DYNAMICS OF FOOD PRICE INFLATION IN EASTERN ETHIOPIA: A MESO-MACRO MODELING

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Abstract

High inflationary pressure especially in food price has been a top agenda in many developing countries since the last decade as it has been hindering their socio-economic development. Though Ethiopia is achieving an encouraging economic growth in recent years, the occurrence of galloping inflation mainly since 2005 is retarding its progress and causing high welfare loss. The very step to struggle this problem is documenting the real causes of inflation. So far, there are only few attempts to document the macroeconomic determinants of general inflation in Ethiopia. Specially, empirical works on meso level price dynamics and focus on certain items are scant. This study is, therefore, designed to assess the macro-meso derivers of food price dynamics in Dire Dawa administration and Harari regional state based on qualitative data collected through key informant interview and quantitative monthly data from January, 2001 to September 2012. A result from Vector Error Correction Model (VECM) revealed that, in the long run, money supply, real income and international food and oil price hikes increase domestic food inflation while rise in exchange rate (depreciation or devaluation) was found to decrease inflation. Inflation expectation, smuggling, rise in world oil price and exchange rate are also documented to impact food price inflation of the study area in the short run. Pursuing conservative monetary policy, promoting competitiveness in the market and reducing the cost of making business would help to mitigate the galloping inflation in the study area.

Key words: Price Dynamics, Inflation, Error Correction Model, Smuggling
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1. Introduction

The rapid rises and volatility of food prices, now days, are at the top agenda of the international community. The people of developing countries, particularly, are highly exposed to food insecurity as they are financially incapable to afford basic food crops. Yonas and Mans (2012) indicated that the high food price inflation has been the most adverse economic shock that has continued to adversely affect the Ethiopian economy where significant proportion of households had to adjust food consumption in response.

Arguments continued as to what caused the recent global food price hike. Generally, several factors such as increase in aggregate demand, shortage of supply, environmental calamities, population increase, diversion of agricultural products usage for non-food purpose, rapid economic growth (mainly in emerging economies), market structure and investment (traders' speculation, market barriers to new entrants, unfair competition, etc), an alarming increase of oil price, etc are claimed for the skyrocketing prices. However, FAO (2008) rejects the claim that emerging economies have been a reason for the food price explosion, since domestic production in countries like China and India has been growing correspondingly during the same period. Rather, the use of agricultural products, in particular maize, wheat, vegetable and oil, for purposes other than food such as feedstock and bio-fuel production has been the most important factor behind the rise of global food. Thus, as stated by Marco *et al* (2011), lack of clarity as to what exactly causes such a spike in price is still a challenge to reinforce sound policies in the course of taking corrective actions. Hence, a further study to identify the real causes of food inflation is still essential.

In Ethiopia, inflation was not a concern until 2002/03 (Alemeayehu and Kibrom, 2011), but afterwards began to increase at an alarming rate. Similar trend is also observed in food price inflation. For instance, the annual average food inflation rate between July 2011 and June 2012 was 36.9% and in October 2012 compared to October 2011 was 30.4% (CSA, 2012).

Several factors have been claimed for the soaring food inflation in Ethiopia. Jema and Fekadu (2012) argue that monetary developments are seminal factors for high food inflation in Ethiopia. World Bank (2007) and IMF (2008) argue that excess aggregate demand generated by expansionary monetary policy were key driving factors, calling for forceful policy tightening. EDRI (2007), on the other hand, pinpointed internal and

external factors such as international commodity price increase, enticing economic performance, increase in money supply and injection of cash into the rural economy, behavioural changes in farmers, and increased local purchases by institutions and agricultural cooperatives are accountable for the recent inflation. Ahmed (2007) has also put the increase in aggregate demand as a preceding reason for food inflation due to high demand for food. Agricultural production dependency on erratic rainfall (Alemayehu and Kibrom, 2011), alarming increase in demand, poor harvest, higher fertilizer, transportation costs; and world oil price hiking (Loening *et al*, 2009), are also mentioned as major causes for food price inflation. However, there is no agreement between academicians, researchers and the government on the real factors responsible to the hiking price of food items in the nation.

Food inflation has been soaring throughout the country and the regional distribution of food inflation took the same pattern as the general inflation (Alemayehu and Kibrom, 2011; John *et al,* 2009). Eastern Ethiopia is one of the food insecure parts of the country sharing similar food inflation phenomena. As official reports of the NBE indicate, Dire Dawa Administration and Harari regional state experienced highest inflation rates and high price instability between 2008 and 2010. The average annual food inflation rate, as reported by the NBE in 2008/09, was 47.3% and 57.3% for Dire-Dawa and Harari regional state, respectively. This indicates that the area is vulnerable to high food price inflation. This area is the inlet and outlet of many exports and imports of the country and dominantly consumer of imported and packed items. To continue the envisaged economic growth, searching for the real causes of inflation is a first step one has to do in order to propose an outright solution to the problem.

In these debatable sphere of reasoning, studying the causes of food price dynamics at meso level, a rarely studied panorama, is very important. The purpose of this study is, therefore, to identify the macro-meso factors causing the food price inflation and volatility in Eastern Ethiopia, particularly in Harari Regional State and Dire-Dawa Administration. To be able to describe the dynamics of prices for major food items across time, four food categories, namely, cereals, pulses, fruits and vegetables, and bread and other prepared foods are considered. However, in modeling the food inflation of the selected regions, it is not only prices of these items but the general food price index is taken in to account. The study area is an area where smuggled products and imported packed foods are highly marketed and consumed and Khat is predominantly produced and commercialized.

The official trade has been unattractive in the area especially to small-scale traders found in the border areas due to structural and policy related problems. The requirements of this type of trade are beyond the reach of small-scale traders (the main actors in the area). These factors led the people in the area to stick to alternative markets, i.e., unofficial cross-border trade. This is undertaken beyond the government's control and thus freed from considerable size of costs. As a result, the study area is well known in its practice of illegal trade so that dozens of smuggled products are supplied to Dire Dawa and Harar markets. Some studies estimate the volume of this trade to be far greater than the recorded trade (Maruye 1992). The main food items that are supplied in this channel and destined to the eastern region are rice, edible oil, spaghetti, sugar, and wheat flour (Tegegne and Alemayehu, 2002). This tends to increases the domestic food supply and expected to trim down the food price in the area.

The impact of such special attributes of the region on food inflation is explored using the meso-macro modeling where the Vector Error Correction Model and monthly data ranging from January, 2001 to September, 2012, were employed and the long-run and the short run food price drivers are identified.

2. Objectives of the study

Based on the context of the research problems, the study is meant to address the following objectives.

- To investigate the dynamics of food price in a disaggregated category overtime.
- To analyze the nature of the grain market in the study area
- To model the meso-macro determinants of food price inflation
- To examine the effect of smuggling on food price.

3. Theoretical View on the Determinants of Inflation

Most of the theories developed to explain causes of inflation in a macroeconomics context are on the basis of the aggregate demand (demand pull) and cost-push theories (Ball and Doyle, 1969).

The demand-pull theory states that inflation results from a rise in aggregate demand. Accordingly, factors that influence demand-pull inflation including increases in money

supply, government spending and the price level in the rest of the world are expected to have similar effect on inflation.

On the other hand, under the cost-push theory, inflation is seen as the result of decreases in aggregate supply which may be due to an appreciation in wages or the price of raw materials. Such increases lead to higher production costs, hence the term 'cost-push' inflation. Keynesians believe inflation is a result of income disturbances and shocks to the economy, like oil price increases, while the Monetarists believe that inflation occurs because of excess demand and inappropriate monetary responses to economic situations i.e 'too much money chasing too few goods'.

In addition, structural factors such as weather conditions, policies aimed at protecting certain industries or just trading policies, may also influence the rate of inflation. If there's a hurricane, which damages food supply and infrastructure, then, prices of goods and services will definitely shoot up. Also, in protecting certain industries, cheaper goods and services may not be allowed into the country, which results in higher prices for certain goods and services. This shows that inflation may be a consequence of weather conditions and trading or protection policies. Frisch (1977) devised another approach to understanding the inflationary process under the Structuralist model of imported inflation. This model shows that a country's dependence on external markets may bring about inflation, since heavy reliance on external variables is expected to motivate upward pressure on domestic prices. Laryea and Sumaila (2001) also argued similarly that price of tradable goods is determined in the world market and depends on foreign prices and on the exchange rate. Further, the Scandinavian model developed by Branson and Myhrman (1976) adds unemployment rate and expected inflation to the determinants of inflation. Formal theoretical models for showing interaction among inflation and its determinants in the context of developing countries can be seen in Laryea and Sumaila (2001).

4. Methodology

4.1 Nature and Source of Data

The study mainly utilized secondary data obtained from the CSA, NBE, IMF and World Bank. A monthly time series data ranging from the January 2001 to September 2012 were employed. In order to investigate the dynamics of food price in disaggregated category overtime, four main food categories, namely, cereals, pulses, fruits and vegetables, and bread and other prepared foods were selected. For

quantitative analysis, secondary data on different variables obtained from different sources was used. These variables include Domestic Consumer Food Price Index (DFCPI), Money Supply (M2), exchange rate (EXR), World Food Consumer Price Index (WFCPI), Gross Domestic Product (GDP), World Oil Price (WOP), and meso level variables including expected inflation (EXP), smuggling (SMUG) and non-food domestic consumer price index (NFDCPI). The datasets for DFCPI, NFDCPI, raw data to compute SMUG and EXP are obtained from the central Statistical Agency (CSA) of Ethiopia, the datasets for M2 and EXR are obtained from the National Bank of Ethiopia (NBE), annual GDP data which was used to compute the monthly one is obtained from the World development indicators (WDI), and the datasets for WFCPI and WOP are obtained from the International Monetary Fund (IMF).

The unusual variable that we hypothesize to affect food price in this study is smuggling. This variable was approximated by the imported cooking oil price difference between the study area and Oromia, which is analogous to the case of black market exchange rate premium measure of Barro (1996). Price differences of imported items in two areas can be taken as a good proxy for smuggling as long as transportation and other transactional costs are proved to be similar. The formal suppliers of imported oil to Harari-Dire Dawa region include legal importers based in Addis Ababa, as well as Dire Dawa and Harar. Following the closure of the Ethiopian rail way since almost the last decade, the principal formal route of import of Ethiopia has been the major highway running from Addis Ababa through Oromia and Afar regions to Djibouti. Finally it will be unloaded at the dry port of Mojo or Semera. Thus, we assume the vehicular transportation cost from Addis Ababa to Harar/Dire Dawa and from Addis Ababa to different parts of Oromia regional state is on average equivalent. Given this equivalence in distance between Oromia and Harar/Dire Dawa from Addis Ababa (particularly Mojo dry port) where imported items are unloaded and under the assumption of similar supply of the domestically produced oil (the substitute product), any price difference on imported cooking oil can be attributed to existence of smuggling. Because if this item were not imported directly from Djibouti port to Dire Dawa and Harar by contraband traders and reduce legal import-related costs, there would no reason that, on average, the price of this imported item is different in the study area as compared to its counterpart Oromia. It is, therefore, based on such reasonable assumption that the average price of imported cooking oil in Oromia region is used as a reference price for the computation of the aforementioned proxy of smuggling in the study area.

The other data considered in the study and used as a proxy for demand and/or market size is GDP. Most of the data owners or sources generating GDP dataset of countries report on annual basis and thus monthly and quarterly data of such macro variables are hardly available. As the rest of our data were constructed in months, to get more observation and reliable model estimates, converting the annual GDP data into its monthly counterparts is necessary. There are some recently introduced techniques of computing monthly GDP. For instance, the Macroeconomic Advisers' index of Monthly GDP (MGDP) introduced by the United States Bureau of Economic Analysis is the well known one (BEA, 2008). Moreover, monthly GDP can also be estimated using the general Kalman filter Framework (Cuche & Hess, 2000). Most researchers also make use of parabolic rule of numeric integration which is used by Goldstein and Khan (1976) and Eviews software package. Nevertheless, the available techniques require monthly data on most of the components of the officially reported GDP and other macroeconomic series, which are hardly available for Ethiopia. On the top of all, these methods are also more appropriate in an economy where output is less sensitive for seasonality. For instance, in developed countries where agriculture (the sector less affected by seasonality) has a negligible share in national output, applying these methods may be appropriate.

However, none of these methods are applicable for Ethiopia. This is because of the fact that, over our study period, near to half of the Ethiopian GDP has been contributed by agriculture. As indicated in Alemayehu *et al* (2011) about 96.9% of the total crop is produced in M*eher* season, September to February, showing that the sector is clearly season dependent. Such a nature of the Ethiopian GDP data conveys a clear message that using any method generating monthly or quarterly series which fails to take seasonality into account leads to misleading results. None of the previous attempts of generating the quarterly or monthly GDP data is successful in capturing seasonality.

In this study, we have developed a new method to estimate monthly GDP data from the annual GDP series which captures the issue of seasonality in agricultural production. The technique we followed is explained as follows. Generally, the Ethiopian GDP is composed of agriculture, industry and service sectors. Unlike in agriculture, nature of production in the other two sectors is not season sensitive. We reasonably assume same distribution of output of service and industrial sector across months in a given year. Given that most of the agricultural practices are rain-fed, however, it is severely affected by season and thus level of output in this sector is

expected to significantly differ from month to month. Crop production currently accounts about 72% and 30% of agricultural GDP and the total GDP, respectively (MoFED, 2012). It is for this component of agricultural output that we made adjustment for seasonal variation. Whereas, like that of industry and service sectors, similar distribution was assumed for animal rearing and fishery since production in these activities are not that much season sensitive.

Therefore, crop production is season sensitive component of GDP and reasonable allocation of its monetary value across months alleviate the problem of seasonality. To this end, we have computed the crop sub-sector's share of total annual GDP for each year from MoFED data. All types of cereals, pulses and oil seeds were considered in constituting the total value of crop sub-sector[3]. The GDP share of all crops was further disaggregated into individual crop type so that the GDP share of each crop type for each year was easily known. Ignoring the production in *Belg* season, the crop component of GDP, in each year, should be attributed to months of the *Meher* season (September to February). However, there is no data showing level or value of agricultural production for each month separately; nor assumption of equal level of production in each of these months and dividing the total value for six is appropriate. In this study, we utilize the concept of crop calendar to allocate production across months[4]. The crop calendar of Ethiopia for all types of cereals, pulses and oil seeds was taken from USDA (2003). This calendar tells the month, on average, during which each crop is harvested. After knowing the GDP share of each crop and the month during which they are harvested, the total value of crops (crop component of GDP) has been distributed over the six months accordingly. For instance, if harvesting season for maize is in the month of December, the entire value of GDP attributed by maize is allocated for December. On the other hand, total value of GDP attributed by sectors that are less sensitive for seasonality are equally distributed for the 12 months in a given year. This procedure enable us generate a more reliable monthly GDP data from the annual ones and the harvesting seasons like December and January were found to have more monthly value than the slack periods, as expected.

The proxy for expected inflation used in this study is derived from the actual inflation using Autoregressive Integrated Moving Average (ARIMA) method following Junttila (2001) and Meylar, et al., (1998). In this approach, expected inflation is estimated as

[3] Here, the value of tubers is ignored because of their negligible share of GDP.
[4] Crop calendar specifies the period (in months) during which different activities (sowing, harvesting etc) of producing a given crop is performed

the fitted value in the regression of actual inflation on lags of its own and the error term. In this study, ARIMA(3,1,3) was used to generate the data on inflation expectations.

All of the variables, except smuggling (SMUG) and expected inflation (EXP), are used in natural logarithmic forms to capture non-linearity in relationships and reduce the problem of heteroskedasticity. Smuggling and expected inflation are used in level forms because they have some negative observations which results in missing values, and thus loss of information, if they are used in logarithmic forms.

In addition, primary data were collected to acquire additional micro level information on qualitative aspects of price dynamics and market performance such as market structure, behavior of major market actors, the pattern and level of competition, the mechanisms of price setting, communication and interdependence among the different actors, smuggling, transportation and storage availability and costs, availability of market information and degree of marketing risk, administrative and legal efficacy and costs, among others. These primary data were collected from key informants including consumer cooperatives, suppliers, retailers, and government officials of trade and industry bureau.

4.2 Methods of Data Analysis

Both qualitative and quantitative data analysis techniques were used. Specifically, time-series (trend and seasonality) and econometric techniques were utilized to address the stated objectives.

The time series analysis helps to understand the temporal variation of food price. Time series data has four components, namely, trend (T), Seasonality (S), cyclical (C) and irregular (I) components (Washington et.al. 2010). The first two components can be modeled to understand their nature while the later two cannot be modeled as they do not exhibited specific pattern. In this study, both seasonality and trend analyses were made to understand the annual and quarterly fluctuations, respectively, of the price of the aforementioned food commodity bundles. Ratio to moving average method was used for seasonality analysis. The trend analysis of prices was made based on deseasonalized data.

Econometric Model

This model is employed to identify the derivers of food price inflation in the study area. Both macro and meso level factors are incorporated in the econometric model. Coupling macro level variables with meso ones are not unusual in modeling meso level prices (see Andrade and Marios, 2011, and Galati *et al*, 2011 for macro-meso framework in modeling inflation). These demand and supply side variables are hypothesized as important derivers of price and they can be put in equation form to determine aggregate food price inflation (DFPCI) as:

$$DFCPI_t = \beta_0 + \beta_1 M2_t + \beta_2 DNFCPI_t + \beta_3 EXR_t + \beta_4 GDP_t + \beta_5 EXP + \beta_6 WOP_t + \beta_7 WFCPI_t + SMUG_t + \varepsilon_t. \quad \textbf{(1)}$$

Where ε is the stochastic term, $\beta_i's$ are the model parameters and the subscript t stands for time.

Following Johansen (1988) and Johansen and Juselius (1990), assuming the variables mentioned above are endogenous and using matrix notation denoted by vector Z_t, the vector autoregressive model (VAR) of order p can be written as

$$Z_t = A_1 Z_{t-1} + A_2 Z_{t-1} + \cdots + A_p Z_{t-p} + U_t. \quad (\mathbf{2})$$

It can be reformulated in a vector error correction model (VECM) as follows

$$\Delta Z_t = r_1 \Delta Z_{t-1} + r_2 \Delta Z_{t-1} + \cdots + r_{p-1} \Delta Z_{t-p} + \Pi Z_{t-1} + U_t \quad \textbf{(2')}$$

Where $r_i = (I - A_1 - A_2 - ..... - A_p)$ (I = 1, 2, .., P-1) and $\Pi = -(I - A_1 - A_2 - ..... - A_k)$ from which the speed of adjustment to equilibrium coefficients and the long run coefficient matrix or the co-integrating vector will be identified. In the empirical estimation, Equation (2') can be augmented to include the deterministic term (time trend and/or intercept) and the appropriate lag length will be selected using Akaike Information Criterion (AIC), Schwarz Criterion (SC) and others.

When we become specific and taking our variable of interest in mind, all the variables in the above VAR model, except smuggling (SMUG) and expected inflation (EXP) which are integrated of order zero or I(0), are found to be I(1). Hence, the appropriate modeling approach to identify the long run and short run determinants of domestic

food price inflation is vector error correction model (VECM). The specification of our VEC model that considers the existence of mixed order of integration of variables can be specified as follows[5]:

$$\Delta DFCPI_t = \alpha_0 \sum_{i=1}^{k} \alpha_{1i} \Delta DFCPI_{t-i} + \sum_{i=0}^{k} \alpha_{2i} \Delta M2_{t-i} + \sum_{i=0}^{k} \alpha_{3i} \Delta DNFCPI_{t-i} + \sum_{i=0}^{k} \alpha_{4i} \Delta EXR_{t-i} + \sum_{i=0}^{k} \alpha_{5i} \Delta GDP_{t-i} + \sum_{i=0}^{k} \alpha_{6i} EXP_{t-i} + \sum_{i=0}^{k} \alpha_{7i} \Delta WOP_{t-i} + \sum_{i=0}^{k} \alpha_{8i} \Delta WFCPI_{t-i} + \sum_{i=0}^{k} \alpha_{9i} SMUG_{t-i} + \alpha_{10} D_t + \gamma(\beta_{1i} DFCPI_{t-1} - (\beta_{2i} M2_{t-1} + \beta 3iDNFCPIt-1+\beta 4iEXRt-1+\beta 5iGDPt-1+\beta 7iWOPt-1+\beta 8iWFCPIt-1) + \varepsilon t. \quad (3)$$

Where γ is the error correction parameter which measures the speed of adjustment towards long-run equilibrium in each period, β_i are coefficients of the long run relationship in the system and D_t is a vector of deterministic variables such as constant and trend. This quantitative analysis coupled with the qualitative assessments or justification is believed to foster to a good understanding of the causes of inflation in the study areas.

5 Results and Discussion

5.1 Marketing System and Price Determination in Harar and Dire-Dawa

There are, currently, about 120 and 252 retailers of food items in Harar and Dire-Dawa markets, respectively. The retail market in the region is highly competitive that retailers are price takers and entry is easy due to low initial capital requirement and absence of market barriers. Retailing price is determined by 'cost-plus' basis, adding mark-up on the total purchasing cost (purchase price, transportation and other transactional costs, etc) commonly employed by all retailers. Few retailers with relatively higher capital and marketing essence purchase crops from the source areas of central and northern Ethiopia (particularly, Shoa, Arsi and Gojam), and keep buffer stock for future sale. However, most of the traders of food items both in Dire Dawa and Harar towns receive supplies mainly from wholesalers that are based in the aforementioned surplus producing areas of the country. Prices charged by retailers move simultaneously due to the quick flow of information in the retail market.

Based on observations and surveys conducted in the markets, the number of suppliers/wholesalers is so small that they have significant monopoly power in

[5] Justification for this is provided in section 4.3.1 along with the unit root test.

determining price. Information from key informants upholds the increased responsiveness of farmers to market changes contributed for the upward pressure in food under a situation of high food demand-supply gap. Administrative inefficiencies of public offices (such as regional trade and licensing bureaus) escalate cost of making business and contributed for price hike. What is more, price change is happened due to seasonal variation of production in and around the study area.

5.2 Seasonality and Trend Analysis of Prices

5.2.1 Seasonality Analysis of Crop Prices

In this section, we discuss the seasonal variation of the prices of four categories of food items, namely cereals, pulses, bread and other prepared food items and vegetables and fruits, based on computed moving weighted average prices. Thus, in order to diagnose the seasonal variation in price, ratio to moving average method of seasonality analysis was employed and actual and deseasonalized prices are also discussed as follows.

Cereals take the lion's share of the consumption bundle of households. Sorghum and maize are the dominant cereals produced in Hararghe area while the rest are mainly supplied from other surplus producing areas. The weighted average price of cereals in the study area over the study period was found to be volatile with a general increasing trend, which is similar to the national trend.

The seasonality index of cereals in winter season shows an increment by 26% than the typical quarter price level of 100, but decline in autumn and summer seasons in Harari. This may be associated with less cereal production practices and different consumption preferences of the community. During autumn and spring, there is rainfall but erratic and farmers produce vegetables supported by the common practice of irrigation. This enables them to reduce their dependence only on cereals, which in turn, relatively reduces the price of cereals due to decrease in demand (see Appendix B, Figure 2). Similar trend was also found in the seasonality analysis of bread and other prepared foods category (see Appendix B, Figure 5). It should be noted, however, that the overall consumption pattern of Harar is difficult to understand and an independent study on consumer behavior and consumption pattern might be essential.

In Dire-Dawa, cereals become expensive particularly during summer and the beginning of autumn (see Appendix B, Figure 1). During these seasons, based on the information obtained from key informants, Djibouti is very hot and people temporarily migrate

from Djibouti to Dire-Dawa to escape the hot period. This scenario raises demand for food and other items putting upward pressure on price.

In winter and spring, price of bread and other prepared foods gets higher (see Appendix B, Figure 6). One possible reason, based on survey findings, for this is that the population in Dire-Dawa tends to consume prepared food items like bread, pasta and macaroni in winter and spring since other durable food types are spoiled by the hot weather of the season.

Pulses, the other food items considered in this study, are not widely produced in the study area. Hence, like cereals, pulses traded in these markets areas are supplied from the surplus producing parts of the country. The graphical representations of pulses are depicted in Figure 3 and 4 of Appendix B. Similar to the price variation of cereals, price of pulses vary but at lower rate. In Dire-Dawa, the prices for pulses varied by 4% and 3% in summer and autumn, respectively, above the typical average quarter price level and approximately with the same rate below the price level during winter and spring.

Finally, Appendix B Figure 7 and 8 reveal the price patterns of vegetables and fruits in the study area. Vegetables and fruits are produced in the eastern part of Ethiopia and supplied to the local markets and to the neighboring countries including Djibouti and Somali land. In this area, the supply of vegetables is relatively high even during spring and autumn due to a strong tradition of rain water harvesting and underground water utilization, thus irrigation, by farmers. Though there is perpetual supply, there was moderate seasonal variation in the price of vegetables and fruits, revealed higher in winter and lower in autumn.

Generally, the variation of prices from season to season was found to be low where as price levels, for almost all food categories, remained high over the study period. Since the end of 2007 and more particularly in 2008, price of food items alarmingly spoke.

5.2.2 Trend Analysis

Trend analysis, a tool to determine the movements of prices overtime, is used to see the trend of sample food prices in the area over the study period. As the trends of the selected categories can be understood from the graphs presented for seasonality analysis, showing separate graphs for all food categories is not necessary. As a result,

only two figures (Figure 9 and 10 in Appendix B) are presented to Harar cereal and pulses data to exemplify increasing trends of prices.

The actual and deseasonalized price of cereals fluctuated over the study period due to cyclical factors. The functional trend line of the price change with time is Y=4.85+0.32t and this enables to project price changes in future t period in the area. Similar to the price of cereals, the price of pulses showed an increasing trend with the actual and deseasonalized price fluctuating around the increasing trend line and sometimes, especially in 2012, going up from the trend line. The function of the pulses price trend line was found to be $Y_t = 5.23 + 0.82t$ again showing the increasing trend over time.

5.3 The Econometric Result

Stationary Test /Unit Root Test

We have carried out unit root test for each variable using Augmented Dickey-Fuller (ADF) test for unit-root null versus a stationary alternative. The test result revealed that (Appendix A, Table A.1) for both Dire Dawa and Harar, all variables except smuggling and expected inflation were not stationary at level. After differencing the non-stationary series, however, the null of unit root were well rejected at conventional level of significance. Thus, smuggling and expected inflation are integrated of order zero, I(0), while all other variables used in the model are integrated of order one, I(1). The result suggests that the food price inflation, our variable of interest, exhibit a stochastic trend or non-stationary drift, rather than mean-reversion to a fixed long-run level, over the sample period. The cointegration analysis attempts to explain these long-run trend developments by identifying long-run determinants, or I(1) explanatory variables, which share a common variable trend, i.e., cointegrate, with food price inflation. Based on the corresponding cointegration estimates, fluctuations in food price can then be decomposed into trend (permanent) and cyclical (transitory) components, depending on the time series behavior and its fundamental determinants.

In the unit root test the fact that variables other than smuggling and inflation expectation appear to be I(1) indicating that they are possible candidates helping to explain the (stochastic) trend in a given endogeneous variable. This mean that the long run cointegration equations will only consist of variables which are I(1). Smuggling and inflation expectation (I(0) variables), however, appear to be stationary so that (transitory) changes in these variables are likely to have only a short-run impact on the explained variable. Thus, these variables should only be introduced in the short run equation of domestic food price inflation. And differences in the long-run level of such

variables should be reflected in the constant terms of the cointegrating equations, representing level rather than trend implications. The construction of our VECM specified in Equation (3) is based on this argument.

5.3.3 Lag Length Determination

Ackakie Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC) and Schwarz Bayesian Information Criterion (SBIC) were used to determine the appropriate lag length (Table 1). Lag two and one are selected to be the optimum lag lengths for Dire Dawa and Harar, respectively, as these are selected by of the majority of the criteria.

Table 1: Test of Lag Length Determination

Lag	Dire Dawa			Harar		
	SBIC	AIC	HQIC	SBIC	AIC	HQIC
0	-6.12911	-8.27831	-8.21768	-7.6927	-7.8434	-7.8218
1	-26.6666*	-27.8602	-27.3751	-27.5444*	-28.7496	-28.2598*
2	-26.1306	-28.3686*	-27.4591*	-26.5493	-28.8900	-27.8907
3	-24.8720	-28.1544	-26.8205	-25.4375	-28.7517	-27.4049
4	-23.7126	-28.0393	-26.2810	-24.4455	-28.8138*	-27.0385

'*' indicates the optimal lag

5.3.4 Johansson Test of Cointegration

The result of the Johansen cointegration test depicted in Table 2 shows that the number of cointegratin equations for both Dire Dawa and Harar is 2.

Table 2: Johansson Cointegration test result

	Dire Dawa		Harar	
Maximum rank	Trace statistic	5%critical value	Trace statistic	5%critical value
0	193.2709	124.24	149.8063	124.24
1	113.5209	94.15	97.7012	94.15
2	65.7360*	68.52	43.2288*	68.52
3	39.7895	47.21	23.4283	47.21
4	22.8401	29.68	10.1341	29.68

* Indicates the rank of the cointegrating matrix

5.3.5 Estimation of the Vector Error Correction Model (VECM)

Macroeconomic theory is mainly based on long-run equilibrium relations and economic theory rarely tells us anything about short-run dynamics. If variables are non-stationary but cointegrated, it is possible that the parameters of long-run relations are estimated (super) consistently without considering the short-run dynamics. In order to estimate long-run equilibrium relations consistently, we no longer need the complete and fully specified model. It is sufficient to know which (non-stationary) variables are elements of these relations (Kirchgässner and Wolters, 2007).

In our pre-estimation diagnostic effort, we have shown that variables are cointegrated. From Granger (1983) and Engle and Granger (1987), if a set of variables are cointegrated, then there exists a valid error-correction representation of the data. This VECM in our case is specified in Equation (3) from which we can estimate the long run and short run determinants of food price.

Given that the cointegrating matrix is of rank two for each case, the two potentially cointegrating equations of the model for each study regions are estimated.

Table 3: VEC Weak Exogeneity Wald Test

No	Variable	Dire Dawa			Harar		
		Chi-square	P-value	Decision	Chi-square	P-value	Decision
1	ln(DFCPI)	34.22	0.000	Endogenous	11.01	0.0007	Endogenous
2	ln(DNFCPI)	6.44	0.0123	Endogenous	5.521	0.011	Endogenous
3	ln(WFCPI)	8.53	0.0007	Endogenous	0.074	0.7995	Weakly exogenous
4	ln(WOP)	3.12	0.0793	Weakly exogenous	26.05	0.0000	Endogenous
5	ln(M2)	0.33	0.6520	Weakly exogenous	1.61	0.4014	Weakly exogenous
6	ln(GDP)	1.21	0.3855	Weakly exogenous	2.31	0.0814	Weakly exogenous
7	ln(EXR)	0.05	0.8532	Weakly exogenous	1.801	0.4109	Weakly exogenous

In order to support the theory by statistical test in the effort of identifying the exogenous and endogenous variables and make the necessary restriction and

normalization, weak exogeniety test was carried out. The test examines the null that the variable is weakly exogenous against the alternative of not weakly exogeneous and the test result is presented in Table 3. The test result suggested that ln(DFCPI), ln(DNFCPI) and ln(WFCPI) (for Dire Dawa) and ln(WOP)(for Harar) are endogenous while others were found to be weakly exogenous. Even if the statistical test reveals that world oil and world food prices are endogeneous, it is unlikely to be true practically and thus the exogeniety restriction was imposed. Therefore, the two cointegrating equations suggested by the rank test are associated to domestic food prices and domestic non-food prices. In estimating the two long run equations for each case, restrictions were imposed and the cointegrating matrix could be identified. In the cointegrated equation where it was normalized for our variable of interest, ln(DFCPI), the long-run drivers of domestic food price inflation were identified. Though there is also another long run equation for the other endogenous variable(non food inflation) estimated simultaneously and it is possible to derive its respective short run dynamics, we did not report and discuss this since we are rather interested only on explaining long run and short run drivers of domestic food price inflation. So, the long run equation of our variable of interest, food price inflation, for Dire Dawa and Harar are:

$$ECM_d = \ln(DFCPI) - 0.37\ln(GDP)^{**} - 0.818489\ln(WFCPI)^{**} - 0.48675\ln(M2)^{**} \quad (4)$$

$$ECM_h = \ln(DFCPI) - 0.475909\ln(GDP)^{*} + 0.9955991\ln(EXR)^{**} - 1.204714\ln(WOP)^{*} - 0.369265ln(M2)^{**}. \quad (5)$$

Where, * and ** show 1% and 5% level of significance and the subscripts d and h stands for Dire Dawa and Harar, respectively.

In the two long run models presented in Equation (4) and (5), only statistically significant regressors are reported. The presence of a cointegrating relationship implies that there exists an error-correction model that describes the short-run dynamics consistently with the long-run relationship (Johansen, 1988). Given evidence about the long-run equilibrium relationship between integrated variables, the short-run dynamics is captured by the lags of the differenced variables and an equilibrium correcting term. As a result, the rest part of the model specified in Equation (3) was fit and the short run coefficients and the speed of adjustment to the long-run equilibrium have been estimated and the parsimonious vector error correction model have been reported in Table 4 along with their significance level.

As it can be seen from these equations, money supply, exchange rate, world food price, world oil price and national income were identified to be the long run determinants of food price, at least in one of the two cases. Whereas inflation expectation, world oil price dynamics, exchange rate and smuggling were found to significantly affect domestic food price inflation in the study area in the short run (Table 4). Exchange rate and world oil price affect domestic food price dynamics both in the short run and the long run. Most of the coefficients in the VECM result have appeared with their expected signs.

The long run estimates presented in Equation (4) and (5) show that a 1% increase in world food price leads to a 0.82% rise in domestic food price inflation (for Dire Dawa Data), *citrus paribus*. This evidence suggests that food price hike at international market pushes the domestic food price up since it makes imported foods more expensive. This is expected as the country is net food importer. The rise in world food price also creates a good motivation to export domestically produced food items, notably, cereals and pulses[6]. Both of these effects compromise the domestic food supply and cause domestic food price to go up. Similar role was found to be played by international oil price from the Harar data. It is known that Ethiopia is highly dependent on imported crude oil and gas for its energy consumption. Hence, the world oil price shock directly affects the domestic food price through its impact on transportation costs and high cost of production. This is particularly true in our study area where most of domestically produced food items are obtained from other surplus producing distant areas.

Table 4: Parsimonious vector error correction model (dependent variable D_ln(DFCPI))

Variables	Dire Dawa		Harar	
	Coef.	P-value	Coef.	P-value
EXP	0.0045427	0.000	0.0021634	0.004
DlWOP	0.0540863	0.027		
DlWOP _1	0.0396307	0.035	0.0722238	0.017
SMUG			-0.0047604	0.006
DlEXR _1	0.1810403	0.000		
ECM_1	-0.0196355	0.020	-0.0071828	0.004

[6] It is because of this fact that, now days, the Ethiopian government has banned exports of some selected cereals and pulses.

Money supply is the other important driver of long run domestic food inflation in the study area. Its coefficient both Dire Dawa and Harari data is significant and positive. Other things being equal, a 1% rise in monetary aggregates causes 0.49% and 0.37% rise in aggregate domestic food price in the long-run as per the results from VEC regression of the Dire Dawa and Harari data sets, respectively. This is because of the fact that the growth in monetary aggregates causes aggregate demand to rise. For a given level of aggregate supply, this might end up with stepping up prices. This finding confirms with Alemayehu and Kibrom (2011) and Jema and Fekadu (2012) though the scope of interest, geographically, is different. The betterment of income represented by real GDP was also significant in aggravating food price inflation in the long run both in Dire Dawa and Harar through increasing purchasing power and aggregate demand.

