815	6	43	0	49	0
Total	8703.5	100	8666	100	13450	100	13733	100	26038.5	100

Source: Author's calculation from EUSES

Annex 8: Estimates of the Choice Equation and the Marginal Effects of the Choice Equation- Heckman Two Step Estimates (Dependent Variable-Remittance is observed where remittance is greater than zero or not observed if it is less than or equal to zero)

Variables	Choice equation		Marginal effects	
	coefficients	Z values	coefficients	Z values
Household composition variables				
Number of household members under age 5	-0.0658	-0.82	-0.0029	-0.05
Number of household members over age 15	0.0706	2.14**	0.05811	2.18**
Age of household head	0.0178	6.80***	-	-
Household size	-0.0207	-0.68	-0.1428	-6.13***
Sex of household head(female dummy)	0.3015	4.29***	-0.1087	-1.84*
Location (1=Addis Ababa,0 otherwise)	-0.014	-0.18	0.1449	2.50**
Migration network				
Amhara	-0.0612	-0.45	0.2252	2.24**
Gurage	-0.2546	-1.57	0.021	0.16
Oromo	-0.0273	-0.18	0.15408	1.39
Tigrayan	-0.0398	-0.25	0.3698	3.12***
Human capital variables				
Number of household members illiterate	-0.1064	-2.62**	-0.0651	-2.04**
Number of household members literate	-0.0621	-0.83	-0.0519	-0.93
Number of household members with primary education	-0.0476	-2.07**	0.0092	0.51
Number of household members with secondary education	0.0052	0.22	0.0726	4.13***
Number of household members with technical and vocational education	0.0334	0.39	0.028	0.45
Number of household members with university education	0.0259	0.62	0.1842	6.18***
Constant	-1.0241	-5.29***		-
Rho		0.3428		-
Sigma		0.6805		-
Chi2(30)		-		243.74
Number of observation		1432		1432

Note: * significant at 10% level, ** significant at 5%, ***significant at 1% level

Annex 9: Estimates of the Expenditure Function
Dependent variable: logarithm of per capita annual expenditure

Variables	Selection corrected		Without selection correction	
	coefficients	Z values	coefficients	Z values
Household composition variables				
Number of household members under age 5	-0.0029	-0.05	0.0218	0.5
Number of household members over age 15	0.0581	2.18**	0.0241	1.53
Household size	-0.1428	-6.13***	-0.1149	-7.45***
Sex of household head(female dummy)	-0.1087	-1.84*	-0.1764	-4.77***
Location (1=Addis Ababa,0 otherwise)	0.1449	2.50**	0.1143	2.76**
Migration network				
Amhara	0.2252	2.24**	0.0506	0.62
Gurage	0.021	0.16	-0.1152	-1.28
Oromo	0.154	1.39	-0.0248	-0.29
Tigrayan	0.369	3.12***	0.181	1.90*
Human capital variables				
Number of household members illiterate	-0.0651	-2.04**	-0.077	-3.91***
Number of household members literate	-0.0519	-0.93	-0.041	-1.18
Number of household members with primary education	0.009	0.51	-0.003	-0.28
Number of household members with secondary education	0.0726	4.13***	0.0536	4.34***
Number of household members with technical and vocational education	0.028	0.45	0.0315	0.71
Number of household members with university education	0.1842	6.18***	0.199	10.11***
Lambda (λ)	0.233	1.38	-	-
Constant	4.614	23.58***	5.032	51.72***
Number of observation		1432		1432

Note: * significant at 10% level, ** significant at 5%,*** significant at 1% level

Annex 10: OLS estimates of predicted per capita annual expenditure and log of annual per capita expenditure (excluding remittance in 2004)

Dependent Variables	Annual per capita consumption expenditure		Logarithm of annual per capita expenditure	
Explanatory variables	**Coefficients**	**Z values**	**coefficients**	**Z values**
Household composition variables				
Number of household members under age 5	9.939	1.05	0.029	0.49
Number of household members over age 15	0.966	0.27	0.011	0.44
Age of household head	0.388	0.57	-0.001	-0.29
Household size	-17.16	-4.82***	-0.097	-4.36***
Sex of household head(female dummy)	-23.306	-2.30**	-0.192	-3.65***
Location (1=Addis Ababa,0 otherwise)	7.800	0.71	0.070	1.19
Migration network				
Amhara	-51.234	-1.47	-0.206	-1.89*
Gurage	-55.246	-1.89*	-0.347	-2.93**
Oromo	-53.326	-1.56	-0.278	-2.35**
Tigrayan	-28.307	-0.68	-0.104	-0.78
Human capital variables				
Number of household members illiterate	-7.792	-2.19**	-0.097	-3.59**
Number of household members literate	-0.397	-0.06	-0.015	-0.33
Number of household members with primary education	-3.498	-1.61	0.022	-1.44
Number of household members with secondary education	4.050	1.57	0.032	1.76*
Number of household members with technical and vocational education	8.334	0.82	0.037	0.55
Number of household members with university education	27.262	5.98***	0.226	7.65***
Constant	258.344	8.02***	5.354	38.93***
Adjusted R^2	0.157	-	0.246	-
F statistics	9.38	-	15.09	-
Number of observation		719		716

Note: the result is based on the regression of non remittance receiving households

Note: * significant at 10% level, ** significant at 5%,*** significant at 1% level

Annex 11: Results of random effect, fixed effect regressions and pooled OLS
Dependent variable: logarithm of real per capita annual expenditure

Variables	Fixed effect regression		Random effect regression		Pooled OLS	
	coefficients	T values	coefficients	Z values	coefficients	Z values
Literate	-0.058	-1.06	0.065	1.58	0.161	4.89***
Primary	0.101	2.05**	0.243	7.51***	0.292	10.64***
Secondary	0.175	2.56**	0.525	13.3***	0.624	18.49***
Techvoc	0.197	1.39	0.598	7.43***	0.733	9.99***
University	0.322	3.64***	0.880	19.48***	1.029	25.32***
Age	0.011	4.52***	0.005	5.29***	0.006	7.74***
Male dummy	0.005	0.07	0.032	1.07	-0.005	-0.25
Hhsize	-0.095	-12.61***	-0.079	-17.42***	-0.096	-22.21***
Awassa	-	-	0.085	1.53	0.094	2.93**
Bahirdar	-	-	-0.101	-1.71*	0.104	2.43**
Dessie	-	-	-0.359	-6.17***	-0.037	-0.9
Dire Dawa	-	-	0.145	2.93**	-0.309	-7.98***
Jimma	-	-	-0.134	-2.87**	0.178	4.95***
Mekelle	-	-	-0.053	-0.79	-0.117	-3.10***
Remit_1	0.002	1.82*	0.002	2.35**	0.001	1.44
Cons	2.031	15.37***	2.043	30.12***	1.958	37.35***
R-squared within	0.049		0.035		-	
R-squared between	0.083		0.232		-	
R-squared overall	0.072		0.170		0.171	
F-statistics	20.64				98.27	
Wald chi2(15)			904.61		-	
Sigma_u	0.711		0.462		-	
Sigma_e	0.650		0.650			
Rho	0.544		0.335			
Number of observations	6302		6302		6302	

Note: time invariant variable (location dummies) dropped from the regression in the case of fixed effect regression.
: * significant at 10% level, ** significant at 5%, ***significant at 1% level

Annex 12: Hausman specification test

	(b)	(B)	(b-B)	Sqrt(diag(v_b-v_B))
	Fixed		difference	S.E.
Literate	-.0554892	.0673566	-.1228458	.0366176
Primary	.0945208	.2308232	-.1363023	.0377009
Secondary	.1658787	.4965503	-.3306715	.0564671
Techvoc	.1766046	.5567475	-.380143	.1157667
University	.302274	.8444387	-5421647	.0758608
Age	.0101907	.0042189	.0059718	.0022076
Maledum	.0267253	.0440057	-.0172804	.0649126
Hhsize	-.0961485	-.0805105	-.0156379	.0060082
Rremit	.0032534	.0055393	-.002258	.0004956

b=consistent under H0 and Ha; obtained from xtreg
B=inconsistent under Ha; efficient under H0; obtained from xtreg
Test: H0: difference in coefficients not systematic
Chi2 (9) = (b-B)'[(V_b-v_B)^(-1)](b-B)
=104.22
Prob>chi2= 0.0000

THE POSSIBLE EFFECT OF ETHIOPIAN TRADE IN SERVICE LIBERALIZATION ON WELFARE: A *CGE* SIMULATION EXERCISE

Teressa Belete[1, 2]

Abstract

The study has focused on the possible welfare effect of the service sector liberalization. The qualitative assessment, which is undertaken by evaluation of Ethiopian service sector policy compatibility to GATS principles, indicates that there is no perfect overlap of the two. This indicates existence of adjustment costs on liberalization. The quantitative assessment, on the other hand, has tried to quantify the net welfare effect of the liberalization with different scenarios at macro level using CGE model. The result of the simulations shows that the country derives higher welfare gain from liberalizing its service sector. Moreover, the comparison of service sector liberalization and goods trade liberalization shows that there is higher welfare gain in case of goods trade liberalization than service trade liberalization due to the relatively low protection in service sector than goods sector. Finally, simultaneous liberalization of the service and goods trade also shows higher welfare gain even though the welfare is less than the additive welfare of the separate liberalization of the two sectors.

Keywords: Liberalization, Services, Barriers, Ethiopia

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1. Introduction

Most traditional international economics textbooks tend to assume that services are largely non-tradable. However, this believe was changed since the late 1980s and the 1990s when the service trade has emerged to become a dynamic sector whose importance continued to rise in most economies (Konan and Maskus, 2006). They indicated that in high-income countries, on average, services constitute nearly two thirds of total Gross Domestic Product (GDP) and among low-and middle income countries they account for smaller share -54%- but still the majority of output. The Ethiopian service sector is not much far from this average. According to the report of National Bank of Ethiopia(NBE), the share of the service sector in GDP has been growing up steadily in recent years reaching 40.8 % in 2006/07 from its level of 36% in 1996/97(NBE, 2006/07).

However, the domestic service sector in many developing countries, including that of Ethiopia, are blamed for delivering high-cost and unproductive input services, thereby limiting economic efficiency gains from trade reforms. This, calls for liberalization of the sector so that it improves welfare and enhance economic growth.

Accordingly, the Ethiopian government requested for WTO accession on 13 January 2003 and the General Council established a working Party on 10 February 2003 (Fortune, 2007). Since then different studies have tried to assess the potential outcome of the accession. Regarding the goods trade liberalization in the Ethiopian case, few studies have attempted to evaluate the ex-ante of the country's accession. Such studies include Dejene et al (2007), Cordella and Esemealem (2005), Phillip and Tadele (2005), and Stasinopoulos and Wendwesson (2005). The findings of the researches are mixed regarding the effect of goods tariff dismantling on the welfare, government revenue, poverty and inequality of the country. For instance, Phillip and Tadele (2005) have found out that the goods trade liberalization will result in loss in government revenue and increased economic growth. The study also indicates that the gain from economic growth doesn't offset the loss from government revenue and hence welfare loss to the country.

Similarly, there are some studies like Self et al (2007), Kiyota et al (2007), Stern et al (2007), Dorel and Mengesha (2005), and Alemayehu and Daniel (2003) who have tried to assess the impact of the accession on service sectors. Many of these studies employ partial analysis of the financial service sector liberalization except Alemayehu and Daniel (2003)[3], who have also considered the airline service liberalization and Self et al (2007), which is limited to the telecom sector liberalization assessment.

[3] Alemayehu and Daniel (2003) is currently published in Oyejid and Lyakura, eds(2008)

Moreover, only some of the studies, only Kiyota et al(2007) and Stern et al (2007)-for the financial sector, have undertaken the quantitative impact assessment using econometrics. Thus, there are limited studies, if any, which have quantified the potential impact of the service sector liberalization using economy wide models such as computable general equilibrium models. This is an important lacuna given the increasing importance of the service sector to conduct this research.

The main objective of this study is, thus, to identify the possible effect of trade in service liberalization on the welfare of the country by undertaking the liberalization policy simulations with CGE model. The study will review theoretical and empirical literatures on the service sector liberalization, assess extents of compatibility of Ethiopian service sector policy with GATS principles and quantify the welfare impact of the service sector liberalization using CGE model. The study used secondary data from different publications of National Bank of Ethiopia (NBE), Ethiopian Investment Authority, International Monetary Fund (IMF) Balance of Payments Statistical Yearbook, Ministry of Finance and Economic Development (MOFED) and UNCTAD data base. The main data to be used for the Computable General Equilibrium (CGE) model simulation is the 1999/2000 Social Accounting Matrix (SAM) constructed by Alemayehu and Tadele (1999/2000).

The rest of the paper is organized as follows. The next section presents the literature, section three and four will undertake the qualitative and quantitative assessment of the liberalization of the service sector respectively, results are presented in section five and section six concludes with some policy recommendations.

2. The literature

The literatures on service sector liberalization are very limited due to the fact that there is lack of comprehensive data on cross-border services trade, and FDI and the associated barriers, together with the difficult conceptual problems of modeling that are encountered. As a result, most CGE or sectoral modeling literatures to date have been focused on barriers to international trade in goods rather than trade in services and FDI (Hoekman, 2006). Despite this fact, there are various literatures, both theoretical and empirical, explaining the impact of service sector liberalization on welfare of an economy. Some argue that it has a positive effect on welfare while others argue the other way round.

Theoretically, service sector liberalization will have an advantage from both the supply and demand side. The supply side benefits are of two types. The first type is that domestic services market liberalization and the opening of the services sector to

external competition are expected to encourage quality improvement and product and process innovation, reduce the scope for waste and rent-seeking, as well as impose significant limitations on the economic power of any individual producer (UNCTAD, 2008). The second type is that service trade liberalization reduces the capacities and tendencies for actual and potential government regulation and control thus leading directly to a more dynamic development process steered by the private sector (Oyejide and Bankole, 2001).

Similarly, from the perspectives of consumers of services (demand side), increased quantity and enhanced quality of services from alternative sources of supply will give rise to substantial reduction in prices and economic distortions. Services market liberalization has the potential to increase the number of services providers, thus engendering competition, quality improvement, product and process innovation, and investment, and reduce government anti-competition regulation, as well as to enhance efficiency of consumer choice and certainty in the market (Hoekman and Matto, 2008). These effects lead both directly and indirectly to increased supply, lower prices, and gains in consumer surplus.

However, there are also costs associated with the service sector liberalization that are expected to reduce the welfare increase argued above. The social Adjustment cost involved in establishing reforms to improve the conditions for investment and growth in the services sector is potentially significant in terms of the employment implications of job losses, skills and professional obsolescence, and adverse effects on social services and culture (Oyejide and Bankole, 2001; Khor, 2006).

The latter argument seems to be critical issue for Ethiopia. Many of Ethiopian service sectors like banking and insurance are intensively using labor relative to capital, compared to foreign banks or insurance companies. Hence, if the sector is liberalized, foreign firms will have opportunity to participate in the domestic banking and insurance service provision. This will change the production function of these services from labor intensive to capital intensive which results in job loses to majority. It might take long period of time for the country until the economy absorbs these displaced employees.

Similarly, the liberalization may also adversely affect culture of the country. i.e., Ethiopia is characterized being home to diversified ethnic groups that have their own culture. Currently, medias like Television and Radios, which are government owned are used to reflect these cultures. But once the service sectors, like TV and Radio, are liberalized foreign companies could take the job of transmission since the sate have no more exclusive right to transmit. This gives a chance to the foreign firms to

affect, could be positively or negatively, the culture of the country by diverting the content towards their own culture.

There are also arguments from the environmental perspective. The perception that the services economy has no significant impact on the environment is increasingly called into question as high income services based economies still account for most of the world natural resources consumption, polluting emissions and impacts on biodiversity (OECD, 2006 ; Tewolde Berhan , 2005; Andrew, 2000). The argument is that the service sector liberalization will result in loss of jobs for some people. This people might degrade the environment while running for alternative job for survival. However, due to the complexity of the topic and its recent development as a field of research, the understanding of the services sector's environmental impacts remains incomplete and fragmentary at best, with the notable exception of certain sub-sectors that are better documented due to their close relationship with the environment and natural resources. This is the case for the tourism and transportation industries (Mayrand and Paquin, 2007).

The empirical literatures also show a mixed effect. Some come out with the positive association between service trade liberalization and welfare while others argue that they have an inverse relationship. One of the studies on the first category is the one undertaken by Konan and Maskus (2006). They build a CGE model to investigate the potential effects of removing barriers to trade in services in Tunisia. They argue that increasing international competition on service markets will reduce the cartel effect- the markup of price over marginal cost- that incumbents are able to charge due to restricted entry; and attenuate what they term the "cost inefficiency effect"—the fact that in an environment with limited competition marginal costs of incumbents are likely to be higher than if entry were allowed. They concluded that removing policies that increase costs can have much greater positive effects on national welfare than the removal of merchandise trade barriers, by up to a factor of seven or eight.

On the other hand, the assessment of the impact of service liberalization on employment and output for China, by Li et al (2003), shows a mixed outcome. They have employed a CGE model designed specifically for this issue and simulated the potential impact of service sector liberalization on employment and output in China. Their analysis suggests that service sector liberalization could produce substantial benefits for China in terms of economic growth and consumer welfare. However, along with the service liberalization, some labor force would move from a narrowly defined service sector to other sectors such as automobile, construction and water. This results in adjustment cost, and they concluded that implementing complementary policy measures to reduce strains in labor market during the process of liberalization is necessary.

Fink et al (2003) have also analyzed the impact of policy reform on sectoral performance in basic telecommunications. Their data cover 86 developing countries globally for the period 1985-1999. They address three questions, covering the impact of: (1) policy changes relating to ownership, competition, and regulation; (2) any one policy reform coupled with the implementation of complementary reforms; and (3) the sequencing of reforms. Their findings are: (1) privatization and the introduction of competition significantly increase labor productivity and the density of telecommunication mainlines; (2) privatization and competition work best through their interactions; and (3) there are more favorable effects from introducing competition before privatization. They further conclude that autonomous technological progress outweighs the effects of policy reforms in increasing the growth of teledensity.

Finally, there are some empirical literatures specific to the Ethiopian case as discussed in section one. One of the pioneering works was by Alemayehu and Daniel (2003), currently published in Oyejid and Lyakurwa(2008). They have tried to see the impact of service sector liberalization on two sectors-Financial and Airline service sectors. In order to assess the impact of the liberalization on these sectors, they have undertaken the thorough analysis of the performance and regulatory framework of the sectors. Their finding regarding the financial sector is that multilateral trade rules may result in myriad of problems such as making domestic banks vulnerable and hence force them out of market in a very short time, foreign domination of the banking sector and failure of the central bank to endure prudence band performance[4]. However, regarding the airlines liberalization, the researchers are optimist in the sense that since Ethiopian air lines is relatively competitive enough to deal with its competitors, the liberalization will not have a remarkable negative impact on the sector.

The other study by Kiyota et al (2007) seems to confirm the recommendations by Alemayehu and Daniel (2003) regarding the financial sector. Kiyota et al (2007) have assessed whether Ethiopia would benefit from allowing foreign participation in the financial sector or not. In order to accomplish their objective, the authors have run a regression to compare the performance of the state-owned and private owned banks. They used different proxy variables for the performance like cost divided by asset,

[4] As a result, the authors recommends: 1)to invest in building the institutions required to adequately regulate and supervise both the existing and incoming new banks by investing on the human resource of the central bank's supervision and regulation department, which is badly staffed,2)the country may need to explore joint venture in the banking sector so as to exploit both learning new technology and also ensure the survival of its indigenous banks,3) protecting domestic banks need not be done for eternity. There should be a clear and transparent procedure which inform the banks when they are expected to graduate from such protection, 4) liberalizing the sector need to be done on gradual and sequential manner with an eye to 'learning by doing', and 5) Since the airline is relatively competent, it can be strategically liberalized with little impact.

return on assets and interest rate spread. The regression output has shown that the state owned financial sectors performed lower and have high cost while the reverse is the case for the private ones. They also noted main reasons why the Ethiopian government opposes the financial sector liberalization based on infant industry protection, argument that led to credit allocation towards large scale industrial and service sector which oppose the Agricultural Development Led Industrialization (ADLI) policy of the economy and it might lead to less saving mobilization to liquidity problem.

Kiyota et al (2007) still recommend many advantages that the country will derive from liberalizing the financial sector gradually. Such advantages include increased efficiency due to high competition, increased employment from high foreign direct investment (FDI) and increased access to credit for the poor. However, the study did not quantitatively show these benefits. Moreover, the regression did not seem to address the impact of the inflow of the foreign financial firms on the domestic firms. What it shows is only the comparison of the performance of the state-owned and private held banks. Since the private banks included in the regression are the one owned by the nationals of the country, it might not address issues like infant industry protection, and saving mobilization which could be a consequence of foreign firm inflow and concern of Ethiopian government.