One of the surprising finding of this study is about the effect of exchange rate on domestic food price. As it can be seen in Equation (5) and Table 4, exchange rate was found to have a negative and significant impact on food prices in the long run while it turns to be positive in the short run for Harara data. The result implies that higher exchange rate (devaluation or depreciation of domestic currency) reduces inflationary pressure in the long run. This might be because of the fact that devaluation or depreciation may discourage import since importing becomes expensive and encourages domestic production following the principle of import substitution. This blocks imported inflation which is proved, even by this study, to be one source of the domestic inflation. In addition, devaluation may encourage foreign investors as it makes investment cost lower and domestic inputs cheaper. Such foreign investment, on one hand, may contribute for positive supply shock and thus lower food price, *citrus paribus*. Added to these, more foreign investment flow following devaluation can be used as a good source of government revenue (from tax and lease). This may contributes for less fiscal deficit and thus less pressure to print excess money as a means of deficit financing. This less fiscal deficit channel can further be strengthened through the contribution of devaluation for improved balance of payment and hence less fiscal deficit, provided that Marshal-Lerner condition is satisfied and external deficit and fiscal deficit are intrinsically related. All these channels may contribute to lower long run inflation following devaluation of Birr. Similar to the widely available literature, we have confirmed devaluation of domestic currency heighten the inflationary pressure, evidence from Dire Dawa data (Table 4). This might be because of its impact in making import expensive and increase cost of production.

Since our study area has a unique feature of widespread smuggled products, especially in consumption items, we were also interested in exploring whether having such feature has any relation with domestic food price movements. To this effect, we have constructed a proxy variable for smuggling as it is described in the methodology section. The short run part of the estimated model for Harar data suggests that smuggling practices plays an important role in cooling down the heat of food price inflation.

There are some plausible explanations of the inverse relationship between price level and smuggling. One possible explanation is that price in Ethiopia is relatively larger than its international parity price precipitating pressure for import. Dire Dawa Administration and Harari regional state are among the major places in Ethiopia where smuggling is practiced owing to their location near to the Gulf of Aden-the major gateway of commodities to Ethiopia. The import augments domestic supply, improves competitiveness and, thus, puts downward pressure on domestic price. Another possible explanation is the high cost of making business in Ethiopia. According to World Bank (2012), Ethiopia is ranked 111th out of 183 countries in ease of doing business in 2012. Hence, the financial as well as non financial cost of doing business in Ethiopia is quiet high and might significantly hamper the motive to engage in formal business. This motivates actors to involve in practices of smuggling whenever the option is available. The same source in the same year ranked Ethiopia 157th in easiness of trading across borders. Therefore, trading across the borders of Ethiopia is very difficult justifying high cost of engaging in formal international trade and high level of smuggling activity in parts of the country which are close to coastlines like Dire Dawa and Harar. Five different types of taxes namely: customs duty, excise tax, VAT, sur tax and withholding tax are levied on most of imports into Ethiopia which are calculated sequentially (Negarit Gazeta, 2009).

Therefore, in the area where no smuggling is undertaken, traders and/or producers have to pass through all the formal procedures to supply consumption items. This involves higher transaction costs as compared to those areas where suppliers do business without bearing the cost of being formal and legal. The effect of such high transaction costs will finally be reflected on selling prices of items. This may be one reason why existence of smuggling plays a stabilizing role in the study area. The smuggling-inflation nexus coveys a message that making the market more competitive (through easing the formal way of doing business) and reducing cost of supply (reducing import tax and tariff for imported items, for instance) may be among the remedies for current galloping inflation. The coefficient of smuggling from the Dire Dawa data,

though negative as expected, is statistically insignificant. This might be due to the significant fall in smuggling practice of the town following the termination of the Ethio-Djibouti rail transport. On the other hand, smuggling in Harar town has continued to be practiced due to its proximity to Somaliland.

The other evidence supported by this study is the positive and significant relationship between current prices and future expectation. As it can be seen in Table 4, higher expectation about future prices creates upward pressure on current actual prices in the short run, which is in line with the theory. Finally, the error correction term in the short run model (Table 4) was found to be negative and significant, as expected. The coefficient of the error correction term is interpreted as the speed of adjustment towards the long term equilibrium. The negative sign of this coefficient implies that the food price adjusts/converges to its long run equilibrium with a relatively higher speed in Dire Dawa and slower in Harar.

The robustness of all these findings have been checked by different post estimation diagnostic tests in addition to the pre-estimation tests discussed before. The lagrangean multiplier (LM) test of autocorrelation was conducted against the null of no serial correlation. The test result reported in Appendix A, Table A.2, shows that the error terms are not serially correlated since P-value at any lag order is greater than 0.05. Again, inference based on VECM requires that the cointegrating equations be stationary and that the number of cointegrating equations be correctly specified. If a VECM has K endogenous variables and r cointegrating vectors, there will be K-r unit moduli in the companion matrix. If any of the remaining moduli are too close to one, either the cointegrating equations are not stationary or there is another common trend and the rank specified in the model is too high. This test is called the VEC stability test. Even if there is no general distribution theory that allows to determine whether an estimated root is too close to one, our test result depicted in appendix A, Table A.3 and A.4 shows that the non- moduli are not too close to one and thus the model is stable.

6 Conclusion and Policy Implication

The purpose of this study is to investigate the determinants of food price inflation at meso or regional level. To this effect, the study was carried out on Dire Dawa Administration and Harari regional state by intermingling meso and macro level variables.

Dire Dawa City Administration and Harari Regional State have experienced high level of price volatility in the last decade. The volatility of food price in this area exhibits both trend and seasonal patterns. The result from the VECM model reveals that the rise in money supply, aggregate demand (GDP), and international food and oil prices exacerbate the domestic food price in the long-run. Similarly, future price expectation and world oil price increment aggravate domestic food price in the short-run. On the contrary, depreciation or devaluation of domestic currency reduces inflation in the long run. Likewise, existence of smuggling practices stabilizes domestic food prices in the short run through its role in supplying consumption items at a lower cost and increasing domestic supply and competitiveness in the market.

In light of the above concluding remarks, some policy implications can be drawn. The fact that money supply appears to be a seminal factor of food price inflation in the long run and short run entails the need to pursue tight monetary policy. Moreover, the significant effect of smuggling on food price determination is an alarm for the government to smoothen the cross boarder trading system and formal way of doing business by avoiding unnecessary and superfluous barriers. In this regard, it is essential to increase domestic supply and induce competitiveness in the market. Moreover, the government may also consider a careful further devaluation of Ethiopian Birr to attract foreign investment and promote domestic production.

Finally, future researchers may consider other regions of the country and utilize their special futures through micro-macro modeling to explain price movements. Researchers may also reconsider the issue we raised by looking at better measures of variables like smuggling.

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APPENDIX

A. Diagnostic Tests Results for Econometric Model

Table A.1: Augmented Dickey-Fuller test for unit root

S. No	Variable	At level	At first difference	Order of integration
A	**Dire Dawa Data**			
1	ln(DFCPI)	0.9990	0.0000	I(1)
2	ln(DNFCPI)	0.9991	0.0000	I(1)
3	SMUG	0.0056	0.0000	I(0)
4	EXP	0.0000	0.0000	I(0)
B	**Harar Data**			
1	ln(DFCPI)	0.9887	0.0000	I(1)
2	ln(DNFCPI)	0.9990	0.0000	I(1)
3	SMUG	0.0001	0.0000	I(0)
4	EXP	0.0000	0.0000	I(0)
C	**National and International**			
5	ln(GDP)	1.0000	0.0002	I(1)
6	ln(M2)	1.0000	0.0000	I(1)
7	ln(EXR)	0.9982	0.0000	I(1)
8	ln(WFCPI)	0.8882	0.0000	I(1)
9	ln(WOP)	0.7501	0.0000	I(1)

Table A.2. Lagrangian Multiplier test for autocorrelation

La lag	P-Value	
	Dire Dawa	Harar
1	0.3561	0.15092
2	0.01749	0.205074

Table A.3: Eigen value stability condition for Harar error correction model

Eigenvalue		Modulus
1		1
1		1
1		1
1		1
1		1
.6014721	+.5196358i	.794852
.6014721	-.5196358i	.794852
.7479841		.747984
.6493061	+.3186011i	.72326
.6493061	-.3186011i	.72326
-.5434745	+.3687132i	.656745
-.5434745	-.3687132i	.656745
-.06855332	+.6224381i	.626202
-.06855332	-.6224381i	.626202
.4491154	+.4259595i	.618988

The VECM specification imposes 5 unit moduli

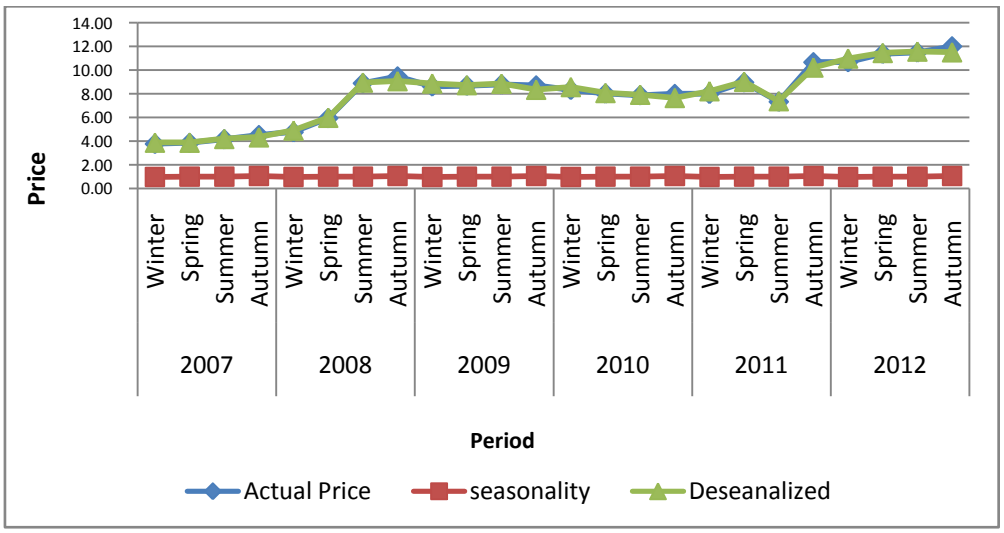
Table A.4: Eigen value stability condition for Dire Dawa error correction model

Eigenvalue		Modulus
1		1
1		1
1		1
1		1
1		1
. 8189528	+ .2546032i	.857617
.8189528	- .2546032i	.857617
-.8447993	+ .02845745i	.845278
-.8447993	- .02845745i	.845278
.5079251	+ .6529895i	.827275
.5079251	- .6529895i	.827275
.02454462	+ .8264356i	.8268
.02454462	- .8264356i	.8268
.3044485	+ .752338i	811604
.3044485	- .752338i	.811604

The VECM specification imposes 5 unit moduli.

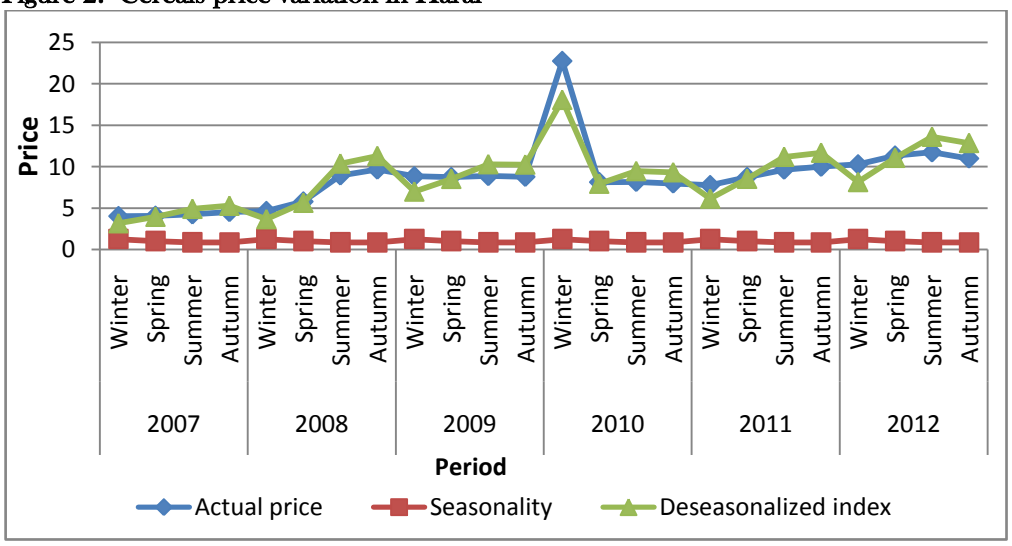
Appendix B: Figure for Trend and Seasonality Analysis

Figure 1: Cereals Price Variation in Dire-Dawa



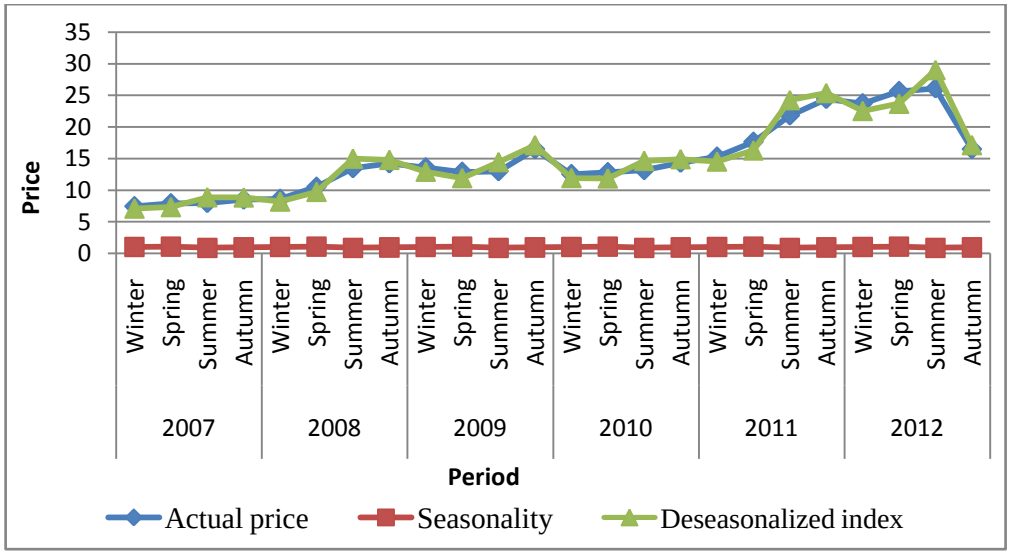
Source: Own computation from CSA Data (2007-2012)

Figure 2: Cereals price variation in Harar



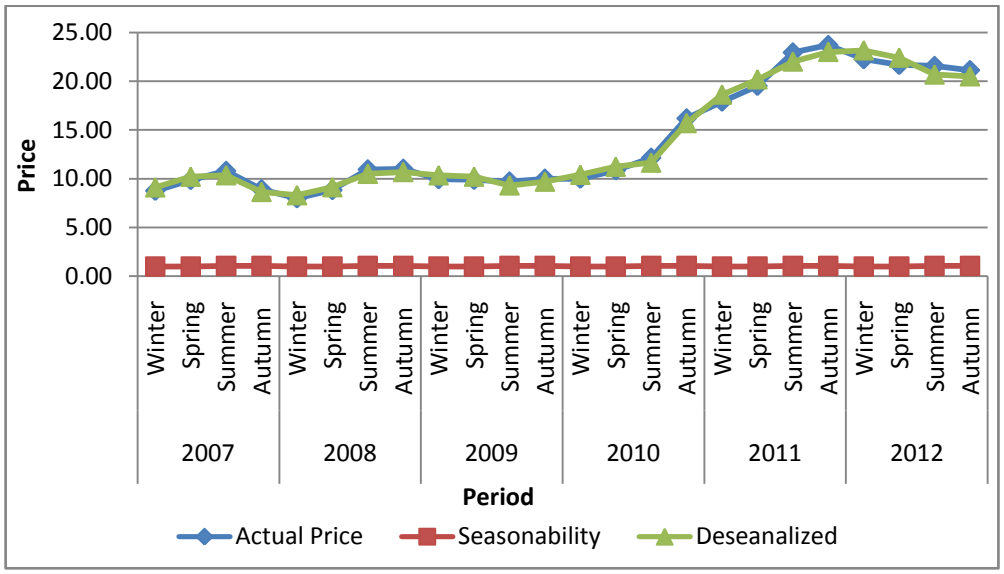
Source: Own computation from CSA Data (2007-2012)

Figure 3: Pulse Price Variation in Harar



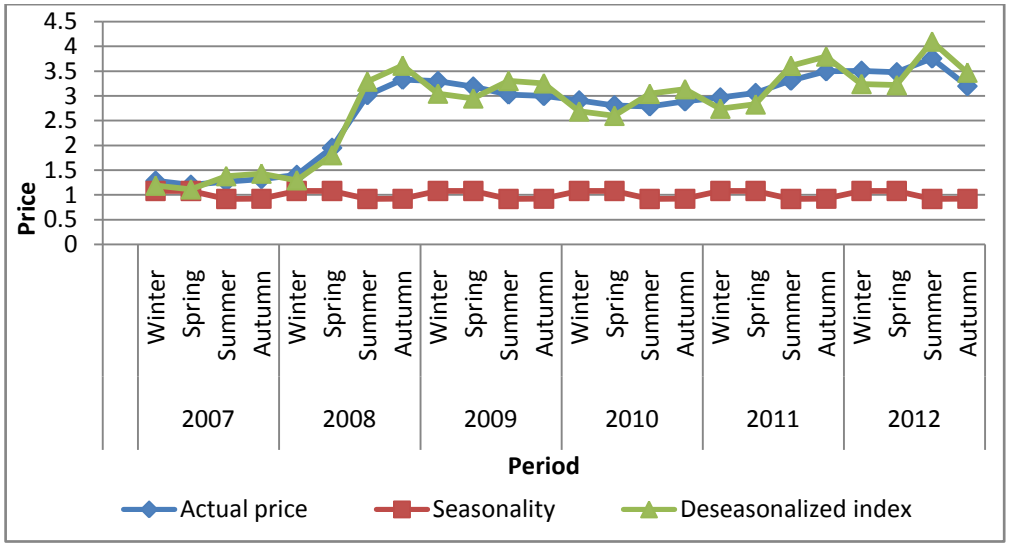
Source: Own computation from CSA Data (2007-2012)

Figure-4: Pulses Price Variation in Dire-Dawa



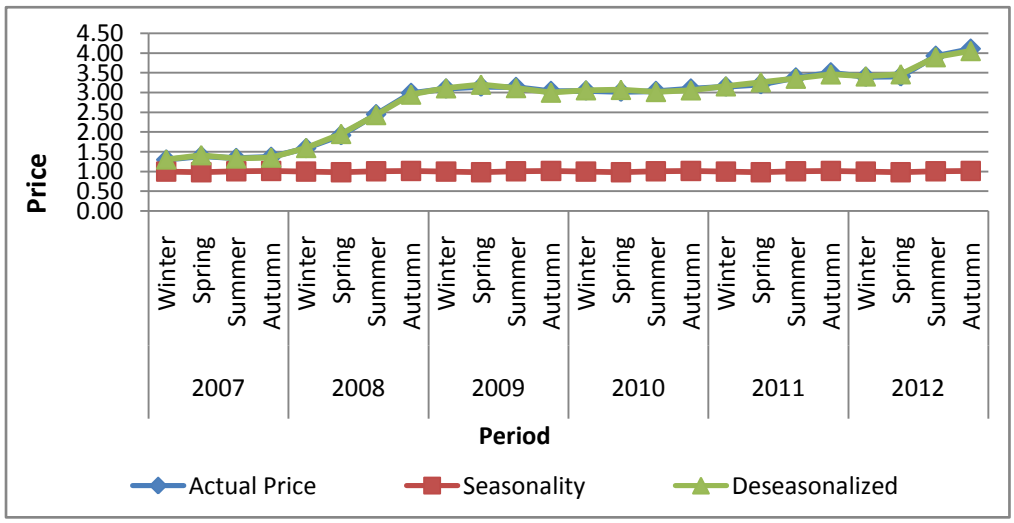
Source: Own computation from CSA Data (2007-2012)

Figure 5: Bread and other prepared foods Price Variation in Harar



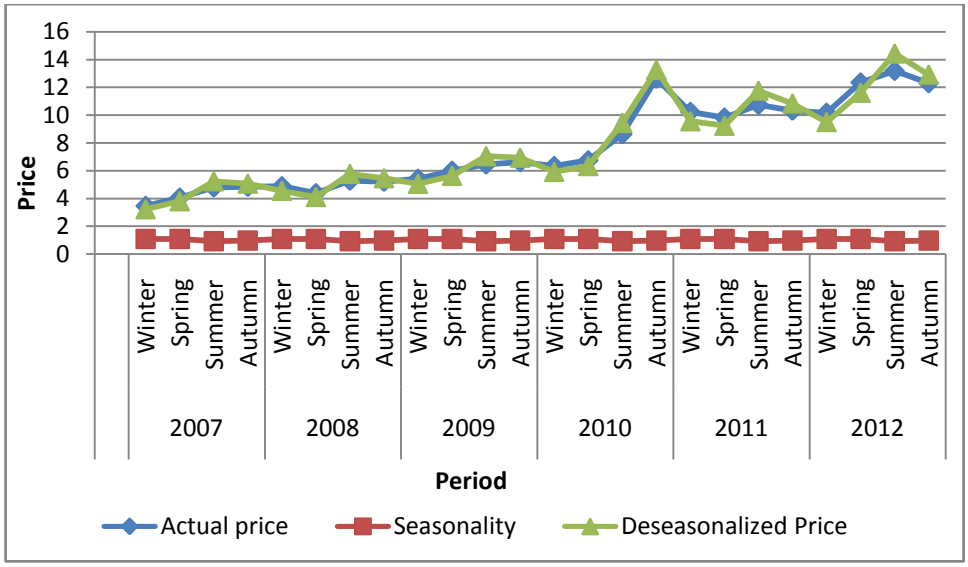
Source: Own computation from CSA Data (2007-2012)

Figure 6: Bread and other prepared foods Price Variation in Dire-Dawa



Source: Own computation from CSA Data (2007-2012)

Figure 7: Vegetables Price Variation in Harar



Source: Own computation from CSA Data (2007-2012)

Figure 8: Vegetables Price Variation in Dire-Dawa

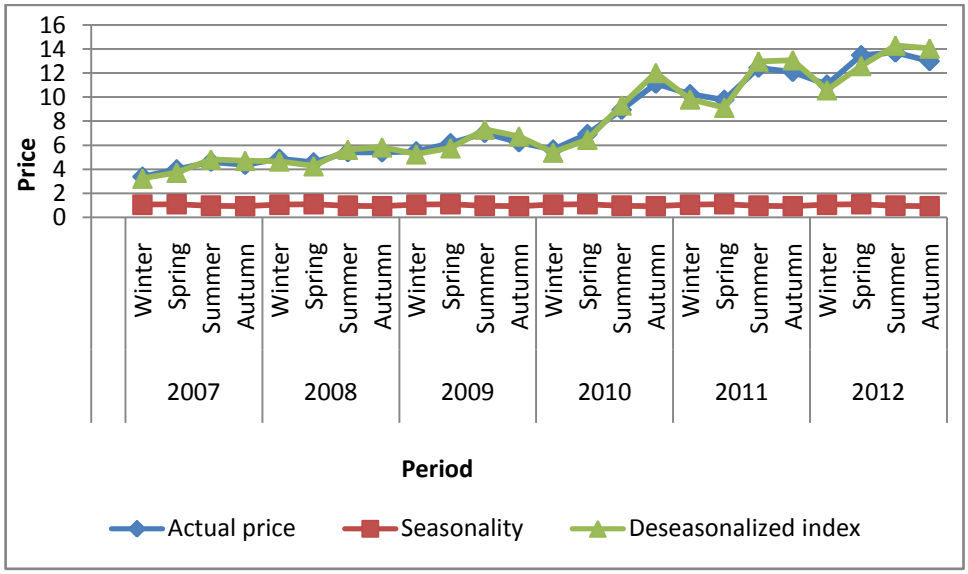


Figure 9: Trend of cereal price in Harar

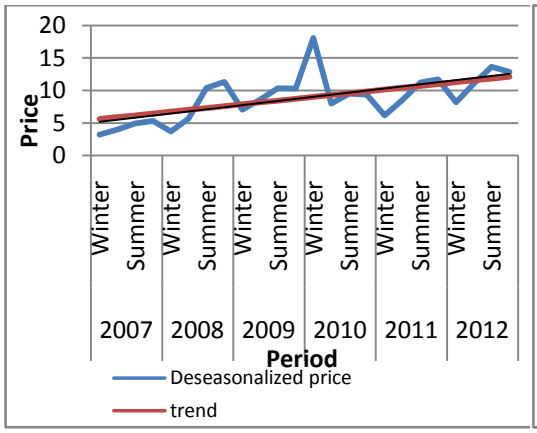
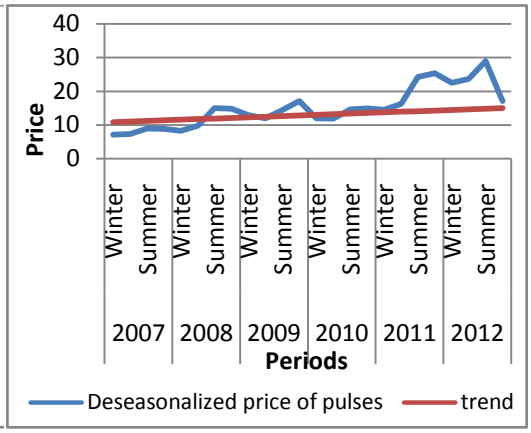


Figure 10: Trend of Pulses price in Harar



HOUSEHOLDS' WILLINGNESS TO PAY FOR RESTORING ENVIRONMENTAL RESOURCE: A CASE STUDY OF FOREST RESOURCE FROM DIRE DAWA AREA, EASTERN, ETHIOPIA

Alem Mezgebo[1]

Abstract

This paper assesses households' perceptions on forest lose and presents empirical results of households' willingness to pay for restoring forest resource in Dire Dawa area, Ethiopia. Probit and Tobit models were applied to determine the mean and factors affecting willingness to pay for forest restoration, respectively. A sample of 393 households was randomly selected, and the survey was used a face to face interviews. However, after checked for sample selection bias 10 protest bidders were excluded from the data set. The descriptive analysis shows that the forest resources have been cleared. That is, 82% of the respondents reported that the reasons attributed to the forest lost were population pressure, overgrazing, soil and water degradation and agricultural expansion. The econometric result shows that the mean willingness to pay from double bound elicitation method was computed at 94.09 ETB with the total willingness to pay 2,026,604.51 ETB (1 US$=18.44 ETB) per annum for five years. Whereas, the mean willingness to pay from open ended elicitation method was computed at 64.82 ETB with aggregation value of 1,396,157.98 ETB per year. The result from double bounded elicitation method is greater than open ended elicitation method. This might be due to anchoring effect from the double bounded method. The result suggested that any forest restoration intervention in the study area needs to consider monthly income, initial bids, perception, educational level, ownership type and access to extension services for successful forest restoration activities. Total farm land holding and sex are also significant variables needs to consider.

Key Words: Willingness to Pay, Contingent Valuation Method, Forest Restoration, Probit Model, Tobit Model

JEL Classification: Q00; Q20; Q50; Q57; Q59.

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1. Introduction

Forest is a minimum area of land with a tree crown cover of more than 10-30% and 0.05-1 hectare with the trees height of 2 to 5 meter at maturity *in situ* (FAO, 2006). Forests, like other natural resources perform a set of functions to meet the needs of people (Cavatassi, 2004; Pak *et al.* 2010). Forests are providing various direct and indirect benefits to human welfare (Dogru, 2001; WWF and IUCN, 2001; Chaudhury, 2006 and Wu *et al.* 2010). Some of these benefits include increase precipitations, recreation, timber production and fuel wood (Bishop 1999; WWF and IUCN 2001 and Turner *et al.* 2004). On the other hand, forest resources are using for protecting watershed, reducing erosion and removing greenhouse gas from the atmosphere (WWF and IUCN, 2001). However, the degree of deforestation and forest degradation is more fast and huge especially in the developing tropical countries (FAO, 2005). It is estimated that 350 million hectares of tropical forest land have been severely damaged (ITTO, 2002). The attenuation and degradation of forest enhance soil erosion, decreasing water quantity and household income, and hence increase poverty (Azene Bekele-Tesemma, 2002 and Maginnis and Jackson, 2003).

In Ethiopia a data on forest resources showed that it is among countries with forest cover of 10-30%. According to this report Ethiopia's forest cover is 12.2 million hectare. It further indicated that the forest cover shows a decline from 15.11million ha in 1990 to 12.2 million ha in 2010, during which 2.65% of the forest cover was deforested (FAO, 2010). This showed that the country is characterized by high rate of deforestation. The major causes of deforestation are expansion of agricultural land, and increasing need for fuel wood, and overgrazing. Consequently, in Ethiopia as well as in the study area because of deforestation households have been faced shortage of fuel wood, land productivity problems, flood, low income and shortage of water. In general, deforestation and over-exploitation of forest resource leads to low economic benefits, unsustainable economic development and hence poverty.

Consequently, restoration of forest resource is very important from both a socioeconomic and environmental angle. Because, forest restoration can be used to reverse some of the more severe impacts of forest loss and degradation by providing a range of forest products (Maginnis and Jackson, 2003). Moreover, forest restoration may mitigate global climate change by reducing carbon stocks. For example, restoring forest resource effectively in the non cultivated land of the study area may continue to provide the economic valuable services of forest resource to the people living around

the resource. However, in the study area no attempt was made to estimate the economic value of forest restoration using acceptable environmental valuation techniques. Fail to estimate the economic value of forest restoration enhance the complexity of forest restoration and management decision.

Yet, in recent decades, concerns have arisen about the proper valuation of environmental resources and progress has been achieved in developing valuation methods (Kramer *et al.* 1997 and Wu *et al.* 2010). An economists use the concept of willingness to pay (WTP) to determine consumers WTP for improved and avoiding deterioration of environmental resource (Agudelo, 2001 and Pearce, 2002). In this study therefore, an attempt was done to estimate the economic values of forest restoration in the non cultivated land of Dire Dawa area. Besides, the study assessed the level of households perception on problems of forest lose, and determined the factors affecting households WTP. It is believed that the study plays a key role in formulation of a successful forest policy and determination of the real contributions of forest resources to sustainable economic development. The study also helps the government and concerned body to identify salient households' features that would increase the targeting and subsequent success of forest restoration activities in the study area as well as in other area with similar characteristics. Contingent valuation (CV) method was used to identify households' WTP for forest restoration.

2. Theory of Welfare Economics

In the case of welfare economics the main purpose of any economic activities is to increase the well being of the responding individuals or economic agents. In this study, the basic assumption is an individual makes a decision to maximize their utility from restoring forest resource given income constraints. Following this, measurement of the economic values of forest restoration is depends on the effect of the hypothesis project on households' welfare.

A Pareto criterion is the best way to explain welfare. It is indicating that policy changes make at least one person better off without making any one worse off. Besides, Pareto improvement noted public intervention is good for efficient resource allocation. If the cost of the public action is less than the sum of the benefits from a public action, it is considered worthwhile by the criterion (Haab and McConnell, 2002). The applied side of modern welfare economics works a variant of the Pareto criterion by trying to find ways to place a dollar value on the improvement and deterioration from environmental

changes. This allows the calculation of net gain or loss from a policy change, and determination of whether the change is potentially Pareto improvement or not. Changes in environmental quantity and quality may affect individual's welfare. Because environmental change may lead to changes in prices an individual pay for marketed goods and inputs. Moreover, it may changes the quantities or qualities of environmental goods such as forest resource, in our case.

Such welfare changes can be measured using ordinary consumer's surplus, compensating variation, compensating surplus, equivalent variation and equivalent surplus. However, ordinary consumer's surplus does holds income constant but not the level of utility. On the other hand, compensating variation and compensating surplus measures of the gains or loss and hold utility constant at the initial level, while equivalent variation and equivalent surplus measures welfare change and hold utility constant at some specified alternative level. Generally, depending on the consumers' property position vis-à-vis the good in question (in this study forest restoration) all these Hicks welfare measures involve either payment or compensation to maintain utility at the specified level (Randall and Stall (1980), cited from Mitchell and Carson, 1989). If the proposed change is welfare increasing (restoring forest resource), which is the focus of this study the appropriate welfare measure, is the compensating surplus. This measure can be interpreted as the consumer's WTP for the environmental resource which maintains their initial utility level constant (Mitchell and Carson, 1989).

In Hicksian welfare measure estimation of the economic benefits of the environmental goods requires identification of the actual demand function for the improvement of the environmental goods. However, it is very tricky to estimate the actual demand curve since it requires accurate market data. Therefore, to fill this problem we should use an alternative method which requires the creation of hypothetical market scenario. The alternative method is that a CVM and this method can generate the WTP data, which will be used to value the forest restoration without having to estimate the actual demand curve.

This concept can be further emphasized from the relationship between the expenditure function and Hicksian compensated surplus measure (CS). According to Haab and McConnell (2002), the expenditure function that provides the theoretical structure for welfare estimation is specified as:

$$M = e(p, q, u) = \min_x \{p.x / u(x, u) \geq u\} \quad (1)$$

Where: M is the minimum amount of income needed to maintain utility level given the price and public good vectors; q= is the vector of environmental goods; p= is a vector of prices; u=is level of utility when $u = V(p, q, y)$, x= is the vector of private goods and y= income.

Let p_0, q_0, u_0, m_0 represent some initial level of those respective arguments and p_1, q_1, u_1, m_1 represent some succeeding levels. The compensation surplus can be specified by:

$$WTP = CS = [e(p_0, q_0, u_0) = m_0] - [e(p_0, q_1, u_0) = m_1] \quad (2)$$

q_1 is preferred to q_0 for proposed new project brings welfare gain (just like in the case of this study). In this case, the compensated surplus (CS) measure tells us the consumers'' WTP for welfare gain. Contingent valuation is capable of obtaining the appropriate Hicksian measure for a proposed change in the public good (Mitchell and Carson 1989). It can be viewed as a way of estimating the change in the expenditure function (Haab and McConnell 2002). Coming to the case of forest restoration of this study the value of forest resource could be determined through household WTP.

3. Empirical Reviews

Contingent valuation surveys have been widely applicable methods in valuing use and non use values of environmental goods and services (like forest resource) (Whittington *et al.,* 1990; Whittington 1998). There have been a large number of studies for valuing non-market benefits of forests in monetary terms using contingent valuation technique. A few selected case studies pertaining to certain forests in the world as well as in Ethiopia are discussed below.

Bin Ramlan *et al.* (2011) were estimated the economic value of forest research institute Malaysia's canopy walkway from visitors using CVM in the form of dichotomous choice elicitation methods. The authors used a Logit and Probit models to estimate the visitor's WTP responses for the access to the walkway. Based on the estimation results, the calculated mean of WTP ranged from MYR5.33 to MYR[2]13.32 for the logit model, whereas the value ranged from MYR5.39 to MYR13.02 for the probit model based on 95 % confidence interval. The study had shown that visitors to forest research institute

[2] MYR refers Malaysian Ringgit which is the Malaysian currency.

Malaysia's canopy walkway are willing to pay about MYR7.61 for the entrance permit. The study concluded that the entrance fee collections are used as additional funds for the costs of maintenance and conservation of forest research institute Malaysia's canopy walkway.