On the other hand, Stern et al (2007) have assessed the impact of the Ethiopian financial sector liberalization both quantitatively and qualitatively. The quantitative assessment tried to assess the impact of the liberalization on financial intermediation, economic growth and income inequality using econometric model. The finding is that the liberalization increases the financial intermediation index by 1.35, the economic growth by 0.5 and the result also suggests that the gains from the development of financial intermediation are equal for both poor and wealthy people. The regression result also shows similar findings to the one by Kiyota et al (2007), discussed above, regarding the performance of the government and private owned banks. But it quantifies that the costs of public banks are 1.6 percentage points significantly higher than those of private banks. Second, the returns on asset of public banks are 1.7 percentage points significantly lower than private banks. These findings imply that public banks are more inefficient than private banks. Third, the interest spread is 1.5 percentage points smaller for public banks than private banks. The qualitative assessment, on the other hand, identifies the potential impact considering the four modes of supply identified by GATS. It considers different scenarios for mode 3 (FDI) supply. In general, the conclusion of the qualitative method is also with recommendation of the liberalization of the financial sector.

In conclusion, there is no consensus on the relationship between service trade liberalization and welfare improvement both theoretically and empirically. The next section tries to assess the impact of the Ethiopian service sector liberalization on welfare qualitatively.

3. Qualitative assessment of the welfare impact of Ethiopian service sector liberalization

The qualitative impact assessment is undertaken by highlighting the GATS principles and Ethiopian service sector policy and assessing the compatibility of the two.

GATS principles

The General Agreement on Trade in Services (GATS) is a pioneering agreement evolved under a multilateral framework that focuses on international transactions related to services. It seeks primarily to secure access into the domestic market of countries by facilitating the progressive negotiation of "offer and acceptance" of conditions among trading countries in order to liberalize all trade in services. Literatures note that there is no single international standard for defining the services sector and there is no precise definition of services in WTO's GATS as well. Instead the GATS uses an informal classification scheme based on the United Nations Central Product Classification that is structured around 12 service sectors and 155 sub-sectors (Mayrand and Paquin, 2007).

The GATS defines trade in services as the supply of services through four modes:

- Mode 1: cross-border supply of services – from the territory of one Member into the territory of any other Member;
- Mode 2: consumption abroad – in the territory of one Member to the service consumer of any other Member;
- Mode 3; commercial presence – by a service supplier of one Member, through commercial presence in the territory of any other Member;
- Mode 4: movement of people – by a service supplier of one Member, through presence of natural persons of a Member in the territory of any other Member.

Mode 1, cross-border supply of services, is essentially similar to trade in goods: only the service itself crosses national frontiers. Mode 2, consumption abroad, refers to the supply of a service in the territory of one country to a consumer located in another country. The consumer travels to the supplying country (e.g. tourism, educational

establishment, ship or aircraft repair, etc) and do not require the service supplier to be admitted to the consuming country. Mode 3, commercial presence, involves the presence in a country's territory of a foreign supplier through foreign direct investment (FDI). Example, establishment of branch offices or agencies to deliver banking, legal advice or communications services. According to Bisset et al (2003), this is the most important mode of supply and probably the most problematic too in terms of policy implications for host governments. The fourth and last mode of supply is the presence of natural persons, which refers to the admission of foreign citizens to provide services. It may be used alone or in conjunction with other modes of supply. This mode of supply does not cover seeking employment, citizenship, residence or employment requirements in another country. Members may still regulate the entry and stay of natural persons by requiring visas but such regulations should not prevent the fulfillment of member countries commitments. This is probably the most controversial mode of supply in the GATS due to its implications for labor and immigration policies (Dabee, 2000).

GATS have three fundamental principles. Namely: national treatment, most favored nation (MFN) treatment, and progressive liberalization. The first principle established a standard for a non-discriminatory market-structure relationship between foreign and domestic suppliers. It thus states that foreign services and services suppliers should be accorded similar treatment provided to nationals in a domestic services market. The second, which is the MFN treatment, concerns a stipulation that prohibits discrimination between other Members of the Agreement in terms of the treatment accorded to their service suppliers, whether nationals or foreign. In this respect, member countries are required to publish all discriminatory restrictions and barriers to market access to ensure transparency. The principle of progressive liberalization is couched on the possibility of using current binding commitments on market access of member countries to provide the basis for future rounds of negotiation. It therefore allows member countries to continue negotiating with a view to achieving a progressively higher level of liberalization in services trade, with the first of such negotiation beginning within five years of entry into force of the agreement (Oyejide and Bankole, 2001).

3.2 Size and policies of Ethiopian service sector

3.2.1 Size of Ethiopian service sector

The Ethiopian services sector comprises of electricity, water, construction, road, rail, ocean, and air transport, communication, tourism, hotel and restaurants, financial services, real estate, health, education and other services. Extensive government intervention has been the usual practice in the majority of the service sector

especially, in the financial and telecommunication services sub-sectors due to their perceived strategic importance in the economy. The contribution of the service sector to GDP of the country is, however, increasing from time to time (see Table 1).

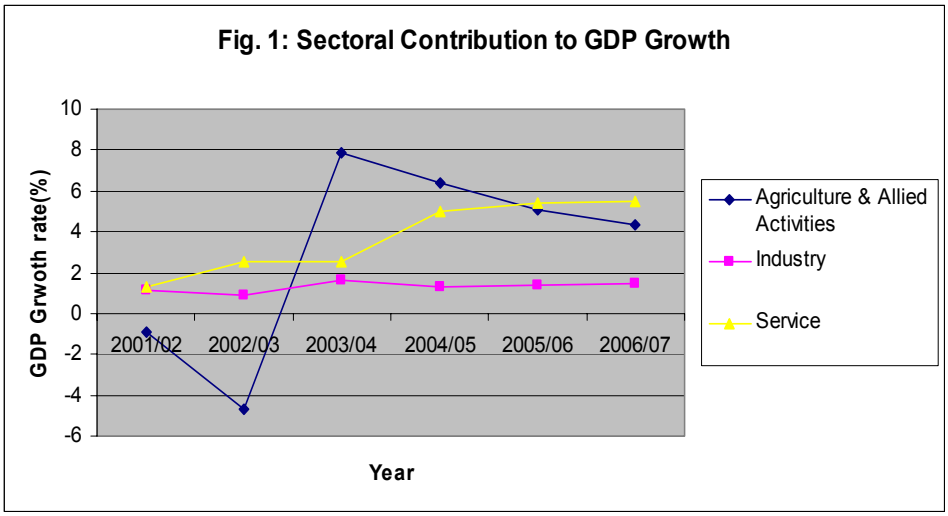
Table 1: Sectoral Contribution to GDP (in Millions of Birr, otherwise indicated)

Sector	2002/03		2003/04		2004/05		2005/06		2006/07	
	Contribution to GDP	Share in GDP(%)	Contribution to GDP	Share in GDP(%)	Contribution to GDP	Share in GDP(%)	Contribution to GDP	Share in GDP(%)	Contribution to GDP	Share in GDP(%)
Agriculture & Allied Activities	29920	44.6	34990	46.7	39729	47	44063	46.7	48226	45.9
Industry	9331	13.9	10420	13.9	11402	13.5	12561	13.3	13944	13.3
Service	27799	41.5	29536	39.4	33312	39.4	37770	40	42877	40.8

Source: National Bank of Ethiopia, Annual Bulletin, 2006/07, P.5

Note: Sectoral Contribution will not add-up to overall GDP growth (100%) because of FISIM (Financial Intermediary Service Indirect Measurement)

As can be seen from Table 1, in terms of sectoral contribution, agriculture has remained the major constituent of the economy having about 46 percent share in the GDP during 2006/07. The service sector is the second dominant sector in contributing to the GDP of the country. Its contribution to GDP has grown from 2.5 percent in 2002/03 to 5.5 percent in 2006/07 while the growth in the contribution of the agriculture and allied activities for the same period is -1.9 and 9.4 percents respectively (see Figure 1). This shows more or less that there is relatively high growth stability in the service sector than the agricultural and allied activities (see also Figure 1 below). This could be attributed to the high dependency of the latter sector on natural phenomenon like rain fall.



Source: Ministry of Finance and Economic Development

Regarding the trade in services of Ethiopia, according to the Balance of Payment Statistical Year Book of IMF, there are three main categories of the components of trade in services for the country (IMF, 2007). These include transportation, travel and other services. The first is further broken down into passenger, freight and other transport carried through air and sea routes, the second has two subcategories namely business and personal travels. 'Other services' comprise many services areas including communications, construction, insurance, financial, computer and information, royalties and license fees, other business services, personal, cultural and recreational, as well as government services.

3.2.2 Service sector related policies

The review of the policies related to each service sub-sector enables us to assess the compatibility of the policy to rules of GATS discussed under section 3.1 above. It is obvious that there are many service sub-sectors. But due to lack of information on some of the sub-sectors and their relative low contribution to service export, only communication, construction, financial and transport services are discussed regarding their policy and compatibility to GATS principles[5]. According to UNCTAD data, these service sectors share on average about 58% from the total service export (UNCTAD, 2008).

[5] The service sector policies discussed here are mainly based on the MOIT Memorandum,2006

To begin with**,** Communications service sub-sector includes the telecommunication and postal services. Under the communication sector, telecommunication services investment is reserved for the government or a joint venture (domestic or foreign) with the government (Proclamation No. 280/2002). However, down-stream activities of telecommunication (resale and tele-centre services, installation and maintenance of cables, wireless local loop, and virtual Internet Service Providers (ISPs) are open for domestic investors. Global Mobile Personal Communication by Satellite (GMPCS) is allowed for both domestic and foreign investors. Postal services are under a government monopoly except courier services which is open for both domestic and foreign investors.

On the other hand, **r**elative to the other service sectors considered here, the construction service sector is the most liberal one. In this sector, more than 90% of the market is handled by the private sector (MOTI, 2006). In this sector, foreign investors are allowed to engage only in Grade 1 Category of construction works (Construction cost above 20 million Birr or above USD 2.3 million) and consulting offices (project value above 30 million Birr or above USD 3.5 million).

The financial Service Sector is however characterized by state monopoly**.** Only Ethiopian nationals can engage in the banking, micro-financing and insurance businesses (except re-insurers) in the country. On the other hand, the transport service which includes road and sea transport, Passenger air transport and Air cargo is another state dominated service sector. Passenger air transport service rendered using aircrafts more than 20 seats is exclusively reserved for the State, while services using an aircraft less than 20 seats are allowed for Ethiopian nationals only. Air cargo is open for private participation. Aviation services provided by different carriers are based on Bilateral Air service Agreement (MOTI,2006).

Freight Forwarding and Shipping Agency activities are only open to Ethiopian nationals pursuant to Investment Proclamation No. 280/2002 and Regulations No.84/2003. Likewise, Commission Agency and Travel Agency are reserved for Ethiopian nationals only. Shipping of export products and import of liquid cargo are open for domestic and foreign companies. Ethiopian Shipping Lines is given the privilege of transporting dry cargo imports. Passenger and goods transport service by road is open for competition, but is reserved for Ethiopian nationals. In the case of road transport, there are bilateral agreements between Ethiopia and neighboring countries such as Djibouti, Kenya and the Sudan. Regarding sea transport, the flag state is the one responsible for qualification, procedures, technical standards and certification and registration of those involved in the provision of shipping services.

3.3 Compatibility by modes of supply of Ethiopian service sector

Mode 1 – Cross-Border Supply

This mode of supply is either subject to restrictions or is prohibited to foreign suppliers. In the communications service sector, as discussed previously, the telecommunication service is supplied by the state alone except the downstream services and Global Mobile Personal Communication by Satellite. Thus, foreigners are hindered from supplying the international telecom services to any country and it is only the state that can do so. Similarly, except the courier services that are currently supplied by the foreign companies, the postal service is also government owned and hence it is only government who supply this type of services internationally. In the financial services sector, we also find that oversea insurers and banks are not allowed. However, there is one exception in the insurance service that transport insurance, and reinsurance are provided in Ethiopia by foreign reinsurance. The transport sector is also relatively state owned while the construction service sector is the most liberal relative to the rest.

Thus, mode 1 liberalization will be riskier for the telecommunication services which are currently fully closed to foreigners on the backbone network. The reason is that the incumbent corporation might not be able to compete with the international telecom providers that are relatively with high technological advancement. However, this doesn't mean that there is no consumer surplus to be driven from the low cost of telecom services due to competition. Thus, the net effect is indeterminate unless quantitative measures are taken. Similar risk will encounter the banking service sector since capital inflow might kick out the domestic banks overnight and the transport sector which is with lack of competition on main services[6]. However, the risk looks less for the postal and insurance services since part of services are currently in line with the GATS principles and it is even less costly for the construction sector where the foreigners are already involved.

Mode 2 – Consumption Abroad

Consumption abroad of financial and communication services is virtually impossible to observe or monitor. However, they might not cause that much capital inflow to the country in the case of financial service sector and competition on the domestic telecommunication or postal service in the case of communication service sector. This mode of supply is also not common feature of construction and transport

[6] However, Alemayehu and Daniel (2003) have argued for high competency of the air transport service in providing the maintenance service

sectors. Hence, the impact might not be significant. In general, because there is little potential impact of Mode 2 liberalization on the Ethiopian service sector or the economy at large, it can be fully bound for all the sectors with little cost[7].

Mode 3 – Commercial Presence

This mode of supply is currently in existent for sectors like communications (except the courier service and satellite telephone) and the financial sector (except reinsurance) and transport services since foreigners are not allowed to undertake foreign direct investments. Thus, the question of commercial presence does not arise for these sectors under the persisting policy. However, it might be for construction services. Thus, there might be pros and cons of the liberalization of this mode of service. The pros of the liberalization include increase in competition in the service sector due to entrance of foreign firms. This in turn reduce price for the consumer resulting in consumer surplus. The cons of the liberalization, on the other hand include, allowing foreign firms to the infant Ethiopian service sector might result in replacement of the domestic infant sectors by the foreign companies. Such problems, however, can be reduced by allowing partial ownership upon accession, with gradually increasing limits on foreign firms and allowing conditional entry of branches upon accession.

Mode 4 – Presence of Natural Persons

There are no sector specific commitments for mode 4. All sectors are subject to horizontal commitments that make provision for the temporary stay of highly qualified personnel. No generally agreed definitions or precise descriptions exist of the types of natural persons to which access is granted. Common types are based on functional or hierarchical criteria, related either to the type of person involved (e.g. executive, manager, specialist) or to the purpose of their movement (e.g. to establish business contacts, negotiate sales, set up a commercial presence, provide services as a contractual service supplier). Thus, the cost of mode 4 liberalization looks relatively low for all sectors as far as care is taken in bounding the commitment in line with mode 3 commitments.

One can also look at the compatibility of the Ethiopian service sector policy as a whole with the three principles of GATS- national treatment, MFN and progressive liberalization. Concerning the first principle of GATS-national treatment-the investment proclamation No.280/2002 and Regulations No.84/2003, for instance, provides tax holidays and duty free privileges for domestic and foreign investors. This is inline with the GATS rule that the national and foreign firms should be treated

[7] This is why this mode of supply is not considered in the scenarios of the quantitative assessment

similarly. Regarding the second principle-MFN- there is no distinction among the services and service suppliers from various countries except in financial and telecom sectors where foreigners are treated differently. However, there are exemptions for sub-regional and regional trade agreements for which Ethiopia is a member. The exemptions to MFN are the regional agreements signed on Economic Integration with the Inter-governmental Authority on Development (IGAD) and Common Market for Eastern and Southern Africa (COMESA). It is also a party to the Africa-Caribbean-Pacific-European Union (ACP-EU) negotiation for the establishment of Economic Partnership Agreement. The third principle is a matter of negotiation and once the country signs GATS, it will undertake the progressive liberalization. Thus, the main problem regarding the compatibility is the limit to market access in most of the service sectors.

In general, the compatibility assessment made so far could help to distinguish the costs and benefits associated with liberalizing each mode for the respective service sectors considered. However, one cannot precisely tell ex-ante the net potential consequence of the service sector liberalization. This calls for quantitative method of estimating the potential outcome(s). The next section, tries to discuss the models used to undertake such assessments and followed by simulation of the liberalization policy.

4. Quantitative assessment of the welfare impact of Ethiopian service sector liberalization

4.1 The benchmark data

As indicated in the introduction, this study uses the 1999/2000 SAM as a `benchmark data. The original SAM is a 40x40 matrix and contains an account each for fifteen production activities, four factors of production, eight commodities, transactions costs, eight institutions, public investment, savings/investments of institutions other than the government, food aid, and the rest of the world (net of food aid). As such it captures the diverse production activities and the interdependencies among the various sectors and institutions that characterize the Ethiopian economy[8]. However, due to two major reasons aggregation of the data is necessary. The first reason is that the management of the results becomes very difficult since many variables are to be included. The second reason is that the scope of this research is limited to be at macro level due to lack of barriers to service at sectoral level for Ethiopia. Hence, it is not relevant to deal with detailed activities.

[8] For more detailed description on the SAM see Alemayehu and Tadele,2004

Thus, for this study, the SAM is aggregated in to three production activities, two factors of production, three commodities, four institutions, saving investment account, three tax accounts and the rest of the world account. The aggregation is made in the following way. The production activities and factors of production are aggregated to agriculture, industry, service and labour and capital accounts respectively. The commodities account includes commodity from agriculture, industry and service activities. The institutions are aggregated in to household, firm, government and rest of the world accounts. The saving-investment account appears as it was in the original SAM and domestic, export and import tax accounts are used in the SAM used for the simulation

The structure of the Ethiopian economy in the benchmark year revealed that the service sector's share in the GDP is about 38%. This puts the sector on the second rank next to agriculture sector, which contributes half of the GDP during the year. The service sector contribution to GDP growth has also grown by 1.3 % while it was negative figure for the agricultural sector during the same year.

4.2 Alternative modeling approaches

Models have paramount importance for trade policy analysis. They provide a theoretically consistent, rigorous and quantitative way to evaluate different economic policies (McDaniel et al, 2004). There are three alternative models or methodologies that are commonly used to quantitatively assess the impact of trade liberalization: Applied general equilibrium (AGE) modeling, partial equilibrium modeling, and econometric analysis such as gravity modeling (McDaniel et al, 2004). The most important question is which of the available models best fit for this research? To answer the question the clear description of the alternative models is presented and the most suiting model is selected and discussed in detail.

AGE models are useful tools to estimate economy-wide effects of trade policy changes. These models are ex-ante tools, used to forecast the economic effects of a policy change (Piermartini and Teh, 2005). Regardless of the great importance of the outputs of such models to policy makers, they are not free of limitations. The critiques include incorporating *ad hoc* assumptions about the price responsiveness of supply and demand, assumption of a representative agent (while individuals reflect different behaviors), the key elements that drive the results of a scenario are not always transparent, and the models and their associated databases are costly to build and maintain (Scrieciu, 2006). CGE models like Global Trade Analysis Project (GTAP) Global Trade and Environment Model (GTEM), and others are some examples of such models.

Partial equilibrium models are also used to evaluate the economic effects of trade liberalization, but within narrowly defined product categories. That is, the model would ignore linkages to other sectors through input-output relationships and do not provide economy-wide effects or broad welfare calculations. However, they are appropriate when the goal is to provide relatively rapid and transparent analysis of the direct effects of a wide range of commercial policy issues (Piermartini and Teh, 2005). Such partial equilibrium models include the Agricultural Trade Policy Simulation Model (ATPSM) developed by UNCTAD, and the Static World Policy Simulation Model (SWOPSIM) of the US Department of Agriculture (Piermartini and Teh, 2005).

Similarly, econometric modeling can be useful in providing a retrospective look at the economic effects of a policy change such as tariff cuts. This type of ex- post analysis is also useful as an input into applied general equilibrium and applied partial equilibrium analysis. Gravity model is an example of such modeling. It was proposed by Jan Tinbergen in 1962 and since then, it is used to analyze the effects of trade liberalization that has already occurred by relating trade growth to tariff cuts, and estimate the trade effects of non-tariff barriers that lack an obvious ad valorem tariff equivalent (Keith, 2003).

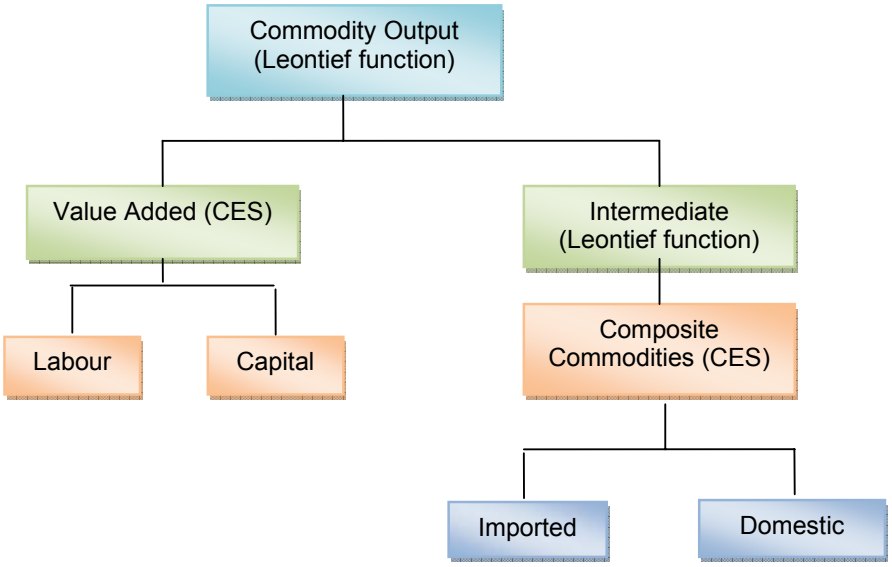
Even though the above discussed models are not mutually exclusive, a researcher can choose one of the models based on the suitability of the model for a particular policy analysis in question. The partial modeling system doesn't enable us to see the economy wide effect of the service trade liberalization. But services are linked to the goods trade (Arnold et al, 2006; Li et al, 2003). Thus, the partial models are not capable of addressing this linkage. On the other hand, the econometric modeling is mainly used for ex-post impact assessments. However, the impact assessment to be made here is ex-ante, since Ethiopia is yet to access WTO (GATS). Moreover, econometric estimations such as gravity model need data inputs like Service Trade Restrictiveness Index which are not available for the Ethiopian service sector.

Thus, Applied General Equilibrium model seems to be the most suitable model relative to the rest of the models. A comparative static standard neoclassical-structuralist CGE model specified by Lofgren et al (2001) is employed here with some adjustments. The model is called mixed type of neoclassical and sturcturalist models since its specification is partially based on neoclassical assumptions about prices(relative prices), and others, and partially based on the sturcturalist CGE modeling, mainly due to its assumption about macro closures and consideration of mark-up prices for the service sector. The model includes a number of features designed to reflect the characteristics of developing countries (Lofgren et al, 2001). These features, of particular importance in developing countries, include household consumption of non-marketed commodities, explicit treatment of transaction costs for

commodities that enter the market sphere, and a separation between production activities and commodities that permits any activity to produce multiple commodities and any commodity to be produced by multiple activities (Lofgren et al, 2001 ; Thurlow and Seventer, 2002[9]). The model can also be used with the Keynesian closure in which aggregate employment is linked to macro variables through a Keynesian multiplier and real investment is fixed (Lofgren et al, 2001). The detailed basic characteristic of the Ethiopian CGE model specified for this research is as discussed below.

The model assumes that producers maximize profit and minimize cost. The technology at the top level is specified by a Leontief function of the quantities of value-added and aggregate intermediate input. Value-added is itself a constant elasticity of substitution (CES) function of primary factors whereas the aggregate intermediate input is a Leontief function of disaggregated intermediate inputs (see Figure 2.).

Figure 2: Production Technology



Source: Author's own construction based on Lofgren et al, 2001.

The mechanism used for equilibrating supplies and demands in factor markets is that the quantity supplied of each factor is fixed at the observed level. Each activity pays an activity specific wage that is the product of the economy wide wage and activity specific wage (distortion) term and the later terms are fixed.

[9] They have used the neoclassical-structuralist model specified by Lofgren et al (2001) to develop a standard computable general equilibrium model for South Africa.

In this CGE model, institutions are represented by households, firms, the government and the rest of the world. Households are utility maximizer and they receive income from the factors of production (directly or indirectly via the firms) and transfers from other institutions. The households use their income to pay direct taxes, save, consume and make transfers to other institutions. Their consumption is allocated across different commodities (both market and home commodities) according to linear expenditure system (LES) demand functions, derived from maximizations of Stone-Geary utility function.[10]

The Ethiopian government collects taxes and receives transfers from other institutions. The government uses this income to purchase commodities for its consumption and for transfers to other institutions. Government consumption is fixed in real (quantity) terms whereas government transfer to domestic institutions (households and firms) are CPI-indexed. One might think that entry into WTO membership may require building new institutions which require more Ethiopian government spending. The reason behind the assumption for such questions is that investments are fixed in real terms, as described below in the closure properties. Government savings (the difference between government income and spending) is a flexible residual.

The final institution is the rest of the world. Transfer payments between the rest of the world and domestic institution and factor are all fixed in foreign currency. Foreign saving or the current account deficit is the difference between foreign currency spending and receipts.

Both domestic output and imports, except the home consumed output, enter the market. Domestic output may be sold in the market or consumed at home. CES function is used to aggregate the marketed output from the different activities of a given commodity. The aggregated domestic output is allocated between exports and domestic sales on the assumption that supplier maximize sales revenue for any given aggregate output level subject to imperfect transformability between exports and domestic sales ,expressed by a constant elasticity of transformation(CET) function. The world prices of imports and exports are exogenous invoking the small country assumption for Ethiopia.

The domestic demand is made up of the sum of demands for households, government consumptions, investment, intermediate inputs, and transactions (trade and transportation inputs).

[10] The Stone-Geary function also known as the linear expenditure system(LES), does not assume unit income elasticity(See Annabi et al,2006)

Regarding the macro closures, there are different macro closures used in CGE models (Lofgren et al, 2001): the Johansen, and the neoclassical closures. The Johanson closure refers to investment-driven closure where investment determines saving or saving adjusts while the latter assumes saving-driven closure where saving determines investment or investment is flexible. The choice between these macro closures depends on the context of the analysis. According to the Lofgren et al (2001), the appropriate closure for the Ethiopian CGE model looks the first type. It recommends that given the analysis is a single period model, a closure combining fixed foreign savings, fixed real investment and fixed government consumption may be preferable for simulations that explore the equilibrium welfare changes for alternative policies(Lofgren et al, 2001).

The CGE model includes three macroeconomic balances. In the government account the level of direct and indirect tax rates, as well as real government consumption, are held constant. As such the balance on the government budget is assumed to adjust to ensure that public expenditures equal receipts. This closure is chosen since it is assumed that changes in direct and indirect tax rates are politically motivated and thus are adopted in isolation of changes in other policies or the economic environment. For the current account, it is assumed that a flexible exchange rate adjusts in order to maintain a fixed level of foreign borrowing (or negative savings). In other words, the external balance is held fixed in foreign currency. This closure is appropriate given Ethiopia's commitment to a flexible exchange rate system.

The savings-investment balance, closures are either investment-driven (the value of savings adjusts) or savings-driven (the value of investment adjusts). The closure is investment- driven. Real investment quantities are fixed. This means that in the case of trade liberalization, a reduction in tariff revenue requires savings to increase through increase in domestic saving to maintain the level of the fixed investment. In such a case, the level of disposable income is reduced with crowding-out effects on private consumption. Finally, the consumer price index is chosen as the numeraire such that all prices in the model are relative to the weighted unit price of households' initial consumption bundle.

4.3 Simulation design for the liberalization

The simulation is structured based on the fact that the service production decisions in the benchmark equilibrium is distorted by imperfect market structure that limit the rights of domestic and foreign enterprises to establish service facilitates in Ethiopia. The liberalization considered mode 1 and mode 3 only since mode 2 is not a problem for any country and mode 4 can be considered in mode 3 for developing countries

(Konan and Maskus, 2006)[11]. Thus, the simulation mainly needs cross border tariffs on mode 1 and the quantification of barriers to FDI(mode 3). The latter parameter is not available for Ethiopia. Where such estimations are not available for the countries concerned, assumptions derived from literature on elasticities estimated for a country with similar characteristics can be applied (Annabi et al, 2006). Accordingly, the parameter is taken from the Tunisian case estimated by Konan and Maskus (2006). This is so because, the 2006 Tunisian service sector is very similar to that of Ethiopian service sector today. However, it must be noticed that Tunisia is not a land-locked country like Ethiopia and as a result have more proximity to European Union , which is the major trading partners to be benefited from in WTO. However, similar estimates from countries that are at least similar to Ethiopia geographically is also missing. Thus, this might overstate the welfare gain undertaken using this estimates.

There are different motives for FDI such as natural resource seeking, market-seeking and efficiency-seeking (Alemayehu, 2006). Here, the motive is assumed to be market seeking and this creates a stiff competition in the service sector. This is assumed to eliminate the price mark ups or rents of the existing firms. FDI in the benchmark equilibrium is also assumed to be null in all the service sectors. This is in fact the case for most of the sectors. However, sectors like construction involve FDI in the benchmark equilibrium (see Annex 2). The marginal analysis for such sectors in the service sector of the country is very difficult, if not impossible, due to data limitation. Thus, this might understate the impact of the liberalization on welfare. Moreover, data limitation on sectoral service sectors confines the simulation to be at macro level. Generally, the simulation scenarios are:

Base Case Scenario

The base case scenario is established to serve as a reference in an absence of any policy shock and serves as a benchmark for policy evaluation. Thus, in this scenario welfare, measured as equivalent variation in the representative agent's real income, and other macroeconomic variables show their value without any shock to the economy.

Scenario 1: Removal of Barriers to Mode 1

A trade barrier in this case might consist of domestic restriction on the cross border service, discriminatory taxes on its operation or regulation on the way consumers consume the service domestically. That is, the rate of tax (tm) on service sector is equated to zero. The initial value to the parameter is assigned from the SAM.

[11] As a result, mode 4 is not separately considered in the simulation.

Scenario 2: Removal of Barriers to Mode 3

Mode 3 of international services provision is arguably the most general and the most important: provision through a commercial presence that is the result of FDI (Deardorff and Stern, 2004). In this mode of service supply, foreign service providers may well face impediments, both to their establishment and to their ongoing operations .These barriers are represented by mp_c parameter. Thus, the simulation is undertaken by equating this parameter to zero.

Scenario 3: Simultaneous Removal of Barriers to Mode 1 and Mode 3

The effect of removal of both mode 1 and mode 3 at a time is considered. Here, unlike the cases under scenario 1 and 2, the tax rate and the barrier to FDI are simultaneously removed from service trade. This scenario also corresponds to the full liberalization of the service sector which will be compared with the full liberalization of goods trade later.

Scenario 4: Full Liberalization of Trade in Goods

Here the extreme case is considered for the goods trade where the tariff on goods trade is assumed to be cut by 100%. Similar to the service sector, the initial value for the goods border tariffs rate (tm) is taken from SAM. Thus, the scenario is equating this value to zero for goods trade liberalization for comparison.

Scenario 5: Simultaneous Liberalization of the Service and Goods Trade

The impact of liberalization of both services and goods trade is simulated. Under this scenario, the simultaneous simulation of scenarios 4 and 5 above are undertaken.

Scenario 6: Simultaneous Removal of Barriers to Mode 1 and Goods Trade

Under this scenario, partial liberalization of services trade is simultaneously undertaken with goods trade full liberalization. The liberalization of cross-border service supply (mode 1) and the goods trade are simultaneously undertaken. That is, (tm) on services and goods is removed while barriers on service FDI (mode 3) are still persistent.

Scenario 7: Simultaneous Removal of Barriers to Mode 3 and Goods Trade

Similar to scenario 6, goods trade liberalization and partial service trade liberalization are simulated simultaneously. However, here the barriers to mode 3, other than mode 1, and barriers to goods trade are removed simultaneously. i.e., mp_c on service FDI and (tm) on goods trade are equated to zero.

One can also undertake other forms of simulation to derive even more robust results for the service trade liberalization impacts. Such scenarios include categorization of the service sectors in to three as: those which can relatively compute with foreign firms like airline and construction sub-sectors, those monopolized by the state like financial and telecom sub-sectors and others. However, such simulation needs sub-sectoral level barriers to FDI, which is lacking for Ethiopia. As a result, the above scenarios become important. The simulation results are presented and discussed in the next section.

5. Results and interpretations

Under this section the simulation results of the different scenarios considered in section four above are presented and the results are discussed in detail.

Table 2: Impact of Mode 1 and Mode 3 Liberalization on Macro Variables (% change from base year Value)

Variable	Scenario 1 (border lib.)	Scenario 2 (FDI lib.)	Scenario 3 (border + FDI lib.)
Welfare(EV)[12]	20.13	29.16	24.75
Consumer price Index	-1.32	-2.63	-2.23
Labor turnover	0.55	0.02	1.37
Capital turnover	0.28	1.33	0.55
Real return to labor	0.54	0.02	1.44
Real return to capital	2.01	5.24	13.12
Government Revenue	-0.77	-1.83	-1.81

Source: Simulation of the Model

Three of the scenarios considered in Table 2 refer to the service sector liberalization. As discussed in section four, scenario 1 refers to the cross border liberalization (mode 1) and scenario 2 refers to the removal of barriers to FDI (mode 3).The last scenario of the table is the combination of removal of cross border tariffs and barriers to FDI simultaneously.

The result exhibits that welfare of the representative agent, measured as equivalent variation in the representative agent's real income, dramatically increases in the three of the scenarios considered here. The welfare increase is higher in the case of removal of barrier to FDI (about 29%) than removal of cross border tariffs (about

[12] Welfare measured as equivalent variation (EV) in the representative agent's real income.

20%) and simultaneous removal of both which is about 25%. This result is in line with the qualitative assessment which argued that since many of the service sub sectors are mainly state dominated, the admission of foreign firms might increase domestic competition and increase consumers welfare by removing mark ups and increasing scope of choice. However, the joint liberalization of both mode one and mode three doesn't imply the additive of the separate welfare gain, which indicates that there is a slightly offsetting interaction between the two scenarios. The consumer price index also shows a significant decline. The cross border liberalization (mode 1) has resulted in the minimum reduction of the CPI-1.32%.

In terms of factor adjustment, about 0.55%, 0.02%, and 1.37% of the labor force would turn over industry of employment under the first, second and third scenarios respectively. Similarly, the turnover for capital is maximum (1.33%) under the mode 3 liberalization. This could be attributed to the fact that FDI in developing countries also results in technology transfer that might result in replacement of outdated technologies available in developing countries like Ethiopia by the modern ones.

The liberalization also shows a decrease in government revenue in the three of the scenarios. In the case of the border liberalization, the reason for the government revenue loses is straight forward. Because the government lose the tariff revenue levied on imported services. But under mode 3, government implicitly earns from the protected incumbent firms like telecommunications and financial institutions. It loses such earnings if other firms are allowed to operate in the respective service sub-sectors. Thus, in all the cases, the liberalization leads to government revenue loses, even though the magnitude is different for the different scenarios considered. This is in line with the results of Phillip and Tadele (2005) government revenue impact in case of goods trade.

Table 3, on the other hand, evaluates four additional simulations. The goods trade alone liberalization (scenario 4), the simultaneous liberalization of goods and service trade (scenario 5), simultaneous liberalization of mode 1 and goods trade (scenario 6) and simultaneous liberalization of mode 3 and goods trade (scenario 7). Scenarios 1, 2 and 3 are also part of this table and are as discussed in Table 2. Scenario 4 considers a 100% import tariff cut on goods trade while the service sector continues being protected, opposite of scenario 3. Under scenario 4, one observes that the welfare has increased by about 32%. This is larger than both the individual liberalization of the two modes of service trade supply or the joint liberalization of the two considered in Table 2 above. There might be many candidate reasons explaining the larger increase in welfare under full liberalization of goods trade than service. The first of such reasons is that there might be lower protection on service trade than

goods trade and hence lower welfare gain from liberalization of service sector. The second could be due to the common problems encountered in measuring the tariff equivalents of non-tariff barriers on services trade (Hoekman, 2006). In the case of the Ethiopian service sectors both reasons look acceptable. From the calibration, the import tariff rate on the agricultural and industrial, and service sectors is on average 0.205 % and 0.127 % respectively. This indicates that there is high protection on agricultural and industrial goods trade than service trade. This results in lower welfare gain in the case of service trade liberalization relative to that of the other sectors. Similarly, surveys assessing the Ethiopian service sector are also very limited. In sum, the result is robust in the sense that the welfare is larger in the case of goods liberalization than service liberalization. The result for Tunisia is the reverse indicating that the barrier is higher in case of service trade and hence higher welfare from liberalizing service sector(Konan and Maskus,2006).

Table 3: Impact of Service and Goods Trade Liberalization on Macro Variables

Variable	Scenario 1 (Border Only)	Scenario 2 (FDI Only)	Scenario 3 (Border +FDI=Service lib)	Scenario 4 (Goods)	Scenario 5 (Goods +Service)	Scenario 6 (Border+ Goods)	Scenario 7 (FDI+ Goods)
Welfare(EV)	20.13	29.16	24.75	31.77	41.61	16.72	18.85
Consumer price Index	-1.32	-2.63	-2.23	-5.07	-16.31	-8.11	-5.88
Labor turnover	0.55	0.02	1.37	3.19	8.47	10.85	1.39
Capital turnover	0.28	1.33	0.55	3.18	15.24	4.69	0.18
Real return to labor	0.54	0.02	1.44	3.13	9.38	10.83	1.34
Real return to capital	2.01	5.24	13.12	0.71	2.74	2.99	21.23
Government Revenue	-0.77	-1.83	-1.81	-6.05	-19.25	-23.44	-5.07

Source: Simulation of the Model

Moreover, the goods liberalization is in favor of the dominant factor of the country (labor) than capital. The change in real return to labor and capital under the service liberalization (scenario 3) is about 1.44% and 13.12% respectively. However, the change in real returns to labor and capital under goods trade liberalization (scenario 4) is 3.13% and 0.71% respectively. This shows that service sector liberalization favors capital while goods trade liberalization favors labor which is abundant factor production for the country in general.

The fifth scenario of Table 3 is the simultaneous liberalization of goods and services trade. The result shows that the simultaneous liberalization of the two sectors doesn't

result in additive welfare change of the individual liberalization of the sectors. The welfare of the representative agent increases by about 42%, which is larger than the separate liberalization of goods and service trade liberalization. However, the gain is below the additive welfare change of the two under isolated liberalization, which is about 57%. This indicates that there is a slightly offsetting interaction between the two commitments. The impact of the blended liberalization of the two sectors on CPI is also significant; it decreases by about 16%.

The six and seventh scenarios of the same table are simulations on partial liberalization of service trade and full goods trade liberalization .The results show that whether goods trade is simultaneously liberalized with mode 1 or mode 3 of service trade, the welfare gain is minimum relative to the rest scenarios. However, it reduces the CPI significantly (see Table 3).

The sectoral price and production effect of the different scenarios considered is also indicated in annexes 2 and 3 respectively. The service sector liberalization scenarios (scenario 1-3) resulted in decrease in import price of the service outputs. The removal of barriers to mode 1 decreases only import price of service trade while mode 3 decreases the import price of agricultural and industrial goods in addition to that of services. The fourth scenario also shows a result similar to scenario 1 with regard to the import price effect. Scenarios 4, 5 and 6 are in line with scenario 2 while scenario 7decreases only agricultural and service import prices.

The production effect (annex 3) also shows that Ethiopia will shift to exporting service outputs. The service export increase by 0.24%, 0.44%, 6.3%, 3.6% and 1.32% under scenarios 1,2 ,3 ,5 and 6 respectively. While it decreases by 2.14% and 0.29% under scenarios 4 and 7. In contrary, liberalization of service sector leads to decrease in import of service outputs except for scenarios 6 and 7, due to import substitution effect (see annex 3).

Moreover, according the Rbyszynski theorem of international trade, the inflow of capital in case of mode 3 liberalization would result in increased output of the sector that uses the capital input intensively(service and industry sector) and reduces that of the labor intensive sector (agriculture).The result here also seems to confirm this theory (see annex 3). Due to mode 3 liberalization, the output of agriculture decreases by about 0.37% .This result is odd compared to the conventional theory and some practical literatures. Theoretically, since service is used as input to most of goods production, liberalization of service increases factor productivity in agricultural production. Rutherford et al (2008), Francois and Wooton (2007), Beck (2002), and Francois and Reinert(1996) empirically show the positive effect of service

liberalization on productivity of goods production for different countries. The negative effect in the Ethiopian case could be due to the weak linkage between agriculture and service inputs. The output of industrial sector increases by about 0.72% due to the admission of the capital inflow as FDI even though it is not the case in the service sector (annex 3).

6. Conclusions and recommendations

6.1 Conclusions

The paper tried to assess both qualitatively and quantitatively the possible effect of liberalizing the Ethiopian service sector on the welfare. The qualitative assessment has shown that liberalizing the different service sub sector will have varying effects on welfare. The welfare gain in relatively open service sub sectors like construction is less compared to closed sectors like financial and telecommunication sub sectors. In the latter sectors, the welfare is high since the liberalization drive out the mark-up prices on service and reduces the scope for resource use inefficiency. This results in higher consumer's surplus relative to the former sectors.

However, this qualitative assessment is with the limitation of showing the quantitative net welfare impact of the liberalization. To fill this gap, the quantitative assessment is undertaken. Due to lack of measurement of ad valorem tariff equivalents of non-tariff barriers on services at sectoral level, the quantitative assessment is made at macro level. The macro level assessment shows that service sector liberalization increases household welfare significantly. Especially the liberalization of the sector to foreign and domestic firms results in maximum welfare increase to the representative household.

The comparison of full liberalization of service trade with that of goods trade also shows that welfare increases more dramatically in liberalization of the latter sector. Moreover, the goods trade liberalization favors labor relative to capital and vice versa for the service sector liberalization, which seems to support the current service sector protection reasoning of the Ethiopian government indicated in the literature. The simultaneous liberalization of service and goods trade also shows the modest welfare increase. The welfare increase under the simultaneous liberalization is less than the additive of the separate liberalization of the two sectors.