A study by Carlsson *et al.* (2004) applied a contingent valuation method to estimate the economic values of community plantations trees in the highlands of Ethiopia. A discrete-continuous elicitation format was applied. The survey covered a total of 1520 households from both East Gojam and South Wollo of Amhara region. The mean WTP from sample respondents is estimated to 10 ETB[3] for the closed-ended responses. The study found that there is a problem in applying a closed ended elicitation format because it would exaggerate the respondent willingness to pay for community plantations trees. Besides, the analysis of the bid function shows that women in villages without any existing community plantation are significantly more interested in the establishment of a plantation than men. The authors recommended that separate interviews are made with heads and spouses when it comes to valuation of local natural resources. The result of the study also showed that the aggregate willingness to pay vary dramatically between villages. Therefore, the concerned body needs to develop good tools for the selection of locations for community plantations if they seek to maximize their contribution to welfare.

Chukwuone and Okorji (2008) were conducted a study to determines households willingness to pay for systematic management of community forests in the rainforest region of Nigeria. The study used the contingent-valuation method in the form of discrete choice with open-ended follow-up question. The study was used a Tobit model, and found that a variables wealth category, occupation, formal education and number of females in a household positively and significantly influence WTP. Male headed households, initial bid, number of males in a household and distance from home to forests area negatively and significantly influence WTP. The authors concluded that organizing the local community in systematic management of community forests for forest conservation will enhance participation and hence poverty alleviation.

A study by Garrod and Willis (1997) estimated the mean WTP of the public for the non-use biodiversity value of remote coniferous forests in Britain using contingent

[3] ETB refers Ethiopian birr which is the Ethiopian currency

ranking method and contingent valuation in the form of double bounded elicitation method. It estimated the public's WTP for a number of forest management standards that could be adopted to improve levels of biodiversity in remote upland coniferous forests, which the respondent would never visit. The authors estimated the value of marginal changes in biodiversity of remote upland coniferous forests, rather than the total value of biodiversity in remote upland coniferous forests as a whole. The value for increasing biodiversity of these forests using contingent valuation at the margin was £10 to £11 per household per year for biodiversity for a 30% increase of the area of this forest type. Whereas, the value for increasing biodiversity of these forests using a contingent ranking method was £0.30 to £0.35 per household per year for a 1% increase in these forests.

Solomon (2004) used a contingent valuation method in the form of open ended, single and double bounded elicitation format to elicit households WTP for multi-purpose tree resources in three selected Districts of Arsi Zone, Ethiopia. The study considered two groups of Trees including the common eucalyptus tree type and three indigenous trees (Guniprus Excise, Acacia Abisinica and Acacia Seyal). The study found that the mean WTP for eucalyptus tree from open ended, single and double bounded elicitation format are computed at 22.79 ETB, 45.81 ETB and 38.06 ETB, respectively. Using similar procedure the mean willingness to pay for indigenous trees using open, single and double bounded probit model were also computed at 22.14 ETB, 44.31 ETB and 26.96 ETB, respectively. The author found that the mean WTP from all elicitation methods were greater for eucalyptus than for indigenous trees. This could be indigenous trees are not, in most cases, fast growing like eucalyptus tree. The results of study also show that age, types of ownership, access to credit, the value of livestock owned by the family and bid are significant influences households' WTP for eucalyptus and indigenous trees. The study concludes that labor was the most preferred payment vehicle than cash and kind.

The study by Tefera (2006) applied contingent valuation method in the form of double bounded elicitation method to estimate the economic values of improved natural forest in Wondo-Wosha Sub-catchment, Ethiopia. A questionnaire survey was conducted on 148 respondents from six peasant associations surrounding the natural forest. The mean WTP for a single household was about 30 ETB (US$ 1 = 8.7 ETB) per year. The mean willingness to accept for a single household was 44.6 birr per year. Moreover, about 72% of the respondents gave the value of the forest at a price of 30 birr or more per year while 18% of the respondents agreed to pay nothing assuming

that they have traditional rights to the land and/or have low level of income. The bid function analysis suggested that household income has minimum influence on WTP. Therefore, it can be concluded that even the poor households were willing to pay the average values in terms of time or labor contribution to save the natural forest. On the other hand, community valuations for forest resources in the catchment do not vary much in magnitude when the payment vehicle was changed from cash to labor contribution. Therefore, people are concerned about conservation issues, what so ever their status and the situations. The concept of valuing forests is well supported by the community.

Tegegne (1999) also applied this method to elicit people's valuation for environmental protection in terms of both cash requirement and labor contribution. He concluded that households in the study area are willing contribute in terms of labor than cash. Moreover, education, age, sex and family size turned out to be factors affecting the willingness to pay in terms of labor.

It may be observed from these empirical studies that there are large numbers of direct and indirect benefits of forests. Using CV method for valuation across regions, different estimates of economic values of tangible and intangible benefits are obtained. The variations in the estimates could be partly on account of different socio-economic variables and the scope of the studies. Furthermore, the literatures above suggested that contingent valuation method is viable techniques to quantify households' WTP for non-marketed goods in the developing countries. Thus the given literature above provided some sound footings to this study to value households WTP for forest restoration in Dire Dawa area.

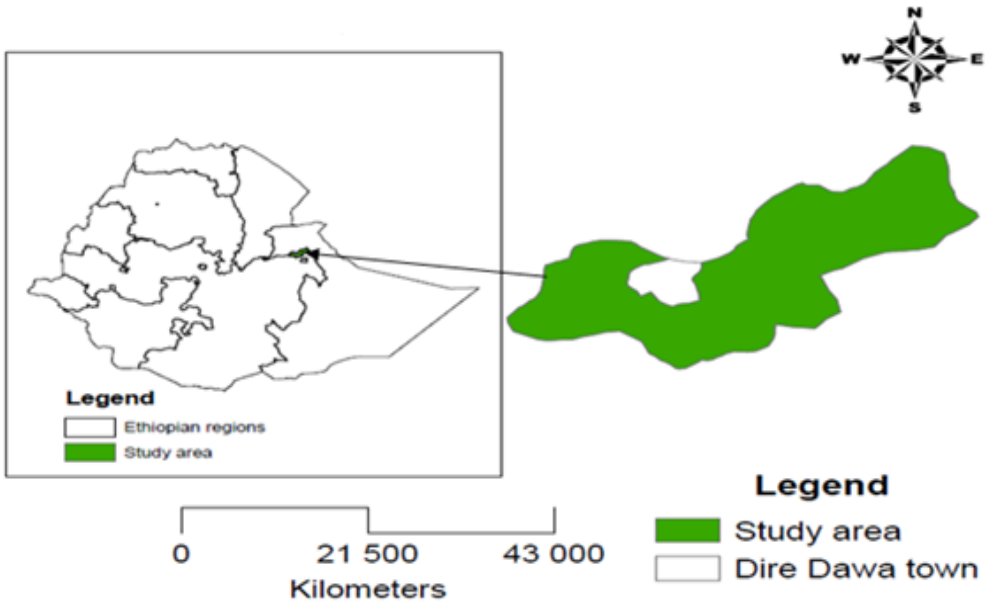
4. Research Methodology

4.1 Description of the Study Area

The study was conducted in Dire Dawa Administrative Council located 515 kms far from Addis Ababa between $9^0$27' and $9^0$49' latitudes north and 41^o38' and $42^0$19' longitude east. The landscape of the study area is varies with an altitude ranging between 950 and 2260 m.a.s.l. The total land coverage of the study area is 128,802 hectares. About 13.47% of the total area of the administration is cultivable land; where as 2.22% and 84.31% of the total area is urban land and non cultivated land, respectively. Specifically, within the four sample kebeles 9,730 hectares is non cultivated land, which is the target area. The total population of the study area is

342,827 with 171,930 male and 170,897 females (FDREPCC, 2008). The livelihood of the population typically depends on the production of perennials and annual crops, and rearing animals. The average farmland holding per household of the rural households is less than 0.5 hectare (FDRE, 2001).

Figure 1: The Study Area (Source: Own sketch)



The annual temperature and rainfall is ranges between 24.8°c and 31.4°c, and 500-850 mm, respectively. The natural forest has been cleared to satisfy the demands of the ever increasing population. The remaining high forests cover less than 1% while the majority of the landmass is covered with shrub lands.

4.2 Sampling Techniques and Method of Data Collection

A three-stage sampling technique was used when selected sample respondents. In the first stage 38 rural kebeles were purposively selected out of the 47 kebeles based on identified as their livelihood is more attached to the environmental resources than the urban kebeles. Secondly, 4 kebeles (Adada, Adigaflema, Eja Aneni and Harela) were randomly selected out of the 38 kebeles. In the third stage, proportionally with population percentage, a total of 393 households were selected randomly. The data was collected using face to face interview with the heads or working members of the households. The author and five local enumerators was administered the survey.

The CVM method was also employed to elicit households WTP for restoring forest resource. In CV surveys, there are about four major elicitation methods, namely payment cards, discrete choice (single bounded dichotomous choice), discrete choice CV with follow-up questions (double-bounded dichotomous choice) and open ended. However, due to limited experience the payment card approach is not used especially in rural areas of developing countries (Venkatachalam, 2004) including our country Ethiopia. The other elicitation method is single bounded dichotomous choice format. It is easier for respondents to make willingness to pay decisions than open-ended questions (Bennett and Carter, 1993). However, the double-bounded dichotomous choice format is better than single-bounded in three ways. It makes clear bounds on unobservable true WTP and sharpens the true WTP, and hence efficiency gains (Haab and McConnell, 2002). Finally, the double-bounded dichotomous choice format is very vital to collect more information about WTP of each respondent's (Hanemann et al. 1991 and Arrow et al. 1993). Therefore, this study employed the double-bounded dichotomous choice format to elicit households' WTP in Dire Dawa area.

4.3 Preliminary Survey and Bids

Before the final survey a pre-test was done using 40 randomly selected households. Then based on the pilot results the starting point prices identified for WTP were 25, 50, 70 and 100 birr per year for five years. Given this, the actual survey was undertaken by dividing the total sampled households randomly into four groups. The field survey was successfully completed with 10 protest zeros. The criteria for selecting protest zero was based on the report of the NOAA Panel on contingent valuation by Arrow *et al.* (1993). The mean difference of households' socio-economic variables of protest and valid responses was compared using t-test and chi square test. Our sample t-test and chi-square test indicated that the mean difference of the households' socio-economic variables of protest and valid responses was insignificant. Therefore, these protest respondents were excluded from the data set.

4.4 Data Analysis Methods

4.4.1 Probit Model

The linear regression analysis is widely accepted to analyze the relationship between the dependent and explanatory variables (Aldrich and Nelson, 1984). In the linear regression analysis the dependent variable is a continuous variable, while the explanatory variables can be either dummy or continuous variables. However, when the

dependent variable in a regression model is binary (0, 1) the analysis can be carried out using either linear probability model, logit and/or probit models (Pindyck and Rubinfeld 1981). But, the results of linear probability model may face the following problems. Firstly, the linear probability model may generate predicted values out of the interval zero and one, which violate the basic principles of probability. Secondly, the coefficient of determination (R^2) is likely to be much lower than one, and it is questionable to use R^2 as measure of goodness of fit (Gujarati, 2004). The third problem with linear probability model is that the partial effect of any explanatory variable is constant (Maddala, 1992).

The limitations of the linear probability model can be solved by applying either logit or probit models or both (Amemiya, 1981). The two models generate predicted values between 0 and 1, which follow the basic principles of probability. The main difference between logit and probit is that the conditional probability approaches zero or one at a slower rate in logit than in probit model (Pindyck and Rubinfeld, 1981 and Gujarati, 2004). Secondly, the error term in the logit model are assumed to follow the standard logistic distribution, whereas in probit model error term is assumed to follow the standard normal distribution. Thirdly, the probit model works well for bivariate models than logit model. However, in most cases the two models are statistically similar (Park, 2008). This statistical similarity between the two models makes a choice of the models depends on the availability and flexibility of computer program, personal preference and experience (Ibid). Therefore, in this study probit model was used to determine the factors that are affecting the WTP of households. Following Cameron and Quiggin (1994), the probit model can be specified as:

$$y_i^* = \beta' x_i + \varepsilon_i \qquad (3)$$
$$y_i = 1 \; if \; y_i^* \geq I_i^*$$
$$y_i = 0 \; if \; y_i^* < I_i^*$$

Where: β'= vector of unknown parameters of the model
x_i= vector of explanatory variables
y_i^*= unobservable households' actual WTP for forest restoration
y_i= discrete response of the respondents for the WTP
I_i^*= the offered initial bids assigned arbitrarily to the i^{th} respondents
ε_i= unobservable random component distributed $N(0, \sigma)$

The bivariate probit model was used to estimate the mean WTP from the double bounded dichotomous elicitation method. But, when the estimated correlation co-efficient of the error terms in bivairate probit model are assumed to follow normal distributions with zero mean and distinguishable from zero (see Equation 4 below), the system of equations could be estimated as seemingly unrelated bivariate probit (SUBVP) model (Haab and McConnell 2002). Therefore, in this study SUBVP was employed to estimate the mean WTP. According to Greene (2003), a bivariate probit model can be specified as:

$$y_1^* = \beta_1 x_1 + \varepsilon_1$$
$$y_2^* = \beta_2 x_2 + \varepsilon_2$$
$$E(\varepsilon_1/x_1, x_2) = E(\varepsilon_2/x_1, x_2) = 0 \quad (4)$$
$$Var(\varepsilon_1/x_1, x_2) = Var(\varepsilon_2/x_1, x_2) = 1$$
$$Cov(\varepsilon_1, \varepsilon_2/x_1, x_2) = \rho$$

Where: y_1^*= ith respondent unobservable true WTP at the time of the first bid offered.
WTP $= 1$ if $y_1^* \geq \beta_i^0$ (initial bids), 0 otherwise;
y_2^*= ith respondent implicit underlying point estimate at the time of the second bid offered.

x_1 *and* x_2 = The first and second bids offered to the respondents respectively.
ε_1 *and* ε_2= Error terms for the first and second equations of Equation 4 above
β_1 *and* β_2= Coefficients of the first and second bids offered

The respondents know their own maximum WTP,y_i^* but to the researcher it is a random variable with a given cumulative distribution function (cdf) denoted by $G(y_i^*, \theta)$ where θ represents the parameters of this distribution, which are to be estimated on the basis of the responses to the CV survey. The log-likelihood function for the responses to a CV survey was specified as:

$$lnL^{DB} = \sum\{d_i^{YY} ln\, G(\beta_i^u; \theta) + d_i^{YN} ln[G(\beta_i^u; \theta) - G(\beta_i^0; \theta)] + d_i^{NY} ln[G(\beta_i^0; \theta) - G(\beta il; \theta) + diNNln1 - G(\beta il; \theta) \quad (5)$$

Where $d_i^{YY} = 1$ if the *i*th response is (Yes, Yes) and 0 otherwise; $d_i^{YN} = 1$ if the *i*th response is (Yes, No) and 0 otherwise; $d_i^{NY} = 1$ if the *i*th response is (No, Yes) and 0 otherwise; $d_i^{NN} = 1$ if the *i*th response is (No, No) and 0 otherwise.

4.4.2 The Censored Regression (Tobit) Model

The study employed Tobit model to investigate results of the open-ended question, which is used as a second elicitation technique in the CV questionnaire of this study to model the actual household's WTP for restoring forest resource. In probit and logit model the dependent variable ($\boldsymbol{y_i^*}$) is not observed, what we observe is the dummy variable. However, in Tobit model the dependent variable, or the WTP, is partially observed and the dependent variable ($\boldsymbol{y_i^*}$) assumes zero values for a substantial part of the sample. That is, $\boldsymbol{y_i^*}$ is observed if $\boldsymbol{y_i^* > 0}$ and is not observed if $\boldsymbol{y_i^* \leq 0}$. If y^* and $\mathbf{x_i}$ were observed for everyone in the population, there would be nothing new, and we could use standard regression methods (ordinary least squares (OLS)) (Maddala, 1992). However, in this study since we deal with maximum WTP for forest restoration which is partly observed, therefore, using OLS leads bias and hence, this study employed Tobit model. In general, the censored regression (Tobit) models generally apply when the variable to be explained is partly continuous. According to Maddala (1992) the equation for Tobit model is specified as:

$$y_i^* = \beta x_i + \varepsilon_i \qquad (6)$$

$$y_i = \begin{cases} y_i^* = \beta x_i + \varepsilon_i \text{ if } y_i^* > 0 \\ 0 \qquad\qquad\quad \text{if } y_i^* \leq 0 \end{cases}$$

where: y_i^* is latent or unobserved willingness to pay for forest restoration; y_i is a household's actual maximum willingness to pay for forest restoration; x_i is vector of explanatory variables; β is a parameter vector common to all households; α is the intercept; and assuming the random error ε_i is independent and normally distributed across respondents, $\varepsilon_i \sim NID(0, \sigma^2)$. Some of the households interviewed did not have any WTP, whereas, some of them had WTP for restoring forest resource. For those not undertaking WTP is zero in Tobit model the WTP is a random variable and has probability distribution and it is possible to determine each observations probability.

$$p(y_i = 0) = p(\varepsilon_i < \beta x_i) = 1 - F(\beta x_i) \qquad (7)$$
$$p(y_i > 0) = 1 - p(y_i = 0) = F(\beta x_i)$$

Where p is probability distribution and $F(\beta x_i)$ is cumulative density function.

The model parameters can be estimated by maximizing the Tobit likelihood function of the following form.

$$L = \prod_{y^*>0} \frac{1}{\sigma} f\, In\left(\frac{y_i - \beta x}{\sigma}\right) \prod_{y^* \leq 0} \frac{1}{\sigma} F\left(\frac{-\beta x}{\sigma}\right) \quad (8)$$

f and F are the density probability function and cumulative distribution function of y_i^*, respectively. $\prod_{y^*>0}$ means that the product over those i for which $y^* > 0$, and $\prod_{y^* \leq 0}$ means the product over those i for $y^* \leq 0$.

The Tobit coefficients do not directly give the marginal effects of the explanatory variables on the dependent variable. But their signs show the direction of change in probability of WTP as the respective explanatory variables changes. Therefore, it is not reasonable to interpret in the same way as the one interprets coefficients in an uncensored linear model (Johnston and Dinardo, 1997). Hence, we should estimate the marginal effect of the Tobit model. Following Long (1997) and McDonald and Maffitt (1980) the following techniques could be used to identify the effects of explanatory variables on the probability of WTP and the amount of households' WTP (the whole and willing respondents only).

The change in the probability of willingness to pay for forest restoration as explanatory variables X_i changes was estimated by:

$$\frac{\partial F(z)}{\partial X_i} = f(z)\frac{\beta}{\delta} \quad (9)$$

The marginal effect of an explanatory variable on the expected value of willingness to pay was estimated by:

$$\frac{\partial E(y_i)}{\partial X_i} = F(z)\beta \quad (10)$$

Similarly, the change in the probability of willingness to pay with respect to a change in explanatory variable among willing respondents was estimated by:

$$\frac{\partial E(y_i / y_i^* > 0)}{\partial X_i} = \beta\left[1 - Z\frac{f(z)}{F(z)} - \left(\frac{f(z)}{F(z)}\right)^2\right] \quad (11)$$

Where, $z = \frac{X\beta}{\delta}$, F(z) is the cumulative normal distribution of Z, f(z) is the value of the derivative of the normal curve at a given point(that is, unit normal density), Z is the Z-score for the area under the normal curve, β is the vector of Tobit maximum likelihood estimates and δ is the standard error of the error term.

5 Results and Discussion

5.1 Characteristics of Sample Households

A total of 393 sampled households were interviewed. However, ten respondents were protested zero bidders. We compare the means of households' socio-economic variables of protest and valid responses using independent samples T test and crosstabs- chi square test. The mean of the households' socio-economic variables of protest and valid responses was insignificant. Thus, only the valid response that is, 383 households were included in the analysis. Of the total 383 respondents, 54% were males while 46% were female respondents. The age of these sampled respondents' ranges from 16 to 78 years with an average of 37.59 years old. The survey results also showed that 71% of the respondents were married and the rest 29% were un-married. A total number of 2731 family sizes were recorded with a minimum of 2 persons and a maximum of 15 persons per households. On average, about 7 persons per household were recorded which was above the national average of 4.7 persons (FDREPCC, 2008). The result on the status of the respondents showed that 68% of the respondents were head of the households, and the rest 32% were working member of the households.

Educational attainment is another parameter considered in our empirical models. The educational status of the sampled respondents ranges from zero (illiterate) to 10+3 years of schooling with an average of about 6 years of schooling. The household survey found that 13.58% of the respondents were illiterate, and most of the respondents (64.23%) never went beyond elementary level. Among the sampled respondents, only 22.19% attained higher level of education beyond elementary school. The total farm land holding of the sampled households was also estimated at 187.75 hectar with average cultivated farm size per household of 0.49 ha. This indicated that the average farm size of the study area is lower than the national average of 0.8 ha (CSA, 1995). Moreover, the result shows that access to extension service of sample respondents. Data with regard to access to extension service showed that 89% of the households' access to extension service whereas the remaining 11% were not.

5.2 Income Sources of Surveyed Households

Households in the study area were engaged in production of cash crop, annual crop and rearing animals. They were also engaged in off farm activities (working in governmental and nongovernmental organizations, trade). The total monthly income of sampled households from the on farm and off farm activities was computed at 629,293.45 ETB with minimum 258 and maximum of 5850 ETB. On average the income of the surveyed households were estimated 1643.06 ETB per month. Taking the average family size of 7, the average per capital incomes was ETB 230.44 per month. This is approximately four times higher than ETB 62.7 monthly average per capital income reported by the IMF at country level (IMF, 2001). Higher average per capita incomes in the study area could be due to production of cash crops like chat and livestock production.

Major sources of income in the study area are from on farm activities, primarily from production of cash crops and livestock production. The total monthly income of these households from on farm activities was computed at 496,452.12 ETB. On the other hand, the monthly income of the households obtained from off farm activities were also computed at ETB 132,841.33. The fact that off-farm incomes contribute smallest to the total family income, it explains that most of the surveyed household can rely mainly on agricultural activities with relatively narrow landholding size for their livelihood. It also indicates that large portion of the households engaged in on farm income generating activities to meet their family livelihood needs. Data related to livestock owned by the respondents was also collected in terms of TLU[4]. The survey result shows that on average 1.95 TLU with a minimum of 1.56 and maximum of 3.87 was recorded per households.

5.3 Causes of forest lose and Its Protection Measures

In the study area vegetation is not found in contiguous form covering large area; rather it is seen as fragmented patches of bush land, shrub land and trees in agricultural sites and hillsides. The natural forest has been cleared to satisfy the demands of the ever increasing population such as construction material, fuel wood, fodder and agricultural expansion. The majority of the landmass is covered with shrub lands with the remaining high forests of less than 1%. Therefore, household perception on the

[4] Conversion factors used in estimation of tropical livestock unit (TLU) were Donkey = 0.7; Cow, Bulls and Ox=1; Calf = 0.25; Sheep and Goats= 0.13; Chicken=0.013 and Camel = 1.25

problems of forest loses has a direct effect on households willingness to value the forest restoration. Most of the respondents are aware about the availability of the resource. About 82% of the respondents were known the goods to be valued properly. They have an experience of using the resource for fire wood, charcoal, construction, shelter, feed, and source of income.

Perceived respondents reported that the availability of forest resource is decreasing from time to time, and the reasons attributed to the problem of forest lost were population pressure, overgrazing, agricultural expansion, and soil and water degradation. More specifically, 22.91% of the respondents frequently mentioned population pressure as the first environmental problem followed by overgrazing and soil and water degradations. On the other hand, about 18.28% of the respondents did not perceive the problems of forest lose (See Table 1 below).

Table 1: Environmental problems of the study area listed by the respondents

Problems	Number of households	%
Population pressure	85	22.91
Agricultural expansion	65	16.97
Soil and water degradations	81	21.15
Overgrazing	82	21.41
None	70	18.28
Total	383	100%

Source: Survey result, 2012

Suggestions were also elicited from the aware respondents to overcome the problem of forest lost. These include massive tree planting, strong government regulation, soil and water conservation, and training forest users (see Table 2 below).

Table 2: Alternative Protection Measures

Protection Measures	Frequency	%
Massive tree planting	81	21.15
Soil and Water Conservation	75	19.58
Strong government regulation	79	20.63
Training forest users	78	20.37
None	70	18.28
Total	383	100%

Source: Survey data, 2012

5.4 Households Willingness to Pay for restoring forest resource

The results revealed that about 89% of the total 383 sample households were willing to pay for forest restoration and their WTP is positive. The double bounded dichotomous choice format was used to estimate the mean WTP from responses of both the first and the second bids offered. The analysis was conducted using seemingly unrelated bivariate probit model. The estimation result of model is reported in Table 3 below.

Table 3: Estimation results of the bivariate probit model

Variable	Coef	Z	P > |z|
Initial bids	-0.0153904	-6.12	0.000
Constant	1.51082	8.37	0.000
Second bids	-0.0215554	-9.8	0.000
Constant	1.978898	11.66	0.000
ρ***	0.926	3.53	0.000
Number of obs	383		
Log likelihood	-398.86335		
Wald chi2(2)	122.05		
Prob > chi2	0.000		
Likelihood-ratio test of rho=0:chi2(1)= 34.351 Prob>chi2=0.000			
Mean WTP[5]= 94.09 birr (At 95% CI, 98.17 to 90 ETB)			

The mean willingness to pay for forest restoration was computed at 94.09 ETB per year per household for five years horizon. At 95% confidence interval the WTP varies between 98.17 to 90 ETB (see Table 3 above). The result shows that the mean WTP from double bound format was greater than the mean value from the open ended response which was computed at 64.82 ETB per year per household for five years. This may indicate the existence of anchoring effect from the double bounded elicitation method. In other word, the open ended elicitation method has an advantage to avoid the anchoring effect. This result is consistent with the various studies (Alemu, 2000; Köhlin, 2001; Carlsson *et al.*, 2004 and Solomon, 2004).

[5] The mean WTP from bivariate probit model was computed using the formula specified by Haab and Mconnell (2002) that is, $mean\ WTP = -\frac{\alpha}{\beta}$; α is a coefficient for the constant term, and β is a coefficient for offered bids to the respondents

5.5 Determinants of Households' WTP

5.5.1 The probit model estimation result

The estimated result on factors affecting the households' WTP for forest restoration is presented in Table 4 below. The sign of all the explanatory variables were as expected. It could be seen that monthly income of the respondent shows positive and significant relationship with the households' WTP. This positive effect indicated that respondents with higher monthly income were more likely to say yes to the first bid than households with lower income. This indicated that households with higher income have a greater ability to pay than the households with lower income. A study by Alemu (2000) and Tefera (2006) recognizes significant association between households' income and WTP. The result also shows that keeping the influences of other factors constant at their mean value, a one birr increase in income of the respondent, increase the probability of accepting the first bid by about 0.02%.

The result of the probit model showed that education level of the respondents is positively and significantly related to WTP. One possible reason could be that literate individuals are more concerned about forest resource than illiterate one. Educated (or literate) individuals relatively know more about the significance of resources, and they are concerned more about the environmental resource. This is consistent with the findings of Tegegne, (1999) and Carlsson *et al.* (2004). Furthermore, the result revealed that keeping the influences of other factors constant, a one year increase in the educational level of the households, the probability of accepting the first bid increase by 1.39%.

Total farm land holding was one of the hypothesized variables in the probit model, and the effect of which on the WTP was estimated by the model. The sign of total farm land holding turned out to be consistent with the prior expectation, and it was positively and significantly related with the WTP. The significant result indicated that households who have higher cultivated land were more likely to say yes response for the initial bid than the respondents with small cultivated land. This is probably due to the fact that larger farm size earns more income from crop production especially cash crops. The result showed that an increase in family size increases probability of saying yes to the offered prices by about 13.10%. Solomon, 2004 also found the same result.

Perception has an expected positive related to likelihood of saying yes to the first bid. That is, households having higher awareness about the forest lose and environmental

problems are willing to pay positively. The coefficient of this variable was significant (at 5%), keeping other things constant changing the dummy from 0 to 1 will increase probability of accepting the initial bid by about 18.16%. The coefficient of ownership also has positive relation to the likelihood of saying yes to the initial bid. That is, keeping the effect of other variables constant changing ownership from 0 to 1 will increase probability of accepting the initial bid by about 14.61%. This is because the respondents feel secure of their right to use the resource after plantation. This finding is consistent with Solomon, 2004, and Lindhjem and Navrud, 2008. Besides, changing access to extension from 0 to 1 would increase probability of accepting the initial bid by about 80.26%. This is because access to extension is an important source of information, knowledge and advice to smallholder farmers. Similar result was found by Azami *et al.* 2012.

The coefficient of starting bid price has negative sign and significant at 5% level of significance. The negative sign and the significance of this coefficient indicated that as the starting bid price increases by one unit, the probability of household's willingness to pay in birr reduces by 0.3%. This may indicate there is income scarcity or cash poverty. Besides, the result shows that demand for forest restoration is decrease as price increases. This is consistent with the findings of Solomon (2004); Carlsson *et al.* (2004); Bin Ramlan *et al.* (2011); and Mousavi and Akbari, (2011).

Table 4: The probit model estimation results of households' WTP

Dependent variable: Choice in the valuation question (no = 0, yes = 1); 383 observations			
Explanatory Variables	**Coef.**	**Marginal effects**	**z**
Households income	0.001	0.0002***	4.13
Age of the respondents	0.007	0.0019	1.05
Educational level of the respondents	0.052	0.0139**	1.98
Sex of the respondents	-0.101	-0.0270	-0.39
Ownership types	0.533	0.1461**	2.54
Respondents marital status	0.153	0.0422	0.53
Respondents status	-0.368	-0.0928	-1.31
Total family size	0.028	0.0076	0.83
Tropical livestock unit	0.226	0.0606	1.56
Perception	0.588	0.1816**	2.33
Access to extension services	2.60	0.8026***	5.07
Total farm land holding	0.488	0.1310**	2.01
Initial bids	-0.011	-0.0030**	-2.39
Constant	-3.978		-4.63
Number of observation	383		
LR chi2(13)	202.48		
Prob>chi2	0.000		
Pseudo R2	0.431		
Log likelihood	-133.648		

*significant at 10%; ** significant at 5%; *** significant at 1% significance levels Source: own survey

5.5.2 The Tobit model estimation result

The result from Tobit model was different from probit model in the significance level and some variables. That is, 5 of the 13 explanatory variables were statistically significant. The other 8 explanatory variables are insignificant effect on the amount of WTP for restoring forest resource. Except for sex the significant variables have a positive effect on the amount of WTP. However, the interpretation of the censored regression model is not straightforward. That is, the marginal effects cannot be adequately explained from the estimated coefficients of the Tobit model (see Table 5 below). Therefore, for interpretation of the Tobit model this paper report three sets of marginal effects: the effect on the probability of a positive WTP, the effect on conditional WTP, and the effect on unconditional WTP.

To be more specific, households' monthly incomes have positive and significant association with the households WTP for restoring forest resource. That is, when the income of the household increase by one birr, it would increase the probability of willingness of a household to pay for forest restoration by about 0.001%. Besides, when income of the household increase by one birr their willingness to pay would increase, on average, by about 0.005 ETB for all observation and 0.0047 ETB for willing respondents', *ceteris paribus*. This shows that forest restoration is a normal economic good whose demand changes in the direction of income change. Respondents with higher education levels were more likely to state positive WTP, and on average, they actually stated higher conditional and unconditional WTP than respondents with lower educational levels. This result suggests that investing in education of people might help to restore forest resource in degraded environment. The marginal effect of the result shows that the respondent being educated, the probability of willingness to pay for forest restoration increases by 0.22%. Also, as the years of education increases by one year, the amount of cash the household is willing to pay for forest restoration increase by 1.024 birr for the whole sample of study, and 0.91 birr for the willing respondents, *ceteris paribus*. The variables ownership type and access to extension services also have positive and significant effect on the amount of WTP. In terms of ownership type a unit changes from 0(government ownership) to 1 (community ownership) the probability being willing to pay increases by 28.53%. That is, the marginal effect result shows that a unit changes from 0(government ownership) to 1 (community ownership), the willingness to pay increased by 12.5 birr and 11.04 birr for the whole and willing respondents respectively, *ceteris paribus*. This is because the households may feel secure of their right to use the resource after restoration. Access to extension service was another variable found to be significant. Since the parameter estimate is positive, it implies that households having access to extension service increases the probability of WTP by 36.07%. This enhanced the awareness of the respondents on the forest lost and restoration. The male respondents would have a 2.4% probability less than a female to pay for forest restoration. That is, female respondents were willing to pay approximately 10 birr more than the males, *ceteris paribus*.

Table 5: The Tobit model estimation results of households' WTP

Dependent variable: Maximum Willingness to Pay; 383 observations					
Explanatory Variables	Coef.	t-value	Marginal effects		
			A	B	c
Households income	0.006***	3.96	0.000011	0.0047	0.005
Age of the respondents	0.146	1.03	0.00031	0.1252	0.141
Educational level of the respondents	1.058**	2.02	0.0022	0.9079	1.024
Sex of the respondents	-11.62**	-2.12	-0.0239	-9.997	-11.25
Ownership types	12.94***	3.27	0.2853	11.04	12.50
Respondents' marital status	4.236	0.76	0.0093	3.613	4.094
Status of the respondents	-1.671	-0.29	-0.0034	-1.437	-1.62
Total family size	-0.261	-0.4	-0.00055	-0.2237	-0.252
Tropical livestock unit	-0.201	-0.07	-0.00042	-0.1727	-0.195
Perception	3.039	0.56	0.0067	2.590	2.937
Access to extension service	59.08***	8.25	0.3607	39.91	50.32
Total farm land holding	6.422	1.64	0.1344	5.513	6.22
Initial bids	-0.600	-7.06	0.0012	0.515	0.5812
Constant	-53.32	-3.87			

(for all sample respondents)

*significant at 10%; ** significant at 5%; *** significant at 1% level of significance

[a] Marginal effects on the probability of being censored

[b] Marginal effects on the truncated expected value(for the willing respondents only)

[c] Marginal Effects on the censored expected value

Source: survey result

5.6 Aggregate WTP for Restoring Forest Resource

An important issue related to the measurement of welfare using WTP is aggregation of benefit (Alemu, 2000). According to Mitchell and Carson (1989) there are four important issues to be considered regarding sample design and estimating a valid aggregation of benefits: population choice bias, sampling frame bias, none response bias and sample selection bias. Random sampling method was used in this study using a list of households. Face to face interview methods was used and protest zero responses were excluded from the analysis and expected protest zeros was accounted in the estimation of the total aggregate benefit of forest restoration in this paper. Hence, none of the above biases was expected in this paper. Mean WTP was used as a measure of aggregate value of forest restoration in this study. The mean is perhaps better than the median since the good dealt with is not a pure public good (Alemu, 2000), as there are

purely private benefits from forest restoration measures. As it is indicated in Table 6 below, the aggregate WTP was calculated by multiplying the mean WTP by the total number of households in the population. Following this, the aggregate WTP for restoring forest resource was computed at 2,026,604.51 birr per year for five years. Whereas, from open ended questions the total WTP for restoring forest resource was also computed at 1,396,157.98 birr per year.

Table 6: Estimation of Total Aggregate Benefits of forest restoration

Total households (Y)	Expected households to have a protest zeros (X)[6]	Expected households with valid responses (Z)[7]	Mean WTP[8]	Aggregate Benefit (in Birr)[9]
22,091	552	21539	94.09	2,026,604.51
22,091	552	21539	64.82	1,396,157.98

Source: own survey, 2012

6 Conclusion and Recommendations

The purpose of this study was to assess the economic value of forest restoration in Dire Dawa area using CVM. The descriptive analysis shows that 82% of the respondents reported that the reasons attributed to the forest lost were population pressure, overgrazing, soil and water degradation and agricultural expansion. In order to restore the forest resource policy makers should encourage and provide technical advice to households who are planting and maintaining tree resource, and practicing soil and water conservation.