Generally, one can conclude that both service and goods liberalization increases welfare. However, the country needs to build prudent policies like admission of joint ventures to learn the new technologies of foreign investors, gradual liberalization (first to national investors and then to foreigners) , especially on the service sector to derive these welfare and other benefits from liberalization.

6.2 Recommendations

Given the literatures reviewed, qualitative assessments and qualitative simulation undertaken on the service sector liberalization of Ethiopia, the following policies are recommended to supplement the liberalization:

- The quantitative assessment has shown that the service liberalization increases capital inflow which is intensively used by the service sector. This favors capital at cost of labor which is abundant resource of the country. On the contrary, goods liberalization favors labor .Thus, Ethiopia should have concert policies on labor employment of the newly established foreign firms on liberalization. This could be done by upgrading her labor force through capacity building and give due consideration to goods liberalization than service liberalization.
- It is important to undertake the service sector liberalization step by step even though the case considered here is a general one. Based on the qualitative assessment, the welfare gain would be larger and sustainable if the country allows foreign firm after empowering the domestic ones on competition. i.e., it would be better if the country undertake domestic liberalization before the international one in sectors like telecom and financial.
- If the country decides to liberalize the service sector, it is advisable to liberalize the sector with the goods sector to minimize the labor turnover.
- While GATS provides for successive rounds of negotiations aimed at achieving higher levels of liberalization, it also clearly states that due consideration must be given to national objectives and to the level of development of a country. In particular, developing countries have the flexibility of opening fewer sectors and of a more gradual increase in market access (Dabee, 2000). Thus, Ethiopia can liberalize those sectors which are relatively open now even though the specific list of such sectors needs further assessment at sectoral level.

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Annex

Annex 1: Foreign Direct Investment Capital Flow (in Thousands of Birr)

Sector/Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Agriculture	318761	344289	99478	1399308	2757474	6542055	25912172	11354753	33666161
Manufacturing	266289	1518072	273312	1214625	2091496	7023190	32935643	11711628	47132295
Service									
Construction	293720	6367	198032	78204	1123072	304935	2518383	456546	1229108
Education	34298	200000	4200	9512	59731	42974	149711	422171	195252
Electricity, gas, steam and water supply					391800	59467		1582	
Health and social works			843238	15460	30219	1099449	114701	1254627	692713
Hotels and restaurants	23893			67526	144479	439051	1781085	5497036	6686344
Real estate, renting and business activities	493938	610716	179793	557589	661247	1137886	5359372	7303778	11936801
Transport, storage and communication	3370			4390	28653	49135	16228	80934	244408
Whole, retail trade and repair service	77480		30388	72955	324835	94543	48254	379072	57035
Other community, social and personal service activities					49750	1700	20900	28000	74385

Source: Ethiopian Investment Authority, 2009

Annex 2: Impact of the Liberalizations on Sectoral Prices

Indicators	% change from Benchmark Value						
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
1. price of exported commodity							
Agriculture	4.39	-3.62	2.85	-5.48	-36.18	5.81	-3.07
Industry	5.93	-1.98	4.94	-5.16	-47.42	5.93	-2.09
Service	4.24	-4.35	1.78	-4.46	-44.48	7.58	-2.68
2. price of activity							
Agriculture	-2.52	-2.72	-3.42	-4.73	-35.21	-8.25	-5.33
Industry	-6.86	-3.24	-7.88	-5.10	-27.34	-19.00	-7.97
Service	-0.85	-1.39	-1.92	-3.30	-32.94	0.43	-5.33
3. price of composite commodity							
Agriculture	-1.23	-2.36	-2.15	-4.82	-38.52	-6.35	-5.23
Industry	-2.75	-3.93	-3.93	-5.40	-40.63	-15.41	-6.28
Service	-0.54	-0.11	-1.41	-3.24	-39.03	2.05	-4.97
4. price of value added							
Agriculture	-8.92	-2.67	-10.54	-2.67	-24.80	-8.11	1.04
Industry	-17.60	-3.47	-19.08	-5.70	-6.32	-22.06	-13.14
Service	9.75	-2.49	10.17	-3.53	-9.13	3.32	-11.62
5. price of imported commodity							
Agriculture	9.09	-3.40	8.32	-19.39	-65.39	-2.63	-19.93
Industry	12.79	-2.84	12.02	-5.03	-75.08	-6.99	1.20
Service	-10.93	-2.76	-13.13	-4.53	-66.56	-0.44	-0.33
6. producer price for commodity c							
Agriculture	-1.34	-2.36	-2.16	-4.42	-39.88	-5.55	-4.32
Industry	-9.97	-4.01	-11.46	-5.13	-24.70	-18.73	-9.51
Service	0.76	-0.65	-0.11	-3.46	-34.96	3.03	-5.41
7. Domestic price of good c							
Agriculture	-2.25	-2.66	-3.17	-4.29	-39.26	-6.44	-4.70
Industry	-10.40	-4.09	-11.98	-5.48	-24.61	-19.31	-9.84
Service	0.65	0.11	0.00	-3.24	-36.89	2.48	-5.50

Annex 3: The Impact of the liberalizations on Sectoral Output

Indicators	% Change from Benchmark Value						
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
1. Quantity of domestic output for com							
Agriculture	-0.30	-0.37	-0.29	-0.27	3.58	-2.22	-0.34
Industry	0.33	0.72	0.53	1.70	-34.94	-1.08	0.53
Service	-0.52	-0.47	-0.36	0.82	2.53	-0.57	0.05
2. Quantity of composite commodity							
Agriculture	-0.01	-0.09	-0.01	0.33	-7.42	-1.06	-0.17
Industry	-0.14	0.39	-0.03	1.98	56.60	-1.46	0.37
Service	-0.03	0.11	-0.03	0.27	-9.01	-0.54	0.08
3. Exported commodity							
Agriculture	5.35	3.93	10.04	4.08	10.32	-13.69	1.75
Industry	-35.91	-22.87	42.06	-67.56	-99.17	-65.90	-91.67
Service	0.24	0.44	6.30	-2.14	3.63	1.32	-0.29
4. Imported commodity							
Agriculture	1.23	-0.95	2.00	-0.46	-92.89	-97.33	-0.34
Industry	-1.12	-0.19	-1.90	-3.00	-5.95	-2.61	-4.86
Service	-1.05	-1.77	-0.01	3.92	-58.75	1.67	1.94

THE DYNAMICS OF INFLATION IN ETHIOPIA: A CASE OF FOOD MARKETS, 1965-2006

Taddesse Emiru Anley[1]

Abstract

Fortunate is the one who can understand the causes of things – Virgil

This thesis tries to identify the major causes of food price inflation in Ethiopia, because not only food takes the lion's share (60%, on average) of the Consumer Price Index (CPI) but also that food price inflation is higher than that of non-food items despite food security is the nation's priority agenda in the Millennium Development Goals (MDGs). The study aims at identifying the major determinants of food price inflation, testing their significance and suggesting policy options to help curb the problem. To this end, annual time-series data on food price index and other variables for the period 1965-2006 (for Model 1) and 1963-2006 (for Model 2) are used from various sources and a Vector Error-correction approach employed. The long-run estimates show a single cointegrating equation in both models and their results support the monetarist contention that money supply is the only significant source of inflation and the direction of causality flows from the money supply (proxied by broad money M2) to food price inflation and not vice versa; but the Keynesian output gap in agriculture doesn't matter to food price inflation. In the short-run, however, structural variables like rainfall and government control on domestic food markets are significant price drivers. As a small open economy, domestic food markets are also found to be significantly affected by world food price inflation indicating the relevance of theories of imported inflation in domestic food markets. Besides, food aid is found to cause dependency syndrome on food producer farmers and hence exacerbating food price inflation. The impulse response analyses in this study suggest agriculture-led sustained economic growth as one way for a lasting solution to curb the malady of food price inflation if combined with tight policies of money supply. Finally, active and selective interventions by the government in the food market is found to be a short-run remedy to curb, at least, 'artificial' inflation of food prices.

KEY TERMS: Food price inflation, money supply and agriculture

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ACRONYM

ADB	Asian Development Bank
ADF	Augmented Dickey-Fuller Test
CPI	Consumer Price Index
CSA	Central Statistical Agency
DPPA	Disaster Prevention and Preparedness Agency
EMA	Ethiopian Meteorological Agency
EPE	Ethiopian Petroleum Enterprise
FAO	Food and Agriculture Organization
IFPRI	International Food Policy Research Institute
IID	Identically and Independently Distributed
IMF	International Monetary Fund
MDGs	Millennium Development Goals
MIT	Ministry of Industry and Trade of Ethiopia
MoFED	Ministry of Finance and Economic Development of Ethiopia
OLS	Ordinary Least Squares
PP	Philips-Perron Test
SD	Standard Deviations
VAR	Vector Autoregressive
VEC	Vector Error-correction
WB	World Bank

1. Introduction

1.1 The problem in context

The Ethiopian economy was known for long for its low inflation. At present, however, it is experiencing high inflation particularly with foodstuffs. Not only does food price inflation exceed that of non-food items in the domestic economy (CSA, 2007 and 2008), but also that food price in Ethiopia is generally more than the world average and has been relatively more volatile (FAO, 2007).[2] Some officials admitted that inflation of food prices is running high, especially in the cities, which resulted in high general price level since food prices account for the lion's share (60 per cent) of the CPI in Ethiopia. To be specific, annual inflation averages 15 per cent during 2005-2008, with the figure slightly higher in Addis Ababa and other regional capitals. Particularly with food prices, as high as 40 per cent inflation is reported (CSA, 2008). Even some scholars hypothesized not less than 60 per cent food price inflation in [urban] Ethiopia recently; for example, Abebe and Andinet (2007), Alemayehu and Abebe (2008).

Throughout the world, inflation is a major source of political unrest (Friedman, 1974 in Richard et al., 1984). On the other hand, it is argued that a moderately high rate of inflation is a necessary byproduct or even a spur to development. In this regard, Sufian (2007) argued, the inflation rate in Ethiopia, which was 6.8 per cent two years ago, stood at 14.7 per cent in 2006/07 due to the economic development the country had achieved in the recent years.[3] The International Monetary Fund, on the contrary, remarked that high inflation in developing countries might be expected to be associated with weak economic performance for several reasons.[4] The plight, however, is that the case in Ethiopia is food price inflation despite good performance of the agricultural sector, especially during the last four years. Why is there food price inflation in the face of agricultural growth, the main supplier of food items in Ethiopia? Seeing that inflation in food items is *not fun agenda* as it puts the lives of rural net food buyers & the urban poor at stake and hence major source of welfare deterioration, the hunch by the public seems not only about the going food price inflation, but also that it may further escalate in the future unless sturdy policy measures are taken. It is frustrating to see that the problem is hardly curbed despite some measures taken by the Ethiopian government that include provision of subsidized wheat & edible oil to the urban poor, export ban on certain food items, removing value added & turnover taxes on [imported] foodstuffs, huge & continued

[2] Mulat et al. (2008) argues that high transportation cost due to high oil prices and poor infrastructure is a possible explanation for this differential.
[3] The Sub-Saharan Informer June 1, 2007
[4] IMF, May 1990 in Ramachandran, 1995

subsidy on oil, introduction of commodity exchange market, etc. Recent reports show that it is under control (below 6%; PM response to the Parliament).

In general, for the government's policy measure to be effective, it requires the identification of the root causes of the food price hike. The interest of the researchers, therefore, is to dig out the real causes and thereby indicate possible policy options that help curb the problem in the country.

More interestingly, the presumption taken up by different intellectuals on the source of the inflation varies significantly. For instance, what the IMF & WB view as the cause of (food price) inflation and what the Ethiopian government suspects lay on the two extremes. The former state increased government expenditure financed by an increased money supply (demand side) while the latter argues for structural factors; that is, even though production has increased, it has not reached the marketplace for 'various reasons'. (Ibid) This, therefore, indicates that the case under scrutiny is not only theoretical quagmire, but also practical. The question remains whether food price inflation in Ethiopia is demand or supply-driven. Is it caused by monetary or structural factors? Or, a combination of these?

The focus on food price inflation is of interest, at least, for three reasons: First, food is a basic need; that is, 'in this ever-changing world, there is one constant, we all need food to live'. Cochrane et al. (1967: 211–7) also noted that even if food supply may be fabulous, inflation on foodstuffs denies the right to entitlement. Besides, for low-income population like ours not only a large proportion of total household income but also a major portion of additional income is disbursed on food. For instance, 72 per cent of household income in Ethiopia went for food in the year 1996 (WB, 2002). This is why food price inflation is agreed to be the major source of welfare deterioration for the urban poor and rural net food buyers. Hence, inflation in food prices as compared to other items should be more critical for low-income economies as it hits low-income households disproportionately adversely even if they sweat hard.[5]

Second, food price dynamics accounts for the lion's share of the CPI in Ethiopia. In 2000, for example, its share was 60 per cent, which is a huge share (CSA, 2007). This entails that food price inflation necessitates general inflationary pressures in the economy both directly and indirectly.

Finally, food prices increased even faster than non-food items that made it the preponderant contributor to high general inflation. For instance, the country-level overall inflation rate stood at 17.2 per cent in December 2007. Similarly, the country-

[5] For details on the social & economic impacts of [food] inflation see Mankiw, 1996 and Dornbusch, 1994.

level food and non-food price inflation rates stood at 22 and 11 per cent in December 2007, respectively (CSA, 2007). Why is the food component of inflation higher than that of non-food items?

Survey of the literature suggests that most of the related studies conducted so far not only focus on general inflation in Ethiopia as opposed to food price inflation but also do they hardly give a comprehensive explanation as to why food prices are soaring although there are attempts by few studies. Therefore, only little is known on the root causes of soaring food prices in Ethiopia. The motivation of this paper emanates from the indicated gap in knowledge.

1.2 Objectives

The study examines the dynamics of inflation in Ethiopia in the case of food markets and aims at identifying the main determinants. Specifically:

- It identifies the most important determinants of food price inflation and evaluate the relative significance of demand and supply side factors;
- It examines the direction of causal relation between food price inflation and other variables;
- It recommends policy options to solve the problem and points out directions for future research.

2. Methodology

This section briefly describes the type of data used [2.1], specifies the model, and discusses estimation techniques [2.2].

2.1 Data Description

To explore the dynamics, annual series data are used that comprise national retail food price index (*FDCPI*), and other structural & monetary variables including average rainfall (*RF*), world food price (*WFDP*), real gross national income (*GNI*), nominal effective exchange rate (*NEER*), in-kind food aid (*FDAID*), money supply (*M2*), and dummy for regime shift (*DDRGM*)[6] for the period 1965–2006. It comes from

[6] DDRGM is 1 for relatively liberalized food markets (Pre-1974 and Post-1991 periods) and 0 otherwise. That is, during the Derg regime (1974–1990), food markets were highly centralized.

various sources and goes through the necessary adjustment for consistency and fit the model.[7]

2.2 Model specification and estimation techniques

Economic theory argues price is a cause as well as an effect variable. The case of food price is also not different. This necessitates the motivation to see the true causality relation food price has with what competing theories state as major drivers. Whilst prior studies examined the determinants of inflation, it may be argued that they do not fully explore the causal relationship between the variables. Besides, most studies focused on general inflation as opposed to food price inflation. This study uses structural VAR modeling approach to address these gaps.[8]

2.2.1 Model specification

Enders (1995:294) noted that when one is not confident that a variable is actually exogenous, VAR models better capture the variables symmetrically. Badawi (2007:1-2) added that there is no prior endo-exogenous division of the series in VAR modeling proper.[9] However, they are criticized of being a theoretical since they use only the observed time-series properties of data to forecast economic variables (Terry et al., 1999). Structural VAR modeling approach, on the other hand, is based on (economic) theory and seeks to identify potentially relevant variables (from competing theories), explores movements that appear to have been causing & highly correlated; and this may, then, be useful in forecasting future food price inflation. This approach, therefore, provides a convenient means of testing causality as it relies on the causal & feedback relations amongst variables. Moreover, it provides an important framework for analyzing both short & long-run relationships among different variables through error-correction models (Johansen and Jeselius, 1992) and facilitates dynamic simulation of variables, which is gaining importance in normative economics (Lutkepohl and Reimers, 1992). Hence, this study utilizes an eclectic structural VAR

[7] Average food price indices for different period based on different base period are linked having December 2000 as a common base. Row station-wise monthly data is aggregated to national average. The potential agricultural output is derived from the trend in the sector's GDP approximated by a linear function. These adjustments are important to capture the true picture of country level food price inflation in Ethiopia because CSA started to collect price data for Addis Ababa since 1963 and country-level data since 1995/6 with the base period changed thrice (1995/6, Dec 2000 and Dec 2006). (CSA, October, 2008 Volume 7, No 1:16 – Amharic Version).

[8] VAR models were first developed by Sims (1980), Macroeconomics and Reality, Econometrica, vol.48

[9] Sims (1980) methodology is referred to by Cooley and LeRoy (1985) as a theoretical macroeconometrics

approach with exogenous series (VAREX/VECM) in order to capture food price drivers from contemporary competing theories.[10]

Before we specify our model the notations should be clear: Z is matrix of endogenous series, and X for exogenous series, β & γ are coefficient matrices and ε is a vector of innovations that may be contemporaneously correlated but are expected to be uncorrelated with their own lagged values and with all of the right-hand side variables. The subscript *t* stands for time period of observation, and Δi for ith difference of a series. In addition, the variables in UPPER CASE are in levels and lower case in logarithms. Then, the model specifies the data generating process as:

$$Z_t = \beta_0 + \beta_1 Z_{t-1} + ... + \beta_{t-k} Z_{t-k} + \gamma_1 X_{t-1} + ... + \gamma_k X_{t-k} + \varepsilon_t \; ; k = \text{ lags} \quad [2.1]$$

Where Z_t and X_t are (nx1) matrices of endogenous and exogenous series, respectively. Each of the β_i's and γ_i's (nxn) is a matrix of parameters, and n is the number of endogenous (*FDCPI*, *GNI*, *M2* and *REER*) & exogenous (*RF*, *DDRGM*, *WFDP*, and *FDAID*)[11] series each. The error-term ε_t is an iid $(0, \delta^2)$.

2.2.2 Estimation techniques[12]

Estimation shall be accompanied by investigation of the (time-series) properties of the data generating process against a *battery-of-tests*: stationarity in the variables and autocorrelation, heteroskedasticity, and normality of the error-terms; model stability for the validity of impulse/experiments; and the direction of causal relations.

If the series contemplated in our models are found to be stationary, we can estimate them using OLS technique. If they are not, which characterizes most economic time-series, OLS may result in spurious results. Yet, it is possible to have valid estimates with non-stationary series if they are cointegrated. Therefore, if the series in our models are found to be non-stationary, cointegration test shall be conducted using the Johansen Procedure for the reason that if a linear combination of non-stationary series is stationary, 'it may cancel out the stochastic trend the series have.' In this

[10] The model treats few series (rainfall, world food price, food aid and dummy for regime shift) as exogenous because: rainfall is a natural phenomenon; small economies like Ethiopia are price-takers in the international (food) market,[10] food aid is a political and/or humanitarian decision and the dummy variable for regime shift speaks for itself.

[11] FDCPI=food price index, GNI=gross national income, M2=broad money supply, REER=real effective exchange rate, RF=rainfall, DDRGM=dummy for regime shift, WFDP=world food price, and FDAID=in-kind food aid

[12] The researchers used Eviews 5 software package to run the data.

case, we say the series are cointegrated and the regression may give meaningful (long-term equilibrium) relationship (Green, 2003:856 and Gujarati, 2004:824). Accordingly, if the variables are cointegrated, the error-correction variants of the model shall be represented by [2.2]:

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + ... + \Gamma_{k-1} \Delta Z_{t-k+1} + \Phi_1 X_{t-1} + ... + \Phi_k X_{t-k} + \Pi\ Z_{t-k} + e_t \ ;.. \qquad [2.2a]$$

More compactly,

$$\Delta Z_t = \sum_{i=1}^{k-1} \Gamma_i\ \Delta Z_{t-i} + \sum_{i=1}^{k} \Phi_i X_{t-k} + \Pi\ Z_{t-k} + e_t \qquad [2.2b]$$

$\Gamma_i = (I - \beta_1 - ..... - \beta_i) = [I - (\sum_{i=1}^{k-1} \beta_i)]$; and $\Pi = -\ (I - \beta_1 - ..... - \beta_k) = -(I - \sum_{i=1}^{k} \beta_i)$ the *error-correction* term

Gaussian error-terms are the basic building blocks for the Johansen cointegration test. Thus, diagnostic tests on the error-terms of our models are indispensable as it determines the validity of the cointegration results. Put differently, it is notorious to the regression results for the error-terms to be autocorrelated, heteroskedastic and/or skewed. Instead, they are expected to be serially uncorrelated, homoskedastic and normally distributed for the cointegration results to be accepted.

We should also mention a concern that the results of the Johansen test can be quite sensitive to the lag length; hence determination of appropriate variables to include (basically from relevant theories) and appropriate lag-order are fundamental. The lag-order (k) is determined using standard model selection criteria, such as Akaike Information Criteria (AIC) and Hannan-Quinn information criterion (HQ) test statistics. Moreover, the importance of each lag is also checked by Lag-exclusion test which evaluates the significance of all endogenous variables at each lag separately and jointly.

The study is interested in the direction of causal relations and the response of effect variables to changes in cause variables. The impact of other variables on food price inflation is of particular interest to this study. Therefore, tests of causality and impulse response analyses are conducted accordingly. The Granger (1969) approach to the question of whether the monetary and structural variables contemplated in the models cause food price inflation is to see how much of the current food price inflation can be explained by its past values and then to see whether adding lagged values of those variables of interest can improve the explanation. A block exogeneity test is also employed to detect whether to incorporate a variable in the model is important. It is a multivariate generalization of the Granger causality test which

determines whether lags of one variable say, money supply, Granger cause any one of the variables in the system.

Given the interrelationship among variables, the dynamics may involve both direct and indirect effects. Impulse response analysis is made to capture both these effects because it represents the time profile of the effect of a shock to one variable on the future values of all endogenous variables. This is particularly indispensable in normative economics and dynamic simulations (Lutkepohl and Reimers, 1992). But, for this inference analysis to be compelling, the model must be stable. To this end, the stability of the VAR should be tested looking at the roots of characteristic polynomial and by checking whether all the roots are lying within a unit circle (Lutkepohl and Reimers, 1992; Enders, 1995:305). If our model is stable, we can make experiments on the direct and indirect impacts of policy related variables (like money supply, exchange rate, rainfall) etc on food price inflation and the policy implications derived.

3. Results and discussion

Logarithmic transformations of the series are used to exploit its advantage of correcting skewed distribution and tackling possible heteroskedasticity (Alemayehu et al, 2007). Only rainfall variable is used in levels for its transformation is found to be *near* stationary and hence disturbs the cointegration relation the model is scrutinizing. Accordingly, the coefficients of the transformed series will have the interpretation of elasticity.

The [in]existence of unit-root and order of integration of the variables are formally checked by ADF and PP tests using general-to-specific modeling approach. And, all the series are found to be integrated of order one (I (1)) at the 5 per cent level and hence ordinary least squares (OLS) regression is invalid as its results are spurious.
In order to see whether the series are cointegrated and determine the number of cointegrating vectors, the lag order and importance of each lag is first determined. To this end, the model is first estimated using VAR modeling approach at the maximum possible lag-order and choice is made based on general consideration of possible signs of autocorrelation in case of shorter lags and over-parameterization (which erodes degrees of freedom) in the case of longer lags. Adoption of general-to-specific approach points to lag-order of one (1) as adequate representation [ANNEX A]. This is stating current food price inflation may be caused by last period changes in monetary and structural variables.

Besides, we checked whether it is *really* important to include this lag in explaining food price dynamics in Ethiopia using Lag-exclusion test [ANNEX B]. It is evident from the estimated results that the lag has a significant contribution to explain current food price inflation and hence legitimate to include in the model. In other words, the null hypothesis that *the lag included can be excluded from the model* is rejected.

3.1 Johansen's Cointegration Test

For the cointegration analyses be valid, diagnostic tests on normality [ANNEX C], heteroskedasticity [ANNEX D] and autocorrelation [ANNEX E] of the error-terms are conducted. The results for these tests establish a legitimate basis for the validity of cointegration analyses since residuals should not be notorious (Alemayehu et al, 2007 and Greene, 2003). The fact that (most of) the series are transformed in to natural logarithms must have 'whiten' the errors. Specifically, the results of Jarque-Bera test of normality show that we fail to reject the null hypothesis (of residual multivariate normality) for the variables individually & jointly since the probability values are reasonably high (joint p-value of 0.4014) – the calculated JB statistics are not statistically significantly different from zero. Therefore, (all) the residuals are statistically normally distributed. Similarly, the White test results show that p-value (0.1330) entail our failure to reject the null hypotheses of homoskedasticity of the residuals.[13] Finally, tests of autocorrelation results indicate that we fail to reject the null hypotheses (of no residual autocorrelation) since p-values are high (the lowest value is 0.2132) and the residuals are not autocorrelated.

Once the error-terms are known to be normal, homoskedastic, and serially uncorrelated, the study tested cointegration relations using the Johansen procedure and the values for both the maximum eigenvalue test (λ max) & the trace test (λ trace) are used to determine the number of cointegrating vectors in the model [ANNEX F]. Both test results indicate the existence of one cointegrating vector in the model. It is found that the maximum eigenvalue test rejects the null hypothesis of no cointegrating vector ($r = 0$) against the alternative of ($r = 1$) at 5 per cent level.[14] On the other hand, the null of at most one cointegrating equation ($r \leq 1$) against the alternative of 2 cointegrating equations ($r=2$) cannot be rejected. And, the same is true for successive tests. This culminates in implying a unique cointegrating vector. By the same token, the results of the trace test for the number of cointegrating

[13] This test is also described as a general test for model misspecifications since the null hypothesis underlying the test assumes that the errors are both homoskedastic and independent of the regressors and that the [linear] specification of the model is correct. Accordingly, the test results prove not only that the VAR residuals are homoskedastic but also that the model is not misspecified.

[14] The test statistics 36.16022 is greater than the critical value 32.11832. The same interpretation follows for others too.

relations ensures that there is a unique cointegrating vector as the test statistic rejects the null hypothesis of no cointegrating vector. Successive rows, nevertheless, indicate that we fail to reject the respective null hypotheses. Hence, these ensure the existence of only one cointegrating vector.

Having seen that our model has revealed a cointegration relation among the (endogenous) variables, ignoring the error-correction element in estimation would result in misspecification problems. From the model estimates [ANNEX G], the equations containing the unrestricted beta coefficients (β) and speed of adjustment coefficients (alpha,α) are given by [3.1]

$$7.0254\ fdcpi + 1.816983\ gni - 23.06772\ m2 - 3.713177\ neer + 2.03418 = 0 \ldots\ldots \text{[3.1a]}$$

After ad-hoc normalization on the variable of interest (logarithm of the food price index), with standard-errors in parentheses, it would appear as in [3.1b]:[15]

$$fdcpi + \underset{(0.54)}{0.25863}\ gni - \underset{(-0.46765)}{3.283468}\ m2 - \underset{(-0.19358)}{0.528535}\ neer + \underset{(0.06037)}{0.289546} = 0 \ldots\ldots\ldots \text{[3.1b]}$$

Eliminating insignificant endogenous variables, we have [3.1c] as the final equation estimating the long-run relationship.[16]

$$fdcpi - \underset{(-0.46765)}{3.283468}\ m2 - \underset{(-0.19358)}{0.528535}\ neer + \underset{(0.06037)}{0.289546} = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{[3.1c]}$$

Therefore, we can make our long-run analyses based on [3.1c]. The long-run estimate implies that, ceteris paribus, there exist a significant positive relation between food price inflation & money supply and nominal effective exchange rate. This seems to confirm the monetarist view that *inflation is a monetary phenomenon*, though may not be always and everywhere. This conjecture sounds in the perspective of expanding role of microfinance institutions and farmers' cooperatives especially in the rural areas and high degree of monetization of the economy especially recently. In this regard, not only the number of microfinance institutions in Ethiopia reached more than 28, mobilizing a total deposit of more than a billion birr, with outstanding loans of approximately 3 billion birr, serving more than one and half a million households, owning assets valued approximately at 4 billion birr, etc (NBE, 2008), but also their role is increasing over time (Andinet et al., 2008 Ch. 5:9).

[15] This ad-hoc normalization involves dividing both sides of the equation by the coefficient of the variable of interest; in our case the logarithm of food price index.
[16] As a rule of thumb, a variable is insignificant if the t-value (ratio of the coefficient to the standard error) is less than 2.

Some researchers including Andinet et al. (2008) indicated that the role of cooperatives has been significantly increasing both in the input and output market through improved access to storage facilities and market information. They added that emergence of farmers' cooperatives and access to credit channeled through microfinance institutions & the Ministry of Agriculture & Rural Development (MoARD) has also greatly contributed to the change in production and marketing behavior of farmers. For instance, '…the availability of [cheap] credit may help farmers reduce/avoid distress selling' (Getachew, 2007) and enabling farmers maintain liquidity (WB, 2007). This may, in turn, contribute to food price inflation through its impact on food supply.

It is not surprising to see nominal effective exchange rate having a positive long-run (ceteris paribus) relationship with food price inflation because Ethiopia is a net importer of food. Besides, it may give the impression that the imported component of food price inflation is a significant determinant of domestic food price inflation. This particularly makes sense when we observe the fact that global food cost hikes have been moving parallelly with that of the domestic, especially in the recent past.

Yet, it should be noted that the coefficients in the above equation shall not be interpreted as they appear unless we know the direction of causal relations among the variables. It is vital to know the direction of causality in order to give economically meaningful interpretation to the coefficients. Granger causality test results help identify this causal relationship with the center of interest for this study being the causal relation of food price inflation with other variables. Accordingly, the results prove that food price inflation has a two-way causal relation with none of the variables, which makes our analyses with regard to this variable of interest more reliable than otherwise [ANNEX H].

More specifically, food price inflation is found to be strongly Granger caused by money supply, and weakly by gross national income (but insignificant), but not by nominal effective exchange rate. The elasticity of food price inflation to money supply is 3.28. This shows that average food price is highly responsive to money supply in the economy since changes in money holding especially by households are mainly for food consumption. The link between the money stock and food price inflation (especially in economies where a larger proportion of household income is spent on food) occurs through a monetary transmission process whereby the amount of money economic agents desire to hold is less than the available money stock. Assuming a stable demand for money, this serves to reduce the value of money thus increasing the price level including food items. The elasticity figure may be high enough to be of interest for future research.

On the other hand, changes in nominal effective exchange rate do not Granger cause food price inflation for the combined reason of imperfect (pegged or at most managed-floating) exchange rate regime in Ethiopia and relatively minor share of food import in domestic supply. Moreover, whereas money supply is found to be exogenous, nominal effective exchange rate is weakly exogenous since the former is a decision variable by the NBE and the latter is determined mainly by the relative appreciation or depreciation of the currencies of (major) trading partners. Having known the direction of causality relationships among the variables, we may proceed to examining their short-run and long-run dynamics using vector error-correction models.

In vector error-correction representation, the short-run dynamics of the series in the system are influenced by the deviation from their long-run equilibrium. Before we proceed to the dynamics of the endogenous series, we shall see the findings on the predetermined exogenous variables.

Focusing on food price inflation, all predetermined exogenous series, are statistically significantly affecting food price changes even at 1 per cent level [ANNEX G]. Specifically, when government actively intervenes in the food market, average food price tend to decline by 10.76 per cent, and vice versa. This is because, in the absence of active price controls by the government, food retailers enjoy a joint monopoly power in setting market prices at least for two reasons: First, food demand is relatively price inelastic; second, there are no (strong) consumers' associations to bargain on retail food prices. This perhaps justifies the need for strategic government intervention in the food market to curb soaring food costs. For example, Elleni (2006) argues 'the introduction of commodity exchange helps to make food markets more transparent & efficient'. Inefficient food markets, if left alone, tend to work at the expense of food buyers.

With regard to rainfall, given Ethiopian agriculture is rain-fed; a statistically significant inverse impact of rainfall on food price inflation is not unexpected. The results indicate that an evenly distributed 'favorable' increase in 10 mm rainfall/irrigation water, to be more realistic, at the national level (but with the biological limit to the amount desired for food production – crop production, grazing land, and fish production) results in average food prices to decline at the rate of 0.00141 per cent, which appears economically insignificant to curb the problem. The researchers would like to shed light on the fact that this finding coincides with the recent experience of Ethiopian domestic food markets – food price hikes in the face of good rainfall/weather condition and bumper harvest. Yet, in a nut shell, good harvest periods due to favorable rainfall may reduce food price inflation via food supply, ceteris paribus. But

the economic significance may be challenged. Yet, this may have interesting implications for potential investors in the food sub-sector.

On the other hand, food aid and world average food price are found to have a strong positive impact on domestic food price inflation; because food aid may have a *disincentive effect* that may exacerbate to the extent of dependency syndrome on the part of the farmers and hence less supply of food.[17] The model estimates confirm doubling in-kind food aid inflow would rather aggravate food price inflation by nearly 2 per cent, ceteris paribus.

As pointed out, domestic food price inflation is more elastic to global food price inflation (0.189) than even food aid, other things being the same. This finding is appealing since Ethiopia is a net importer of food. Domestic food price inflation fetches nearly 19 per cent of global food price hikes (ceteris paribus), which is in line with theories of imported inflation/cost-push theories. Nonetheless, global food price inflation is not totally reflected in domestic food markets because the share of food import in domestic food supply may be minimal.[18]

With regard to the short-term dynamics of the endogenous variables, a variable reacts to deviations from long-run equilibrium relation occurring in the previous period if the coefficient of the lagged error-correction term is significant. It is evident that average current food prices adjust to previous period's error at the rate of 43.37 per cent. Put differently, these rates show how fast short-run deviations in average food price changes adjust to its long-run values.

The test on exogeneity resulted in a combination of both coefficients of short-run dynamics and adjustment parameters to prove the tendency of money supply to be strictly exogenous and effective exchange rate weakly exogenous (see Abdulaziz, 2008 for discussions in the context of general inflation).

Finally, the cointegration test results appear to argue for the hypothesis of long-run neutrality of money because money supply is found to have statistically insignificant impact on national output (income). This study, nevertheless, does not take this as adequate representation to surmise on the hypothesis.

[17] For a comprehensive argument of aid dependency in Africa with particular emphasis to Ethiopia, see Alemayehu et al (1998)
[18] The share of food import in Ethiopia in total merchandise import averages at 11.3 per cent during 1993-2003 (IFS, 2007 Database Researchers' computation)

3.2 Impulse response analysis

In passing, note that economic variables are interrelated! So far, we saw only the direct effects by way of vector error-correction modeling approach. This, however, does not show the indirect effects of variables with long-run equilibrium relationship and hence cannot conclude about total effects. This shall be done using the impulse response analysis as it captures both direct and indirect effects.

Price stability, of which food price inflation is a core element, is a major macroeconomic objective in most economies including Ethiopia. Given this objective, the ability to predict the process of food price adjustments is essential. In understanding and predicting food price inflation in Ethiopia, it is necessary to understand the impact of shocks and the underlying process. From normative economics perspective, an understanding of such interactions and transmission process between (the main) macroeconomic variables and food price inflation serves to guide the process of policy formulation and implementation. Before we embark on actual impulse response analysis, the stability of the VAR models is checked using the roots of characteristic polynomial [ANNEX I] and results indicate that no root lies outside the unit circle and hence guarantees a reliable forecast about the future values of food price inflation in response to changes in other variables (the study did up to 30 periods).[19]

Accordingly, the finding [ANNEX J] supports the Keynesian contention of downward price rigidity in the Ethiopian food markets. One standard deviation shock in food price hike is followed by a persistent increase in the same for decades. Specifically, a unit standard deviation shock in food price inflation causes further inflation of as high as 0.08 standard deviations, especially immediately after the shock both directly & indirectly. This could be why it is not uncommon to see food price surges are difficult to bring back to normal. Besides, expectations could play a vital role in explaining this downward rigidity because current food price inflation may signal further inflation and hence buyers may tend to demand more today. This could instigate additional food price hikes if not supported by a proportional increase in food supply. Besides, if the mass-media is exceptionally broadcasting about ongoing food price inflation, it might aggravate food costs through the *announcement effect*.

[19] This measures the ability of the model to track changes of variables of interest outside the sample. If the models are not stable, innovations analysis would generally be invalid as the model would have poor forecast ability about the future values of a series following a change in an endogenous variable, while all the above analyses remaining valid. Only if a model is stable, inference using impulse response analyses would be valid.

Similarly, the monetarist argument is supported by high elasticity of food price inflation to shocks in money supply explained by as high as 0.03 standard deviations positive response of the latter to a unit standard deviation shock in the former. On top of this, it is important to note that food price inflation has a sustained high elasticity to shocks in money supply, approximately 0.02 standard deviations for decades. On the other hand, a shock in gross national income brings about food price deflation for some 7-8 years, followed by sustained but very low (0.01 SD) food price inflation. One may draw a lesson that sustained economic growth could be a lasting solution for the problem of food price inflation. Because one standard deviation increase in gross national income initially holds food price changes down by as high as 0.025 standard deviations. Besides, food price inflation after nearly a decade of economic growth is not harmful even to final consumers, at least for two reasons: the resulting food price inflation is less than 0.01 standard deviations and sustained economic growth may enable buyers to shoulder such food price inflations as far as it trickles down to the poor.

Finally, one standard deviation increase in nominal effective exchange rate is followed by an immediate brief deflation for about 3-4 years, followed by a persistent inflation in average food prices. This culminates in indicating that food price inflation is less elastic to effective exchange rate – one standard deviation depreciation/devaluation of our currency (as compared to the currencies of our trading partners, on average) fetches only about less than 0.01 standard deviation inflation directly and indirectly in the domestic food markets.

4. Conclusion, recommendation and directions for future research

This section concludes on the major findings [4.1], suggests policy options to curb the malady of food price inflation in Ethiopia [4.2] and directions for future research [4.3].

4.1 Concluding remarks

This paper examined the dynamics of food price inflation in Ethiopia during the period 1965–2006 covering three regimes. It focused on average food price inflation in the context of contemporary theories using a vector error-correction model.

It examined the relative importance of monetarist and structuralist theories in explaining the dynamics of inflation in food markets. The time-series properties of the

variables are checked and found to be econometrically plausible for cointegration and error-correction analyses.

Accordingly, food price inflation is found to have a statistically significant long-run (ceteris paribus) positive relation with money supply (3.283468) and effective exchange rate (0.528535) with elasticities in brackets. But gross national income has insignificant long-run relation with food price inflation.

Granger causality test results found food price inflation to have a bi-directional relationship with none of the variables included in the model. Specifically, nominal effective exchange rate does not Granger cause food price inflation for not only the foreign exchange market in Ethiopia operates under imperfect regime but also food import has a shallow share in domestic food supply. Therefore, the only relevant endogenous variable that Granger causes food price inflation is money supply. This appears to suggest food price inflation in Ethiopia is a monetary phenomenon at least in the long-run.

Nevertheless, results also revealed that food price inflation in Ethiopia is the result of the interplay of monetary & structural variables and domestic & non-domestic factors because the exogenous structural variables like rainfall, regime shifts, world food price inflation and food aid are found to be statistically significantly affecting food price inflation.

Domestic factors are important in explaining food price dynamics in the short run. Specifically, rainfall inversely affects food price inflation since agricultural sector (the major supplier of foodstuffs) is rain-fed. In the effort to solve this malady, more efficient water management through irrigation in an environmentally sustainable way and better agronomics may help because doubling efficient water use is found to deflate food price by 0.0141 per cent on average.

Besides, active intervention by the government is found to help deflate food prices by 0.107633 per cent, on average, at least, through control over speculation in food markets. This indicates that it is worse than futile for the government to expect the inefficient market system to resolve the malady of food price inflation in Ethiopia.
However, food price inflation in Ethiopia is caused by not only domestic but also global factors. Specifically, global food price hikes contribute for domestic food market ailment through food imports. Domestic food price inflation responds to changes in price of the same global market with elasticity of 0.189126 – about 19 per cent of global food price shocks are transferred to the domestic market.

Moreover, food aid to the country is clearly found to be harmful at least in aggravating food price inflation. The elasticity of domestic food price inflation to food aid inflow is 0.018645 indicating the doubling of food aid inflow would exacerbate domestic food price inflation by nearly 1.86 per cent, ceteris paribus.

The impulse response analyses suggest that expectations in the food market are important because food prices are downward rigid and any triggered inflation on food prices would tend to come up with a spiral of the same. But, more importantly, money supply is found to have a strong positive total effect on food price inflation in Ethiopia confirming again the monetarist conjecture that (food price) inflation is a monetary phenomenon.

On the other hand, the demand-pull inflationary pressure of increased (gross national) income is more than offset (in the short-run) by the increased domestic food production as agricultural sector is the backbone of the economy. Even in the long-run (after 7-8 years), the inflationary pressure triggered by the direct and indirect effect of sustained growth (increase in gross national income) appears *manageable* as this will boost the per capita income enabling food buyers shoulder such an inflation on food items as cheap food is no more expected even at the global level. This culminates in pointing out that an efficient utilization of the potential of the economy in general and the agricultural sector in particular may help solve the problem of food price inflation in Ethiopia. Sustained economic growth, therefore, is a lasting solution for the malady of inflation in the Ethiopian food markets.