The results of the study on willingness to pay showed that the households were willing to pay for restoring forest resource. The annual mean WTP value of households for restoring forest resource based on the double bounded dichotomies choice was computed at 94.09 birr per year for five years. Whereas, the annual total WTP from open ended format was also computed at 64.82 birr per year. The study found that the

[6] 10(2.5%) of 393 sampled households were protest zeros. We excluded those protest zeros from further analysis after we have tested for sample selection bias. So X is the expected number of households which are expected to protest for the proposed project. It is calculated by the percentage of sampled protest zeros (2.5%) by the total population 22091 (Y).

[7] Y-X is the total households in the study area which are expected to have a valid response

[8] Is the mean willingness to pay calculated from the double bounded dichotomous choice estimation and open ended elicitation methods

[9] Is mean multiplied by the number of total households which are expected to have valid response (Z*Mean WTP) measured in ETB

value of forest restoration from open ended format was lower than double bounded elicitation format significantly. The study conclude that there could be a problem in applying a closed-ended elicitation format to forest restoration in developing countries since a forest restoration typically implies a community based scenario and such a scenario invites to anchoring effect. The well-known problem of anchoring effect and/or compliance bias is also difficult to avoid in such settings. Application of a closed-ended format under such circumstances would exaggerate the WTP for forest restoration.

The empirical findings on the determinants of WTP indicated that monthly income, access to extension service, ownership types and initial bids are key factors influencing the willingness to pay in both probit and Tobit models. Besides, the study estimated that there are statistically significant and quantitatively non-negligible effects of perception and total farm land holding on the households' WTP in probit model. The variable sex is also significant effects from Tobit model. Such differences are worth considering when planning households contribution in projects for restoring forest resource. Generally, the study leads us to conclude that understanding of socio-economic characteristics that significantly influenced households WTP is a necessary and first step to achieve restoring forest resource. Moreover, specific factors that affected the valuation of a household for restoring forest resource in open ended elicitation method should be analyzed separately from the valuation of households for restoring forest resource in dichotomous choice elicitation method in order to restore the forest resource.

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RURAL NONFARM SECTOR AND POVERTY: EVIDENCE FROM SOME VILLAGES OF AMHARA REGION, ETHIOPIA[1]

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Abstract

This study examines the effect of poverty on participation and intensity of rural nonfarm sector (RNFS) in some villages of Amhara region of Ethiopia. Probit and censored-Tobit regressions were run on a pooled data of 366 random rural households from the last two rounds (2004 and 2009) of the Ethiopian Rural Household Survey. The results of the study reveal that poverty does have a significant effect on households' participation in and income share of RNFS. Both participation and intensity are estimated to be higher for the poor. More specifically, compared to the non-poor, those who persistently fell into poverty throughout the five-year period are more likely to participate. Income share of RNFS is higher for households owning less number of oxen. Besides poverty indicators, controls such as credit, crop and labor prices as well as locational and time dummies are found as other significant determinants of both participation and intensity. The findings imply that rural intensification of the existing micro-credit schemes and improvement of rural institutions and infrastructure that promote the functioning of rural labor markets are crucial to initiate and deepen the engagement of the rural poor in RNFS.

Keywords: rural nonfarm sector; poverty; Amhara region; Ethiopia
JEL Classification: D13, J22, J32, Q12

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1. Introduction

Land and labor are obviously the most viable factors of production in the Ethiopian rural setting. On the one hand, land is alarmingly becoming too scarce. On the other hand, however, primarily due to high fertility rates, total population and working force in rural areas is increasing. Explaining the prevalence of high youth unemployment/underemployment rates in rural Ethiopia are also lack of adequate urban jobs for rural-urban migrants and their low literacy levels. Although agricultural production and productivity could be augmented through extensive use of other complementary inputs such as fertilizer, there is still a limit given the fixed land. Coupled with the seasonal nature of many farm activities, all those could open a good ground for rural residents to participate in some form of nonfarm activities. The youth may get organized and participate in micro and small scale business and manufacturing activities thereby reducing rural unemployment and thus rural-urban migration in line with one of Todaro (1969)'s conclusions.

Studies make use of various terminologies and definitions to refer to rural nonfarm activities (RNFA). Terms such as 'nonfarm', 'off-farm' and 'non-agricultural', are frequently used to explain perhaps similar types of activities. Though the term 'nonfarm' is used in this paper, no distinction is made between those terms. Following Lanjouw and Lanjouw (2001) and Atamanov and van den Berg (2012), the current study considers rural nonfarm activities as all economic activities in rural areas except primary activities (crop and livestock production, fishing and hunting). Remittances, however, are excluded as they do not represent an income from the supply of household resources (Lemi, 2009). The types of RNFA rural dwellers could get income from and/or complement their agricultural incomes in Ethiopia are quite heterogeneous and may generally of wage employment and self-employments. Woldehanna (2002) identified such wage employment activities as paid community development work or food-for-work, farm work and manual work in construction, masonry and carpentry; and self-employment activities like small trading, transporting goods by pack animals, selling fuel-wood, making charcoal, selling fruits, making pottery and handicrafts and stone mining. In many instances, it is observed RNFA in Ethiopia are highly related with the agricultural sector.

Rural nonfarm sector (RNFS) plays a pivotal role in the rural economies of many developing countries. It accounts for roughly 25% of fulltime rural employment and 35-40% of rural incomes across the developing world (Haggblade *et al.*, 2002) and as

much as 40%, 32% and 42% of average household income in Latin America, Asia and Africa respectively (Reardon *et al.*, 2000). In Ethiopia, the sector was found to have an income share of 17% in 1994 (Lemi, 2009) and this became 14% in 2004 and 25% in 2009. In the Amhara region of the country, a region of over 18 million people and on which this study focuses, RNFS is a sector from which some 25% and 23% of rural dwellers make some form of livelihood in 1994 and 1997 respectively (Lemi, 2009), reaching as high as 37% in 2009. The literature on what factors motivate people to participate in the RNFS generally identifies two micro-level determinants–push factors and pull factors (Barrett *et al.*, 2001; Davis *et al.*, 2009). The former include households' efforts to manage income risk in agriculture via income diversification and to cope with short-term shocks such as drought while the latter are attributed to households' attempts to reduce risk or increase returns from RNFS.

RNFS as related to poverty is found to be worth examining for a number of reasons. Firstly, the empirical literature on the effect of poverty on participation in and intensity of nonfarm activities provides mixed results elsewhere (Lanjouw and Murgai, 2009; Malek and Usami, 2009; Bagamba *et al.*, 2009; Sanusi, 2011; Atamanov and van den Berg, 2012). Secondly, studies linking RNFS to poverty in Ethiopia at national and regional levels are quite lacking. Moreover, the existing studies, in addition to being inconclusive, either (*i*) are made at a point in time and hence incapable of capturing the overtime changes (Woldehanna, 2002; van den Berg and Kumbi, 2006; Kimhi, 2011) or (*ii*) do not take into account the effects of the recent economic growth in the country and the dynamics of poverty (Lemi, 2009; Bezu *et al.*, 2012). To date, no in-depth analysis of RNFS in the Amhara region of Ethiopia has been made. This inadequacy in literature may be held responsible for the lack of clear policy and institutional support to the sector at different administrative levels. The present study tries to address those issues by considering a longitudinal data set.

Lastly, poverty reduction is at the forefront of the agenda of the Ethiopian government. According to a recent report, yet 29.6% of the country's total population and 30.4% of the rural population live below the national poverty line in 2010/11 (MoFED, 2012). In Amhara region, these figures are slightly high, reaching 30.5% totally and 30.7% in rural areas. It is, hence, imperative to look into all the possible ways of tackling poverty, one of which could be rural dwellers' engagement in nonfarm activities. It is said that a high growth in the agricultural income alone is insufficient to achieve rapid reduction in rural poverty. This is so because such growth applies mainly to those with access to the key factors of production (land and water) and because growth linkage effects on

incomes in the rural non-agricultural sector are small. It may, therefore, be critical to encourage the nonfarm sector to bring about rapid rural poverty reduction in virtually all sides. In areas where landlessness prevails, rural nonfarm activity offers important economic alternatives for the rural poor (Haggblade *et al.*, 2002). Moreover, income from agriculture is subject to high risk due to climatic factors, price fluctuations, pests and diseases (van den Berg and Kumbi, 2006). Earnings from nonfarm employment may thus help buffer the resulting income fluctuations and improve household security (Lanjouw and Lanjouw, 2001).

The basic purpose of this study is, therefore, to measure the effect of socioeconomic status on participation and intensity of RNFA. It specifically seeks to ascertain how poverty contributes to rural households' participation in and income share from RNFS in the Amhara region of Ethiopia. It uses a five-year-gap longitudinal data of the 2004 and 2009 harvest years. The selected years may be relevant to capture the effects, if any, of economic growth witnessed in a row from 2004 and the associated price increments in the country.

The remainder of the article is structured as follows. Section two briefly reviews the literature. Section three discusses about issues related to data and econometric model while the fourth section is devoted to results and discussion. Section five finally provides concluding remarks.

2. Brief review of the literature

Despite the virtually-conclusive literature on the various roles played by the rural nonfarm sector (highlighted in the introduction), the literature on the determinants of participation in and intensity of RNFS is yet undecided. Though coming up with different signs and magnitude, the majority household and individual level studies identified demographic (age, family size, dependency ratio, gender), seasons, other income and assets, wages, education, access to infrastructures, etc. as the important determinants (Abdulai and Delgado, 1999; Arif *et al.*, 2000; Matshe and Young, 2004; Lanjouw and Murgai, 2009; Bagamba et al., 2009; Lemi, 2009; Sanusi, 2011; Atamanov and van den Berg, 2012).

For instance, Bagamba *et al.* (2009) find that education and road access have positive effects on the amount of time allocated to off-farm activities in Uganda. Matshe and Young (2004) also find, for Zimbabwe, that gender (in favor of men), education

(positive) and assets (positive) have significant effects in participation while these same variables affect the hours worked (intensity) in off-farm in opposite signs and different sizes. Such dissimilar effects of factors in participation and intensity are also evidenced using Kyrgyz data by Atamanov and van den Berg (2012) for livestock ownership (negative in the former and positive in the latter).

A similar inconclusiveness is also observed in the literature on the effect of poverty on engagement in and intensity of RNFA. Several studies analyze one or more indicators of socioeconomic status of households or individuals as determinants and results are far from obvious (Arif *et al.*, 2000; Barrett *et al.*, 2001; Lanjouw and Shariff, 2002; Lanjouw and Murgai, 2009; Malek and Usami, 2009; Bagamba *et al.*, 2009; Sanusi, 2011; Atamanov and van den Berg, 2012).

On the one hand, since the poor usually have lower 'reservation' wages, they end up participating more and getting more share of their consumption expenditure from RNFS (Lanjouw and Shariff, 2002). An alternative argument may be that the rural poor, compared to their non-poor counterparts, have little choice but to diversify out of farming into some form of unskilled off-farm labor (Barrett et al., 2001). They are usually landless rural households so that even a low return from participation in RNFS may contribute to enhance income of households (Arif *et al.*, 2000). Poorer household heads are more likely to participate in nonfarm activities than non-poor household heads and that they earn more income in the *Ibarapa* area, Nigeria (Sanusi, 2011).

On the other hand, the better educated, usually the rich, have more freedom to choose among a wider range of options (Barrett *et al.*, 2001) and thus tend to have more opportunities for non-agricultural employment (Lanjouw and Shariff, 2002). Liquid asset-rich households in terms of livestock receive higher nonfarm incomes in Kyrgyzstan (Atamanov and van den Berg, 2012).

Not all RNFA are feasible for the rural poor. Many studies have thus tried to disaggregate RNFA for better empirical scrutiny (Arif *et al.*, 2000; Malek and Usami, 2009; Lanjouw and Murgai, 2009). In India, the poor get significant shares of income from casual nonfarm wage employment (Lanjouw and Shariff, 2002); casual labor and self-employment in the nonfarm sector reveals greater involvement by disadvantaged groups in 2004 than in the preceding rounds (Lanjouw and Murgai, 2009). According to Arif *et al.* (2000), the poor concentrate in construction, transport and manufacturing sectors in Pakistan. In Bangladesh, land-poor households are most likely to earn

income from low-return non-farm wage employments, for example, nonfarm daily labor (Malek and Usami, 2009).

The few available studies in Ethiopia linking poverty and RNFS are also no different (Woldehanna, 2002; van den Berg and Kumbi, 2006; Kimhi, 2011; Lemi, 2009; Bezu *et al.*, 2012). The first three are region-specific studies made respectively in Tigray, Oromia and Southern Nations, Nationalities and People's regions of the country. The last two are based on a national data and employ previous rounds of the same survey the current study uses. According to Woldehanna (2002), rural people participate in nonfarm activities when agriculture is unable to support the growing population. The study reveals further that district level service trades, small enterprises and microenterprises are negatively correlated with farm output supporting the residual sector hypothesis that nonfarm activities absorb workers who cannot be readily absorbed into agriculture. van den Berg and Kumbi (2006) show that the coefficient for own cultivated land, the most important productive asset, is negative and significant for all three activities, indicating that poorer households earn more income from the nonfarm sector. In a gender-wise analysis, Kimhi (2011) finds that female nonfarm income is the only income source that significantly reduces per-capita income inequality which implies that RNFS is pro-poor.

Capturing socioeconomic differential by crop production and sales in different seasons and livestock value, Lemi (2009) finds that the increased production and sale of part of production during the main harvest season leads households to engage less in off-farm activities. His result supports the view that mainly cash-poor farmers tend to engage more in off-farm activities and that RNFA are practiced as a means of subsistence when crop production fails. His findings also confirm that an increase in the value of livestock lowers both participation and intensity of off-farm activities. However, the recent study of Bezu *et al.* (2012) comes across that relatively wealthy households benefit more from RNFS participation than do poorer ones.

The current study, at least by examining the effects of dynamic and persistent household socioeconomic status to participation in and intensity of RNFS, while still retaining the traditional determinants, will be different from previous studies linking socioeconomic status and RNFS.

3. Methodology

3.1 Theoretical model of the study

Following Strauss (1986) and Abdulai and Delgado (1999), the economic model of the study is summarized below. It is assumed that goods produced at home and purchased from the market by a household are perfect substitutes. Hence, people are assumed to be indifferent to whether the goods and services they consume are produced at home or purchased in the market. Households in the model therefore allocate each of their members' time endowment among three main activities: farm production, nonfarm production and leisure.

Given those assumptions, the final decision problem will be to choose the quantity of consumption goods to purchase (Q), the hours of farm work (F_f) and nonfarm work (F_{nf}), and the quantity of purchased non-labor farm inputs (X) so as to maximize household utility (U). This can be expressed as:

$$\begin{aligned}\zeta &= U(Q, L; Z, S) + \eta(T - F_f - F_{nf} - L) \\ &\quad + \psi[W_{nf}F_{nf} + P_y Y(F_f, H, X; G, M, S) - P_x X - W_f H + R - PQ]\end{aligned} \tag{1}$$

where L is leisure time; T is total household time endowment; Z is a vector of (household) demographic and socioeconomic characteristics; S is fixed effects of sub-location like the state of infrastructure; Y is output produced from the farm; P_y is price of farm output; H is hired labor; W_f is farm wage rate; W_{nf} is nonfarm wage rate; P is price of consumption goods; G is household characteristics affecting production decisions; M is fixed factors such as land; R is non-labor income such as land rent, nonfarm assets, and transfers received; P_x is price of non-labor farm inputs; η is the Lagrangian multiplier associated with the inequality constraints on the work of each labor type; and ψ is the Lagrangian multiplier associated with the income inequality constraint.

When households allocate time to the three activities, one may proceed to obtain the structural demand functions for farm labor and leisure as:

$$F_f^* = F_f(W_f,\ W_{nf}, P_y, P_x; G,\ M,\ S) \tag{2}$$

$$L^* = L(W_f,\ W_{nf}, P_y, P_x; P, R;\ Z,\ G,\ S)\ . \tag{3}$$

The corresponding nonfarm labor supply function then becomes (since $F_{nf}^{*} = T - F_{f}^{*} - L^{*}$):

$$F_{nf}^{*} = F_{nf}(W_f,\ W_{nf}, P_y, P_x; P, R;\ Z,\ G,\ S) \tag{4}$$

The reservation wage for nonfarm work is the marginal value of the individual's time when all of it is allocated to farm labor and leisure. It is obtained from Equation (4) by setting nonfarm hours worked equal to zero (i.e, $F_{nf} = 0$), and solving for $W_{nf} = W_{nf}^{r}$. It is given by:

$$W^{r} = W^{r}(P_y, P_x, P, W_f,\ W_{nf}, R;\ Z,\ G,\ S). \tag{5}$$

As the initial assumption of perfect markets leading to separation of household production and consumption does not seem to work in underdeveloped markets, such as in Ethiopia, a sort of adjustment is required. Arcand and d'Hombres (2006) consider different forms of market imperfections and analyze their effects on the optimal results derived earlier. These sources of non-separability include: credit constraints, labor market imperfections, marketing constraints, tenancy (or sharecropping) market and insurance market failure. Various constraints measuring the majority of those sources are, therefore, added to the previous models in the empirical estimation.

3.2 Empirical model and estimation issues

The empirical reservation and nonfarm wage equations (Huffman, 1989; Abdulai and Delgado, 1999) can be defined as:

$$W_{it}^{r} = \phi_1 C_{1it} + u_{1it} \tag{6a}$$

$$W_{it}^{m} = \phi_2 C_{2it} + u_{2it} \tag{6b}$$

where the C_{jit} are exogenous explanatory variables such as household and sub-locational characteristics; and u_{1it} and u_{2it} are random disturbance terms.

A nonfarm work participation indicator variable (Z_i^*) for household i can be defined as:

$$Z_{it}^{*} = \begin{cases} 1 \text{ if } W_{it}^{m} > W_{it}^{r} \text{ i.e., a household's member participates in RNFS} \\ 0 \text{ if } W_{it}^{m} < W_{it}^{r} \text{ i.e., a household's member does not participate in RNFS} \end{cases} \quad (7)$$

Since u_{1it} and u_{2it} are random variables, the probability of participating in RNFS can be:

$$Pr(Z_{it}^{*}) = Pr(W_{it}^{m} > W_{it}^{r}) = Pr(u_{1it} - u_{2it} < \phi_2 C_{2it} - \phi_1 C_{1it}) = F_v(\phi \mathbf{C}_{it}) = \phi \mathbf{C}_{it} + v_{it} \quad (8)$$

where $v_{it} = u_{1it} - u_{2it}$; $\phi \mathbf{C}_{it} = \phi_2 C_{2it} - \phi_1 C_{1it}$ and $F(.)$ is a cumulative distribution function for the random variable v. Different poverty indicators will be incorporated in the vector of variables $\mathbf{C}_{it}$ as variables of interest.

The reduced-form nonfarm labor supply (F_{nfi}) functions can be specified as:

$$F_{nfit} = \beta \mathbf{X}_{it} + \varepsilon_{it} \quad (9)$$

The vector $\mathbf{X}$ represents the independent variables specified on the right-hand side of Equation (4) and ϕ and β are vectors of parameters to be estimated.

The important models to be estimated ultimately are Equation (8) measuring participation in RNFA and Equation (9) measuring intensity of RNFS. For estimation of the model in Equation (8), the dependent variable is whether or not a member of the household participates in any type of nonfarm activity in the last four months before the respective surveys of 2004 and 2009. In the absence of well-organized RNFS labor supply data in the ERHS, the share of cash income from RNFS in consumption expenditure is considered as a dependent variable in Equation (9). A similar approach is also pursued by Lemi (2009) and Bezu *et al.* (2012). While the participation Equation (8) is estimated using probit, censored-Tobit regression is run on the intensity Equation (9). The pooling of observations is compensated by introducing year dummy as a control variable.

The study's variables of interest are variables measuring whether a household is in poverty (the conventional consumption-poverty) and other asset-poverty indicators such

as number of oxen and size of cultivated land during the main harvesting season. Interactions of consumption-poverty variable with year dummies are also considered to capture the effects of the dynamism and persistency of poverty. Control variables include demographic characteristics such as age and family size, average food crop prices in a nearby market to the village, land size covered by major crops, livestock ownership, various sorts of shocks that might have been faced such as drought, *etc.* (Table A1 of the Appendix contains description of all the variables.)

One concern here is the possible endogeneity of the poverty-indicating 'explanatory variables'. While they affect decision of participation and intensity of RNFS, it may also happen that they themselves are determined by other factors including income from RNFS so that parameters become biased. Such a possibility could be checked by estimating two regressions, first without the indicators and next with the indicators, thereby comparing the signs and magnitudes of the coefficients of the common covariates. If there is no significant difference, then the concern is not severe (Lemi, 2009). Though this is not an ideal way of testing endogeneity, it at least helps to check its severity. This exercise, applied to our data, shows that there is no severe problem of endogeneity.

3.3 The data and descriptive statistics

The data

The study employs data from the Ethiopian Rural Household Survey (ERHS), a unique longitudinal survey of seven rounds to date. Though initiated by the International Food Policy Research Institute (IFPRI) in 1989 in only six peasant associations (PAs), the current format started in 1994 encompassing 1477 households in 15 PAs and across four regions of the country. In addition to two 1994 rounds, the survey was conducted in 1995, 1997, 1999, 2004 and 2009. These round surveys were undertaken by the cooperative efforts of the Department of Economics at Addis Ababa University, IFPRI and the Center for the Study of African Economies at Oxford University. While sample households within villages were randomly selected, the villages themselves were chosen to ensure that the major farming systems are represented. However, the 15 villages included in the sample are not statistically representative of all rural Ethiopia. In addition, the sample does not include pastoral households.

For the specific purpose of the study, use is made only of the last two rounds, 2004 and 2009, and part of the data collected in the Amhara region of the country. Households in those rounds were interviewed from three administrative zones of the region – North *Shoa* (NS), North *Wollo* (NW) and East *Gojjam* (EG). The following PAs were then chosen: *Dinki, Yetmen, Shumshesha, Debrebirhan Milki, Debrebirhan Kormargefia, Debrebirhan Karafino* and *Debrebirhan Bokafia*. In this paper, the last four PAs are aggregated as *Debrebirhan zuria*. The study finally employs a balanced panel data set from 366 households interviewed in the above PAs of Amhara region in each of the two rounds.

Descriptive statistics

As presented in Table 1, almost all relevant economic variables show a nominal increment on the average in 2009 compared to their 2004 values. Exceptions are for real per capita consumption and land covered by major food crops in the region, each of which register a huge reduction. The mean of cash obtained from participation in nonfarm sector has increased by more than three-fold while its share in consumption has increased from as small as 10% to over 16% between 2004 and 2009. Not surprisingly, average food crop prices and daily wages in the nearby markets to the peasant associations have shown a sharp rise during the five-year period.

Table 1: Descriptive statistics of some socioeconomic and demographic variables: Amhara region

Variable	2004				2009			
	N	Mean	Min.	Max.	N	Mean	Min	Max
Age of household head	366	51.61	19	89	366	53.66	18	100
Household size	366	5.19	1	14	366	5.21	1	12
Cash income from nonfarm	366	46.10	0	1770	366	146.62	0	5564
Real per capita consumption expenditure (in 1994 prices)	366	118.65	14.53	1109.39	366	64.70	3.60	256.56
Share of nonfarm income	366	0.10	0	2.84	366	0.16	0	6.85
Farm wage in a PA, average (br/day)	366	5.67	5	6.25	366	16.33	13.25	18
Price of major food crops, average (br/kg)	366	1.89	1.68	2.10	366	5.34	3.8	6.7
Area covered by major crops (ha)	366	2.15	0	14.44	366	1.11	0	10
Total number of oxen	366	1.20	0	8	366	1.38	0	5
Tropical livestock unit	366	4.36	0	19.35	366	7.70	0	38.38

Source: Author's computation based on Ethiopian Rural Household Survey (ERHS) 2004 and 2009 rounds.

4. Results and discussion

4.1 Overview of rural nonfarm activities and poverty in Amhara region

The national and regional participation rates and shares of rural nonfarm sector in 2004 and 2009 are shown in Figures 1A and 1B. Though the agricultural sector still remains to be the dominant employer of people in rural Ethiopia, RNFS is also increasing in importance. 34% of the nationwide sample households in 2004 had at least one member participating in the sector, rising to 42% in 2009. And over a quarter of the consumption expenditure of households in 2009 was covered by cash income from RNFS, an increase by over 10 percentage points in five years time.

Figure 1A: RNFS participation rates by region in 2004 and 2009

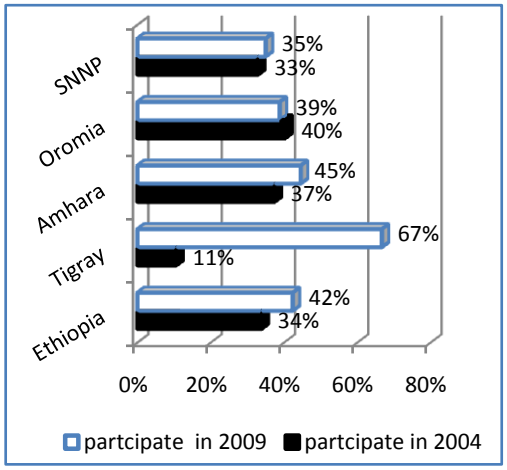
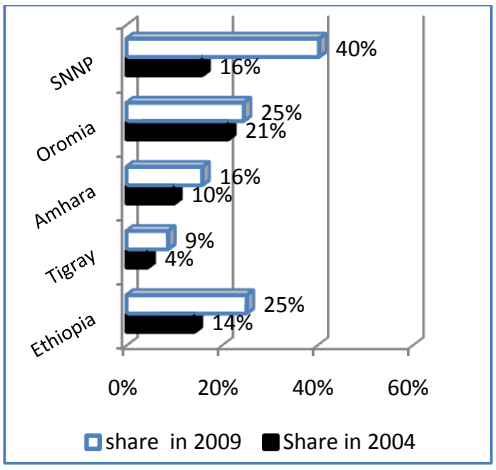


Figure 1B: Mean RNFS income shares by region in 2004 and 2009



Note: SNNP=Southern Nations, Nationalities and Peoples

Source: Author's computation based on Ethiopian Rural Household Survey (ERHS) 2004 and 2009 rounds.

Besides those seasonal differences, there also exist regional differences in both participation and income shares during the survey periods. In terms of participation, a surge has been observed in the Tigray region of the country in 2009 while other regions did not show much deviation from the national averages of the respective years. Rural households in SNNP saw the largest rise in their shares of RNFS income in 2009. The shares have also increased in all other regions. Unlike the participation in 2009 in rural Tigray, the shares figures remain small compared to other regions. RNFS participation

rate in rural Amhara region in 2004 was 37% which rose to 45% in 2009. These compare with 25% in 1994 and 23.3% in 1997 (Lemi, 2009).

In Table 2, average real per capita consumption expenditures by region and year for a balanced panel of both RNFS participating and non-participating households are presented. Sampled households saw a fall in their real consumption in an unprecedented manner over the five-year period, both nationally and across regions. This reduction in consumption was highest in Tigray and lowest in Oromia. The number of households falling in poverty showed an almost similar trend. As presented in Table A2, except in Oromia region, increases in both neighborhood and absolute poverty were seen for the similar households followed in 2004 and 2009. The increase in poverty in Amhara region is despite an average 8.5% per capita output growth recorded in the country during the same period and a recent government report of falling rural poverty in 2010/11 to only about 31% in the region (MoFED, 2012).

Table 2: Mean rural household real per capita consumption expenditure* in 2004 & 2009 by region

	Ethiopia	Tigray	Amhara	Oromia	SNNP
Real per capita consumption expenditure in 2004	90	74	119	92	65
Real per capita consumption expenditure in 2009	58	28	65	84	41
Balanced panel of households in each survey year	1210	132	366	329	383

*In 1994 prices.

Source: Author's computation based on Ethiopian Rural Household Survey (ERHS) 2004 and 2009 rounds.

The types of nonfarm activities in Amhara region seem to provide a possible explanation to the above finding. The majority of the activities are created by the government. For instance, in the region during 2009, over 38% of the participants end up in food-for-work, paid community development activities to support poor and food insecure families. Others include paid farm works, skilled activities like carpentry, professional activities like teaching, religious works, guarding, and other unskilled activities (see Table A3 in the *Appendix*).

More detailed descriptive statistics may provide extra insights into the links between poverty RNFS. As can be seen from Table 3, out of the 366 rural households followed

in 2004 and 2009 in Amhara region, the engagement of the poor in RNFA has shown a rise in 2009. It reached 49% from only 32% in 2004. Once again, the rise in participation by the poor in the sector goes in line with the increase in rural poverty in the region between 2004 and 2009 (see Table A2). This supports the view that many RNFS participants could be the poor as many of such activities do not require special skills and are usually low-return (Barrett *et al.*, 2001). However, a marginal reduction in the share of RNFS income for the poor over time was observed while it almost doubled for the non-poor.

Table 3: RNFS participation rate (% of households) and mean RNFS income share (% of consumption expenditure) by poverty status: Amhara region, 2004 and 2009

	poverty status: 2004			poverty status: 2009		
	non-poor	poor	total	non-poor	poor	total
RNFS participation rate (%)	39	32	37	41	49	45
RNFS income share (%)	7	22	10	13	20	16

Source: Author's computation based on Ethiopian Rural Household Survey (ERHS) 2004 and 2009 rounds.

A further scrutiny could also be made by relating RNFS participation and income shares to poverty status relative to neighboring households. As shown in Table A4 (of the Appendix), the first 20% poorest, who had only 32% participation rate in 2004, increased their participation to about 53% in 2009. It is simple to notice that participation dominance in nonfarm activities was reverted among the poor and the non-poor during the five-year period in favor of the poor. The shares figures, however, did not show any regular trend; though households in the first quintile saw a more-than-doubled share in five years, those in the fourth quintile (the second richer) did the same.

4.2 The effect of poverty on RNFS in rural Amhara region

In this sub-section, we present and discuss the econometric results of the study, composed of estimation of participation and intensity models. The probit estimation results of the participation model are presented in Table 4. Only marginal effects of the corresponding variables of interest and controls are shown. The model is estimated on 732 observations (366 households pooled in two years). A total of 14 and 19 variables

were fit as possible covariates in each of the 'without' and 'with' estimations respectively. As noted earlier, there are no significant differences between the signs and sizes of the common significant coefficients of these two estimations so that our analyses below will be based on the 'with' results.

Two of the socioeconomic status indicators used in the estimation, which are created by interacting poverty dummy with year dummies, are found to be statistically significant. One result shows that, compared to the non-poor, those who fell into poverty throughout the five-year period (captured by the variable *'Poor in both 2004 and 2009'*) were more likely to participate in the RNFS in the rural villages of Amhara region. The implication is that the more household poverty persists the higher would be the probability of participation in RNFS. Though not in its dynamic context, Sanusi (2011) also finds a similar positive poverty coefficient for Nigeria. Evidence from Kyrgyzstan similarly shows that asset-poor households, in terms of livestock and land ownership, tend to incline more to nonfarm activities (Atamanov and van den Berg, 2012). In another supportive finding, the negative coefficient associated with variable 'Poor only in 2004' indicates that the probability of engagement in RNFS by the rural poor in 2004 was lower compared to the non-poor and all others in 2009. Complemented with the insignificance of '*Non-poor only in 2009'* and the significant positive sign of '*Year dummy: 2009'*, the overall suggestion is that the poor tended to participate more in 2009 than in 2004. This is also consistent with our previous finding at the end of sub-section 4.1.

Nonetheless, our asset-related measures of socioeconomic status – number of oxen owned and cultivated agricultural land – are found not to determine participation at any acceptable level. Abdulai and Delgado (1999) similarly come across an insignificant livestock variable using data of Ghanaian married couples. However, Lemi (2009), using a similar survey as ours but the 1994 and 1997 rounds, finds that households who own more livestock and less land tend to participate less in off-farm activities.

The regression results further show that the diversification into RNFS is primarily due to push factors than pull factors. A push scenario occurs when participation in nonfarm activities is driven by the inability to earn enough from agricultural activities due to a poor asset base or a risky agricultural environment (Atamanov and van den Berg, 2012). As many rural poor in the region are either landless or possess very small per capita land upon which farming entirely depends, such a findings is no surprise. The

poor may not be left with any option than using activities like food-for-work and farm labor as means of survival.

Table 4: Covariates of participation in RNFS in rural Amhara region: marginal effects after probit estimation

(Dependent variable: Dummy for participation in RNFS by any household member)

Covariate	Without poverty indicators		With poverty indicators	
Age of the household head	-0.006	(0.002)***	-0.006	(0.002)***
Household size	0.019	(0.009)**	0.022	(0.010)**
Member of eqqub	-0.020	(0.053)	-0.025	(0.052)
Taken credit	0.081	(0.040)**	0.077	(0.041)*
Shock: drought	0. 031	(0.052)	0. 035	(0.053)
Shock: pests	0.023	(0.055)	0.029	(0.056)
Price of major food crops, average	-0.447	(0.090)***	-0.536	(0.108)***
Farm wage in the PA, average	0.116	(0.032)***	0.149	(0.037)***
Some primary schooling	0.050	(0.042)	0.054	(0.043)
Some secondary schooling	-0.140	(0.191)	-0.143	(0.196)
PA dummy: Yetmen[b]	-0.408	(0.040)***	-0.430	(0.038)***
PA dummy: Shumsheha	0.276	(0.070)***	0.299	(0.075)***
PA dummy: Debrebirhan zuria	-0.360	(0.081)***	-0.422	(0.090)***
Year dummy: 2009[c]	0.391	(0.135)***	0.302	(0.150)**
Number of oxen			-0.016	(0.022)
Area covered by major crops (Meher)			0.014	(0.020)
Poor only in 2004			-0.283	(0.061)***
Non-poor only in 2009			0.009	(0.061)
Poor in both 2004 and 2009			0.170	(0.086)*
No. of observations	732		732	
Log-likelihood	-432.267		-423.94	
Chi-square	106.32***		109.05***	
Pseudo-R^2	0.1275		0.1443	

*, **, *** show significance at 10%, 5%, 1% levels respectively. Standard errors adjusted for clusters in parentheses.

[a] No education is the base; [b] Dinki is the base; [c] 2004 is the base.

A number of other control variables are also found to affect participation in RNFS. Ceteris paribus, households headed by relatively aged ones are less likely to participate. Expectedly also, family size positively influences participation as it increases the opportunity to spend some time out of agricultural activities, if any. Further,

households who manage to get credit are found to have a higher chance of engagement in the sector. Lemi (2009) records that increased crop production and sale of part of production during the main harvest season led households to engage less in off-farm activities. This crowing-out effect of the agricultural sector is also confirmed by our finding that producer prices of major food crops negatively and significantly affect participation in RNFS. Surplus food crop producers would have a good chance of obtaining higher incomes from sales, thereby unfavorably affecting their involvement in RNFS. The positive effect of mean agricultural wage is justifiable since paid farm work is considered as one of the important nonfarm activities in the region (see Table A3).