4.2 Recommendation

Based on the findings of the study, the following (policy) interventions are suggested:
The monetary authority shall carefully monitor the money supply through selective money market operations in order to control food price inflation.[20]

The Ethiopian economy is predominantly agrarian and the agricultural sector is predominantly rain-fed. Decreasing dependence on rain-fed agriculture through effective water management, like irrigation and conservation, should be a priority agenda for the Agricultural Development Led Industrialization (ADLI) strategy to thwart the problem.[21]

[20] See Samuel M. (2005) for the demand of monetary policy in Ethiopia
[21] See International Water Resources Management (2004) for detail treatment on experience and opportunities for promoting small-scale micro-irrigation and rainwater harvesting for in Ethiopia

Ethiopia is a net importer in the international food market; and imported inflation has been significantly contributing for domestic food price hikes. The study, therefore, suggests for efforts to substitute food imports by domestic production so that dependence on food import is reduced through encouraging domestic food processing firms since the lion's share of food import constitutes processed food items. Without adequate substitution efforts, removing taxes on imported food items could be a way out only in the short-run as increasing international food prices continue to be imported.

Similarly, Ethiopia needs to minimize its dependence on food aid as it exacerbates domestic food price inflation through its potential to cause dependency syndrome on the part of recipients both at the household as well as national level. Rather, the study suggests for short-term emergency food aid scheme for unforeseen vagaries of nature combined with efforts to support and teach recipients not to fall in to the trap.
On top of these, active and careful monitoring of food markets by the government through organizing & supporting consumer associations as well as farmer cooperatives, introduction & strengthening of commodity exchange markets in different parts of the country and designing specific policy tools to control creation of artificial shortages and unfair speculation, etc is essential.

4.3 Directions for future research

The study treated food prices in aggregate while the exact causes of food price hikes may be better identified through a careful analysis of specific food items. Hence, it may give a better insight for future studies to focus on major cereals and livestock individually. More importantly, the researchers would suggest for oil price changes to be considered in future studies. In line with this, an interesting question particularly in Ethiopia would be to try to see food price inflation if all world oil price shocks were totally transferred to final consumers as oil has direct or indirect linkages to food price via like transportation of agricultural inputs & outputs. In addition, a kind of panel study considering other rain-fed agriculture dominant African economies may shed more light on the issue as well.

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Annexes[1]

Annex A. Vector Autoregression Lag-order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	47.689570000	NA	0.000002650	-1.496734000	-0.625967000	-1.189748000
1	196.891900000	**225.819800***	**0.00000000204***	**-8.69686000***	**-7.12948100***	**-8.14428600***
2	207.172500000	13.337010000	0.000000003	-8.387704000	-6.123712000	-7.589541000
3	225.482200000	19.794250000	0.000000003	-8.512552000	-5.551946000	-7.468800000
4	239.230000000	11.889990000	0.000000005	-8.390812000	-4.733592000	-7.101470000
5	253.900800000	9.516190000	0.000000009	-8.318962000	-3.965130000	-6.784033000

Endogenous variables: *fdcpi, gni, m2* and *neer;* Exogenous variables: *DDRGM, fdaid, RF,* and *wfdp*

Sample: 1965 2006; Included observations: 37

* indicates lag-order selected by the criterion

LR: sequential modified LR test statistic (each test at 5 per cent level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

NA=Not Available

[1] Annexes are arranged in line with the relevant discussion in the paper for the purpose of easy reference.

Annex B. Lag-exclusion Test (chi-squared test statistics, p-values in parenthesis)

Lag	*Fdcpi*	*m2*	*gni*	*neer*	*Joint*
1	997.2083 [0.00000]	10903.55 [0.00000]	6096.143 [0.00000]	173.217 [0.00000]	**14685.44 [0.00000]**
D.f.	4	4	4	4	**16**

Annex C. VAR Residual Normality Jarque-Bera Test

Component	**Endogenous Variables**				
	fdcpi	***m2***	***Gni***	***neer***	**Joint**
JB Statistics	2.215924	2.429419	2.909072	0.780616	**8.335031**
D.f.	2	2	2	2	**8**
Prob.	0.3302	0.2968	0.2335	0.6768	**0.4014**
Included observations are: 41					

Annex D. VAR Residual Heteroskedasticity White Test

Chi-square Stat.	**Degrees of Freedom (D. f.)**	**Probability Value**
169.38050	150	0.1330

Annex E. VAR Residual Serial Correlation LM Tests

Lags	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
LM Stat.	20.1588	14.6060	18.9569	13.7901	14.3003	15.1666	15.6187	27.5465	26.4866
Prob.	0.2132	0.5537	0.2709	0.6143	0.5764	0.5125	0.4799	0.3580	0.4760
Probabilities are calculated from $\chi 2$ with 16 and 4 degrees of freedom for model 1 and model 2, respectively									

Annex F. Unrestricted Cointegration Rank Test (Johansen Procedure)

Trace Test

Hypothesized Number of			0.05 Critical Values	Probability
None *	0.595056	73.4677	63.8761	0.0063
At most 1	0.415631	37.30748	42.91525	0.1625
At most 2	0.222901	15.81856	25.87211	0.5072
At most 3	0.133486	5.731069	12.51798	0.4952

Maximum Eigenvalue Test

Hypothesized Number of		Maximum Eigen	0.05 Critical Value	Probability
None *	0.595056	36.16022	32.11832	0.0151
At most 1	0.415631	21.48892	25.82321	0.1687
At most 2	0.222901	10.08749	19.38704	0.6095
At most 3	0.133486	5.731069	12.51798	0.4952

* Denotes rejection of the null hypothesis at the 0.05 level

Annex G. Vector Error-Correction Model Coefficient Estimates [with t-values]

Error-correction:	Dependent Variables			
	$\Delta fdcpi_t$	$\Delta m2_t$	Δgni_t	$\Delta neer_t$
Coint. Eq.	–0.433779 [–4.1899]* * *	0.061724 [1.0791]	– 0.108701[–2.20612]* * *	0.303444 [1.69799]* *
$\Delta fdcpi_{t-1}$	– 0.095634 [–0.60985]	0.012444 [0.14363]	0.271279 [3.63485]* * *	– 0.3796 [–1.40236]*
$\Delta m2_{t-1}$	– 0.622075 [–1.69864]* *	– 0.00742 [–0.03667]	– 0.211164 [–1.21154]	0.649044 [1.02673]
Δgni_{t-1}	– 0.128793 [–0.40884]	0.002271 [0.01305]	– 0.369481 [–2.46443]* * *	0.272432 [0.50101]
$\Delta neer_{t-1}$	– 0.070904 [–0.62772]	0.065821 [1.05471]	0.011363 [0.21137]	0.039737 [0.2038]
C	– 1.179846 [–2.70664]* * *	– 0.26625 [–1.10553]	– 0.846755 [–4.08151]* * *	1.050832 [1.39656]*
$DDRGM_t$	0.107633 [2.38475]* * *	0.001801 [0.07223]	0.08664 [4.03342]* * *	– 0.183874 [–2.36015]* * *
RF_t	– 0.000141 [–8.8919]* * *	– 4.0000092 [–0.56103]	0.000249 [3.29941]* * *	– 0.000142 [–0.5179]
$fdaid_t$	0.018645 [2.1975]* * *	– 0.005301 [–1.13092]	0.008195 [2.02933]* * *	– 0.024254 [–1.65601]*
$wfdp_t$	0.189126 [2.25578]* * *	0.106475 [2.29862]* * *	0.120316 [3.01528]* * *	– 0.130186 [–0.89956]
R-squared	0.461059	0.289811	0.591011	0.215558
Adj. R-squared	0.299376	0.076754	0.468315	0.019774
F-statistic	2.85163	1.360253	4.816853	0.915973
Log likelihood	43.91582	67.6485	73.61531	22.08012
Akaike AIC	– 1.695791	– 2.882425	– 3.180765	– 0.604006
Schwarz SC	– 1.273571	– 2.460205	– 2.758546	– 0.181786

***, ** and * imply that the variable is significant at 1 per cent, 5 per cent and 10 per cent levels, respectively. The critical values for these levels are 2.021, 1.684 and 1.303

Annex H. VAR Granger Causality/Block Exogeneity Wald Tests

Excluded	Dependent Variable											
	Fdcpi			*m2*			*Gni*			*neer*		
	Chi-sq	**Df**	**Prob**	**Chi-sq**	**Df**	**Prob**	**Chi-sq**	**Df**	**Prob**	**Chi-sq**	**df**	**Prob**
fdcpi				0.836498	1	0.3604	0.074619	1	0.7847	0.591072	1	0.442
m2	12.03168	1	0.0005				8.622477	1	0.0033	0.404739	1	0.5247
gni	4.465567	1	0.0346	0.811411	1	0.3677				0.120245	1	0.7288
neer	0.026346	1	0.8711	0.743715	1	0.3885	0.240106	1	0.6241			
All	**20.71705**	**3**	**0.0001**	**1.700226**	**3**	**0.6369**	**15.63141**	**3**	**0.0013**	**1.97483**	**3**	**0.119**

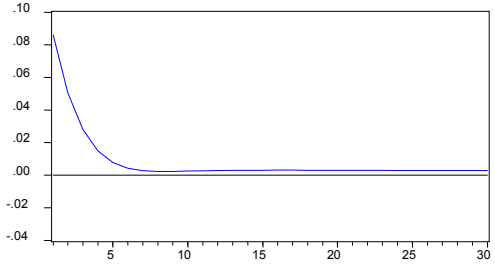
Annex I. Roots of Characteristic Polynomial: Tests of Model Stability

Root	0.9931	0.58732 – 0.15924i	0.58732+ 0.15924i	0.58386
Modulus	0.9931	0.60853	0.60853	0.58386

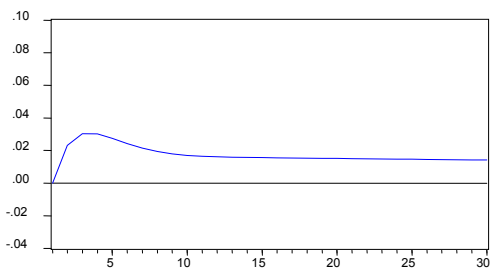
No root lies outside the unit circle – The VAR models satisfy the stability condition

Annex J

(a) Response of food price inflation to innovations in food price inflation



(b



ECONOMIC SHOCKS AND EARLY CHILDHOOD NUTRITIONAL ACHIEVEMENTS: A CASE IN 20 VILLAGES OF RURAL AND URBAN ETHIOPIA

Tassew Woldehanna[1]

Abstract

While the Ethiopian national emergency and food security programs support farmers hit by area-wide shocks such crop failure brought by drought, insects and pests, the idiosyncratic shocks such as illness and death of household member, lose of assets and separation of family or divorce are not covered by any of the social assistance programs. The absence of assistance program to support vulnerable households may lead to serious problem of malnutrition among poor children.

Using longitudinal data of children collected at the age of one and five years (younger cohort data of Young Lives Study), we have examined the effect of area-wide and idiosyncratic economic shocks on nutritional achievement of five-year old children measured by height for age, change in height for age and stunting. The economic shocks considered are those occurred before and after the birth of the child. We have controlled for initial nutritional achievements (at the age of one year), household wealth and household compositions when we regress nutritional achievements on shocks. The serious shocks reported by the respondents that occurred before the birth of the child are (1) decrease in food availability; (2) crops failure; (3) death of livestock death, (4) severe illness or injury; (5) job loss/source of income/family enterprise; (6) birth of new household member, (7) death of household members. The shocks that occurred after the child was borne are (1) illness and death of household members, (2) drought, (3) crop failure, (4) pests and diseases, (5) place employment shutdown or job loss, (6) natural disaster such as drought and flooding (7) divorce or separation of family, (8) death of livestock, (9) increased input prices, (10) decreased output prices, (11) theft and robbery, (12) having to pay for education, and (13) birth or new household member. we found significant effect of shocks not only shock that occurred after the child was born, but also shocks that occurred five years before the child was born implying the long-term consequence of shocks on children growth performance. In addition to the area-wide shocks such as crop failure brought by drought, insects and pests, idiosyncratic shocks such as separation of family, death of breadwinners are important determinants of malnutrition. Although the area-wide economic shocks are very important on which government need to focus more, the idiosyncratic shocks have also considerable contribution to the improvement of children's height for age and consequently to the reduction of stunting and sever stunting in Ethiopia. Therefore, it is still worth if government assistance programs are inclusive of idiosyncratic shocks such as death and illness of household members and separation of family or divorce.

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1. Introduction

Reductions in child mortality' and episodes of illness are often considered as main indicators of social development. As a result, one of the targets of millennium development goals is reducing child and infant mortality rates by two-thirds. In the Ethiopian context, the target set by the Ethiopian national survival strategy is to reduce under-five mortality rate from 140 to 85 per 1000 and infant mortality rate from 97 to 45 per 1000 births between 2005/06 to 2009/10 (MoFED, 2006a, 2006b). Thus Ethiopia has to reduce mortality rate substantially in order to achieve millennium development goals. Nutritional achievement of children is a key in reducing these mortality rates. As a result stunting (long-run nutritional achievement) is also considered as indicators of social development. In this connection, a main question that remains to be answered is that "what are the mechanisms of reducing stunting and child mortality in Ethiopia?"

In Ethiopia it is common that households are hit by shocks which are area-wide such as drought and crop failure and idiosyncratic shocks such as illness and death of household members, increase in food prices, and lose of employment. While these shocks are common in Ethiopia, there is no clear evidences to what level the shocks have persistent effect on children's nutritional achievements.

Therefore, determining the long-term consequences of shocks on children's nutritional achievement at a later period are requires careful analysis. Analysing nutritional achievements and childhood mortality are also useful in identifying health programs that are effective in reducing child mortality.

Moreover, according to Ethiopia's Health Sector Development Program (FMoH, 2005), the major causes of child mortality are pneumonia, neonatal conditions, malaria, diarrhea, measles, malnutrition and HIV/AIDS. In order to reduce child mortality, therefore, ways have to be found that effectively improve the sanitation, nutritional and health seeking behavior of children in the country. Although improvements in nutrition achievement in Ethiopia over the last 10 years have been observed, episodes of illness have increased and health service consultations have decreased over this period (Woldehanna, et al. 2008). As a result reducing child mortality may be problematic. Hence studying the underlying causes of episodes of illness, health seeking behavior, and malnutrition is crucial in order to know more about the underlying causes if child mortality.

In developing countries, economic shocks or crises have been shown to negatively impact child health (Paxson and Schady 2004, Hill et al 1993 and Pongou et al 2005).

Many of these studies have been mainly concerned with the health effects of economic downturns in the short run (Dercon and Hoddinott, 2003) and at household level (Behrman and Rosenzweig, 2004; Haddad et al. 2003). Obviously shocks can have short-term effect on child growth, but as long as social assistances are in place and effective (Yamano, Alderman and Christiansen, 2005), a onetime economic shock should not have long-term impact on children's nutritional achievements. In this regard, there are no studies so far conducted in Ethiopia regarding the long-term consequences of shocks.

The main objective this paper is to assess the long-term impact of economic shocks on child nutritional of nutritional achievement (measured by height for age and stunting). Using the concept of health production function, we analysed the relationship between child malnutrition on the one hand and economic shocks on the other hand. Child's health production function is usually derived from a household's utility maximisation problem subject to income and time constraints (Becker, 1965; Grossman, 1972a, b; Cropper, 1977; Rosenzweig and Schultz, 1983). We used two rounds of Young Lives Survey data of the younger cohort (one and 5-year-old cohort) which follows 2000 such children every 3-4 years starting from 2002. Both round one (conducted in last quarter of 2002) and round two data (collected in last quarter 2006) contain information on height for age of the one year and five years old children, respectively, and on the incidence of economic shocks that hits households up to five years before the surveys. The information on initial height for age of children and on economic shocks that hit household before and after the child was born helped us to assess the short and long run effect of economic shocks on children's nutritional achievement and stunting. The detail information on households' initial wealth and household composition also enables to find the effect of economic shocks controlling for initial conditions of household in which the children live in.

The rest of the chapter is organized as follows. Section two briefly reviews literature on determinants of malnutrition, and the role of shocks. Methodologies of the study and data sources are described in section three. A section four presents the results along with discussions. Concluding remarks are provided in section five.

2. Brief review of literature on shocks and child malnutrition

2.1 Impact of child malnutrition

Malnutrition is currently the single leading cause of the global burden of disease (Ezzati et al. 2002) and has been identified as the underlying factor in about 50% of

deaths of children under 5 years of age in developing countries (Frimpong and Pongou, 2006; Black et al 2003). Nearly a third of these children are stunted and a quarter are underweight, a situation which is expected to worsen in some parts of the world including sub-Saharan Africa (Frimpong and Pongou, 2006; De Onis et al 2000).

Malnutrition in children leads to permanent effects and to their having diminished health capital as adults (Strauss and Thomas, 1998; Alderman, Hoddinott, and Kinsey, 2006; Linnemayr et al. 2008). Young children are believed to be especially vulnerable to shocks that lead to growth faltering (Smith et al. 2003; Beaton, 1993; Martorell et. al, 1994, 1998). Children are particularly susceptible to shocks in their first two to three years of life, and there are several potential reasons for this observation (Omitsu and Yamano, 2006; Martorell, 1999; Behrman, Alderman, and Hoddinott, 2004). First, the growth rate is the highest in infancy, thus adverse factors have a greater potential for causing retardation at this time. Second, younger children have higher nutritional requirements per unit (e.g. kilogram) of their body weight and are also more susceptible to infections. Third, they are also less able to make their needs known and are more vulnerable to the effects of poor care practices (Omitsu and Yamano, 2006).

There is a growing literature that explores whether health shocks have permanent or transitory effects on child health status. This is especially important in light of the epidemiological evidence that stature by age three is strongly correlated with attained body size at adulthood (Dercon and Hoddinott, 2003; Martorell, 1995, 1999). Children that experience slow height growth are found to perform less well in school, score poorly on tests of cognitive function, have poorer psychomotor development and fine motor skills; interact less frequently in their environment, fail to acquire skills at normal rates, and tend to have lower activity levels (Grantham-McGregor et al, 1997, 1999; Johnston et. al., 1987; Lasky et. al., 1981; Dercon and Hoddinott, 2003). They also tend to delay school enrollment, and score less well on cognitive tests (Martorell, 1997).

Moreover, the detrimental effects of slow height growth during early childhood may be long lasting. Alderman, et al. (2002) find that in Zimbabwe lowered stature as a preschooler following exposure to the 1982-84 drought resulted in a permanent loss of stature of 2.3 cm, a delay in starting school of 3.7 months, and 0.4 grades less of completed schooling. The combined effect of these factors was estimated to reduce lifetime earnings by 7 per cent (Yamano et al, 2005). Hoddinott and Kinsey (2001) have found that children aged 12 to 24 months have lost 1.5-2cm of growth in the aftermath of droughts in Zimbabwe in 1994 and 1995, although they did not find a similar negative loss among older children. Yamano et al. (2005) also find a negative

shock on child growth in height only among children aged 6 to 24 months, not older children (Omitsu and Yamano, 2006). Using longitudinal data with information at national and sub national levels, Pelletier and Frongillo (2003) found a significant relationship between child mortality and weight-for-age after controlling for socioeconomic factors and changes in policy.

Child height has proven to be an informative and longer-run indicator of nutritional status of children (Waterlow et al., 1977; Falkner and Tanner, 1986). While height is clearly determined by the time an individual reaches adulthood (apart from shrinking later in life), there is some debate in the literature about the extent to which adult stature is completely determined by the time the child has progressed beyond early childhood (Strauss and Thomas, 1998). Nevertheless, to the extent that height does affect labor outcomes, it will clearly reflect returns to human capital investments made during early childhood and, perhaps, return to strength (Strauss and Thomas, 1998). Dercon and Hoddinott, 2003 found adult height to be correlated with earnings and productivity, poorer cognitive outcomes and premature mortality due to increased risk of cardiovascular and obstructive lung disease. An increasing body of evidence links adult weight or Body Mass Index (BMI) to agricultural productivity and wages (Dasgupta, 1993; Dercon and Krishnan, 2000; Strauss and Thomas, 1998; Pitt, Rosenzweig and Hassan, 1990). Low BMI is correlated with a large number of health-related indicators, including early onset of chronic conditions and increased risk of premature mortality (Waaler, 1984; Higgins and Alderman, 1997). Taller women are also found to experience fewer complications during child birth, typically have children with higher birth weights and experience lower risks of child and maternal mortality (Strauss and Thomas, 1998).

Weight varies in the short run and so provides a more current indicator of nutritional status (Strauss and Thomas, 1998). Since a light person may also be small, and thus not underweight given height (and, conversely, a heavy, tall person may not be overweight), nutritionists have found it convenient to analyze weight given height (Strauss and Thomas, 1998).

2.2 Determinants of child malnutrition

Malnutrition in children is evidently shown to lead to permanent effects and to result in diminished health capital as adults. Linnemayr et al. (2008) further argue that there may also be an intergenerational cycle of malnutrition as a worse health capital stock may be passed on from adults to their children. Thomas and Frankenberg (2002) argue that there is ample evidence at the macroeconomic as well as the microeconomic level that health is positively associated with other dimensions of

economic prosperity, and that causality goes both directions: people with higher income invest more in their human capital and become healthy while healthier workers tend to be more productive and receive higher earnings.

Case and Paxson (2002) examine parental behavior in both the prenatal period and childhood in an attempt to document the ways in which parental behavior and socioeconomic status affect children's health. They present evidence on the correlation of this behavior with income and parents' socioeconomic status, and on the ways in which parents' actions affect children's health. They conclude that while health insurance coverage and advances in medical treatment may be important determinants of children's health, they cannot be the only pillars: Protecting children's health also calls for a broader set of policies that target parents' health-related behavior.