Strong seasonal, as in Lemi (2009), and locational differences in participation are also identified. It is found that average participation in 2009 increased compared to 2004. Rises in prices of food items, applicable to net food purchasers, and other non-agricultural consumables in 2009 compared to 2004 might have forced people to try to engage in some activities off their farm. Locationally, higher likelihood of participation is observed by households in *Shumsheha* peasant association of North *Wollo* zone compared to all other PAs. Since this PA is one of the drought-prone rural areas in Amhara region, the result is expected and is in line with the 'push' scenario. Similarly, households in *Yetmen* of East *Gojjam* zone and *Debrebirhan zuria* of North *Shoa* are found to have lower RNFS engagement probabilities relative to those in *Shumsheha* and *Dinki* of North *Shoa* zone.

Table 5 gives the censored-Tobit estimation results of the intensity (share of RNFS income) model. We find generally that the factors affecting the intensity of RNFS are not necessarily similar to those affecting participation and this is the same as that in Matshe and Young (2004) and Malek and Usami (2009).

Table 5. Covariates of rural nonfarm income share in Amhara region: results from censored-Tobit estimation (Dependent variable: share of nonfarm income)

Covariate	Without poverty indicators		With poverty indicators	
Age of the household head	-0.007	(0.006)	-0.005	(0.006)
Household size	0.018	(0.034)	0.061	(0.038)
Member of eqqub	-0.014	(0.239)	0.056	(0.240)
Taken credit	0.584	(0.157)***	0.449	(0.148)***
Shock: drought	-0.318	(0.197)	-0.304	(0.193)
Shock: pests	0.177	(0.222)	0.212	(0.220)
Price of major food crops, average	-1.694	(0.391)***	-1.848	(0.409)***
Farm wage in the PA, average	0.344	(0.138)**	0.392	(0.144)**
Some primary schooling	-0.014	(0.188)	0.066	(0.188)
Some secondary schooling	1.912	(1.418)	2.016	(1.370)
PA dummy: Yetmen[b]	-0.755	(0.400)*	-0.680	(0.406)*
PA dummy: Shumsheha	1.444	(0.315)***	1.558	(0.318)***
PA dummy: Debrebirhan zuria	-1.007	(0.388)**	-0.872	(0.388)**
Year dummy: 2009[c]	2.170	(0.712)***	2.307	(0.719)***
Number of oxen			-0.304	(0.108)**
Area covered by major crops (Meher)			0.053	(0.079)
Poor only in 2004			-0.195	(0.372)
Non-poor only in 2009			-0.109	(0.252)
Poor in both 2004 and 2009			0.428	(0.348)
Constant	-0.014	(0.541)	-0.147	(0.524)
No. of observations	732		732	
Observations left-censored at 0	589		589	
Log-likelihood	-433.414		-426.462	
F-value	4.17***		3.46***	
Pseudo-R^2	0.0773		0.0921	

*, **, *** show significance at 10%, 5%, 1% levels respectively. Standard errors adjusted for clusters in parentheses.

[a] No education is the base; [b] Dinki is the base; [c] 2004 is the base.

The study finds that RNFS participating households who own more oxen have lesser share of RNFS income in total household consumption expenditure. The negative coefficient for number of oxen is expected, confirms the competition between farm and nonfarm incomes and is a further evidence for the pro-poor feature of RNFS in Amhara region. It also means that the rural asset-poor, once they participate in RNFS,

finance their consumption expenditures more from rural nonfarm activities than what the non-poor do. In many parts of the region, ox is an important factor of crop production and is sometimes considered as 'capital' together with its plough complements. In our sample rural villages, the mean number of oxen per household was 1.20 in 2004 and 1.38 in 2009 (Table 1), lower than the required number of 2 for ploughing normally. Farmers having more oxen are likely to spend much time on the farm so that their incomes are fetched more from farm than nonfarm activities. Our findings supporting the view that RNFS is pro-poor in terms of intensity are consistent with Lemi (2009). He, using censored-Tobit regression, estimates that all the variables measuring asset (e.g. livestock) and income (e.g. seasonal sales income from crops) are negative and significant, implying that asset-poor households get more income from RNFS than their well-to-do counterparts.

Elsewhere, akin to the participation case, credit, average crop and labor prices, as well as locational and time dummies are found to significantly influence income shares of nonfarm activities.

5. Concluding remarks

The study has tried to measure the effect of poverty, proxied by both consumption expenditure and asset indicators, on rural nonfarm sector (RNFS) participation and intensity (measured as share of RNFS income in consumption) in Amhara region of Ethiopia. Probit and censored-Tobit regressions were run on a pooled data of 366 random rural households for 2004 and 2009 harvest years. A number of control variables (demographic, socioeconomic and locational and seasonal dummies) specific to the household, the head and the rural village were also included.

The results reveal that poverty does have a significant effect on households' participation in and income shares of RNFS. The participation and share of nonfarm income are higher, on the average, for the poor than for the non-poor. The rural poor, who usually are either landless or of large family size, use rural nonfarm activities (RNFA) as a means of survival. It is found generally that the sector is pro-poor and that it is a last resort for those segments 'pushed' by unfavorable socioeconomic environments. Besides poverty, controls such as credit, crop and labor prices, as well as locational and time dummies are important other determinants of participation and intensity.

Policymakers need to give the sector due attention on the ground. A note must be taken that the types of RNFA pursued are low-return and related to governmental projects. But, there must still be an environment for active participation of the private sector such as 'model farmers'. A separate office for promotion of these and for sustenance of the RNFS would be quite relevant. Since agricultural offices focus on the agricultural sector and trade and industry offices work almost only in urban areas of the region, such a coordinating office may do better by also identifying high-return activities.

The study's results also suggest that if policymakers seek to maximize the benefits of the RNFS going to the poor, certain other things related to removal of barriers are crucial. The first focuses on credit. The current rural micro-credit schemes (such as of the Amhara Credit and Saving Institution) may need to be modified and intensified in favor of the rural poor. This not only enhances their participation in RNFS but also helps them shift to medium- or high-return RNFA, thereby augmenting RNFS income. According to our results, wages have the effect of increasing both participation in and incomes from RNFS. In line with this finding, the second issue would be improvement of rural institutions and infrastructure promoting the functioning of rural labor markets.

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Appendix

Table A1. Description of variables

	Variable name	Description
1.	Participation in RNFS	=1 if any member of a household was engaged in nonfarm activities during the past 4 months before the survey
2.	Share of RNFS income	Share of total cash income from rural nonfarm sector in the total household consumption expenditure
3.	Real per capita consumption expenditure	Real per capita consumption expenditure (birr per day in 1994 prices)
4.	Poor	=1 if average real per capita consumption expenditure is less than 50 br per day (in 1994 prices)
5.	Age of household head	Age of the household head
6.	Marital	=1 if the household head is married
7.	Male head	=1 if the household head is male
8.	Household size	Household size
9.	Number of oxen	Number of oxen possessed by the household
10.	Area covered by major crops (Meher)	Land covered by major crops (maize, wheat, teff, bean, barley, chickpea, sesame, linseed, sinar) (during the Meher season)
11.	Member of eqqub	Any household member is a member of eqqub? =1 if yes
12.	Taken credit	Any household member has taken a credit of at least 20 br in the past 12 months? = 1 if yes
13.	Shock: drought	Faced drought in the last 5 years? = 1 if yes
14.	Shock: pests	Faced pests in the last 5 years? = 1 if yes
15.	Price of major food crops, average	Average price of major food crops in the nearby market to the PA (maiz, wheat, teff, bean, barley, chick pea, sesame, linseed, sinar) (br/kg)
16.	Farm wage in the PA, average	Average farm wage in the PA to an adult man for land preparation, planting, weeding and maintenance, harvesting and livestock herding/watering (br/day)
17.	Year dummy: 2009	=1 if year=2009
18.	Some primary school	=1 if the head of the household has attended any primary education
19.	Some secondary school	=1 if the head of the household has attended any secondary education
20.	PA dummy: Yetmen	= 1 if peasant association is Yetmen
21.	PA dummy: Shumsheha	= 1 if peasant association is Shumsheha
22.	PA dummy: Debrebirhan zuria	= 1 if peasant association is around Debrebirhan

Table A2: Percentage of households falling in the quintiles of consumption expenditure and in absolute poverty by region: 2004 and 2009

		2004					2009				
	Quintile	Eth.	Tig.	Amh.	Oro.	SNNP	Eth.	Tig.	Amh.	Oro.	SNNP
Relative poverty	Poorest 20%	16	22	4	13	27	26	61	10	8	43
	2nd poorer 20%	18	14	13	20	21	24	30	24	17	26
	Middle 20%	19	25	17	19	20	20	7	30	20	16
	2nd richer 20%	20	20	25	21	15	19	2	23	29	11
	Richest 20%	27	19	41	26	17	12	1	13	25	4
	Total	100	100	100	100	100	100	100	100	100	100
Absolute poor (%)		37	42	19	38	53	54	93	42	29	73

Note: Eth.=Ethiopia; Tig.=Tigray; Amh.=Amhara; Oro.=Oromia; SNNP= Southern Nations, Nationalities & Peoples

Source: Author's computation based on Ethiopian Rural Household Survey (ERHS) 2004 and 2009 rounds.

This table is generated from a balanced panel data of 1210 households in Ethiopia in each of 2004 and 2009 (132 in Tigray, 366 in Amhara, 329 in Oromia and 383 in SNNP). It also refers to both RNFS participating and non-participating households.

Table A3: Types of rural nonfarm activities: Amhara region, 2004 and 2009

Type of rural nonfarm activity	2004		2009	
	Count*	Percent	Count*	Percent
Food-for-work	81	54.73	67	38.29
Farm work (paid)	43	29.05	43	24.57
Unskilled nonfarm work	13	8.78	39	22.29
Skilled nonfarm work	7	4.73	12	6.86
Professional (teacher, health worker, etc.)	3	2.03	4	2.29
Religious work	-	-	4	2.29
Guard	1	0.68	3	1.71
Trading	-	-	2	1.14
Domestic servant	-	-	1	0.57
Total	148	100.00	175	100.00

* Not necessarily number of households as more than one member in a household may participate.

Source: Author's computation based on Ethiopian Rural Household Survey (ERHS) 2004 and 2009 rounds.

Table A4: RNFS participation rate (% of households) and mean RNFS income share (%) by quintiles of real per capita consumption expenditure: Amhara region, 2004 and 2009

Quintile	RNFS participation rate		Share of RNFS income	
	2004	2009	2004	2009
Poorest 20%	31.8	53.2	12.3	29.7
2nd poorer 20%	30.8	47.4	23.4	13.6
Middle 20%	36.5	42.9	13.8	14.7
2nd richer 20%	41.7	40.9	8.1	17.8
Richest 20%	37.6	42.0	6.3	5.4
Overall	**37.4**	**44.5**	**10.0**	**15.9**

Source: Author's computation based on Ethiopian Rural Household Survey (ERHS) 2004 and 2009 rounds.

EXCHANGE RATE PASS-THROUGH TO IMPORT AND CONSUMER PRICES: EVIDENCE FROM ETHIOPIA

Helen Berga[1]

Abstract

The fact that Ethiopia adopted managed floating exchange rate policy since 1992 as well as various trade reform measures taken makes the country's import and consumer prices susceptible to the effects of exchange rate movements. Thus, the study investigates the degree of ERPT to import and consumer prices in Ethiopia between 1991/92 and 2010/11 using Structural Vector Autoregressive (SVAR) model where the degree of pass-through is estimated by the means of impulse response functions. The paper found that ERPT in Ethiopia during the period under review is significant, moderate and persistent in the case of import price and low and short lived in the case of consumer prices. These results are robust to a number of alternative specifications of the model, such as the use of different ordering and identification schemes.

Keywords: exchange rate pass-through, consumer price, import price, SVAR, Ethiopia
JEL Classification: C32, E31, F31, F41

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1. Introduction

One of the most crucial issues in small open economies like Ethiopia is exchange rate pass-through (ERPT). ERPT is defined as the change in prices caused by the change in nominal exchange rate. In particular, the percentage by which import, export or domestic prices change when the home currency changes by one percent is called the degree of ERPT. A one-to-one response of prices to exchange rate changes is known as complete ERPT while a less than one-to-one response is known as incomplete ERPT (See for example, Goldberg and Knetter, 1997; Devereux and Yetman, 2002).

The degree to which exchange rate movements are passed-through to import and domestic prices holds a central place in international finance and is a much-debated question among policy makers. In fact, a large body of theoretical and empirical research shows that the degree of ERPT has important implications for the timing of current account adjustment (Krugman and Obstfeld, 2003)[2], the conduct of monetary policy (example, Adolfson, 2001; Smets and Wouters, 2002; Corsetti and Pesenti, 2001; Gagnon and Ihirg, 2004 and Monacelli, 2005)[3], the choice of exchange rate regime and the international transmission of shocks (see, Engel, 2002; Devereux and Engel, 2003; Betts and Devereux, 2001 cited in Bouakez and Rebei, 2006).

The empirical literature revolving around ERPT is vast. In general the literature so far suggest ERPT to import and domestic prices is: (1) incomplete for most developed (Goldberg and Knetter, 1997; Yang 1997; McCarthy, 2000; Campa and Goldberg, 2002; Campa *et al.* 2005 and An, 2006), developing (Choudhri and Hakura, 2003; Rowland, 2003; Kiptui *et al.*, 2005; Mwase, 2006 and Aliyu, *et al.*, 2010) including Africa and emerging markets (Zorzi *et al.*, 2007 and Bhattacharya *et al.*, 2011) and (ii) declining overtime[4] (Taylor, 2000; Choudhri and Hakura, 2003; Devereux and

[2] If the degree of pass-through is high the adjustments in trade balances will be relatively prompt whereas it would takes longer time for trade balance to adjust if the degree of pass-through is low (Krugman and Obstfeld, 2003, Ito and Sato, 2006)). Also, if domestic prices in general respond to the nominal exchange rate depreciation one-to-one (i.e. pass-through is not only to import prices but to CPI in general), then any export competitiveness from nominal depreciation would be cancelled out (Ito and Sato, 2006).

[3] For instance, Adolfson (2001) showed that the optimal policy reaction and its implications are dependent on the degree of pass-through and Smets and Wouters (2002) indicated that the presence of imperfect pass-through reduces the incentive for the central bank to actively use the exchange rate channel.

[4] Where most of these studies suggested that this decline is attributed to change in monetary policy towards stabilizing inflation in most developed countries while Campa and Goldberg (2002) implied that the industry composition of trade is more important than inflation performance in explaining the decline in the degree of pass-through in developed nations.

Yetman, 2002; Campa and Goldberg, 2002; Gagnon and Ihrig, 2004; Bailliu and Fuji, 2004 and Marazzi et al. 2005).

In Ethiopia, the emphasis on knowing the ERPT is underpinned by the fact that the country imports large amount of primary and intermediate goods which severe as inputs to the manufacturing sector. Also the country imports considerable amount of finished consumer goods.[5]. Despite the observed high growth rate of exports, the country suffers from a continuous and significant trade deficit which reached a value of 6.26 billion US dollars in 2009/10 fiscal year (NBE, 2009/10). Thus, the need to make the external sector competitive through appropriate exchange rate adjustments has made the study of ERPT to import and consumer prices in Ethiopia imperative. In addition, the fact that understanding the impact of exchange rate movements on prices would help to determine appropriate monetary policy coupled with the recent inflationary environment in Ethiopia signifies the importance of studying ERPT.

Recent developments in the external sector of the Ethiopian economy revealed that the National Bank of Ethiopia (NBE) devalued the Birr by 10% vis-à-vis the US dollar in January 2009 and by August 2010 it had depreciated the Birr by some 16% since September 2008 (NBE, 2009/10). In addition, in recent years, the Ethiopian economy is facing high inflation especially in food price. Starting from 2005/06 there is a continuous increase in the price level of goods and services. The highest increase is observed in food items where it is recorded to be 44.2 and 41.5 percent at national level and Addis Ababa respectively in year 2008/09 which is the highest ever. Starting from 2003/04 the country level general inflation rate increased at about 17 percent on average during the past six years (Own computation based on CSA data).

Concerns are what would be the implications of these developments on the extent of pass-through on import and consumer prices. Most of the empirical researches on the theme are on the developed or emerging economies. There are of course few studies which are conducted on the issue of ERPT in the African context (see for example, Mwase, 2006; Daniel, 2007, Siaw and Adam, 2010 and Aliyu, *et al.*, 2010). In Ethiopia, Choudhri and Hakura (2003) and Devereux and Yetman (2002) in their cross country study, founds ERPT to be zero between the period 1997-2000 and 1975-1999,

[5] The share of the countries import as percentage of GDP (which can be considered as a measure of import penetration) continues to increase. For instance, the percentage of total import to GDP have been on average 14 percent between the periods 1991/92-2000/01 and increased to 26.1 percent between the periods 2001/02-2010/11 (own computation based on NBE data).

respectively. Devereux and Yetman (2008) found a higher (0.35 percent) degree of pass through for Ethiopia by extending the sample period from 1970 to 2007.

Although these studies are informative, there is a need to take further studies in the area in Ethiopian context due to the following reasons. First these studies are basically conducted to see cross country differences in pass-through and hence country specific study is required so as to obtain more evidence. Also, these studies apply single equation estimation techniques. However several recent empirical studies suggested the use of Vector Autoregressive models (VAR) in analyzing ERPT. Since the exchange rate and inflation rate are expected to be influencing each other in many theoretical models, it seems more appropriate to estimate a system that would treat both of them endogenous. Thus the use of VAR models would allow the reverse causality from price indices to the exchange rate which avoids arbitrary assignment of variables as endogenous and exogenous. In sight of this argument, this study will analyze ERPT to import and consumer prices in Ethiopia using VAR models. More specifically, the research is expected to address the following questions: (1) Do changes in the exchange rate have significant effect on import and consumer price inflation? (2) How much is the extent (degree) of ERPT to import and consumer prices?

2. Theoretical Background

The starting point to study the link between exchange rate and domestic prices is the law of one price (LOP) which states that the price of identical commodities sold in different market should be the same when it is converted into the same currency (Pilbeam, 1998).

The LOP is mathematically expressed as follows;

$$P_t = E_t P_t^* \qquad (1)$$

Where *P* is the domestic price index, *Et* is the nominal exchange rate (defined as domestic currency per unit of foreign), and *Pt* represents foreign prices. (Relative) purchasing power parity tests use price indices across countries to test whether this relationship holds.

Based on this fundamental relationship various researchers develop different more advanced models to analyze the degree of pass-through by starting form the following basic model;

$$P_t = \gamma e_t + \varepsilon_t \quad (2)$$

Where, ε_t is an error term and γ is the ERPT coefficient. The extent of pass-through coefficient is based on the value of γ. A one to one response of import prices to exchange rate is known as a complete ERPT (γ=1) while the case where pass-through coefficient is less than 1 (γ<1) is known as partial or incomplete ERPT. However according to Campa and Goldberg (2002) this reduced form equation is problematic for hypothesis testing because it represents a non-structural statistical relationship. More specifically, Campa *et al.* (2005) indicated that Eq. (2.2) is purely statistical relationship between exchange rates and prices, and does not have a meaningful economic interpretation.

The micro-foundations of pricing behavior by exporters are a better starting point for generating more meaningful specifications based on economic theory that are appropriate for hypothesis testing. Hooper and Mann (1989), Goldberg and Knetter (1997) and Barhoumi (2006) considered a representative foreign firm having some degree of control over the price of its goods in an importing country. They assume that this representative firm establishes the price of its exports to country i in its own currency ($P_t^{x,i}$) at a markup (λ_{it}) over its marginal cost of production (C_{it}^*), that is:

$$P_t^{x,i} = \lambda_{it} C_{it}^* \quad (3)$$

The import price in the domestic currency $P_t^{m,i}$ is obtained by multiplying the export price $P_t^{x,i}$ by the exchange rate of the importing country i, E_{it}, that is,

$$P_t^{m,i} = E_{it} P_t^{x,i} = E_{it}\ \lambda_{it} C_{it}^* \quad (4)$$

The markup is assumed to respond to both demand pressure for the exporting country (Y_{it}^*) and competitive pressure in the importing country. Competitive pressure in the importing country is measured by the gap between the competitor prices in the importing country market (P_{it}) and the production cost of exporting firm. Therefore, according to Hooper and Mann (1989) the markup λ_{it} is given by;

$$\lambda_{it} = \{P_{i,t}/(E_{it}C_{it}^{*})\}^{\alpha} Y_{i,t}^{\beta} \quad (5)$$

Where $0 < \alpha < 1$ and $0 < \beta < 1$

Substituting Equation (5) into (4), we have

$$P_t^{m,i} = (E_{it}C_{it}^{*})^{1-\alpha} P_{it}^{\alpha} Y_{it}^{\beta} \quad (6)$$

If we take the logarithm of Equation (6), the ERPT, defined as the partial elasticity of import price with respect to exchange rate, is (1-α). Campa and Goldberg (2002:5-6) hypothesized a similar, yet more general, model. The pricing equation of an exporter from country *x* -- and its elasticity of response to an exchange rate movement -- depend on the structure of demand and costs confronting the exporter. If the import prices of country $P_t^{m,j}$, are the dependent variables, the pricing rule of the foreign exporters *x* supplying *j* is:

$$P_t^{m,j} = E_t P_t^{x,j} = E_t \lambda_t^{x,j} \left(P_t^{m,j} / P_t \right) C^{x,j}\left(W_t^{j}, Y_t, E_t\right) \quad (7)$$

Where $\lambda_t^{x,j} = P_t^{x,j}/C_t^{x,j}$, $C_w^{x,j} > 0$, $C_E^{x,j}$, $C_Y^{x,j} > 0$

$\lambda_t^{x,j}$ represents the markup rate of prices over costs for the exporter. Markup rates are industry specific and depend on the demand curve facing exporters *x* in country *j*. This demand depends, in turn, on $P_t^{m,j}/P_t$ the prices of imports relative to prices of country *j* producers. $C_t^{x,j}$ is the marginal cost function of the exporter in his own currency. This exporter marginal cost function is increasing in export market wages, $W_t^{x,j}$, and increasing in country *j* demand conditions *Yt*. The exchange rate is an argument in the exporter's cost function to the extent that the exporter relies on imported inputs or has other costs that move with the relative value of the destination market currency.

All the above models of ERPT are fundamentally grounded in partial-equilibrium setups which arise from the problem of a single exporter/importer or from the industrial organization of one industry. This approach ignores the view that exchange rates are endogenous economic variables and looks at the impact that an exogenous exchange rate movement has on the resulting equilibrium price in the industry.

However, exchange rates are by definition the relative prices of currencies and are endogenous variables in which their value gets determined within a general equilibrium context, alongside other asset prices. (Campa *et al.*, 2005:3).

The second strand of literature embeds a more general-equilibrium approach, whereby prices are sticky in one currency, i.e., set in advance of the realization of the exchange rate by exporters. In their pioneering work, Obstfeld and Rogoff (1995) introduced nominal rigidities and market imperfections into a micro-founded dynamic general equilibrium model. However, PPP was maintained at all times, and the pass-through was complete. Betts and Devereux (1996, 2000) cited in Bailliu and Fuji (2004) then developed an extended version of the Obstfeld-Rogoff model allowing for pricing to market (PTM). More precisely, whereas the two models feature the same simple form of price rigidity (prices are predetermined for one period), they differ in the assumed pricing strategy of firms. In the Obstfeld-Rogoff-model, nominal prices are set in producers' currencies (PCP) while in the Betts-Devereux model, a fraction of firms is allowed to set prices in destination countries' currencies (LCP).[6] Also, assuming sticky prices and the exchange rate being an endogenous variable, these models demonstrate that ERPT is a function of the underlying shocks in the economy and the given competitive structures of the industries involved.

However, these early models neglected some important aspects. In particular, neither the original Obstfeld-Rogoff-model nor the Betts-Devereux-model explicitly distinguishes different stages of the distribution chain. More recently, a strand in the literature has been established that considers imports as intermediate goods that undergo non-traded production order distribution processes before being consumed. These production or distribution channels may dampen the impact of exchange rate shocks on consumer prices. Hence, imperfect pass-through into consumer prices may be observed even in the case of PCP (Stulz, 2006).

McCarthy (1999) introduced a new analytical approach to examine ERPT which seems to address these issues. He applied the model of pricing along a distribution which captures the endogenous nature of the exchange rate and permits one to track the pass-through from exchange rate fluctuations to each stage of the distribution chain in a simple integrated framework.

[6] When prices are determined in the exporter´s currency (PCP) ERPT tends to be much larger than when prices are set in the importer´s currency (LCP). In the extreme case of a purely exogenous exchange rate shock, ERPT would be one under PCP and zero under LCP.

McCarthy's model basically put inflation at each stage-import, producer and consumer-in period t is assumed to be comprised of several components. The first component is the expected inflation at that stage based on the available information at the end of period *t-1*. The second and third are the effects of period *t* domestic "supply" and "demand" shocks on inflation at that stage. The fourth component is the effect of exchange rate shocks on inflation at a particular stage. Next are the effects of shocks at the previous stages of the chain. Finally, there is the shock that belongs to that stage. The shocks at each stage are that portion of a stage's inflation that cannot be explained using information from period t-1 plus contemporaneous information about domestic supply and demand variables, exchange rates, and inflation at previous stages of the distribution cycle. These shocks can be thought of as changes in the pricing power and markups of firms at these stages (McCarthy, 1999:4). Under these assumptions, the inflation rates of country *i* in period *t* at each of the three stages, import, producer and consumer, can be written as:

$$\pi_{it}^{m} = E_{t-1}(\pi_{it}^{m}) + \alpha_{1i}\varepsilon_{it}^{s} + \alpha_{2i}\varepsilon_{it}^{d} + \alpha_{3i}\varepsilon_{it}^{e} + \varepsilon_{it} \quad (8)$$

$$\pi_{it}^{w} = E_{t-1}(\pi_{it}^{w}) + \beta_{1i}\varepsilon_{it}^{s} + \beta_{2i}\varepsilon_{it}^{d} + \beta_{3i}\varepsilon_{it}^{e} + \beta_{4i}\varepsilon_{it}^{m} + \varepsilon_{it}^{w} \quad (9)$$

$$\pi_{it}^{c} = E_{t-1}(\pi_{it}^{c}) + \gamma_{1i}\varepsilon_{it}^{s} + \gamma_{2i}\varepsilon_{it}^{d} + \gamma_{3i}\varepsilon_{it}^{e} + \gamma_{4i}\varepsilon_{it}^{m} + \gamma_{5i}\varepsilon_{it}^{w} + \varepsilon_{it}^{c} \quad (10)$$

Where π^{m}_{it}, π^{w}_{it} and π^{c}_{it} are import price, producer and consumer inflation respectively; ε_{it}^{s}, ε_{it}^{d} and ε_{it}^{e} are supply, demand and exchange rate shocks respectively; ε_{it}^{m}, ε_{it}^{w} and ε_{it}^{c} are import, producer and consumer price inflation shocks, and $E_{t-1}(.)$ is the expectation of a variable based on the information set at the end of period t-1. The shocks are assumed to be serially uncorrelated as well as uncorrelated with one another within a period.

To complete the model, McCarthy proceeds by specifying the supply, demand, and exchange rate shocks.[7] In addition the model incorporates the central banks reaction function and money demand to capture the reaction of monetary policy to exchange rate fluctuations. The reaction function relates short-term interest rates (r_{it}) to the

[7] To identify aggregate demand and supply shocks and exchange rate shocks, he made the following assumptions. (1) Supply shocks are identified from the dynamics of oil price inflation denominated in the local currency. (2) Demand shocks are identified from the dynamics of the output gap in the country after taking into account the contemporaneous effect of the supply shock. (3) Exchange rate shocks are identified from the dynamics of exchange rate appreciation after taking into account the contemporaneous effects of the supply and demand shocks.

previously cited variables in the model as central banks use the short-term rate as their monetary policy instrument. The money demand function relates money growth (Δm_{it}) to the other variables in the model.

$$r_{it} = E_{t-1}(r_{it}) + C_{1i}\varepsilon_{it}^{s} + C_{2i}\varepsilon_{it}^{d} + C_{3i}\varepsilon_{it}^{e} + C_{4i}\varepsilon_{it}^{m} + C_{5i}\varepsilon_{it}^{w} + C_{6i}\varepsilon_{it}^{c} + \varepsilon_{it}^{MP} \quad (11)$$

$$\Delta m_{it} = E_{t-1}(r_{it}) + d_{1i}\varepsilon_{it}^{s} + d_{2i}\varepsilon_{it}^{d} + d_{3i}\varepsilon_{it}^{e} + d_{4i}\varepsilon_{it}^{m} + d_{5i}\varepsilon_{it}^{w} + d_{6i}\varepsilon_{it}^{c} + d_{7i}\varepsilon_{it}^{MP} + \varepsilon_{it}^{MD} \quad (12)$$

Finally, to express the model in standard format and to make it plausible for estimation it is assumed that the conditional expectations $E_{t-1}(.)$ in Equations (1)-(5) can be replaced by linear projections on lags of the variables in the system (McCarthy, 2000:8). Generally, given the theoretical underpinnings on the pass-through of shocks on prices, the model of pricing along a distribution chain which considers the effects of shocks (exchange rate and other external shocks) on prices at different stages of distribution is of great interest for our analysis.

3. Methodology

3.1 Data Set

The major objective of this paper is to shed light on the transmission of fluctuations in the exchange rate into import prices (MPI) and consumer prices (CPI). Thus, these three variables are the center of our empirical analysis. It is assumed that prices are set along the distribution chain, i.e. exchange rate shocks[8] are initially passed along to import prices and then to producer prices[9] and finally lead to a reaction in consumer prices. Next, the model includes a measure of the output gap (Y^{Gap}) in order to control for domestic economic activity (demand shock). A broad measure of money (M2) is also included which allows to capture the effects of monetary policy. Finally, world commodity prices (WCPI)[10] are considered to capture international supply shocks (imported inflation) which might affect the exchange rate and domestic prices.

[8] The nominal effective exchange rate (NEER) is used in our model. Though, many studies have used the bilateral exchange rate vis-à-vis the US dollar, the effective exchange rate is the right concept to use when the total effect of the exchange rate changes is attempted to be measured in a country with diversified trading partners (Ito and Sato, 2006).

[9] However our base line model did not include producer price index because data is not available prior the period 2000.

[10] In our model, international supply shocks are identified by the world commodity price inflation unlike McCarthy and others that include oil price inflation as a proxy for supply shock. This is because, even

Based on this, we specify a six variable VAR model which includes exchange rate, import price, consumer price, output gap, world commodity price index and money supply following McCarthy (1999); Smets and Wouters (2002); Hahn (2003); Ito and Sato (2006), Bhattacharya *et al.* (2011) and others as shown in Equation 13.

$$y_t = [WCPI, y^{Gap}, NEER, MPI, CPI, M2] \quad (13)$$

Where, all the variables are as defined earlier.

3.2 Source of Data

The study used quarterly time series data obtained from National Bank of Ethiopia (NBE), Central Statistical Authority (CSA), Ministry of Finance and Economic Development (MoFED), International Financial Statistics (IFS). The period between 1991/92-2010/11 will be covered under this study. Quarterly NEER[11] and Money Supply data are obtained from NBE. Data on CPI is obtained from CSA and IFS. World commodity price index, 2005=100, which includes fuel and non fuel price indices, is taken from IFS. Since there is no ready-made import price index data for Ethiopia we are obliged to proxy it by constructing unit value import price index.[12]
Output gap is obtained by taking the difference between actual and potential GDP where the latter is estimated by using the HP filter method[13]. Since quarterly GDP is not available it is constructed by using method introduced by Haile Kibret (2001) because it captures country specific issues in a better way.[14]

though Ethiopia is highly dependent on imported oil, and hence the change in the price of oil has significant impact on the economy, oil price has been administrated by the government for long time and hence we did not include this variable in the base line model.

[11] NEER measures the nominal effective depreciation or appreciation of domestic currency against weighted baskets of foreign currencies. Note that an increase in NEER indicates appreciation of Birr and vice versa.

$$\text{NEER} = \sum_{j=1}^{n} W_j E_j$$

[12] See appendix A.1 for detailed information on the construction of import price index.
[13] The method decomposes a given time series in to trend and cyclical component
[14] For detailed information about the method, interested readers can refer Haile Kibret (2001).

3.3 Estimation Technique

The baseline empirical model is estimated as a VAR with six endogenous variables. The SVAR form representation of the model may be written as:

$$B_0 y_t = B_1 y_{t-1} + \ldots\ldots + B_p y_{t-p} + \varepsilon_t \quad (14)$$

Where $y_t = [\Delta wcpi, y^{Gap}, \Delta neer, \Delta mpi, \Delta cpi, \Delta m2]$ vector of k = 6 variables. B_0 is an invertible *(6×6)* matrix of coefficients of contemporaneous relations on the endogenous variables; B_i *'s* are *(6×6)* matrices which captures dynamic interactions between the *k* variables in the model, ε_t denotes a mean zero *(6×1)* vector of structural error terms, also referred to as a structural innovation or structural shock and p is the number of lags. Equivalently the model can be written more compactly as: $B(L)y_t = \varepsilon_t$ where $B(L) = B_0 - B_1 L - B_2 L^2 - \cdots - B_p L^p$ is the autoregressive lag order polynomial of order p in the lag operator L.

The variance-covariance matrix of the structural error term is typically normalized such that:

$$\mathbf{E}(\boldsymbol{\varepsilon_t \varepsilon_t'}) = \boldsymbol{\Sigma_\varepsilon} = \mathbf{I_k}$$

In order to allow estimation of the structural model we first need to derive its reduced-form representation (since the structural model is not observable). This involves expressing y_t as a function of its lags. To derive the reduced form representation, we pre-multiply both sides of the structural VAR representation by B_0^{-1}:

$$B_0^{-1} B_0 y_t = B_0^{-1} B_1 y_{t-1} + \ldots\ldots + B_0^{-1} B_p y_{t-p} + B_0^{-1} \varepsilon_t \quad (15)$$

Hence, the same model can be represented as:

$$y_t = A_1 y_{t-1} + \ldots\ldots + A_p y_{t-p} + u_t \quad (16)$$

Where $A_i = B_0^{-1} B_0$, i=1, ..., p, and $u_t = B_0^{-1} \varepsilon_t$. Equivalently the model can be written more compactly as: $A(L)y_t = u_t$, where $A(L) = I - A_1 L - A_2 L^2 - \ldots - A_p L^p$ and E $(u_t) = 0$ and E $(u_t u_t') = \Sigma_u$ denotes the autoregressive lag order polynomial. Standard estimation methods allow us to obtain consistent estimates of the reduced-form

parameters A_i, i=1,..., p, and the reduced-form errors u_t, and their covariance matrix E $(u_t u_t^{'}) = \Sigma_u$ (Kilian, 2011:2).