Linnemayr et al. (2008) empirically show that mothers' education and access to clean drinking water are important determinants for the nutritional status of children. They found evidence of a positive impact of female education at the primary level on nutrition, as well as a negative effect of weak social status of the mother measured as a significant age difference to the head of the household.

Frimpong and Pongou, 2006 used data from Ghana and conclude that malnutrition could be associated with health care system and maternal factors. They further argue that it is also important to note that macro-level economic growth that may lead to improvements in household economies may not necessarily translate into improvement in child health and nutrition. The findings from the study reiterate the importance of interventions that address characteristics associated with specific populations within communities. Policy and interventions should emphasis individual, community and governmental level approaches. Empowering parents with necessary tools and information concerning the importance of proper nutrition could potentially overcome differences in occupation, employment status, and mechanisms of decision-making that negatively impacts child malnutrition.

By applying the conditional or quasi-reduced nutrition demand approach to household data from three consecutive welfare monitoring surveys over the period 1996–98, Christiaensen and Alderman (2004) identify household resources, parental education, and food prices as key determinants of chronic child malnutrition in Ethiopia. Though largely consistent with findings from other malnutrition studies, they claim that, their empirical results with respect to the community sanitation, health, and communication infrastructure are less robust, possibly because of confounding factors, such as the quality of health care or lack of variation in the variables. Their results further indicate that it is quite plausible that maternal nutritional knowledge, as measured by the

community's diagnostic capability of growth faltering, also plays an important role in the determination of child malnutrition. For example, increasing the community's ability to rightly diagnose stunted and non-stunted children, respectively, as stunted and non-stunted by 25 percentage points has similar effects as does providing at least one female adult per household with primary education. When community-based programs to enhance knowledge are implemented in addition to the more general development interventions, such as income growth and increased primary schooling, the authors anticipate that chronic child malnutrition in Ethiopia could be reduced by up to 31%.

Using quintile regressions, Aturupane, Deolalikar, and Gunewardena (2006) explored the effects of variables such as a child's age, sex and birth order; household expenditure per capita; parental schooling; and infrastructure on child weight and height at different points of the conditional distributions of weight and height. They find that OLS estimates of the determinants of child weight and height, which effectively estimate the effects of intervention variables at the mean, can be misleading. The results of their quintile regressions indicate that the belief that increases in income are associated with strong nutritional improvements is generally true only at the upper end of the conditional weight and height distributions. Over much of the lower end of the distributions, household expenditure per capita is not a significant determinant of child weight or height. What this means is that income-generating interventions, while very important for a number of other social outcomes, are unlikely to be effective in raising the nutritional levels of those at the greatest risk of malnutrition. They also found evidence asserting discrimination against girls at the lower end of the weight and height distribution, suggesting that even though on average girls are not nutritionally-disadvantaged relative to boys, among children at the highest risk of malnutrition girls are disadvantaged relative to boys. Policy interventions to address child malnutrition need to be sensitive to this reality, and need to especially target girls at high risk of under-nutrition.

The quintile regressions further show that most of the explanatory variables of child malnutrition considered in their study (such as parental education, electricity access, and even availability of piped water) tend to have larger and more significant effects on child weight and height at the higher quintiles than at the lower quintiles. The implication for policy is that since these general interventions are not as effective in raising the nutritional status of children in the lower tail of the conditional weight and height distributions, it may be important to target direct nutritional interventions, such as food supplementation programs to at-risk children (Aturupane, Deolalikar, and Gunewardena, 2006).

2.3 Shocks and child malnutrition

The available empirical evidence to date on the effect of income shocks on child growth suggests pervasive growth retardation (Martorell, 1999; Hoddinott and Kinsey, 2001). As such temporary income shocks may cause permanent damage to children's future welfare and cognitive abilities (Yamano et al, 2005). Using three nationally representative surveys conducted during 1995-96, Yamano et al (2005) find that income shocks, measured by crop damage, reduce child growth substantially, especially among children aged 6 to 24 months. Children in this age group may lose 1 cm growth over a six-month interval when half of their crop area is damaged (Yamano et al, 2005). As early child growth faltering may cause permanent damage, appropriate insurance mechanisms to help households protect their consumption from income shocks are crucial. This holds especially in Ethiopia, where stunting among pre-school children has persisted at alarming levels over the past decades and where droughts are a recurrent phenomenon.

The common feature across both child and adult studies is that temporary shocks can have permanent effects (Dercon and Hoddinott, 2003). As such, conventional studies that focus on the short-term welfare losses associated with reduced consumption following shocks that are not fully insured against may understate the full consequences of these shocks. Dercon and Hoddinott (2003), hence, explored the impact of shocks on health status, making particular use of evidence from Ethiopia and Zimbabwe on the impact of droughts and other serious shocks. They find that health status, as measured by height and body mass, is affected by these shocks, suggesting that they are imperfectly insured against. Livestock and other assets play a role in mitigating these shocks. The evidence also suggests that poor people are using their body as a store of energy, in ways consistent with poorly functioning asset and food markets. This implies welfare losses and puts them at risk of further ill-being. The authors further disclose that the impact of shocks is not uniform within the household. Younger preschoolers are more adversely affected than older preschoolers. Adult women are more often adversely affected than adult men. Amongst adult women, daughters of the household head are more vulnerable than other women. The shocks can have long-term consequences, reducing final attained stature and schooling outcomes. This adversely affects the employment prospects and productivity of these young people. Further, taller (and better educated) women have, on average, taller (and healthier) children, and so the impact of these transitory shocks may well be felt for several generations.

Economic shocks at birth have lasting impacts on children's health several years after the shock. Akresh, Verwimp, and Bundervoet (2007) calculate height for age z-scores

for children under age five using data from a Rwandan nationally representative household survey conducted in 1992. They exploit district and time variation in crop failure and civil conflict to measure the impact of exogenous shocks that children experience at birth on their height several years later using a two-by-two difference-in-differences table. They find that boys and girls born after the shock in regions experiencing civil conflict are both negatively impacted with height for age z-scores 0.30 and 0.72 standard deviations lower, respectively. Conversely, only girls are negatively impacted by crop failure, with these girls exhibiting 0.41 standard deviation lower height-for-age z-scores and the impact worsening for girls in poor households. The authors claim their results to be robust to using sibling difference estimators, household level production, and rainfall shocks as alternative measures of crop failure.

Similarly, using two nationally representative surveys from Nicaragua conducted during 1998 and 2001, Omitsu and Yamano (2006) find that children who experienced a shock (Hurricane Mitch) when they were younger than 2.5 years old have 0.35 points lower height-for-age Z-scores and have 6.6 percent higher probability of stunting than expected in 2001, more than two years after experiencing the shock. The authors used pooled cross section models to identify the impacts of the Hurricane Mitch by using interaction term between the age and year dummies. Dividing the children under 5 into two groups (younger and older than 2.5 years old in the two surveys) and estimating determinants of height-for-age Z-score and stunting in the pooled cross section models, they found results that are consistent with earlier studies which indicate that children aged 2 to 3 years old are vulnerable to economic shocks.

Using household panel data that include directly solicited information on economic shocks and employing household fixed-effects estimation, Carter and Maluccio (2003) explore how well households cope with shocks by examining the effects of shocks on child nutritional status. Unlike in the idealized village community, some households appear unable to insure against risk, particularly when others in their communities simultaneously suffer large losses. Households in communities with more social capital, however, seem better able to weather shocks.

2.4 The Ethiopian case

Substantial efforts have been made to monitor the evolution of child malnutrition in Ethiopia (Central Statistics Authority's Rural Nutrition Survey (Addis Ababa, 1983, 1992); Health and Nutrition Survey (Addis Ababa, 1998); Welfare Monitoring Surveys (Addis Ababa, 1995–96, 1997, and 1999–2000)). The first striking observation is the

sheer magnitude of child malnutrition in Ethiopia; the incidence of underweight children has been consistently around 45%, much larger than the average incidence of 33% underweight children in sub-Saharan Africa in the nineties (Morrisson et al, 2000; World Bank, 2000; Christiaensen and Alderman, 2004). Similarly, surveys in Ethiopia have found more than half the children under 5 years old to be stunted, with stunting rates most often attaining more than 60% while the average prevalence of children stunted for 19 sub-Saharan African countries in the mid-nineties was 39% (Morrisson et al, 2000; Christiaensen and Alderman, 2004).

There are several possible explanations for the high rate of child malnutrition in Ethiopia. Household resources, parental education, and food prices are identified as key determinants of chronic child malnutrition in Ethiopia while maternal nutritional knowledge, and the community's diagnostic capability of growth faltering, also play an important role in the determination of child malnutrition (Christiaensen and Alderman, 2004).

Shocks are also found to negatively affect health status in Ethiopia. Making particular use of evidence from Ethiopia on the impact of droughts and other serious shocks Dercon and Hoddinott (2003) find that health status, as measured by height and body mass, is affected by these shocks. Similarly Yamano et al (2005) showed that income shocks, measured by crop damage, reduce child growth substantially, especially among children aged 6 to 24 months and suggested that the average value of food aid received in a community has indeed a large positive effect on early child growth.
Gilligan and Hoddinott (2007) studied the impact of food aid programs on household food security and welfare and, nutrition and found out that food aid programs such as general food distribution or food-for work have at most a small impact on food consumption or nutrition and often only a short-run effect on aggregate consumption while EGS programs and receiving free food raises growth in food consumption but negatively impacts food security; and suggest that food aid results in accumulated and persistent effects.

The studies cited hitherto unambiguously suggested that shocks can have a detrimental effect on child growth, but as long as there is some kind of social protection program effectively in place, the long term effects of shocks can be deterred. There is, however, a significant gap in the literature with regard to studies conducted in Ethiopia that relate children's nutritional achievements, the impact of economic shocks and the role played by social protection programs. This particular study intends to bridge this gap by investigating the effect of short and long-long-run effect of economic shocks on nutritional achievement of children amid with social assistance programs that existed more than a decade ago.

3. Method, data source and description of data

3.1 Econometric model

As indicator of child health production, child malnutrition (height for age and stunting) are analysed using an econometric model (described below) derived from a household's of utility maximisation subject to income and biological health production constraints (Grossman, 1972a, b; Cropper, 1977; Rosenzweig and Schultz, 1983). The dependent variable is child's height-for-age (stunting). While the variables of interest are economic shocks that occurred before and after the birth of the child, various independent variables are used as controlling factors. Some of these variables are initial conditions such as height for age or stunting in round one, wealth index and household composition in round one. Lagged height-for-age is expected to help to capture lagged effects of health inputs and nutritional achievement. In order to make the model parsimonious, avoid the problem of endogeneity and have clear causal inferences, we used lagged variables (initial conditions) as explanatory variables for household wealth, education, and household compositions. Moreover, these variables are clearly exogenous variable in our setting as the dependent variable is nutritional achievement of five years old children who have not yet started to supply labour for the household that could influence household income. Shocks that hit the household before and after the birth of the child are included as these shocks affect health inputs and household income. Specifically the following three econometric models were examined with the objective of checking the robustness of results:

$$\Delta\left(\frac{H}{A}\right) = \beta_1 + \beta_2\left(\frac{H}{A}\right)_{t-1} + \beta_3 X_{t-1} + \beta_4 S_{t-4} + \beta_5 S_{t-8} + \varepsilon_t \quad \textbf{(3.1)}$$

$$\Delta\left(Z\,score\,of\,\frac{H}{A}\right) = \beta_1 + \beta_2\left(Z\,scoer\,of\,\frac{H}{A}\right)_{t-1} + \beta_3 X_{t-1} + \beta_4 S_{t-4} + \beta_5 S_{t-8} + \varepsilon_t \quad \textbf{(3.2)}$$

$$\Delta \ln H_t = \beta_2 + \beta_2 H_{t-1} + \beta_3 X_{t-1} + \beta_4 S_{t-4} + \beta_5 S_{t-8} + \varepsilon_t \quad \textbf{(3.3)}$$

$$\left(\frac{H}{A}\right)_t = \beta_1 + \beta_2\left(\frac{H}{A}\right)_{t-1} + \beta_3 X_{t-1} + \beta_4 S_{t-4} + \beta_5 S_{t-8} + \varepsilon_t \quad \textbf{(3.4)}$$

where H/A is height-for-age; H is height of the child in centimeters, H_{t-1} is lagged height of the child in centimeters; A stands for the age of the child in months; X_{t-1}

lagged values of covariates other than those included in the regression; S_{t-4} is shocks at time t minus four years (shocks that occurred after the birth of the child) and S_{t-8} is shocks that occurred before the birth of the child (at most eight years before round two survey); β are parameters to be estimated, t is time, and ε is the error term. The shock variables (S) include drought, crop failure, breadwinners' illness, death of household members, theft, etc, while covariates (X_{t-1}) include household socio-economic characteristics such as household composition and household wealth. The variables of interest are shocks that occurred before and after the birth of the child (i.e., S_{t-8} and S_{t-4}). In all regressions, we did not include age of the child as explanatory variable because the children considered in this paper are around the age same age (one year in round one and five years in round two) and hence there is little variation in age among the children. Moreover using the same set of independent variables, we run a probit model of probability of a child being stunted and severely stunted.

3.2 Data source and description of data sets

We used Young Lives data of the younger cohort combing data of round one and ro0und two. For the economic shock variables, we used data obtained from round one which are shocks that occurred before the child was born and those obtained during the second round survey which are shocks that occurred after the child was born. For the outcome variable, we used height for age, changes in height for age, changes on z score of height for age. As a robustness check we also run a probit model in which the dependent variables are stunting and sever stunting.

3.3 Description of variables

Wealth and asset indices. Table 3.1 presents levels and percentage changes of asset and wealth indices between two rounds. Wealth and asset indices were constructed using various assets and services households have access to. While wealth index are constructed from final wealth excluding assets used as inputs into production such as land, livestock and farm implements, asset index includes final wealth plus those assets used as inputs in production such as livestock, land, farm implements and other equipments used for non-farm activities. The two indices are constructed in such way to lie between 0 and 1 (see Appendix A for the detail of the construction of wealth and asset index). Both the wealth and asset indices have increased in round two compared to that of round one. The increments are statistically significant for both indices at less than one percent level although the magnitude of the change was higher for the wealth index than that of asset index. A comparison of the wealth and asset indices for urban and rural areas shows that

there was a statistically significant increase in these indices in round 2 compared with round 1. Similar comparisons by region show that asset ownership as reflected by the asset index has increased in round 2 compared with round 1, but the result is not statistically significant for SNNP region in the older cohort sample. While a comparison of wealth index by region between the two rounds indicates a statistically significant increase for four of the five regions covered by the survey, a statistically significant decrease is observed for Tigray (Woldehanna et. al 2008), mainly due to a reduction in access in sanitation facilities and safe water, perhaps due to lack of maintenance of the services.

Table 3.1: Wealth and asset index by urban/rural and region

	Rural			Urban			Total		
	R1	R2	% change	R 1	R2	% change	R1	R2	% change
Wealth Index	0.08	0.13	60.39***	0.33	0.37	12.84***	0.18	0.23	25.42***
Asset Index	0.21	0.26	21.34***	0.12	0.16	26.93***	0.18	0.21	21.02***

% change refers to (R2-R1)/R1 times 100. Na=not available.

In our definition household with less than 0.2 wealth index are considered as extremely poor. The percentage of children living in households, in the young cohort, with wealth index below 0.2 decreased from 42.0 to 32.4 which represent an improvement over time by about 23 percent. This difference is statistically significant at less than 1 percent level. The differences are similar for the percentage of children living in households with asset index less than 0.2 with the change over time being slightly larger (about 29 percent) but still statistically significant at the 1 percent level (Table 3.1). A comparison of the percentage of children living in households below a wealth index of 0.2 by region also shows similar results except for Tigray where the difference was not statistically significant. The improvement is the largest for Addis Ababa (92.31%) compared with other regions and it is larger for urban areas (44.29%) compared with rural areas (16.21%). A similar comparison of asset index by location shows, however, that there was no statistically significant change for urban areas. Moreover, the percentage of children living in households with asset index below 0.2 has decreased for four of the five regions, the exception being SNNP for which the difference was not statistically significant (see Woldehanna et. al., 2008 for details).

Malnutrition. We calculated the main statistics that is used in the literature to measure malnutrition among children, namely, height for age and stunting for the younger cohort (1 and 5 years old children). In order to measure nutritional achievements such as stunting, severe wasting and Z-scores of nutritional

achievements of the one and five years old children, we used the recently developed table by WHO in 2007 (WHO, 2007; WHO Multicentre Growth Reference Study Group, 2006) based on Brazil, Ghana, India, Norway, Oman and USA as a reference population. We categorized children's' nutritional achievements into three based on the z-score values. Children with z-score greater than or equal to minus two are considered as normal child, that is, children not stunted, while children with z-score less than minus two reflect stunted and z-score less than minus three reflect severely stunted.

Table 3.2: Malnutrition among one and five years old children

	Total			Rural			Urban		
	R1	R2	% change	R1	R2	% change	R1	R2	% change
Stunted	34.84	31.33	-10.0**	41.34	36.41	-11.92**	25.03	23.65	-5.51
severely stunted	15.46	8.22	-46.80***	19.2	10.63	-44.64***	9.83	4.6	-53.19***

R1=Round 1; R2=round 2; % change= ((R1-R1)/R1))*100; *Significant 10, ** significant at 5%, and * significant at 1%;**

As can be seen in Table 3.2, stunting declined significantly, both in terms of magnitude and in the statistical sense as indicated by the t-tests. According to the statistics, the severe form of height for age has declined substantially. This is an impressive accomplishment in the span of time period elapsing between the two data collection periods, which can be attributed to improvement in wealth level of households and increased access to health services. One should, however, take note of the fact that these measures were quite high in round 1. Thus, what we observe could easily be one of recovery of child nutrition status.

When we observe, the split in terms of rural-urban residence of households, we see relatively larger percentage points of improvement for children living in rural areas. However, caution should be taken in interpreting this result as well, since children living in rural areas started with a relatively higher incidence of malnutrition in round one. Moreover, the percentages for incidence of malnutrition are still higher in rural areas. Consequently, much needs to be done for rural children to catch up with their urban compatriots.

Except for female stunting (height for age z-score less than minus 2) showed an improvement for both genders that are more or less equal in magnitude (Table 3.3). The changes between the two rounds have also been statistically significant. Thus,

the improvements in the nutritional status of children, whenever they occurred were not gender biased.

Table 3.3: Younger cohort: Changes in the proportion of children malnourished by gender of child

	Male			Female		
	Round 1	Round 2	% change	Round 1	Round 2	% change
Stunted	0.39	0.33	-16.4***	0.3	0.29	-0.6
Severely stunted	0.18	0.08	-54.4***	0.12	0.08	-33.7***

*Significant at 10%, ** Significant at 5% and *** Significant at 1%

Table 3.4 reports the results for malnutrition outcomes by wealth index quartile among the younger cohort of the Young Lives data. Change in stunting showed insignificant changes between the two rounds) For the other outcome variables, the poorest 50% of the sample have attained improvements in the children's malnutrition status as indicated by the reductions in the percentages of children below the cut-off point of -2 and -3 z-scores. It is also important to note that in almost all the cases, except for the case of stunting to be precise, the percentage in the difference is larger for the poorest two quartiles (the poorest 50%).

Changes in malnutrition indicators between the two rounds for younger cohort of Young Lives children categorised by education level of household head are provided in Table 3.5. It may seem surprising to see that there is little, if any, change for these indicators where the household head has post-secondary education. On the other hand, children that were under the severe malnutrition category have shown statistically significant changes, in the improvement direction, for all household heads with lower than post secondary education including the illiterate ones. One should, however, take into account the fact that for households with heads having post-secondary education, the incidence of severe malnutrition was relatively smaller than the others in Round 1. Moreover, the proportion of this category in the whole sample was also small. All the forms of malnutrition (except for female stunting -- height for age z-score less than -2) showed an improvement for both genders that are more or less equal in magnitude (Woldehanna et al. 2008). The changes between the two rounds have also been statistically significant. Thus, the improvements in the nutritional status of children, whenever they occurred were not gender biased.

Table 3.4: Changes in the proportion of stunted children between round 1 and round 2 by round 1 wealth quartile

	Quartile	Round 1	Round 2	% change
Height for age z-score < than – 2: (stunted)	1	0.43	0.43	0
	2	0.44	0.36	-18.2***
	3	0.32	0.29	-9.4
	4	0.2	0.17	-15
Height for age z-score < than -3: (severely stunted)	1	0.21	0.16	-23.8**
	2	0.2	0.09	-55***
	3	0.13	0.06	-53.8***
	4	0.08	0.02	-75***

*Significant at 10%, ** Significant at 5% and *** Significant at 1%

Table 3.5: Younger cohort: Changes in the proportion of children malnourished by education of household head (test changes for significance)

	Illiterate			Grade 1-4		
	R1	R2	% Δ	R1	R2	% Δ
Stunted	0.39	0.35	-8.4	0.38	0.33	-14.8
Severely stunted	0.17	0.10	-43.7***	0.16	0.09	-40.9**

*Significant at 10%, ** Significant at 5% and *** Significant at 1%; Δ= change

Economic shocks. Young lives survey has observed various economic shocks that affect household wellbeing during both round one and round two surveys. Those asked during round one survey are shocks that affect households five years before round one survey and hence these shocks are shocks that occurred before the index child was born. Shocks asked during round two surveys are those occurred after the child was born, but before round two surveys.

Table 3.6 and 3.7 presents the incidence of shocks that affect households before and after the child was born, respectively. The highest incidence of shock observed before the child was born was for decrease in food availability followed by crop failure and for urban areas job lose. Among those shocks that occurred after the child was born are drought, crop failure, pests and diseases.

In general the most serious shocks reported by the respondents that occurred before the child was born are (1) decrease in food availability; (2) crops failure; (3) death of livestock death, (4) severe illness or injury; (5) job loss/source of income/family enterprise; (6) birth of new household member, (7) death of household members. Although they have very little perceived impact on child welfare, crime, divorce or separation of family members, paying for child's education, and migrated of family

members were also reported shocks that occurred before the index child was born. The shocks that occurred after the index child was borne are (1) illness and death of household members, (2) drought, (3) crop failure, (4) pests and diseases, (5) place employment shutdown or job loss, (6) natural disaster such as drought and flooding (7) divorce or separation of family, (8) death of livestock, (9) increased input prices, (10) decreased output prices, (11) theft and robbery, (12) having to pay for education, and (13) birth or addition of new household member.

Table 3.8 presents descriptive statistics of household composition for round one and round two surveys. The family size was 5.2 in 2002 during the round survey. After 4 years the family size increased to 6.7. Table 3.9 and 3.10 present descriptive statistics of variables used in the regressions.

4. Results and discussion

We have estimated several versions of model specified in section 3.2 above to explain child nutritional achievement measured in terms of height for age, Z-score of height for age, stunting and sever stunting (see equation 3.1 to 3.4. above). In the estimation of the models, we used data of 1860 children of 4.5 to 5.5 years old of which 1119 are living in rural areas while 741 are living urban areas. Estimated results of equations 3.1, 3.2, 3.3 and 3.4 as well as probit regressions of stunting and severe stunting are presented in Table 4.1 to 4.6. As a robustness check the dependent variables are specified differently in these regressions. In equation 3.1, the dependent variable is change in height for age, while it is change in z-score of height for age in equation 3.2. In equation 3.3, we used change in natural logarithm of height. To check the results in levels, the dependent variables in equation 3.4 is specified as height for age in round two. In all regressions, we included initial height for age in the list of explanatory variables. To further check the robustness of our result, we run two probit regressions of stunting and sever stunting on the same set of explanatory variables as well as on initial stunting and sever stunting, respectively. The independent variables in all regression in equation 3.1 to 3.4 as well as in the probit equations include initial height for age (stunting or sever stunting), initial household level wealth index and initial household compositions (number of male and female household members separately for less than seven and above 65 years old, between 7 and 17 years old, between 17 and 65 years old, members). As a focus of the paper, we include events occurred before and after the child was born that were reported to have affected the household welfare negatively. The types of shocks occurred before the child was born which are included in the regression are (1) decrease in food availability; (2) crops failure; (3) death of livestock death, (4) severe illness or injury; (5) job loss/source of income/family enterprise; (6) birth of new

household member, (7) death of household members and (8) divorce or separation of family members. Shocks that have very little perceived impact on household welfare such as crime, paying for child's education, and migrated of family members were not included in the regressions. The included shocks that occurred after the index child was borne are (1) illness and death of household members, (2) drought, (3) crop failure, (4) pests and diseases, (5) place employment shutdown or job loss, (6) natural disaster such as drought and flooding (7) divorce or separation of family, (8) death of livestock, (9) increased input prices, (10) decreased output prices, (11) theft and robbery, (12) having to pay for education, and (13) birth or new household member. We also included interaction of these shocks with the initial wealth index, however, non-of the interaction were found to have significant influence on the child nutritional achievements. The interaction variables increased the level of multicollinearity among the regressors measured by condition index (Betsey et al., 1980) and variable inflating factor (VIF) following Gujarati (2003). Initially, we also included boys' dummy (to account for the gender of the child) as one of the explanatory variable, but we dropped later because the coefficients for boys' dummy was not statistically significant at any reasonable level of significance in any of the regression equations we estimated.

Since the types of shocks that affect households are potentially different for rural and urban areas, we did not intend to run the same model for rural and urban areas. However estimating separate equations for rural and urban areas will be inefficient if the pooled regression works well. Hence we had to conduct chow test before we estimate separately for rural and urban areas. According to the Chow test we conducted, we reject the null hypothesis that coefficient for rural and urban area the same at one per cent level of significant suggesting that we have to estimated the models separately for rural and urban areas[2].

Estimates of equation 3.1 to 3.4 are provided in Table 4.1 to 4.6 separately for rural and urban areas. For both rural and urban areas, the data fits quite well in the all OLS and probit regressions: about 99% of the variations in changes in height for age are explained by the explanatory variables in the model specified in equation 3.1. For equations 3.2 and 3.3 more than 50% of the variations are explained by the model. In the probit regressions, the Psedu R^2 is 11% and 14% for rural and urban areas, respectively. We have checked for multicollinearity, and heteroscedasticity, and omitted variable biased. After we tested for multicollinearity, we decided to drop the interaction variables, because it makes the condition index to be above 30 and the

[2] For example for equation 3.1, the test statistics χ^2 is given by 67.2 which greater than the critical value with 29 degree of freedom at 1 % level. This indicates rejection of the null hypothesis that the coefficient for rural and urban area are the same.

coefficients to be highly insignificant. After we dropped the interaction variables, we found condition index is 15.3 which according to Greene (2003) is tolerable. The variable inflation factor was 4.5 when interaction of shocks and wealth index variables are included in the regression. When we exclude these interaction variables, the variable inflation factor reduced to 2.2. In order account for hereoscedasticty, we estimated robust standard errors using site dummies as cluster variable. Using *stata* built-in command called Ramsey RESET test that regresses the squared residuals on powers of the fitted values of the dependent variable, we could not reject the null hypothesis that the model has no omitted variables indicating that the models we estimated do not suffer from omitted variable biases. As we can see in Table 4.1 to 4.6, for all models, we estimated two versions where version one includes all explanatory variables except the interaction terms and version two includes explanatory variables whose t-values are above or equal to one[3]. The interpretation of the results presented in this paper is based on version two estimates.

Although the focus of this paper is on economic shocks and children's nutritional achievement, it worth mentioning the other factors that affect childhood nutritional status such as initial nutritional status (height for age, stunting and severe stunting), household wealth and household compositions. As expected height for age at the age of one year (initial nutritional achievement) has positive and statistically significant effect on height for age at the age of five years and negative and significant effect on the growth of height for age at the age of five implying that the effect of the early (initial) nutritional status increases late childhood nutritional status, but the increment declined over time and hence makes the effect transitory. The positive results of the effect of height for age at the age of one year on nutritional achievement of five years old children are supported by the result obtained from the stunting and sever stunting regressions. Stunting and sever stunting at the age of one year has positive and statistically significant effect on the stunting and sever stunting of children at the age of five years. These effects are substantial in magnitude and are consistent and similar for rural and urban children. The results in general imply that efforts to achieve better nutritional status of children should start early stage of child development perhaps at pregnancy and birth of the child.

The other factors found to affect nutritional achievements at the age of five years is initial household wealth (measured by wealth index). Consistent with many finding and previous Young Lives result (Alemu et al., 2005), for both rural and urban children, we found initial household wealth index have statistically significant and positive effect on height for age and change in height for age at the age of five years.

[3] When explanatory variables with T-values below one are deleted, it increases the adjusted R^2 and improve the model.

The squared wealth index is found to have statistically significant negative effect on height for age and change in height for age at the age of five years indicating the effect of household wealth on nutritional achievement of children is non-linear. Consistent with this results are that wealth index negatively affects stunting and sever stunting at the age of five years for both rural and urban children. These effects are statistically significant at one per cent level for all children living in both rural and urban areas. However the square of wealth index was not found statistically significant for both stunting and sever stunting and for both rural and urban children. To check the robustness of the result, we replaced wealth index by asset index and the result is the same in that household asset index in round positively affect height for age and change in height for age and negatively affect stunting and sever stunting at the age of five years, while the effect of squared asset index is the opposite sign indicating again a non-liner effect.

We have included four kinds of household composition variables namely (1) number of people below the age of seven and above the age 65, (2) number of people between 7 and 17 years old, (3) number of male members between 17 and 65 years old and (4) number of female members between 17 and 65 years old. Among these four kinds of household composition variables, we found number of people between 7 and 17 years old have statistically significant and negative effect on height for age, change in height for age and stunting of children for rural children only. This signifies the fact that households with more number of dependents in the household will face significant resource constraints to feed children and improve the health of child. We did not find this variable to have statistically significant effect in urban areas although the sign of the effect is negative. The number of female family members between 17 and 65 years old are found to have positive and significant effect on height for age and change in height for age of the five years old children in urban areas only. In rural areas this variable does not have significant and positive effects. The rest of the household composition variables were not found to have statistical significant effect on both heights for age and change in heights for age. Especially in sever stunting regression; none of the household composition variables are found to have any significant effect.

Coming to main focus of the paper, let us discuss the result in relation to economic shocks and children's nutritional achievements. Controlling for early (initial) nutritional achievements of children, and initial household wealth and compositions, we found that height for age, change in height for age are affected negatively (and stunting and sever stunting affected positively) by shocks that affects household before and after the birth of the five years old children (which are under consideration in this paper).

Economic shocks occurred after the birth of the five years old children. When we look at rural children, among those shocks that occurred after the child was born, natural disaster including drought, crop failure and pest and diseases have significant and negative effect on the height for age and the changes in height for age and positive effect on stunting of the five years old children. The effect of this shock on sever stunting is not statistically significant although the sign of the effect is positive. Unexpectedly, decrease in output price affected nutritional achievements of children positively and stunting and sever stunting negatively which are all statistically significant. Given many of the rural households in young Lives sites are poor and are perhaps net buyers of food, a decrease in output price may be a positive shock to many households instead of being negative economic shocks and as result had affected children's nutritional achievement positively.

In urban areas, we found only one economic shock namely dummy for divorce or separation of family to have a negative effect on height for age and change in height for age of five years old children. When we see stunting of the five years old children, it is affected by dummy for death of livestock, while sever stunting of the five years old children is not affected by any of the economic shocks that affect the household after the birth of the child.

Economic shocks occurred before the child (five years old children) was born. Relatively speaking, shocks that hit the household before the child was born are found more damaging to children than the shocks that affected the households after the child was born in both rural and urban areas. In rural areas, decrease in food availability, death of household members, divorce or separation of family affected height for age and change in height for age (including changes in z-score) negatively which are statistically significant. For stunting we found only decrease in food availability and divorce or separation of family that affected household before the child was born have negative and significant effect on the probability of a five years old being stunted, while we found the only shock that hit households before the birth of the five years old children that has a significant and negative effect on sever stunting of five years old child is divorce or separation of family. These results in general imply that the idiosyncratic shocks have long-term consequences on child welfare due to the fact that the idiosyncratic shocks are not covered by any of the government and no-government social assistance programs. If the idiosyncratic shocks are not going to be covered by social assistance program, the current crisis such as unemployment and inflation will have consequence on the nutritional achievements and hence mental development of our future children and generations. Therefore, government and donors need to revise their assistance program to make idiosyncratic shocks be included in the assistance programs.

In urban areas, it is only crop failure that hit the household before the child was born that affect height for age and change in height for age of the child negatively, which is statistically significant. Unexpectedly, divorce or separation of families that hits the household before the birth of the five years old child affects child height for age and change in height for age positively, which is statistically significant, but requires further investigation. In general the results in this study suggest that rural children are more vulnerable to economic shocks than urban children. Therefore, government social assistance program designed to reduce household vulnerability to various shocks should focus mainly in rural areas. Perhaps the type of economic shock included in the survey questionnaire is mainly focused on rural areas and those shocks that affect urban households (such as inflation from which many Ethiopian urban households are suffering from general increase in cost of living since 2003) were not included. Therefore, further study on shocks in urban areas has to be conducted in order to examine the effects on nutritional achievement effect of other shocks which are not included in Young Lives questionnaire.

Given such result, the next questions is “what are the policy options that help improve the nutritional achievements of children or reduce malnutrition of children in rural Ethiopia?” As malnutrition is a question of household poverty or wealth and the highest effect on stunting is observed for household wealth, the first and most important policy option is increasing the wealth status of household substantially so as to reduce the incidence of stunting among children. Moreover, improving household wealth (income) will reduce households’ vulnerability to various economic shocks which have short-term and long-term consequences on nutritional achievements of children. However, given the frequency of shocks especially area-wide shocks that hits rural and urban Ethiopia, it is unlikely that increasing income is the only option to reduce malnutrition in Ethiopia. In many cases household wealth itself is highly vulnerable to area-wide and idiosyncratic economic shocks. Over the last 15 years Ethiopia experiences area-wide economic shocks every four or five years. Not only poor, but also richer households are vulnerable to the area-wide economic shocks such as drought, insect and pests. Every year households are hit by various idiosyncratic economic shocks such as illness of household members, breadwinners and caregivers, as well as separation of family members or divorce. Surprisingly, substantial number of household (more than 50%) are vulnerable to these idiosyncratic economic shocks. Therefore, intensifying the social assistance program to effectively reduce households’ vulnerability to both area-wide and idiosyncratic economic shocks seems the second option to reduce malnutrition of children in Ethiopia. To assess this latter option, we conducted a simulation exercise on the effectiveness of reducing household vulnerability to area-wide only and to both area-wide and idiosyncratic economic shocks via intensification of social assistance programs in Ethiopia.

The first simulation exercise comes from the fact that government and non-governmental organizations can intensify the social assistance program to effectively reduce household vulnerability to area-wide shocks such as drought, insect, pests and diseases through increasing the resources to social assistance program such emergency relief, productive safety net and other food security programs such as resettlement and household food security package programs. Currently, about 63% of the Young Lives rural households are vulnerable to natural disaster such as drought, insect, pests and diseases. At national level, about 12% % of the households are vulnerable to drought (Woldehanna et al. 2008). If the effectiveness of social assistance program in rural areas increase, say, from the present 63% to 10%, the change in height for age among the five years old rural children will increase by 94% % of the initial (at the age of one year) height for age score and stunting of five years old rural children will be reduced from the present 36.4 % to 33.4 % while sever stunting will decline from 10.6 % to 8.7%. If, on the other hand, the social assistance become inclusive of idiosyncratic shocks such as illness of household member so as to reduce vulnerability of households from the present level of 7% to 5 % and unavailability of food from the present 50% to 10% through prop-poor health care financing, the change in height for age will increase by 99 percent and stunting of five years old children will change from the present 36.4 % to be 29.2 per cent, while sever stunting will decline from 10.6 % to 2.5%. This implies that although area-wide economic shocks such as drought are very important on which government need to focus more, the idiosyncratic shocks have considerable contribution to the improvement of children's height for age and consequently to the reduction of stunting and sever stunting in Ethiopia. Therefore, it is still worth if government assistance programs are inclusive of idiosyncratic shocks such as death and illness of household members (bread winners and caregivers) and separation of family or divorce.

5. Summary and conclusions

Using longitudinal Young Lives younger cohort data, we examine the effect of economic shocks on nutritional achievement of index children (five-year old children). The economic shocks considered are those occurred before and after the child was born. The data set used include round one and two survey data collected in the third quarter of 2002 and 2006, respectively. The most serious shocks reported by the respondents that occurred before the child was born are (1) decrease in food availability; (2) crops failure; (3) death of livestock death, (4) severe illness or injury; (5) job loss/source of income/family enterprise; (6) birth of new household member, (7) death of household members. Although they have very little perceived impact on child welfare, crime, divorce or separation of family members, paying for child's education, and migrated of family members were also reported shocks that occurred

before the index child was born. The shocks that occurred after the index child was borne are (1) illness and death of household members, (2) drought, (3) crop failure, (4) pests and diseases, (5) place employment shutdown or job loss, (6) natural disaster such as drought and flooding (7) divorce or separation of family, (8) death of livestock, (9) increased input prices, (10) decreased output prices, (11) theft and robbery, (12) having to pay for education, and (13) birth or new household member.
We control for initial nutritional achievements (at the age of one year), household wealth and household compositions when we analyzed the effect of shocks on nutritional achievement. We found that shocks that occurred before the child born have significant effects on the five year old children's nutritional achievements. In rural areas increased in output prices has positively associated with nutritional achievement of children and while reduction in household food availability, household head death, and divorce occurred before the child was born reduced children's growth. Natural disaster including drought that hit the households after the birth of the child reduced children's growth (nutritional achievement). In urban areas, only crop failure and job lose that occurred before the child was born and natural disaster including drought that occurred after the child was born reduced children's growth (nutritional achievements), while separation of mother and fathers and increase in input prices positively affect children's nutritional achievements. The same effect was found when we assess the effect of these shocks on stunting explaining the robustness of the result. The results in this study also suggest that rural children are more vulnerable to economic shocks than urban children and hence government social assistance program designed to reduce household vulnerability to various shocks should focus mainly in rural areas.

Simulation exercise indicate that dealing with the effectiveness of social assistance programs on recuing vulnerability of household to area-wide economic shocks such as drought are far more important, providing more additional focus on idiosyncratic shocks will also help reducing malnutrition of children in Ethiopia. Therefore, in order to improve children's' nutritional achievements, government and non-governmental organizations should intensity the provision of social assistance program such as emergency relief, productive safety net, household food security packages, and resettlement programs as well as provision of free health care faculties for the poor via the heath care financing strategy.

The fact that idiosyncratic shocks have long-term impact on child nutritional achievement tells that social assistance program should include not only area-wide shocks, but also individual idiosyncratic shocks if one wants to protect the future children from being affected by shocks. Therefore, government and non-governmental organizations in Ethiopia should revise their social assistance program to make it inclusive of idiosyncratic shocks that affect households frequently and consequently children.

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Appendix A. Wealth and asset indices

Definition of wealth index

An important variable in YL data is the wealth index, which attempts to measure the relative poverty status of households. The wealth index was constructed based on the following variables:

The number of rooms per person as a continuous variable;

1. A set of eleven consumer durable dummy variables, each equal to one if a household member owned a radio, fridge, bicycle, TV, motorbike/scooter, motor vehicle, mobile phone, landline phone, modern bed, table or chair, and sofa;
2. A set of three dummy variables equal to one if the house had electricity, brick or plastered wall, or a sturdy roof (such as corrugated iron, tiles or concrete);
3. A dummy variable equal to one if the dwelling floor was made of a finished material (such as cement, tile or a laminated material);
4. A dummy variable equal to one if the household's source of drinking water was piped into the dwelling or yard;
5. A dummy variable equal to one if the household had a flush toilet or pit latrine; and
6. A dummy variable equal to one if the household used electricity, gas or kerosene.

The wealth index captures variables that are broader than production assets, such as home ownership and the durability of that home, plus access to infrastructure such as water and sanitation. The construction of the wealth index is summarized in the following table.

Table: Construction of the wealth index

Components of index and score	Contributing variables
H = Housing quality (/4)	Rooms/person, wall, roof, floor durability.
CD = Consumer Durables (/11)	Radio, fridge, bicycle, TV, motorbike/scooter, motor vehicle, mobile phone, landline phone, modern bed, table or chair and sofa.
S = Services (/4)	Electricity, water, sanitation, cooking fuel.
Wealth Index = (H+CD+S)/3	Range = 0.0 – 1.0

Method used to construct asset index:

The asset index is constructed in such a way that the possible values of the index are between 0 and 1, possibly inclusive. It is calculated so that the asset index for round 1 is comparable to that for round 2. The asset index is calculated as a simple average of the following five separate indices (each of which are between 0 and 1): livestock, land held, house owned, consumer durables owned and productive assets. These five indices are in turn calculated as follows.

1. Livestock owned: the livestock are classified into the following four groups, with the weights (tropical livestock units, TLUs) attached to each group indicated in parentheses: draught animals (1); cattle (0.7); sheep, goat and pig (0.15); and rabbit and poultry (0.05). For each of these four groups of livestock, the maximum number of livestock owned by a household in each cohort (and for both rounds) is also taken into account in the computation.
2. Land held: this index is calculated as the ratio of land owned by the household to the maximum land size owned by a household in each cohort (and for both rounds).
3. House owned: This is a dummy variable which is 1 if the household owned the house it lived in and 0 if it did not.
4. Consumer durables: This is calculated the same way it is calculated for the computation of wealth index. Thus, dummy variables for ownership of eleven items were assigned and the simple average of this variable is calculated.
5. Productive assets: There were two productive assets on which data exists about ownership in the two rounds. These are pump and sewing machine. We used dummy variables to identify those who owned the item (with a value of 1) from those who do not (with a value of 0). We also used the average prices reported for these items in the surveys as weights to calculate a weighted average.

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