The structural model represented by system (3.2) must be identified for the purpose of policy analysis and must be given economic interpretation. The fundamental problem here is that ε_t is not directly observed but needs to be identified (Stulz, 2006). The next question is how to recover the elements of B_0^{-1} from consistent estimates of the reduced-form parameters, because knowledge of B_0^{-1} would enable us to reconstruct ε_t from $\varepsilon_t = B_o u_t$ and B_i, $i = 1 \dots \dots p$ from $B_i = B_0 A_i$. By construction, $u_t = B_0^{-1}\varepsilon_t$. Hence, the variance of u_t is:

$$E\left(u_t u_t^{'}\right) = B_0^{-1} E(\varepsilon_t \varepsilon_t^{'}) B_0^{-1'}$$
$$\Sigma_u = B_0^{-1} \Sigma_\varepsilon B_0^{-1'} \quad \text{but, } \Sigma_\varepsilon = I$$
$$\Sigma_u = B_0^{-1} B_0^{-1'}$$

One popular way of recovering the structural innovations ε_t from the reduced-form innovations u_t is to apply Cholesky orthogonalization to the reduced-form residuals. Mechanically, this can be accomplished as follows. Define a lower-triangular K×K matrix S with positive main diagonal such that $SS^{'} = \Sigma_u$. It follows immediately from the condition $\Sigma_u = B_0^{-1} B_0^{-1'}$ that $B_0^{-1} = S$ is one possible solution to the problem of how to recover u_t. Thus, the Cholesky decomposition encompasses the decomposition of the variance covariance matrix Σ_u of the reduced form residuals in a lower triangular matrix S and an upper triangular matrix $S^{'}$ which allows as recovering the structural shocks[15] (Ito and Sato, 2006:11). Accordingly, the relationship between the reduced-form VAR residuals and the structural disturbances can be written as follows:

$$\begin{bmatrix} u_t^{WCPI} \\ u_t^{yGap} \\ u_t^{Ex} \\ u_t^{MPI} \\ u_t^{CPI} \\ u_t^{M2} \end{bmatrix} = \begin{bmatrix} s_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ s_{21} & s_{22} & 0 & 0 & 0 & 0 & 0 \\ s_{31} & s_{32} & s_{33} & 0 & 0 & 0 & 0 \\ s_{41} & s_{42} & s_{43} & s_{44} & 0 & 0 & 0 \\ s_{51} & s_{52} & s_{53} & s_{54} & s_{55} & 0 & 0 \\ s_{61} & s_{61} & s_{63} & s_{64} & s_{65} & s_{66} & 0 \end{bmatrix} \begin{bmatrix} \varepsilon_t^{WCPI} \\ \varepsilon_t^{Gap} \\ \varepsilon_t^{Ex} \\ \varepsilon_t^{MPI} \\ \varepsilon_t^{CPI} \\ \varepsilon_t^{M2} \end{bmatrix} \qquad \textbf{(17)}$$

[15] The Choleski decomposition of Σ_u implies $\Sigma_u = PP'$ where the Choleski factor, P, is a lower-triangular matrix. Since E $(uu_t') = SE(\varepsilon\varepsilon_t^{'})S' = SS'$ (where structural disturbances are assumed to be orthonormal, i.e., $E(\varepsilon_t \varepsilon_t^{'}) = I$, the lower-triangular matrix S is equal to the Choleski factor P.

Where ε_t^{WCPI}, ε_t^{Gap}, ε_t^{Ex}, ε_t^{MPI}, ε_t^{CPI} and ε_t^{M2} are the structural disturbances, that is, world commodity price, output gap, NEER, import price, consumer price and money supply shocks respectively, while u_t^{WCPI}, u_t^{Gap}, u_t^{Ex}, u_t^{MPI}, u_t^{CPI} and u_t^{M2} are residuals in the reduced form of equations.

The structural model is identified because the k (k −1)/2 economic restrictions, necessary to identify the structural model, are imposed as zero restrictions on the matrix S, which links the reduced form and the structural residuals. The resulting lower-triangular matrix S implies that some structural shocks have no contemporaneous effect on some endogenous variables given the ordering of endogenous variables. Economic interpretation is attached to this model by the selected ordering of the variables, as the ordering indicates which shocks are not allowed to contemporaneously affect which variables (Hahn, 2003 and Ito and Sato, 2006).

In order to identify shocks or their respective impulse-response functions via Cholesky decomposition, the variables need to be given a plausible ordering. Following McCarthy (2000), Hahn (2003) and Ito and Sato (2006) we assume a recursive ordering. The aforementioned studies apply different ordering depending on the characteristics of the country/ region under consideration and the problem explored. McCarthy (2000) applies the following ordering: the change in oil prices is ordered first because the reduced-form residuals of oil prices are unlikely affected contemporaneously by any other shocks in the system while oil price shocks are likely affect all variables in the system contemporaneously. The output gap is ordered next as he assumes that the output gap is contemporaneously affected by only oil price shocks while output gap (demand) shocks have a contemporaneous impact on other variables except oil prices. The exchange rate is ordered third followed by domestic prices which are ordered according to the distribution chain (i.e. MPI, WPI, and CPI). Finally, the monetary variable is ordered last assuming that monetary policy may react to exchange rate fluctuation.

Hahn (2003) and Ito and Sato (2008) follow the same ordering as McCarthy but the monetary policy variable[16] is ordered prior to exchange rate and prices by assuming that monetary policy reacts not to realized inflation but to expected inflation. The difference between the two authors's is that Hahn orders the monetary policy variable prior to out gap while Ito and Sato ordered it next to output gap.

[16] Where the former use interest rate while the latter use money supply to proxy monetary policy

Against this background we assume the following order for Ethiopia.

$$\Delta wcpi \rightarrow y^{Gap} \rightarrow \Delta neer \rightarrow \Delta mpi \rightarrow \Delta cpi \rightarrow \Delta m2$$

For small open economies like Ethiopia, world commodity prices are assumed to be exogenous because the country has insignificant power in the world market to affect international prices. Thus, changes in world commodity price are ordered first because the reduced-form residuals of commodity prices are unlikely affected contemporaneously by any other shocks except commodity price shocks per se, while world commodity price shocks would likely affect all variables in the system contemporaneously. We therefore model the world commodity price shock as independent to the shocks to other variables.

Excess demand shocks which are proxied by output gap are assumed to be influenced by exogenous factors, such as adverse weather conditions. This is manifested by the fact that the Ethiopian economy is highly dependent on agriculture and in turn the agricultural sector is highly dependent on the prevailing whether condition (rain feed agriculture). Thus, output gap is ordered next, as we assume that the output gap is contemporaneously affected by only world commodity price shock while output gap (demand) shocks have a contemporaneous impact on other variables except world commodity prices.

Shocks to the exchange rate largely reflect exogenous factors, such as unexpected surge in aid inflows and terms of trade improvements which increase the country's foreign reserve and policy interventions which are assumed to be independent of other disturbances (money supply and domestic prices) in the model. Ethiopia has adopted a managed float exchange rate regime since 1992 and is still maintained with the NBE intervening in the foreign exchange market to smoothen excessive fluctuations. Thus NEER is ordered third, which implies that the NEER responds contemporaneously to world commodity price and output gap (demand) shocks. The exchange rate shocks are assumed to have a contemporaneous effect on money supply and domestic inflation.

Import price is ordered in the fourth place followed by consumer price index based on the pricing chain. The order of the monetary variable is somehow controversial in which different researchers give different ordering for this variable. Some (such as McCarthy) order it last assuming that central banks react to changes in the exchange rate and prices indices (i.e. assuming reactive nature of monetary policy). Others (such

as Hahn and Ito and Sato) order it prior to exchange rate and prices by assuming that monetary policy reacts not to realized inflation but to expected inflation (forward looking behavior). This one lets prices react to central bank policy, i.e. central banks set the target of M2 after observing leading indicators for inflation like oil prices, output changes etc. The current study orders M2 last in the base line model assuming monetary policy in Ethiopia is reactive (passive) rather than forward looking[17].

Given these, the size and speed of pass-through will be estimated using impulse response functions and variance decompositions are computed to point out the relative importance of various shocks in explaining fluctuations in the price indices.

4. Empirical Results and Analysis

This section presents and discusses the empirical results derived from the SVAR model. In analyzing time series data testing for stationarity is the first vital condition. The results obtained by using non-stationary time series may be spurious in that they may indicate a relationship between variables which does not exist. In order to receive consistent and reliable results, the non-stationary data needs to be transformed into stationary data.

Before one pursues formal tests for stationarity, it is always advisable to plot the time series under study because visual plot of the data is usually the first step in the analysis of any time series. Such a plot gives an initial clue about the likely nature of the time series. The plots of the variables included in our model are provided in appendix A.2. The first impression that we get from these graphs is that at level most of the time series shown in the figures seem to be "trending" either upward or downward, albeit with fluctuations[18]. WCPI, M2 and CPI plots shows upward trend, while that of NEER show a downward trend. MPI seem to have upward trend with very significant fluctuation. This suggests that the mean of all the above variables might be changing which perhaps implies they are not stationary at level. Such an intuitive feel is important starting point for more formal tests of stationarity. Thus, as explained in the previous chapter, formal testing for stationarity and the order of integration of each variable are undertaken mainly using three standard methods, namely Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) and the

[17] However in alternative models we gave different order for M2 to check the sensitivity of estimated pass-through coefficients to change in the order of this variable

[18] Except output gap which is stationary by construction

results are summarized in appendix A.3. The lag length for each variable is automatically selected by Schwartz Information Criterion (SIC) and both intercept and trend are included in test equation for all variables. Each of the three tests shows that all variables except output gap (Y^{Gap}) are stationary at first difference – I (0) where the latter is stationary by construction.

Accordingly, the SVAR is estimated in first difference of the variables and hence the estimated results represent short-term dynamics as opposed to long-term equilibrium relationships between variables. In this regard, impulse response functions of import price and consumer prices to each shock in the system are presented in Section 4.1. In Section 4.2, variance decomposition is utilized to assess the relative importance of the exchange rate for variation in import and consumer price indices. Section 4.3 presents an analysis on robustness of results to changes in the order of variables and use of different methodology.

Choosing appropriate lag length is vital before estimating a VAR model because the VAR results could be highly sensitive to the number of lags included for the endogenous variables in estimation. The optimal lag order is determined by using lag length selection criterions of LR, FPE, AIC, SIC and the HQ and as given in appendix B.1 two lags are selected by most of the criterions at the 5% level of significance. Even if the lag order selection criteria choose two lags to be included in the model, it may also be possible for some of the lags (of some endogenous variables) that are chosen as optimal to have insignificant contribution in the model. Therefore, it should be checked whether the two lags (chosen as optimal) of all variables are jointly important and hence should be included in the estimation of the VAR model. This was done using the Wald lag exclusion test (which is asymptotically chi-square distributed) and the results are reported in appendix B.1. Based on the joint hypothesis for lag 2, we reject the null hypothesis which states that the restricted model is viable (model without lags) and accept the model with lags because the first and the second lags of all endogenous variables are jointly significant. This suggests that the use of the two lags in the model is suitable. The VAR model therefore is estimated with a constant and two lags[19].

[19] We also undertake various post-estimation diagnostic tests which are of crucial importance for further analysis and the results are reported in appendix B. The test for stability suggests that the VAR is stable while the LM test indicates that the model is free from autocorrelation problem. Also White test for heteroscedasticity fails to reject the null hypothesis of homoscedastic variance. However the Jarque-Bera test rejects the null hypothesis of normality indicating residual normality problem.

4.1 ERPT to Import and Consumer Prices: Impulse Response Analysis

This subsection discusses to what extent exchange rate shocks are passed through into import and consumer prices in Ethiopia. Based on the fact that the model passed important diagnostic tests, we perform impulse response analysis with Cholesky orthogonal shock structure from the estimated baseline model including WCPI, NEER, Y^{Gap}, MPI, CPI and M2. Figures 1 and 2 shows the estimated orthogonalized impulse response functions for import and consumer price inflation to a one standard deviation innovation in NEER[20]. The accumulated impulse responses (solid line in the Figures) are presented over a time horizon of twelve quarters. The dotted line in figures denotes a two standard error confidence band around the estimates.

The impulse response functions indicate a moderate degree of ERPT to import price inflation and a low degree of pass-through to consumer price inflation. Figure 1 shows response of import price to one standard innovation in NEER. A positive exchange rate shock (i.e. an exchange rate appreciation) results in a decrease in import price for the entire forecast horizon. Concerning the speed of pass-through, import price quickly responds to exchange rate shock. As indicated by the confidence bands, the responses are significantly different both from zero and one, over the whole time horizon considered implying ERPT to import price is incomplete. Figure 2 tracks the pass-through of a one standard deviation shock in the exchange rate into consumer price inflation. As we can see from the figure, the response of consumer prices to exchange rate shock is low which dies shortly after 5 quarters. This implies that ERPT to consumer price inflation is low and transitory.

[20] The response of MPI and CPI to other variables is given appendix C

Figure 1: Exchange rate pass-through to import prices

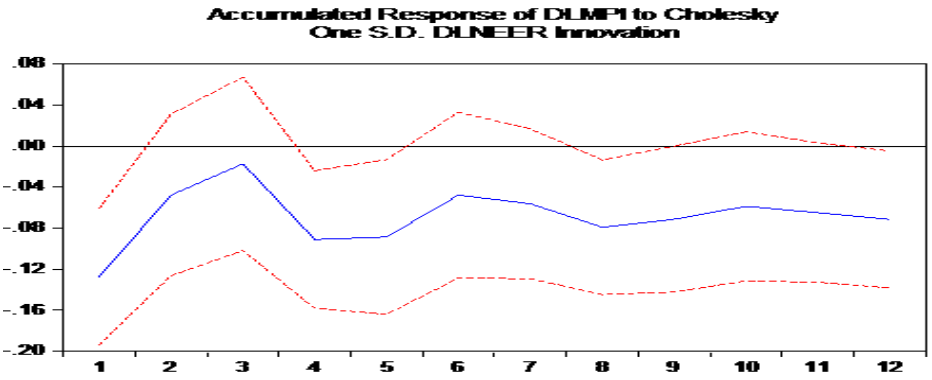
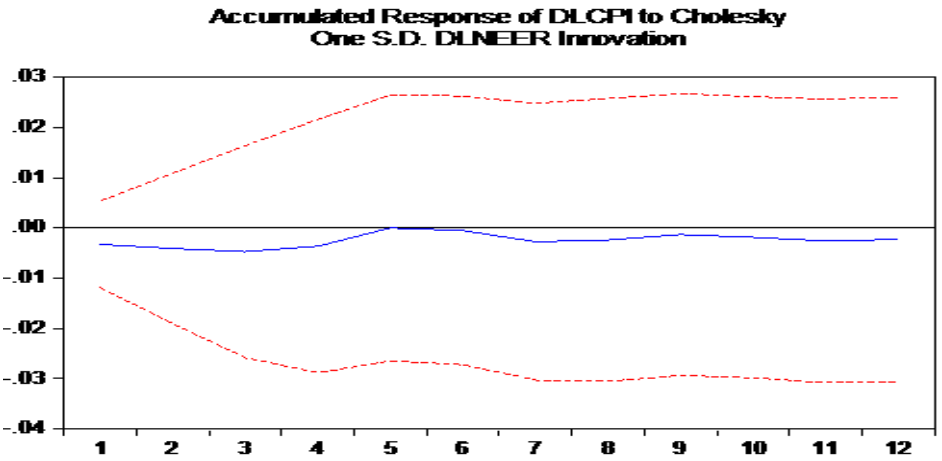


Figure 2: Exchange rate pass-through to consumer prices



The estimates of the cumulative pass-through coefficients are derived from the impulse response functions. In order to measure the pass-through coefficients, the shocks should be transformed from one standard deviation to one percent. This is done by dividing the cumulative impulse responses of each price index after j quarters by cumulative response of the exchange rate to its own shock after j quarters. The coefficients therefore show the estimated response of prices to an exchange rate shock after accounting for the disturbances of the other endogenous variables in the model[21]

[21] The pass-through coefficient is defined as:

$PT_{t,t+j} = P_{t,t+j}/E_{t,t+j}$

Table 1: The response MPI and CPI to one percent change in NEER

Horizon	MPI	CPI
T=1	-0.489	-0.013
T=2	-0.179	-0.015
T=3	-0.065	-0.018
T=4	-0.332	-0.014
T=5	-0.322	-0.0001
T=6	-0.177	-0.002
T=7	-0.208	-0.010
T=8	-0.29	-0.009
T=9	-0.262	-0.005
T=10	-0.217	-0.007
T=11	-0.239	-0.009
T=12	-0.263	-0.008

Table 1 presents the response of import price and consumer prices to one percent change in exchange rate. Concerning ERPT to MPI, a positive exchange rate shock is passed-through to import price by about 0.49 percent after one quarter, by 0.33 after one year, and amounts to about 0.26 percent after three years (12 quarter)[22]. This indicates in Ethiopia, ERPT to import price is moderate[23] and declines slowly as the estimating horizon increased. For instance, a 100 percent exchange rate appreciation results in a 49 percent decrease in import price at the first quarter and about 26 percent decline after 3 years. This shows that ERPT to import price is persistent in the case of Ethiopia.

Compared with the ERPT to import prices, pass-through of exchange rate to consumer prices is low. A one percent positive shock in exchange rate leads to 0.013 percent decline in CPI inflation in the first quarter, 0.014 percent after one year (four quarters ahead) and become almost zero in the fifth quarter (and in all subsequent periods). The estimated pass-through coefficient is somehow higher compared to the finding of Choudhri and Hakura (2003) and Devereux and Yetman (2002). The aforementioned studies obtained zero ERPT to consumer prices for Ethiopia between the periods 1997-2000 and 1975-1999, respectively as it is discussed in previous chapters. In our study even if the degree of pass-through to CPI is low it is significantly different from

Where, $P_{t,t+j}$ is the cumulative change in the price is level and $E_{t,t+j}$ is the cumulative change in the nominal exchange rate between quarter t and t+j (see, Leigh and Rossi ,2002; Hyder and Shah, 2004; An, 2006 and Minh, 2009)

[22] Note that exchange rate shocks refer to an appreciation in the exchange rate

zero up to one year. This different result could be partly caused by different estimation methodology and partly due to different sample size used.

Various reasons can be given to explain the low pass-through of exchange rate to consumer prices. First, in the model of pricing along the distribution chain the impact of exchange rate dies out along the price chain. That is the impact of the exchange rate change is primarily transmitted to import price then to producer price and finally to consumer price. Concerning this Ito and Sato (2006) argue that the impact of the exchange rate on CPI is much more indirect and remote than that of imported prices. Thus, it is reasonable that the response of CPI is smaller than that of MPI. The level of pass-through from exchange rate to CPI could also depend on monetary policy and the resulting inflation environment. As hypothesized by Taylor (2000) a lower inflationary environment generally leads to lower degree of pass-through. Therefore, the low inflation environment that Ethiopia experienced for a long time (expect the recent years) can explain the lower degree of ERPT to consumer prices.

Additional reasons may also be given to explain why the rate of pass-through to consumer prices is low compared to import prices. According to Bailliu and Fuji (2004), the extent of pass-through to consumer prices will depend on the rate of pass-through to import prices and the share of imports in the consumer price index. The extent of ERPT to import prices is found to be moderate through the entire forecast horizon. This could be then another reason why pass-through to consumer price inflation is low in Ethiopia.

Moreover, the structure of domestic market and local distribution costs such as transportation costs, marketing, and services can drive a wedge between import prices as measured in the import price index and the prices of these goods as reflected in the CPI. For instance, if there is complete pass-through to import prices following appreciation (i.e. if import price decreases by one percent following one percent appreciation of exchange rate), consumer prices will decrease by less than one percent given the structure of the market. In imperfectly competitive markets domestic importers might be less responsive to exchange rate appreciation and hence the full effect of decrease in import price might not be reflected in the final price consumers pay.

Finally, the low ERPT to consumer prices suggests that inflation is most likely affected by other factors than the exchange rate in Ethiopia. Among the variables included in

our model, consumer price inflation responds significantly to shocks in world commodity price, money supply and shock to CPI itself. For instance, increase (positive shock) in WCPI results in significant increase in CPI inflation implying that the country is vulnerable to international price shocks (imported inflation). Also CPI inflation shows significant response to M2 after one year (four quarter) and in all subsequent periods. Furthermore, the significant and persistent response of inflation to its own shock shows the existence of adaptive expectation and inflation inertia.[24]

4.2 The Relative Importance of Exchange Rate and Other Shocks for Variation in MPI and CPI

While impulse response functions provide information on the size and speed of the pass-through, they give no information on the importance of the respective shocks for the variance of the price indices. In contrast, variance decompositions (VD) indicate the percentage contribution of the different shocks to the variance of the T-step ahead forecast errors of the variables. Hence, the relative importance of different shocks for the development of the price indices may be assessed using VD analysis.

The results of the VD analysis complement the results from the impulse response analysis. Since our main objective is to analyze the degree of ERPT to import and consumer prices, Table 2 reports only the VD results for MPI and CPI.

The VD analysis for the MPI shows that in the first quarter, a shock to the exchange rate contributes 16.6 percent variation to the MPI series, while the M2 and output gap has only a zero and 0.39 percent contribution, respectively. After four quarters (one year) the contribution of exchange rate declines to 14.7 percent, while that of money supply and output gap increases to 1.3 and 7.4 percent respectively. WCPI contributes 0.16 percent of the variation in MPI in the first quarter while its contribution increases to around 5.8 percent in the remaining quarters. MPI contributes much for its own variation which amounts to be 82.9 percent in the first quarter and it becomes around 63 percent as the forecast horizon is extended.

[24] For impulse response of consumer prices to other variables see appendix C

Table 2: Variance decomposition analysis

The relative importance of exchange rate and other shocks to variation in MPI and CPI							
	Period	WCPI	Y^{Gap}	NEER	MPI	CPI	M2
VD Of MPI	T = 1	0.162336	0.391894	16.59516	82.85061	0.00000	0.000000
	T = 4	4.925207	7.377324	14.65767	66.86527	4.916063	1.258473
	T = 8	5.743395	9.145884	13.90118	63.42031	6.526990	1.262244
	T = 12	5.830135	9.400638	13.82277	62.97437	6.698974	1.270732
	T = 16	5.841488	9.434606	13.81774	62.91840	6.715913	1.271861
	T =24	5.842803	9.439305	13.81701	62.91125	6.717674	1.271958
VD Of CPI	T = 1	9.864119	3.993058	0.607052	0.018242	85.51753	0.000000
	T = 4	19.47688	12.33309	0.474939	5.684429	60.72456	1.306105
	T = 8	18.95365	12.91174	1.081356	7.737759	57.33358	1.981919
	T = 12	18.87306	12.95291	1.144462	8.030774	57.00711	1.991685
	T = 16	18.86299	12.95545	1.152082	8.066227	56.97243	1.991059
	T =24	18.86173	12.95571	1.152715	8.070648	56.96824	1.990952

The exchange rate has a contribution to the variation in CPI of 0.61 percent and 1.2 percent in one quarter and twelve quarter ahead in the forecast horizon, respectively. The contribution of exchange rate in the variation of CPI is very low compared to its contribution in the variation of MPI which is consistent with the impulse response result. Money supply contributes only 1.31 percent to the variation in CPI four quarters ahead in the forecast horizon. This slightly increases to 1.9 percent after 12 quarters. Output gap contributed 3.9 percent of the variation in CPI in the first quarter while its contribution increases to 12.9 percent after 12 quarters (3 years). The significant contribution of output gap to variation in inflation indicates that domestic structural factors have significant effect on consumer price inflation than movements in exchange rate.

We also found that WCPI have a significant contribution to the variation of CPI inflation. It explains 9.9 percent of the variation in CPI in the first quarter and increases to 19.5 percent four quarters ahead. This shows the existence of significant imported inflation to consumer prices. Lastly, inflation explains 85.52 percent of its own variation at the first quarter, 60.72 percent after one year and 56.97 percent after 3 years. This indicates the increase in consumer prices is mainly attributed to its own variations, suggesting that the inflation process in Ethiopia has significant inertia.

4.3 Robustness Analysis

Results from SVAR models may highly depend on the specification of the underlying model. Therefore, the robustness of the estimated pass-through elasticities should be examined by subjecting the baseline model to various modifications. Identification by means of the Choleski decomposition of the covariance matrix Σ is only unique up to the ordering of the variables in the system. Consequently, the same is true for the orthogonalized impulse responses (Stulz, 2006). In this section, two alternative identification strategies are applied to check the robustness of the base line model. The first option is giving different ordering to some variables included in the VAR while the second option is to apply different methodology in estimating the impulse responses. Concerning the first option we check whether the base line model is sensitive to the order of two variables. In the first alternative model we gave different ordering to the monetary variable (M2) thereby accounting for the fact that the appropriate position of the money supply is somewhat controversial in the context at issue (see the discussion in section 3.4). In the second alternative models we gave different VAR ordering to output gap.

In the base line model M2 was ordered at last assuming reactive nature of monetary policy. In the alternative model we change the order of this variable by placing it prior to exchange rate as Hanhn (2003) and Ito and Sato (2006) did, assuming forward looking nature of monetary policy.

$$\Delta wcpi \rightarrow y^{Gap} \rightarrow \Delta m2 \rightarrow \Delta neer \rightarrow \Delta mpi \rightarrow \Delta cpi \ldots\ldots\ldots \text{ Alternative Model 1}$$

Identification is then achieved as described in section 4.3.1, i.e. by applying a Cholesky decomposition of the covariance matrix Σ. However, we do not find any significant changes in the estimated pass-though parameters due to a different ordering of M2. The results obtained from Alternative Model 1 are reported in appendix D. The estimated responses of import price to exchange rate marginally increases compared to the baseline model. In case of ERPT into consumer prices, the results are almost similar to those obtained from the baseline model. Thus, the ordering of the M2 is of little importance for the pass-through estimates.

Second, following Ito and Sato (2006) we assume the lagged availability of information on the output gap, which results in no contemporaneous effect of output gap shocks on the central bank's monetary policy. It is also assumed that the NEER responds

contemporaneously to world commodity price shocks and monetary policy shocks but not to output gap shocks. Accordingly, the "Alternative Model 2" is

$$\Delta wcpi \rightarrow \Delta m2 \rightarrow \Delta neer \rightarrow y^{Gap} \rightarrow \Delta mpi \rightarrow \Delta cpi \ldots\ldots\ldots \text{ Alternative Model 2}$$

The estimated response of the MPI and CPI from the above alternative model is reported in appendix D. Again the result from this model shows no significant difference to those of the other models.

As a second alternative, generalized impulse responses are calculated instead of Cholesky orthogonalized impulse responses. As it is discussed in Stulz (2006) the concept of generalized impulse response was advanced in Koop et al. (1996) and applied to VAR models in Pesaran and Shin (1998). Unlike traditional impulse responses, this approach does not require orthogonalization of the shocks, and is invariant to the ordering of the variables. Thus generalized impulse response is estimated and the results are reported in appendix D. The results obtained from this method are also virtually similar to those of the other models. Generalized responses of import prices to exchange rate shocks is similar to the baseline (orthogonalized) responses while that of consumer prices are somewhat stronger than in the baseline case though the difference is not that much significant[25].

5. Conclusion and Policy Implications

The study examined the degree of ERPT to import and consumer prices in Ethiopia during the period 1991/92 and 2010/11. The study estimates the pass-through coefficients using SVAR model where pass-through coefficients are estimated based on impulse response function obtained from the VAR models. Based on the SVAR model, using the impulse response function, we establish that the degree of ERPT to import and consumer prices to be incomplete, persistent (in the case of import price) and significant in the short run. Pass-through to import prices was found to be significantly higher (also quick) than that of CPI and this suggests that ERPT declines along the pricing chain in Ethiopia. Accordingly, based on the fact that the concept of

[25] Also, given the variables in the system are I (1) we check for the existence of cointegration and re-estimate the model using structural vector error correction method (SVECM) so as to see if there is any significant difference in the result obtained. The impulse response resulted from the estimated VEC models shows nearly similar degree of pass-through to import and consumer prices compared to SVAR model. Selected results of the SVEC model are given in appendix D.

ERPT has important implication for exchange rate and monetary policy, the following policy implications are drawn based on the findings.

The finding that ERPT to import prices is incomplete in Ethiopia has important implication about the effectiveness of exchange rate measures which are intended to improve the country's trade balance. Specifically, devaluation measures which are taken to correct trade balance might not be effective to the extent they are expected due to incomplete response of import price (and the resulting change in domestic demand) to exchange rate movements.[26] This means if import prices are less responsive to movements in the exchange rate, the "expenditure-switching" effects might be dampened. For instance, a depreciation of the Birr would increase the price of imported goods relative to domestic goods, which should—all else being equal—reduce the domestic demand for imported goods. But, since pass-through to import prices is found to be incomplete in Ethiopia, the change in the price of imported goods will be small and hence the incentive for consumers to switch expenditures from imported to domestic goods will be reduced. Thus policy makers should take into account the incomplete response of import prices when they decide to devalue the currency so as to improve trade balance.

Our finding of incomplete ERPT also has important implication for monetary policy. As it is shown by Adolfson (2001) and Smets and Wouters (2002) incomplete pass through makes the exchange rate channel less effective. In addition, a low ERPT also implies that larger exchange rate movements are necessary for relative price adjustments.

A low degree of ERPT to consumer prices indicates that nominal exchange rate appreciations might not be an effective mechanism to lower inflationary pressures in Ethiopia. However, since the pass-through of exchange rate change to import prices is moderate, it is recommended that a more flexible exchange rate regime with a larger band of fluctuation can allow the national bank to promptly respond to both domestic shocks and foreign shocks, while bearing less risk of the impact of exchange rate change on inflation. In addition, low ERPT provides greater freedom for pursuing independent monetary policy and makes the adoption of inflation targeting regime relatively easy.

[26] irrespective of several other factors which might determine the effectiveness of exchange rate policy (such as supply factors, elasticity of foreign and domestic demand, availability of substitutes etc)

Lastly, even if the study addresses its objectives there are still different areas for further research concerning ERPT. To mention some, in this study the analysis is conducted based on aggregate price indices (at macro level). In order to investigate which sector or items in the consumption basket are more affected by exchange rate shock, analysis is required at a more disaggregated level (if industry or sector-specific data is available in the future). Undertaking the study at disaggregated level also allows one to study the determinants of ERPT in Ethiopia.

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Appendices

Appendix A.1: Construction of Import Price Index (Taken from Loening and Higashi, 2010)

The import unit value index of the component i is:

$$P^*_{mi,t} = \frac{P_{mi,t}q_{m,it}}{q_{mi,t}}$$

Where $P_{mi,t}$ and $q_{mi,t}$ represent the import unit value and the quantity of the component i at time t. The overall import price index ($P_{m,t}$) is a weighted average of all components:

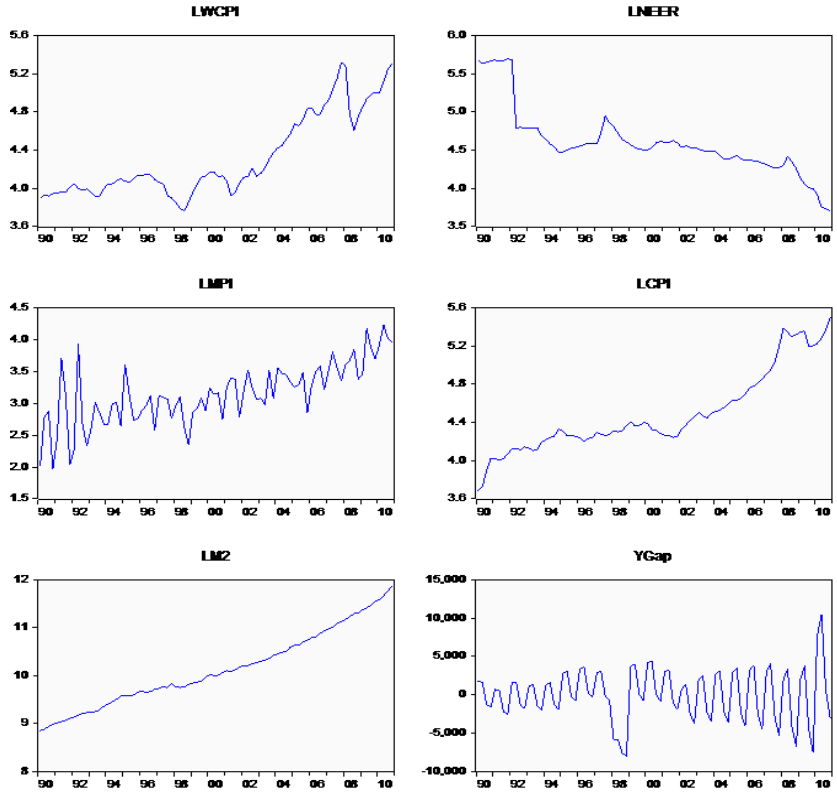
$$P_{m,t} = \sum_{i=1}^{n} W_{xi,t}P^*_{mi,t}$$

Where $W_{xi,t} = \frac{P_{mi,t}q_{mi,t}}{\sum_{i=1}^{n} P_{mi,t}q_{mi,t}}$

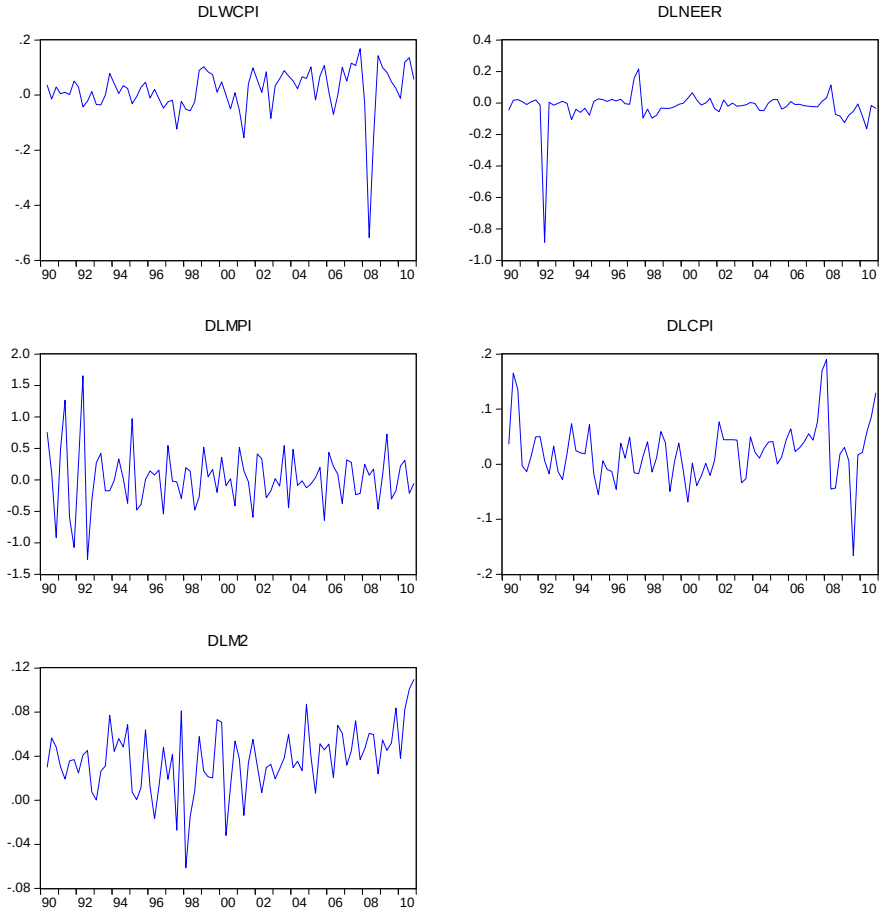
Note: To construct the index the unit value of major imports items from the class of semi-finished goods, capital goods and consumer goods including petroleum products are considered.

Appendix A.2: Time Series Plots

i) Variables Used in the Empirical Analysis at Level



ii) Variables Used in Empirical Analysis at First Differences



Appendix A.3: Unit root test results

Variable	ADF		Phillips-Perron		KPSS		I(d)
	Level	Differenced	Level	Differenced	Level	Differenced	
LWCPI	-1.6268	-7.3302	-1.6882	-5.9132	0.2701	0.0486	**I(1)**
LNEER	-2.4610	-8.3791	-2.3050	-8.3742	0.1285	0.1025	**I(1)**
LMPI	-2.4777	-14.4483	-3.1465	-8.6751	0.1619	0.1338	**I(1)**
LCPI	-1.3991	-5.8944	-1.1361	-5.5529	0.2464	0.1368	**I(1)**
LM2	1.9852	-5.0509	2.0384	-8.0157	0.2779	0.1086	**I(1)**
YGap	-4.5577	-	-5.2608	-	0.0329	-	**I(0)**

Note: ADF and PP critical values are -3.4566 and -3.1593 at 5% and 10% level of significance respectively. The KPSS critical values are 0.146 and 0.119 at 5% and 10% level of significance respectively.

LWCPI, LNEER, LMPI, LCPI and LM2 show the natural logarithm of world commodity price index, nominal effective exchange rate, import price index, consumer price index and broad money supply respectively.

Appendix B.1: VAR Lag order Selection Results

i) VAR Lag Order selection Criteria

Endogenous variables: DLWCPI YGap DLNEER DLMPI DLCPI DLM2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	433.6927	NA	7.99e-13	-10.82766	-10.64770*	-10.75557
1	487.4866	98.05473	5.11e-13	-11.27814	-10.01843	-10.77346
2	***544.1673***	**94.70706***	**3.07e-13***	**-11.80170***	**-9.462250**	**-10.86445***
3	572.9020	43.64767	3.84e-13	-11.61777	-8.198570	-10.24794
4	607.0141	46.63415	4.36e-13	-11.56998	-7.071025	-9.767558

* indicates lag order selected by the criterion

ii) VAR Lag Exclusion Wald Tests

Chi-squared test statistics for lag exclusion:
Numbers in [ ] are p-values

	DLWCPI	Y^{Gap}	DLNEER	DLMPI	DLCPI	DLM2	Joint
Lag 1	17.40069	47.00177	0.908023	42.73635	40.26389	8.183881	158.9562
	[0.007918]	[1.87e-08]	[0.988860]	[1.32e-07]	[4.04e-07]	[0.224939]	[0.000000]
Lag 2	7.665978	44.09297	6.794962	77.42173	15.34229	11.19456	153.2235
	[0.263610]	[7.08e-08]	[0.340226]	[1.22e-14]	[0.017755]	[0.082546]	[2.22e-16]
Df	6	6	6	6	6	6	36

Appendix B.2: VAR Diagnostic Tests

i) Stability Test

Roots of Characteristic Polynomial
Endogenous variables: DLWCPI YGap DLNEER DLMPI DLCPI DLM2

Root	Modulus
-0.050152 - 0.765496i	0.767138
-0.050152 + 0.765496i	0.767138
0.127994 - 0.546686i	0.561469
0.127994 + 0.546686i	0.561469
0.531278 - 0.090283i	0.538895
0.531278 + 0.090283i	0.538895
0.012561 - 0.449274i	0.449450
0.012561 + 0.449274i	0.449450
-0.355277 - 0.109002i	0.371623
-0.355277 + 0.109002i	0.371623
0.277633 - 0.227543i	0.358965
0.277633 + 0.227543i	0.358965

No root lies outside the unit circle.
VAR satisfies the stability condition.

ii) Test for Residual Autocorrelation

VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h

Lags	LM-Stat	Prob
1	42.29716	0.2176
2	45.92372	0.1243

Probs from chi-square with 36 df.

iii) Test for Residual Normality

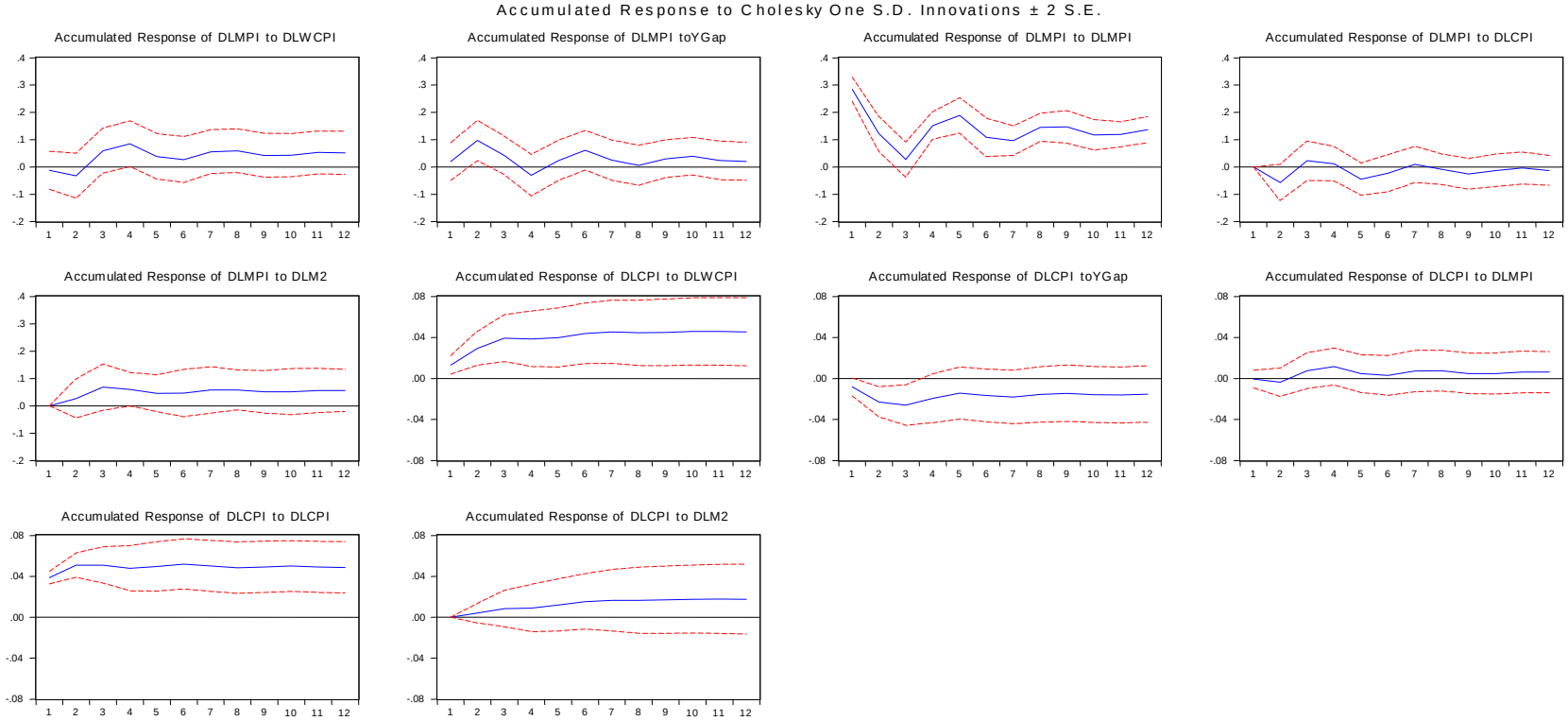
Component	Jarque-Bera	Df	Prob.
1	104.6114	2	0.0000
2	16.88396	2	0.0002
3	2883.356	2	0.0000
4	2.144029	2	0.3423
5	113.9991	2	0.0000
6	2.896483	2	0.2350
Joint	3123.891	12	0.0000

iv) Test for Residual Heteroskedasticity

VAR Residual Heteroskedasticity Tests:
No Cross Terms (only levels and squares)
Joint test:

Chi-sq	df	Prob.
578.9345	504	0.5432

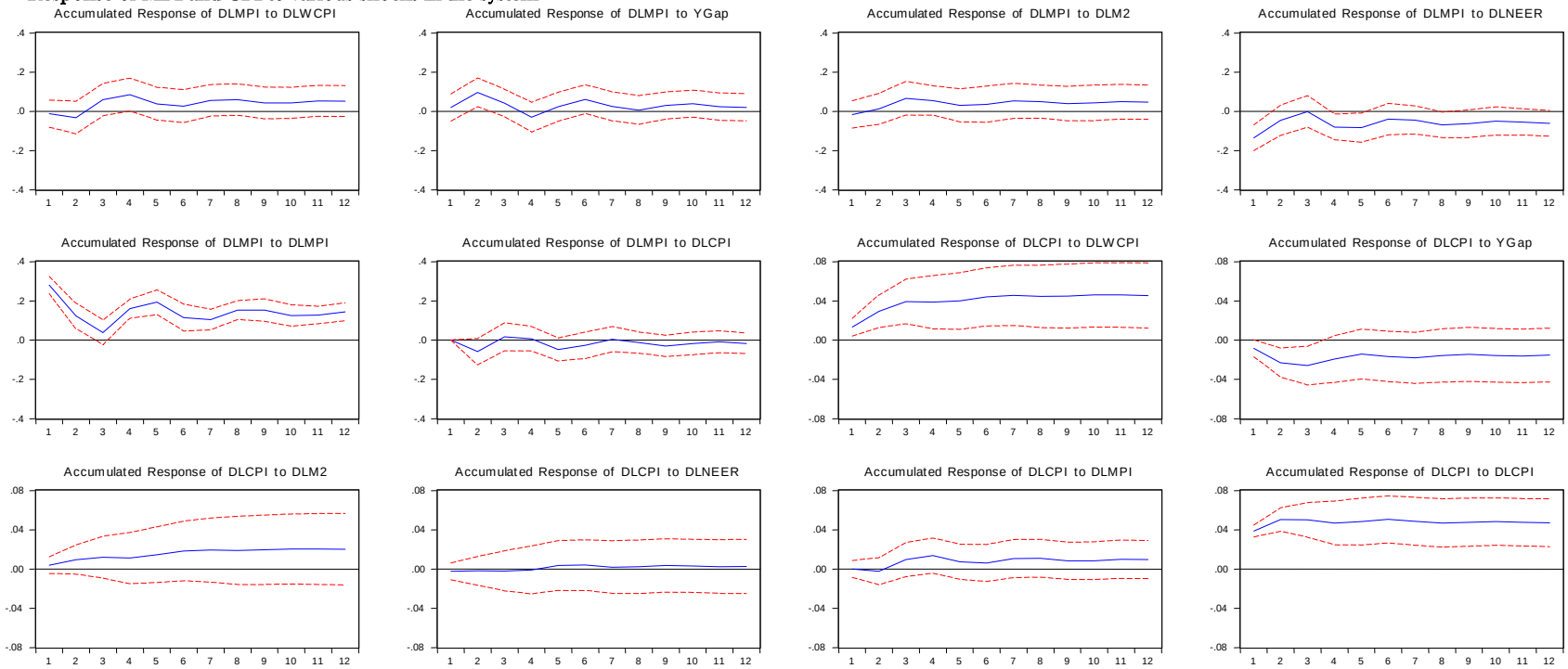
Appendix C: Impulse Response Results of MPI and CPI to Shocks in Other Variables (base line model)



Appendix D: Results of Alternative Models

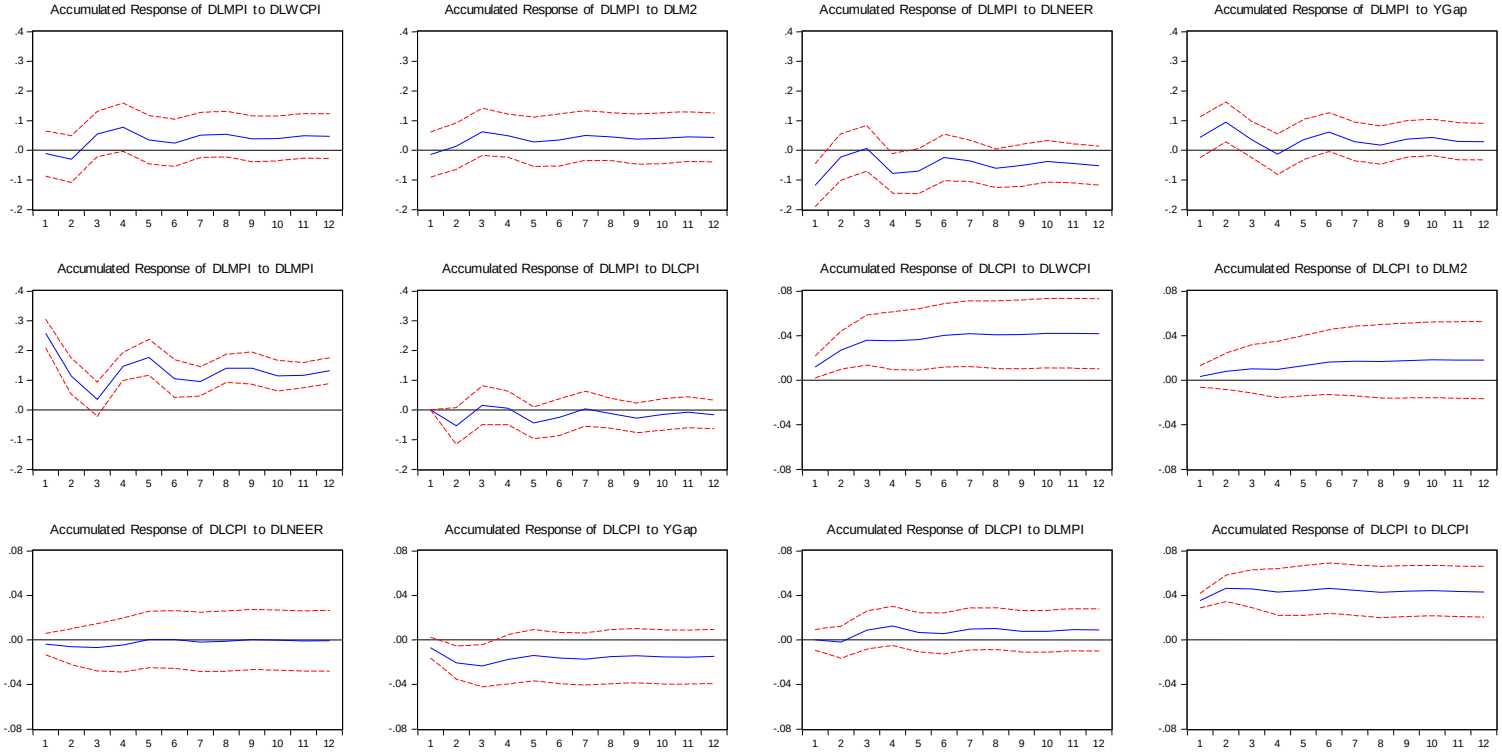
i) Alternative Model 1: $\Delta wcpi \rightarrow y^{Gap} \rightarrow \Delta m2 \rightarrow \Delta neer \rightarrow \Delta mpi \rightarrow \Delta cpi$

Response of MPI and CPI to various shocks in the system



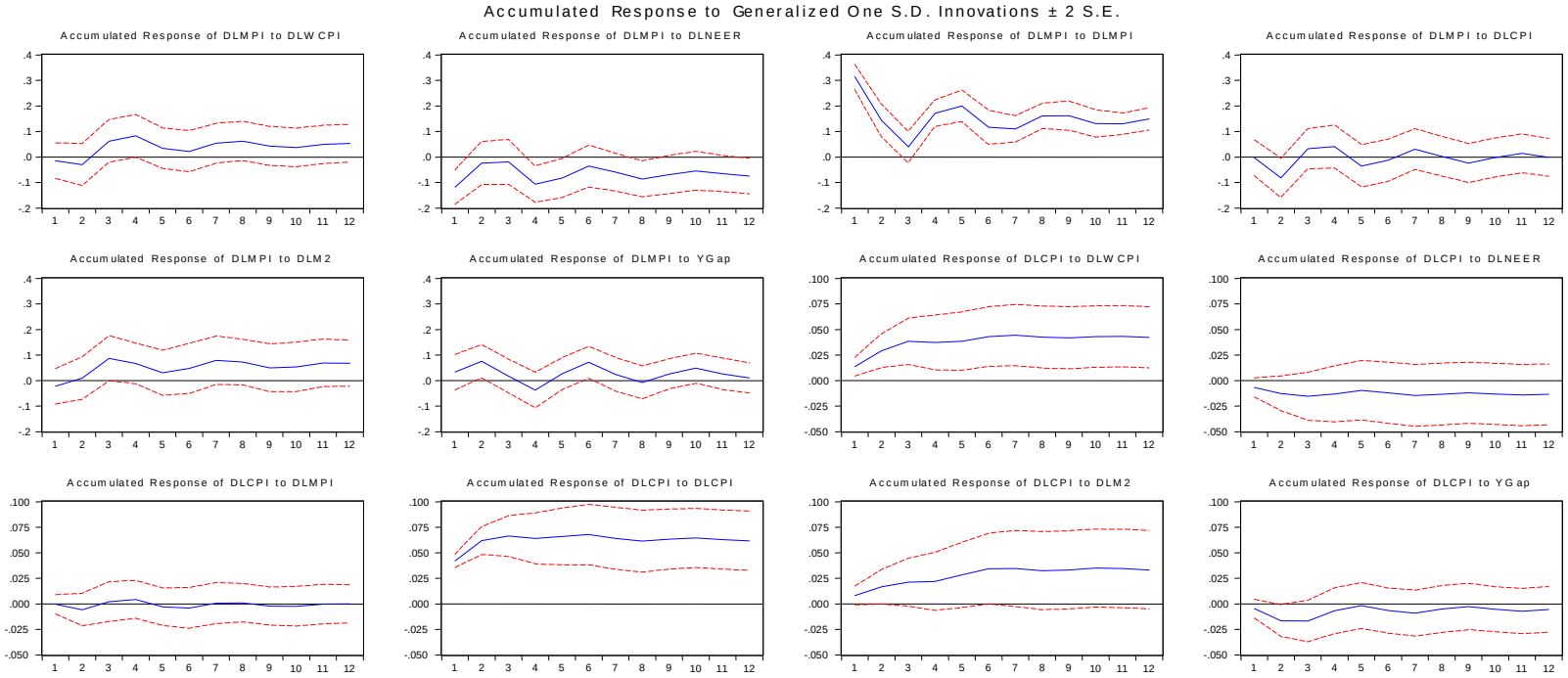
ii) Alternative Model 2: $\Delta wcpi \rightarrow \Delta m2 \rightarrow \Delta neer \rightarrow y^{Gap} \rightarrow \Delta mpi \rightarrow \Delta cpi$

Response of MPI and CPI to various shocks in the system



iii) Generalized Impulse Response Results

Response of MPI and CPI to various shocks in the system



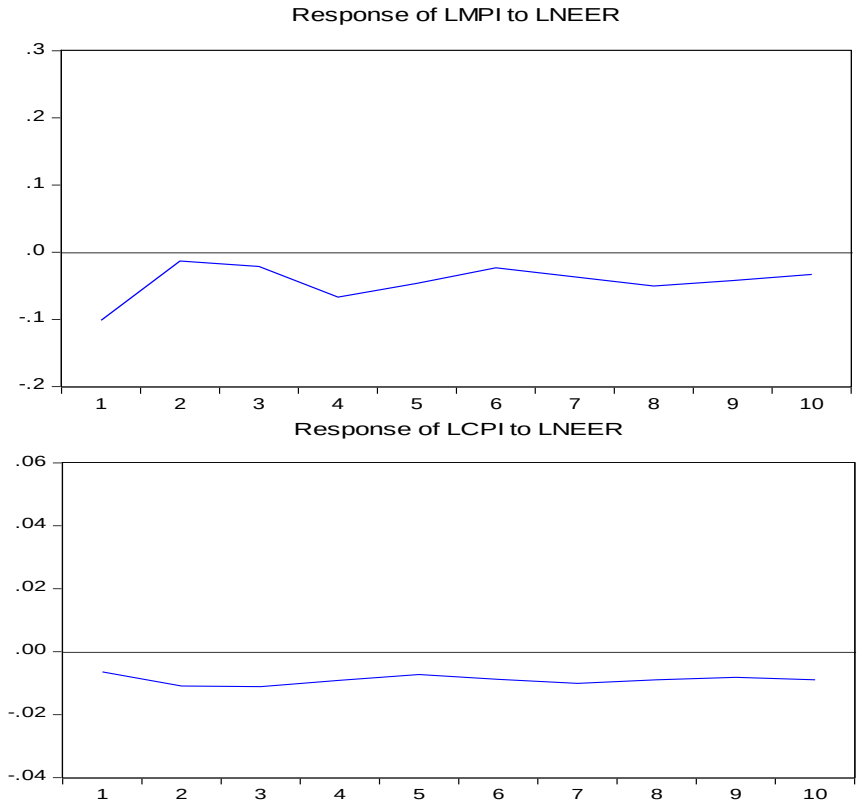
iv) SVECM results

a) Johansen cointegration test results

Hypothesized No. of CEs	Eigenvalue	Trace statistic		Max-Eigen statistic	
		Statistic	C.V	Statistic	C.V
None	0.600086	153.2232*	69.81889	75.15354*	33.87687
At most 1	0.421080	78.06965*	47.85613	44.82050*	27.58434
At most 2	0.223628	33.24914	36.79707	20.75612	21.13162
At most 3	0.126289	12.49302	15.49471	11.07041	14.26460
At most 4	0.017199	1.422603	3.841466	1.422603	3.841466

Both Trace and Max-eigenvalue test statistic indicates 2 cointegrating equation(s) at the 0.05 level of significance. *denotes rejection of the hypothesis at the 0.05 level.
C.V: Critical Value

b) Impulse response of LMPI and CPI to Cholesky one standard deviation innovation



Note: (1) Standard Errors are not reported for the VECM impulse response results

(2) Identification is achieved through Cholesky orthogonalization where the ordering of the variables is as given in the base line model.

(3) Given all the variables in the system are I (1), in the SVEC model output gap which is I (0) by construction is replaced by logarithm of real GDP because the VECM is more generally valid when each of the variables in the system is integrated of the same order.

UNEMPLOYMENT IN URBAN ETHIOPIA: DETERMINANTS AND IMPACT ON HOUSEHOLD WELFARE

Abebe Fikre Kassa[44]

Abstract

Data from the 2004 wave of the Ethiopian Urban Socio Economic Survey on four major cities of Ethiopia is used to investigate the determinants of unemployment in urban Ethiopia and its impact on household welfare. Regression results from a binary probit model estimation show that urban unemployment in Ethiopia in 2004 is determined by age, marital status, education beyond primary school and living in the capital Addis Ababa. Moreover, the results from OLS regression of consumption indicate that unemployment adversely affects household consumption expenditure and hence household welfare. One more unemployed household member results in a 4.6 percent decline in per capita real consumption expenditure available to the household. Since unemployment negatively affects household welfare, efforts aiming at reducing unemployment will most likely improve welfare. Mechanisms to reduce household size such as family planning are recommended for better household welfare via their effect on household consumption.

Key words: urban, unemployment, consumption, welfare, probit, OLS
JEL Classification: I31, 018, J64.

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1. Introduction

Unemployment is one of the major challenges facing today's world. Coupled with population growth and increased poverty, it has a significant impact on growth and development at large. It causes a waste of economic resources such as the productive labor force and affects the long run growth potential of an economy. Unemployment gives rise to private and social problems in the society such as increased crimes, suicides, poverty, alcoholism and prostitution (Rafik et al., 2010 and Eita and Ashipala, 2010). High level of unemployment rates can also contribute to the spread of HIV/AIDS in developing countries (Henry et al., 1999 and Haile 2003). In general, unemployment affects household income, health, government revenue and hence GDP and development at large. Studying unemployment therefore helps tackle these problems through some kind of policy actions.

Unemployment is a problem for both developed and developing countries. However, the impact and intensity might differ. According to Rafik et al. (2010), unemployment has been the most consistent problem in both advanced and poor countries. In 2009 for example, as indicated in the World Bank data base (2011), the general unemployment rate stood at 20.5% in Ethiopia, 23.5% in South Africa, 4.3% in China, 5% in Japan, 9.1% in France, 8.3% in Brazil and Sweden and 9.3% in the US. Recently, unemployment has increased due to the global economic crisis of 2007/08 which caused the collapse of aggregate output and led to job cuts. According to Dao and Loungani (2010) there were about 200 million unemployed people in the world in 2010, 75% of which came from the advanced economies and the rest from emerging economies, and the number has increased substantially since 2007. However, though still high, unemployment in the low income countries declined during the recent crisis.

Ethiopia is a poor agrarian country with per capita income of USD350 (World Bank, 2011). Recently, however, the country has been achieving a promising economic growth. According to The Economist (January 6, 2011), the country had the 5th fastest growing economy in the world during the periods 2001-2010 at an average annual GDP growth rate of 8.4% and the 3rd with a forecast of 8.1% during the periods 2011-2015. Despite such improvements, unemployment is high and is one of the socio economic problems in the country. The general unemployment rate was 20.5% in 2009. It was higher for females at 29.9% compared to males which stood at 12.1%. (World Bank, 2011)

The rural population of Ethiopia makes about 83% of the total population but this paper focuses on urban rather than rural unemployment. Even though the urban population makes only about 17% of the total population, its absolute size is big at 15,448,536 (Central Intelligence Agency, 2011). Moreover, most of the educated labor force is concentrated around cities in search of better opportunities and infrastructure, and the rural agricultural sector employs relatively unskilled labor force. The urban sector is also characterized by both skilled and unskilled private sector employment which will all make the analysis of the education effect of unemployment convenient.

Another explanation may be that urban unemployment might be more serious than rural unemployment for example in creating political instability. For instance, the recent uprising in the Middle East especially in Egypt and Tunisia which toppled the respective regimes is motivated by major socioeconomic problems such as rising unemployment (Behr and Aaltola, 2011). It is also vital that the obstacles for productivity (which unemployment can be one) should be studied not only in the agricultural sector but also in the urban non-agricultural sector so as for both to contribute for growth and job creation. Unlike most African countries where poverty incidence differs and is relatively higher in rural than urban areas, it is almost similar both in urban and rural Ethiopia. Urban poverty stood at 37% and rural poverty at 45% in 2005 (World Bank, 2005). Growth, unemployment and job creation in urban areas therefore require equal attention for poverty alleviation.

Studies addressing urban unemployment in Ethiopia are relatively few. Serneels (2004) studies the nature of youth unemployment and analyzes incidence and duration and concludes that urban youth unemployment for males stands high at 50% in 1994 and mean duration is about 4 years. Duration is shorter for those aspiring for high paying public sector jobs and for those with their fathers are civil servants. Haile (2003), using data from the 1994 and 2000 waves of the Ethiopian Urban Socio Economic Survey, studies the incidence of youth unemployment in Ethiopia with special focus on the urban youth and finds that youth unemployment was high at more than 50%. Haile (2008) also studies the determinants of self-employment in urban Ethiopia and concludes that self-employment was less among the young, the educated and those who migrated to urban areas recently.

Dendir (2006) analyzes the determinants of unemployment duration in urban Ethiopia and concludes that mean duration is 3 years for completed spells and 4.7 years for incomplete spells. Denu et al., (2005/07) in a study on the characteristics and

determinants of unemployment, underemployment and inadequate employment in urban Ethiopia, finds that the youth are characterized by relatively high unemployment which differs among the youth group across location, gender and education.

Studies surveyed in this paper are found to mostly concentrate on urban youth unemployment and a few focused on general unemployment. The welfare impact of unemployment is also found to be less explored in the literature at least in the context of Ethiopia. This paper therefore adds to the discussion by focusing on the determinants of unemployment in urban Ethiopia and its impact on household welfare. Specifically it investigates how unemployment behaves over the years 1994-2004. What determines the likelihood of being unemployed in urban Ethiopia in 2004? What is the impact of unemployment on household welfare? The main purpose is answering these questions using household data from the 2004 Ethiopian Urban Socio Economic Survey. Recent data set could not be used due to the absence of one. Even though there may be changes in socio economic factors between 2004 and at present, it is presumed that major factors affecting unemployment will more or less remain the same.

The Ethiopian rural labor market is characterized by disguised unemployment (Denu et al., 2005/07). Disguised unemployment exists when few jobs are filled by many people in which case productivity will be low. There is also not much formal employment in rural Ethiopia as most people work in the traditional agricultural sector. Due to these reasons, together with the absence of any rural data in my data set, I will not address rural unemployment. Two econometric methods will be used to answer the research questions: First, with the aim of understanding the determinants of unemployment, a binary probit model will be used. Second, to analyze the impact of unemployment on household welfare, ordinary least squares regression technique which estimates household per capita consumption as a function of unemployment and other household characteristics will be employed.

The rest of the paper is presented in the following sequence: section two discusses the literature review and section three the econometric framework. Section four discusses the data and descriptive statistics followed by empirical findings. The paper will then wrap up with conclusion and recommendations.

2. Literature Review

2.1 Overview of Unemployment and the Ethiopian Urban Labor Market

2.1.1 Unemployment: Causes, Costs and Overview

The labor market, like any other markets, has both supply and demand sides. The supply side, also called the labor force or the economically active population, has two components: the employed and the unemployed (Hussmanns, 1989). The demand side on the other hand consists of jobs (filled posts) and job vacancies (unfilled posts). According to Olsson (2009), since labor is not a "normal" good, we do not have a condition where labor demand equals labor supply at equilibrium wage rate. The prevailing situation in countries around the world is instead the demand for labor is less than the supply due to the higher than equilibrium wage rate and hence there is an excess supply of labor. This gap between the supply and the demand for labor is referred to as unemployment.

It is important to understand the causes of unemployment and its consequences for possible intervention. In this section, the causes of unemployment which might slightly differ between developed and developing countries will be discussed. The costs of unemployment will also be discussed briefly. To understand the nature of the labor market in urban Ethiopia, earlier studies on the same will be surveyed.

2.1.1.1 Causes of Unemployment in Developed and Developing Countries

The causes of unemployment are among the extensively debated issues by economists. Keynesian economics stresses on the inadequate aggregate demand in the economy as the major cause. Real wage rigidities and/or real interest rates cause low output and high unemployment. Real wage rigidity, "the failure of wages to adjust until labor supply equals labor demand" according to Mankiw (2002), can cause unemployment.

In the real world, wages are set at a higher level than the equilibrium wage rate and the reasons for this can be grouped into three broad views. Efficiency wages theory assumes that higher wages give incentive for workers to exert more effort and reduce shirking. Hence, firms pay higher wages. "The insider-outsider theory" asserts that firms are prevented from cutting wages by labor unions and contracts (Romer, 2005 and Olsson, 2009). The major assumption of this model is that labor unions try to maximize the interests of only their members (the insiders) who are already employed and do not care about non-members(the outsiders). In doing so, firms and the insiders bargain to

knock the outsiders out of the job market and thereby create unemployment. Another explanation for higher than equilibrium wages is the search and matching model which emphasizes on the heterogeneity of workers and jobs as the cause for unemployment. Heterogeneity of workers in skills and preferences, information asymmetry and heterogeneity of jobs in their attributes all make it difficult to find the right person for the right job-hence, unemployment.

According to Krugman (1994), the welfare system in developed countries particularly in Europe can have an impact on unemployment. Krugman also argues that productivity growth may not come with good employment performance or the vice versa. Instead, increased productivity and employment creation are features of competitiveness and unemployment is part of a decline in economic performance. On technology and unemployment, he asserts that the rapid information and communication technology growth has increased skills premium and possibly played a role in unemployment problem in Europe.

Another study by Bassanin and Duval (2006) on unemployment in OECD countries shows that among the determining factors for rising unemployment are high and continuous unemployment benefits, "high tax wedges", and "stringent and anti-competitive product market regulations". According to Stiglitz (1974), unemployment in developing countries like those in East Africa is a result of rural to urban migration motivated by the high wage differential. Noveria (1997), on the other hand, states that the major causes of rising unemployment in urban areas in LDCs are education expansion, urbanization which results in rural to urban migration, population growth and job aspiration.

In the Ethiopian case, the World Bank (2007) indicates that the potential causes of urban unemployment include the increasing number of the youth labor force, the rising internal migration and literacy rate. Another study by Haile (2003) states that some of the most important causes in developing countries especially in Ethiopia are the rapidly growing size of the labor force, poor to modest macroeconomic performance, low level of job creation and low level of aggregate demand in the economy.

Kingdon and Knight (2004) analyze unemployment in South Africa and they show that unemployment is determined by education, race, age, gender, home ownership and location among others. Echibiri (2005) investigates unemployment in Nigeria using data from 220 randomly selected youths in the city of Umuahia and finds that

unemployment is influenced by age, marital status, dependency ratio, education, current income and employment preference (paid or self-employment).

Eita and Ashipala (2010) study the determinants of unemployment in Namibia for the periods 1971-2007 and conclude that unemployment is positively correlated with investment, wage increase and with an output level below the potential output. They also found that unemployment is negatively related to inflation. Another study by Alhawarin and Kreishan (2010) on long term unemployment in Jordan indicates that age, gender, marital status, region, work experience and education are the major determinants.

2.1.1.2 Costs of Unemployment

Unemployment comes up with costs. According to Feldstein (1997), one who wants to analyze the costs of unemployment should start by disaggregation. The costs of unemployment can be classified broadly as private and social. The private costs of unemployment are those costs borne by the unemployed themselves. The social costs on the other hand refer to those costs to the nation at large and can be the cumulative result of private costs. In this approach, the cost of unemployment can be seen as the opportunity cost of unemployment to the nation i.e., the cost is the national income forgone (Feldstein, 1997 and Haile, 2003).

Unemployment results in a waste of economic resources such as the productive labor force and thereby affect the long run growth potential of the economy. It gives rise to increased crimes, suicides, poverty rates, alcoholism and prostitution (Rafik et al., 2010 and Eita et al, 2010. These evils in turn come up with a cost (cost of crime prevention) and channel resources to their prevention which rather could have been used for other developmental purposes.

Unemployment may also have a scary effect. Previous spell in unemployment has a discouraging effect on future participation in the labor force, earnings and welfare in general (Haile, 2003). Children are affected by the unemployment situation of their parents. According to Dao and Longani (2010), children of jobless parents tend to perform less in their education in the short run. In the long run, a parent's lost income due to unemployment reduces the child's earning prospect. Unemployment has an adverse effect on health and mortality via its economic, social and psychological effect on the unemployed. It is also considered as one of the risk factors for HIV/AIDS.

2.1.2 Unemployment in Ethiopia and the urban labor market

In this section, the Ethiopian labor market and studies on unemployment will be briefly reviewed.

Studies addressing urban unemployment in Ethiopia are relatively few and most of those surveyed in this paper concentrate on youth unemployment. Krishnan (1996) studies the role of family background and education on employment in urban Ethiopia and finds that family background (especially father's education) strongly affects entry to public sector employment but it is not significant in determining entry to lower status private employment. Entry to public sector employment is also affected positively by education while age (being older) positively affects being in the labor force.

Dendir (2006) studies unemployment duration in urban Ethiopia and finds that the mean duration is 3 years for completed spells and 4.7 years for incomplete spells. Haile (2003), using data from the Ethiopian Urban Socio Economic Survey from 1994 to 2000, finds high urban youth unemployment in Ethiopia with more than 50% of the youth unemployed. Between the periods 1994-2000 teen age youth unemployment increased and was higher for women. Those from families of at least secondary school education are found to be affected less according to this study.

Serneels (2004), using the 1994 Ethiopian Urban Socio Economic Survey, studies the incidence and duration of unemployment in urban Ethiopia emphasizing on the youth. According to this study, in the year 1994 Ethiopia's urban unemployment rate was one of the highest in the world with male unemployment standing at 34% and the urban youth unemployment rate was even higher at 50%. Serneels indicates that mean duration of unemployment is 4 years and those youth whose parents are civil servants have shorter durations. It is also indicated that public sector was the top employer hiring one third of the adult men. A negative relationship is found between unemployment incidence and duration, and household welfare. There is evidence that households reduce their savings and consumption to cope with unemployment. With regard to job aspirations, well-educated first time job seekers who aspire to well-paying jobs are more affected. On family background, Serneels concludes that mother's education may play a role but father's education has a strong effect for labor market performance in urban Ethiopia.

Denu et al. (2005/07) study the characteristics and determinants of youth unemployment and underemployment in Ethiopia from 1984-2001 and conclude that the youth is substantially affected by unemployment and significant differences exist within the youth group across location (urban-rural), gender and education. The urban youth unemployment stood at 7.2% while it was 37.5% for the rural, the latter facing high rate of underemployment. Unemployment for the youth women was 17.3% in 1999 while it was 6.9% for their men counterparts. Regarding education, 44.5% and 32.6% of the unemployed youth were illiterate or had only primary education. The paper indicates that the private sector plays a huge role in employment as a result of policy change by the current government to promote the private sector as opposed to the previous government's policy where most enterprises were government owned. Using data from the Ethiopian Urban Socio Economic Survey from 1994 to 2000, Haile (2008) studies the nature of self-employment "for the first time in Ethiopia" and finds that the young, the educated, those that migrate to urban areas recently and those whose parents are not self-employed are less likely to be found in self-employment.

The World Bank (2007), with its report in two volumes, acknowledges important improvements in urban unemployment between 1995 and 2005 though the labor market situation remained unchanged. According this study, the rapid rise in the urban labor force creates pressure on the labor market and it can be seen as both a challenge and an opportunity for the Ethiopian government. The rising number of educated labor force entering the market each year as a result of education expansion and internal migration necessitate enhanced job creation in the country. Another feature of the Ethiopian urban labor market indicated in this study is the increasing literacy rate. This is implicated in World Bank (2011) that the net primary school enrollment rate in Ethiopia increased to 87.9% in 2010 from 68.5% in 2005.

Low wages characterize the Ethiopian urban labor market although it differs among the type of employers, sector and worker characteristics. Even though females are relatively less skilled yet, the literacy rate and their participation in the labor force is increasing. There is labor market segmentation with a relatively wanted public sector and formal private sector, and a large number of unemployed and a large informal sector with low wages and mostly occupied by women. Women in urban Ethiopia are relatively more affected by unemployment and they are paid lower wages (World Bank, 2007).

As can be noted, many of the studies surveyed so far have concentrated on youth unemployment in urban Ethiopia and not many of them focused on general unemployment.

4. Econometric Framework

In this section, two models will be specified for analyzing the research questions. First, a binary choice model (probit) estimation technique will be used to analyze the determinants of unemployment. To investigate the impact of unemployment on household welfare, a second model, OLS regression technique will be employed.

Model 1:

In this first model, the possible determinants of unemployment will be investigated. The main variable of interest is unemployment, a latent variable, where the individual may be classified as either employed or unemployed. The appropriate econometric technique to deal with micro data of this type is using a latent variable approach which can be specified as:

$$y_i^* = \boldsymbol{X}_i'\boldsymbol{\beta} + u_i \qquad (1)$$

Where y_i^* is the probability of being unemployed for individual i and has a linear relationship with the possible factors determining unemployment, $X_{i's}$. β is a vector of slope parameters for the determinants and u_i is the stochastic error term which takes care of all the possible factors determining unemployment and which might have not been included in the model.

Unemployment is assumed to be a function of household characteristics like age, gender, education, marital status, parental characteristic like parents' occupation and education, and location. These factors are widely used in most studies that addressed the determinants of unemployment. (Alhawarin and Kreishan, 2010; Bhorat, 2008; Serneels, 2004; Haile, 2003; Kington and Knight, 2001; Noveria, 1997 and Krishnan, 1996)

$$Unemployment = f(age, gender, education, marital\ status, parental\ background, location)$$

The unemployment status of an individual and the possible determinants cannot be observed directly but can be inferred from their responses. We can observe the net benefit of the determinants on the probability of getting employed ($y_i = 0$) or unemployed ($y_i = 1$).

$$y_i = 0 \text{ if } y_i^* < 0$$
$$y_i = 1 \text{ if } y_i^* \geq 0 \quad (2)$$

The error term,u_i, has a binomial distribution and its variance conditional on X is:

$$Var[u|X] = X\beta(1 - X\beta) \quad (3)$$

Using Equations (1) and (2), the probability of getting unemployed can be modeled as:

$$P(y^* > 0|X) =$$
$$P(u > -X\beta|X) =$$
$$P(u < X\beta|X) =$$
$$P(y = 1|X) = \Psi(y_i^*) \quad (4)$$

$\Psi(.)$ represents a cumulative distribution function (CDF). Maximum likelihood estimation technique can be used to estimate the parameters of binary choice models. For each individual i, the probability of being unemployed conditional on$x$, i.e., conditional on the individual's educational level, age, gender, marital status, parents' occupation, parents' education and location can be calculated as:

$$P(y|X) = \{\Psi(X_i\beta)\}^{y_i}\{1 - \Psi(X_i\beta)\}^{1-y_i}, \; y_i = 0,1 \quad (5)$$

The log likelihood for each individual i can then be set as:

$$\ell_i(\beta) = y_i log\{\Psi(X_i\beta)\} + (1 - y_i)\log\{1 - \Psi(X_i\beta)\} \quad (6)$$

There are two commonly used estimation techniques for binary choice models: the binomial *probit* and binomial *logit.* For the probit model, the distribution of the cumulative distribution function (CDF), $\Psi(.)$, follows normal distribution and for the logit model, the CDF follows a logistic distribution.

A standard normal distribution has a mean of 0 and a variance of 1 while a standard logistic distribution possesses a mean of 0 and a variance of $\pi^2/3$ (Verbeek, 2008). Else, the CDF of both distributions are similar and both estimation techniques yield similar results in applied work. For analyzing the determinants of unemployment in

urban Ethiopia, I use probit model. This method is widely used in many literatures addressing unemployment (Cattaneo, 2003).

In binary choice models, it is difficult to interpret the estimated parameters directly since they tell only the sign of the change in the dependent variable in response to a change in the explanatory variable. Hence, marginal effects have to be calculated. The effect of a change in each determinant on the probability of being unemployed can be found as:

$$\frac{\partial P(y=1|X)}{\partial x_j} = \frac{\partial P(y=1|X)}{\partial x\beta} . \frac{\partial X\beta}{\partial x_j} = \Psi'(X\beta).\beta_j = \psi(X\beta).\beta_j \qquad (8)$$

Equation (8) depicts that the effect of a change in a given determinant (x_j) on the probability of being unemployed is the product of the effect of the determinant (x_j) on the latent variable (y^*) and the derivative of the distribution function evaluated at the latent variable (y^*).

Model 2:

Household welfare is assumed to be affected by unemployment situation in urban Ethiopia. The country does not have unemployment benefit system which may imply that most of the unemployed are supported by the employed member in the household. For checking this, a second model will be estimated using ordinary least squares (OLS) estimation technique. The main purpose in here would be to investigate the effect of unemployment on household welfare.

The literature says that income and consumption are the two alternative measures of welfare. According to Deaton (1997), in developing countries income is underreported and difficult to remember. So, consumption is used to measure household welfare here and it is modeled as a function of unemployment (the number of unemployed member in the household) and household characteristics.

$$Consumption = f(age, gender, education, occupation, household\ size, \\ dependency\ ratio, location, number\ of\ unemployed\ members)$$

The OLS regression model in a matrix form can be specified as:

$$y = X\beta + U \qquad (9)$$

Where X is a matrix of determinant variables for consumption expenditure (y) and U is the disturbance term with a zero conditional mean (Baum, 2006). β is the coefficient of the explanatory variables. Equation (9) is also assumed to fulfill all the other classical linear regression assumptions: linearity, absence of multicollinearity among explanatory variables, the disturbances are uncorrelated and possess equal variance, and absence of correlation between regressors and disturbances. To make the distribution of consumption expenditure more normal $logconsumption$ will be used as the dependent variable. With the absence of unemployment benefit system in Ethiopia, unemployment is expected to have a negative impact on consumption expenditure and hence on household welfare.

4. Data and Descriptive Statistics

4.1. The Data

The data used in this paper is from the 2004 wave of the Ethiopian Urban Socio-Economic Survey (EUSS) collected by Addis Ababa University, Department of Economics, in cooperation with the University of Gothenburg. The data covers 1,500 households from four major cities in Ethiopia-Addis Ababa, Hawassa, Mekelle and Dessie. These cities are believed to represent the socioeconomic characteristics of households in urban Ethiopia (Alem and Söderbom, 2011, and Haile, 2003). The data used for analyzing the determinants of unemployment is individual level and the one for investigating the impact of unemployment on welfare is household level. Summary statistics for unemployment and consumption will be discussed first which will then be followed by the empirical findings. The following table shows the descriptive statistics for the individual level data.

4.2 Descriptive statistics

Summary statistics for determinant variables for unemployment and welfare variables are presented in Tables 1 and 2 respectively.

From Table 1, we can see that there is a fairly equal representation of gender in the sample with men making up 51.7% and females 48.3%. Looking at the age category, the teen age group of the labor force (15-19) constitutes 8%. The age groups 20-24, 25-29 and 30-65 constitute 24.3%, 12.5% and 44.5% of the labor force respectively. 24.7% are married. Looking at the education category, 7.1% of the respondents (heads) are

illiterate, 17.9% completed primary school, 21.4% completed junior secondary and 37% have secondary education. Those who completed tertiary education including college diploma, bachelor and Post graduate degree make up 11.4%.

Table1: Descriptive statistics for the labor force of ages between 15 and 65

Variable (%)	Share (%) (2004)	Standard Deviation
Male	51.7	.499
Female*	48.3	.499
Age:15-19	8	.272
Age:20-24	24.3	.429
Age:25-29	12.5	.331
Age:30-65*	44.7	.497
Married	24.7	.432
Others(single, separated, divorced, widowed, too young)*	75.3	
Illiterate*	7.1	.257
Primary school completed	17.9	.384
Junior secondary school completed	21.4	.411
Secondary school completed	37.4	.484
Tertiary school completed	11.4	.318
Mother primary school completed	11	.312
Mother less than primary school completed*	89	.312
Father secondary school completed	11.8	.323
Father less than second. school completed*	88.2	.323
Father working in the private sector	3.8	.191
Father working in the public sector	19	.392
Father working other*	77.2	
Living in Addis	83	.375
Living in Hawassa	7.1	.257
Living in Dessie	5.5	.228
Living in Mekelle*	4.3	.203
Unemployed	30.9	.462
Employed*	69.1	.462
Tot. obs.	2510	

** denote reference group*

Another variable worth looking at is mother's education. The proportion of those whose mothers have an education level of less than primary education is high at 89%. This is not surprising as women in the past were disadvantaged and had relatively less

education level in Ethiopia. Father's education is no exception. 88% of the fathers have less than secondary education and probably that is why only 3.8% of them work in the public sector. As most of the fathers have less than secondary school education, they might not be able to make it to the public sector and to the formal private sector and hence most of them (77.2%) work "other" jobs. The sample consists of more respondents from the capital Addis Ababa (83%). 7.1%, 5.5% and 4.3% of the respondents come from Hawassa, Dessie and Mekelle respectively.

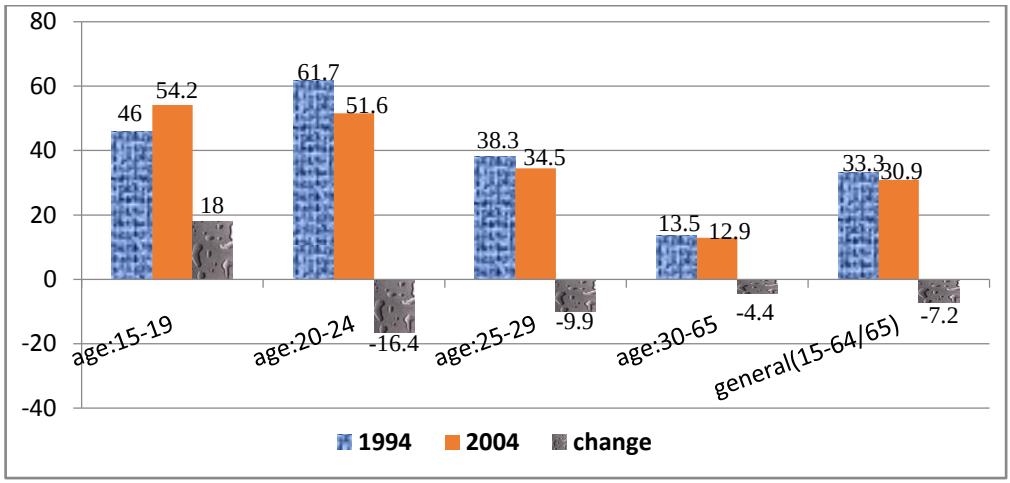
A study by Haile (2003) indicates that the urban unemployment rate in Ethiopia stood at 33.3% and 32% respectively in 1994 and 2000. In 2004, which this paper is trying to address, unemployment rate stands at 30.9%. The marginal decline may be due to the rapidly growing labor supply driven by population growth and education expansion against the lower absorptive capacity of the labor market, among other possible reasons. The fact that it is declining looks somehow good news but its slow pace is discouraging and urges intervention.

4.2.1 Urban unemployment by age, gender and location: 1994 V 2004

For better understanding of the unemployment situation, this section discusses unemployment disaggregated by age, gender and location. I will also compare the situation in 2004 with 1994 and discuss the changes. The 1994 figures are taken from Haile (2003) and they cover ages of 15 to 64 while for the 2004 analysis age ranges from 15 to 65.

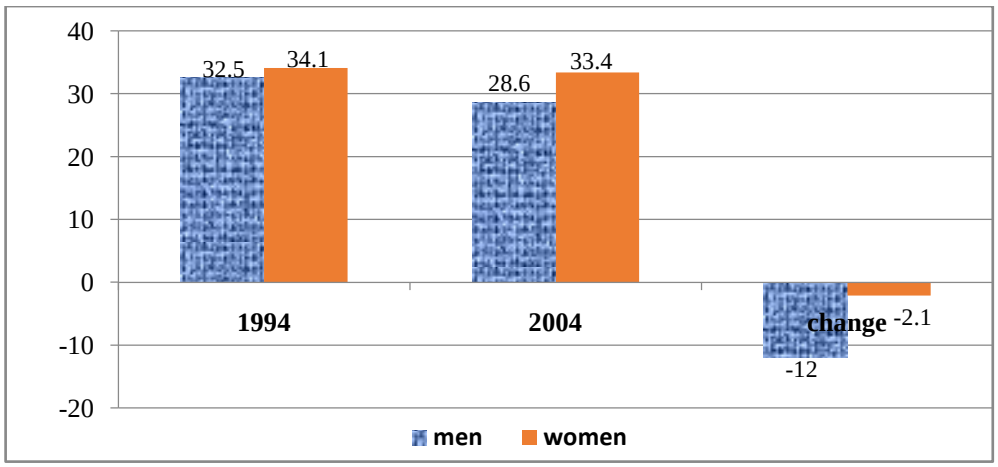
As can be seen from Figure 1 below, unemployment rate declined from 33.3% to 30.9% in 2004. On average youth unemployment remains high during both periods. Average unemployment declined in 2004 except for the age group 15-19 which increased by 18 percentage point and the age group 30-65 has lower unemployment rate on average. The rate goes down as one advance to the higher age group. This might be due to the fact that as age increases, people get more education, trainings and experience and hence better employment opportunities.

Figure 1: Unemployment rates by age group (1994 and 2004)



How does unemployment differ between men and women? Figure 2 below shows that both in 1994 and 2004 on average female unemployment were higher than male unemployment. The unemployment rate for men has reduced by 12% in 2004 compared to its level in 1994 and by 2.1% for the female category.

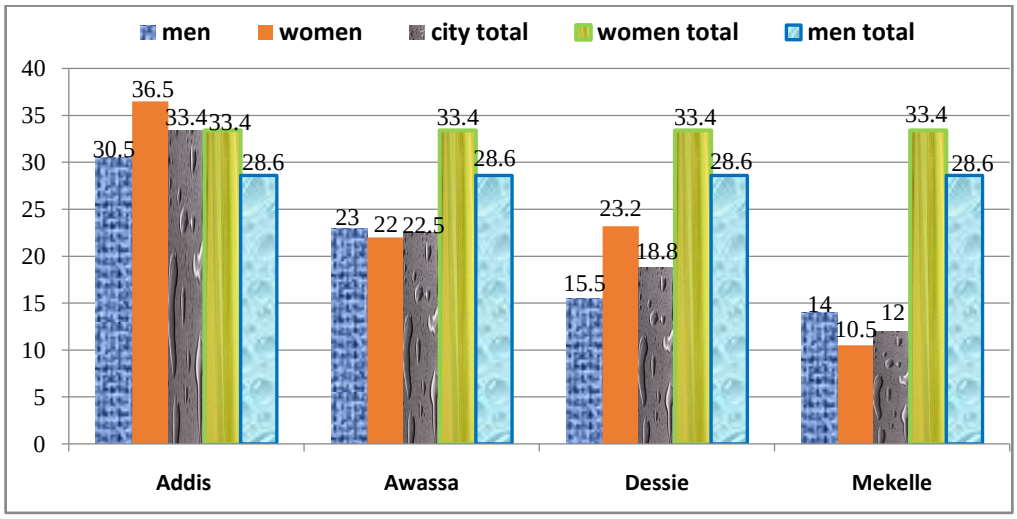
Figure 2: Unemployment by gender (1994 and 2004)



Let us now look at city differences in male and female unemployment. It can be read from Figure 3 that on average, both male and female unemployment is higher in Addis compared to the other cities. However, this may be a result of the possible difference in the education composition of the respondents among others. Female unemployment in Addis is even higher than the average unemployment for the whole sample. On

average, there is relatively higher unemployment rate in the capital Addis Ababa (33.4%) and lower unemployment rate in Mekelle (12%).

Figure 3: Unemployment by gender and location (2004)



Summary statistics for welfare variables is presented in Table 2. As can be read from the table, 54% of the households are male headed and 46% are female headed. The average household has 6 members among which one member is unemployed. The dependency ratio stands rather high at 53% which is a burden to the productive labor force in particular and the country in general and hence requires intervention. The larger number of respondents is again from Addis Ababa with 74% coming from the capital and a fairly equal sample is represented from the other cities-8.6% from Hawassa, 8.7% from Dessie and 8.4% from Mekelle. The mean per capita real consumption expenditure expressed in 1994 prices, the main variable of interest in this section, is 165 Ethiopian Birr per month although there is a large variation ranging from 11 to as high as 1,754 (also reflected in the high standard deviation of 164.6).

The sample consists of a few skilled labor force with 31% of the respondents recorded as illiterate and another relatively big number, 27%, having only primary education. When we see the job distribution, 21% work own activity, about 13% work as civil servants, 4.4% for the public sector, 10% in the private sector and 9% as casual workers. Since the sample covers major cities, it is not surprising that fairly many respondents work in the urban formal sector.

Table2: Descriptive statistics for welfare variables

Variable	Mean	Std. Dev.
Real consumption per adult equivalent unit (rconsaeu)	160.1	164.58
Age	51.0	14.11
Household size	6.0	2.69
Dependency ratio (%)	53.3	.59
Number of unemployed members	1.0	1.08
Male (%)	53.9	.49
Female (%)*	46.1	
Illiterate (%)*	31.2	
Primary school completed (%)	27.0	.45
Junior secondary school completed (%)	14.8	.36
Secondary school completed (%)	17.5	.38
Tertiary school completed (%)	9.0	.29
Employer (%)	1.0	.11
Own activity (%)	21.4	.41
Civil servant (%)	12.6	.33
Public sector employee (%)	4.4	.21
Private sector employee (%)	9.8	.30
Casual worker (%)	9.4	.29
Out of the labor force (%)	41.0	
Living in Addis (%)	74.2	.44
Living in Hawassa (%)	8.6	.28
Living in Dessie (%)	8.7	.28
Living in Mekelle (%)*	8.5	.28
No. of Observations	1118	

*denote reference group

5. Econometric Results

This section discusses empirical findings. Section 5.1 deals with unemployment where its determinants are discussed and the second part takes care of consumption where the impact of unemployment on welfare is investigated.

5.1 Determinants of Unemployment

In this section, a probit model is estimated for the probability of being unemployed. The dependent variable is unemployment and the explanatory variables are age, gender, marital status, education, mother's and father's education, father's occupation

and location (city). All or most of these variables are used in literatures that addressed unemployment (Alhawarin and Kreishan, 2010; Bhorat, 2008; Serneels, 2004; Haile, 2003; Kington and Knight, 2001; Noveria, 1997 and Krishnan, 1996).

The unemployed are defined as those looking for work but unable to find any. Serneels (2004) includes those individuals in the labor force but not looking for work as unemployed with the thinking that in a high unemployment environment people will not sit and wait but they actively look for a job. In this study, however, those "not at paid work and not looking for work" are excluded from the labor force since the strictly unemployed, according to the International Labor Organization (ILO) definition, are those looking for a job and be able to work but unable to find any (Bhorat, 2008). The other obvious categories excluded include students, the disabled, housewives, children and pensioners.

Post estimation link test is a model specification test which checks for the call for additional variables in a model and is done by carrying out a new regression by taking the observed Y as the dependent variable and the predicted Y-hat ($X\beta$) and Y-hat-squared as independent variables. With the null hypothesis being "no specification error", we fail to reject if –hat-squared is not significant (Reyna). Accordingly, it is found for unemployment that the_hat is significant and the_hat squared is not (Table 3; standard errors in brackets) and, therefore, the model is correctly specified and no omitted variable exists. The model does not have multicollinearity problem either. (Table A7 in the appendix)

Table 3: Link Test

unemployment	Coefficient
_hat	1.085***
	(0.931)
_hat squared	.0783
	(0.722)

Average marginal effects for each of the explanatory variables are calculated and reported in 4 below.

Table4: Determinants of unemployment-Probit regression results.

Variable	Coefficient	Marginal Effects
Gender, male	-0.087	-0.0255
	(0.058)	(0.0170)
Age: 15_19	0.845***	0.2478
	(0.103)	(0.0286)
Age: 20_24	0.773***	0.2268
	(0.069)***	(0.0190)
Age: 25_29	0,350***	0.1028
	(0,087)	(0.0258)
Married	-0.483***	-0.1418
	(0.081)	(0.0234)
Primary school completed	0.015	0.0043
	(0.117)	(0.0358)
Junior secondary school completed	0.424***	0.1244
	(0.110)	(0.0335)
Secondary school completed	0.624***	0.1832
	(0.104)	(0.0312)
Tertiary school completed	-0.289**	-0.0847
	(0.140)	(0.0430)
Mother, primary school completed	-0.049	-0.0143
	(0.093)	(0.0279)
Father, secondary school completed	-0.023	-0.0067
	(0.097)	(0.0290)
Father, working in the private sector	-0.174	-0.0512
	(0.150)	(0.0458)
Father, working in the public sector	0.047	0.0137
	(0.076)	(0.0226)
Living in Addis	0.486***	0.1426
	(0.176)	(0.0500)
Living in Hawassa	0.164	0.0480
	(0.208)	(0.0582)
Living in Dessie	0.128	0.0375
	(0.218)	(0.0652)
Log-likelihood	-1302.81	-1302.81
Pseudo R^2	0.1607	0.1607

Note: ** significant at 5%; *** significant at 1%; standard errors in brackets

Reading from Table 4, compared to the age group 30-65 all the other age groups are positively associated with unemployment. For the teen age group for instance, heads who are one year older that the mean age have a 24.8% more likelihood of being unemployed. The same situation results in an increase in the probability of getting unemployed by 22.7% and 10.3% for the age groups of 20-25 and 25-29 respectively. This is consistent with the finding by Serneels (2004) for the youth.

For the education variable, the result reveals that up to the education level of secondary school, one is likely to be unemployed as the level of education increases, consistent with Serneels (2004) for the urban youth. Contrary to Serneel's finding, however, tertiary education is significantly and negatively associated with the likelihood of being unemployed. This is also consistent with the finding by Bhorat (2008) for South Africa. Those with tertiary education are 9% less likely to be unemployed compared to the illiterate. This is because people with tertiary level of education have better job opportunities since they are more skilled. Primary education is insignificant and this may be due to the fact that in urban areas, there is relatively lower demand for unskilled labor force.

Contrary to the finding by Krishnan (1996) and Serneels (2004), parent's education and occupation are insignificant in determining unemployment. As mentioned in the descriptive statistics earlier, 89% of the mothers have education level of less than primary school and that may be why mother's education could not play a role in defining unemployment. The same logic applies to father's education among which 88% have less than secondary education.

Location is another variable that determines unemployment. Contrary to the finding by Serneels (2004) for the youth but consistent with Bhorat (2008) for South Africa, living in the capital Addis Ababa is associated with high probability of being unemployed. On average people living in Addis have a relatively 14.3% higher probability of being unemployed compared to those in Mekelle. This could be due to congestion caused by the absolute size of people living in the metropolitan looking for better opportunities.

There is a negative association between getting married and being unemployed. This is consistent with the finding by Krishnan (1996). Looking at the marginal effect, married people have a 14.7% less probability of being unemployed. It may not be the case that when people get married, they have better likelihood of getting employed. Instead, it may be that they strive to find a job before getting married as marriage is believed to come up with responsibilities and most people get married after securing some source of income for future life or looking for one after getting married.

In sum, unemployment in urban Ethiopia in 2004 is found to be determined by age, marital status, education above primary school and living in the capital Addis. As for the other variables, gender, parental characteristics like mother's and father's education and occupation are insignificant in determining unemployment, all things remaining the

same. However, even though insignificant, the signs of their estimated coefficients meet expectation. The probability of unemployment: decreases for a male, decreases for those whose mothers have at least primary education and whose fathers' completed secondary school and for those whose fathers work in the private sector. In the following sections, the impact of unemployment on household welfare will be investigated.

5.2 Unemployment and Household Welfare

In this section, OLS regression model is estimated for consumption with the main objective of investigating the impact of unemployment on consumption expenditure and hence on household welfare. To account for the size of the household and its composition, household consumption expenditure per adult equivalent rather than aggregate consumption is used and transformed into log form (Alem and Söderborm, 2011). The independent variables used are age, age squared divided by 1000 (to make the number manageable), household size, number of unemployed members in the household (which captures unemployment), dependency ratio (the ratio of the labor force to those out of the labor force), gender, education and location.

Some or all of these variables are used in studies that addressed consumption (Alem and Söderborm, 2011, and Bigsten and Shimeles, 2005). Table 7 presents the results from OLS for log real consumption per adult equivalent unit. In a single log-model like this one, the estimated coefficients are semi elasticities measuring the percentage change in the dependent variable as a result of a unit change in the predictor variable, keeping all others constant. Robust standard errors are used to take care of heteroskedasticity.

Ramsey RESET test is performed on each of the predictors to check for any omitted variables bias. The result below shows that the null hypothesis of no misspecification can be accepted at 5% significance level (since P(F)>5%) and it can be concluded that the model is fitted well and there are no omitted variables.

Table 5: Ramsey RESET Test

Ramsey RESET test using powers of the fitted values of log real consumption per capita
Ho: model has no omitted variables
F(3, 1094) = 1.68
Prob > F = 0.1686

Multicollinearity may inflate standard errors. However, as long as there is no perfect multicollinearity (which the stata software detects automatically) the regression estimates will not be biased.

To check whether perfect multicollinearity is a problem, variance inflated factors (VIF) are calculated and presented in Table 6. If the highest variance inflation factor is greater than 10, there is evidence of collinearity. However, near collinearity that doesn't influence the main variable of interest in a model may not be a big problem and can be ignored (Baum, 2006). As can be noted from Table 6, age and age squared have a VIF of greater than 10 and since they are not the main concern here and since the exclusion of one of them do not influence the result, I ignore their high VIF. Because the VIF of all other explanatory variables is less than 10, it can be concluded that multicollinearity is not a problem in the data.

Table 6: Variance Inflation Factor(VIF)

Variable	VIF	1/VIF
Age	35.84	0.027899
Agesq	35.09	0.028497
Hhs	9.28	0.107712
Hhssq	8.57	0.116650
Addis	2.75	0.363709
Awassa	1.95	0.513036
Dessie	1.89	0.527900
Secondary	1.84	0.542948
Junsec	1.64	0.610689
Tertiary	1.61	0.619901
Primary	1.56	0.641548
Civil	1.54	0.648250
Male	1.43	0.697707
Unempmb	1.38	0.725883
Casual	1.37	0.727481
Ownacct	1.36	0.735782
Private	1.33	0.752856
Public	1.19	0.837146
Depratio	1.16	0.860047
Employer	1.06	0.942790
Mean VIF	5.69	

Table7: Determinants of log real per capita consumption- OLS regression results

Variable	Coefficient	Robust Std. Err.
Age	.008	.009
Age squared/1000	.001	.988
Household size	-.192***	.022
Household size squared	.008***	.001
Dependency ratio	-.084**	.036
Gender, male	.015	.046
Primary school completed	.152***	.056
Junior secondary school completed	.413***	.068
Secondary school completed	.612***	.070
Tertiary school completed	.873***	.086
Employer	.379*	.218
Own activity	.007	.056
Civil servant	-.103	.067
Public sector employee	.053	.109
Private sector employee	-.055	.075
Casual worker	-.269***	.069
Living in Addis	-.079	.075
Living in Awassa	.081	.095
Living in Dessie	-.368***	.092
Number of unemployed member	-.046**	.021
Intercept	5.022***	.230

Note: * significant at 10%; ** significant at 5%; *** significant at 1%

Consistent with the finding by Alem and Söderborm (2011), the result in Table 7 indicates that the larger the household size, the less the real consumption expenditure per adult equivalent will be, keeping all other variables constant. One more household member results in a 19% decline in the real per capita consumption expenditure available to the household.

The dependency ratio, since it is the ratio of people out of the labor force to those in the labor force, simple logic tells us that the higher the dependency ratio, the less per capita consumption in a household. The results confirm this. A one unit increase in the dependency ratio decreases the real consumption per adult equivalent by about 8%. Education is observed to strongly increase real per capita consumption expenditure, consistent with Alem and Söderborm (2011). Keeping all other variables constant, those households with the head having tertiary education have 8.6% higher real consumption expenditure per adult equivalent compared to the ones with no education. This may be due mainly to the income effect of education. Better education is likely to increase income which in turn increases consumption.

Occupation of the head is also one of the factors affecting consumption expenditure. Being an employer, for instance, means a relatively better income and hence better consumption expenditure. The result indicates that families with heads working as employers have 37.9% higher real consumption expenditure per adult equivalent. The result on the head working as casual worker confirms the finding by Alem and Söderborm (2011) that relatively speaking, households with heads working as casual workers have less consumption expenditure. These households have 27% less real per capita consumption expenditure compared to those working other jobs. There is no evidence that location matters for consumption except that those living in Dessie have 36.8% less real consumption per capita expenditure compared to the ones in Mekelle.

Since there is no unemployment benefit system in Ethiopia, it is highly likely that the burden of the unemployed member rests on the shoulder of the household. This in turn affects consumption expenditure and hence household welfare. Accordingly, one more unemployed member in the household results in a 5% decline in the real consumption expenditure per adult equivalent. This goes with the expectation in the beginning of this paper that unemployment has a negative impact on consumption and hence on welfare.

Age of head, age of head squared/1000, gender, working own activity, working as civil servant, public, private employment, Addis and Awassa city dummy variables are not significant in determining real consumption expenditure per adult equivalent.

6. Conclusion

In this study the determinants of unemployment in urban Ethiopia and its impact on household welfare is investigated using data from the 2004 wave of the Ethiopian Urban Socio Economic Survey on four major cities-Addis Ababa, Awassa, Dessie and Mekelle. Comparison of the unemployment situation by age, gender and location has also been made for the periods 1994 and 2004.

30.9% of the Ethiopian urban labor force was unemployed in the year 2004. The rate slightly decreased from its level of 33.3% a decade ago. Both 1994 and 2004 data have witnessed high female unemployment rates on average although the rates have declined in 2004. Teen age unemployment is high at 54.2% and increased by 18 percentage point in 10 years. Given the relatively larger sample size, Addis is characterized by higher average unemployment for almost every age group and gender compared to the other cities.

Probit model estimation technique is employed for the purpose of understanding the determinants of unemployment. The evidence indicates that the factors determining urban unemployment in Ethiopia are age, marital status, education above primary school and living in Addis. The likelihood of unemployment increases with age, taking ages of 30 to 65 as reference. Heads with education levels up to secondary school have relatively higher probability of being unemployed and those with tertiary education have 8.7% less probability of getting unemployed.

Living in the capital Addis Ababa is associated with high probability of being unemployed which may be due to the relatively larger sample size used. Another possible explanation could be the increased pressure on the labor force caused by the rising population size in the capital. The result also shows that married people are 14.7% less likely to be unemployed.

A second model, OLS regression, is estimated for log real household consumption expenditure per adult equivalent. The result shows that the factors determining consumption expenditure in urban Ethiopia are household size (negatively), dependency ratio (negative), education (positive), being an employer (positive), casual work (negative) and the number of unemployed members in the household which captures unemployment. With the absence of unemployment benefits in Ethiopia, the evidence indicates that unemployment has a negative impact on household consumption expenditure and hence on household welfare. One more unemployed household member decreases household consumption expenditure by 5%.

Since unemployment adversely affects household welfare via its impact on consumption, every effort to reduce unemployment will be translated into welfare. If the problem of unemployment can be reduced, welfare will improve in a way. The following recommendations therefore intend both to reduce unemployment and improve welfare. Efforts being exerted for alleviating poverty in the country will come up with short term and long term employment opportunities. If such policies and strategies are implemented successfully, welfare will improve. Improving urban infrastructure will also create short term and long term employment opportunities and thereby improve welfare, all other things remaining the same. It is observed that household size reduces welfare and hence family planning awareness may help in reducing household size and thereby increase welfare. Since tertiary education decreases unemployment, there should be enhanced effort on skill and employment creation for the skilled labor force.

Serneels (2004) in his study on unemployment based on the 1994 socioeconomic survey finds no association between ethnicity and unemployment. If data be available, it is worth investigating whether this trend is the case at present. Local language and affiliation (political and/or personal) could also be one of the determining factors for unemployment in urban Ethiopia which also requires further research.

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Appendix

Note: ** taken from Haile (2003);** and *** for 1994, age covers 15-64 and 16-65 for 2004. The 2004 figures are own calculations.*

Table A1: Unemployment rates by age group.

	1994*	2004	Change
Age:15-19	46%	54.2%	18.0%
Age:20-24	61.7%	51.6%	-16.4%
Age:25-29	38.3%	34.5	-9.9%
Age:30-64/65**	13.5%	12.9%	-4.4%
Age:15-64/65***	33.3%	30.9%	-7.2%

Table A2: Unemployment rates for men

Age	1994*	2004	change
15-19	55.7%	58%	4.1%
20-24	61.9%	48.3%	-22.0%
25-29	40.8%	34.7%	-15.0%
30-64/65**	13.8%	13%	-5.8%
15-4/65***	32.5%	28.6%	-12.0%

Table A3: Unemployment rates for women

Age	1994*	2004	change
15-19	40.2%	51.5%	28.1%
20-24	61.5%	54.7%	-11.1%
25-29	35.8%	34.3%	-4.2%
30-64/65**	13%	12.8%	-1.5%
15-64/65***	34.1%	33.4%	-2.1%

Table A4: Unemployment rates by gender and location

	Male		Female		City Total	
	Freq	Percent	Freq	Percent	Freq	Percent
Addis	1092	30.5%	994	36.5%	2086	33.4%
Awassa	87	23%	91	22%	178	22.5%
Dessie	69	15.5%	69	23.2%	138	18.8%
Mekelle	50	14%	57	10.5%	108	12%

Table A5: Unemployment by age group and location

	Age: 15-19		Age: 20-24		Age: 25-29		Age: 30-65	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Addis	171	56.1%	525	53.5%	272	36.4%	891	14.8%
Awassa	13	53.8%	42	42.9%	20	35%	83	1.2%
Dessie	12	25%	27	40.7%	10	20%	83	8.4%
Mekelle	5	60%	16	31.3%	11	-	65	7.7%

TableA6: Unemployment by age group, gender and location

Age		15-19				20-24				25-29				30-65			
Gender		*Male*		*Female*		*Male*		*Female*		*Male*		*Female*		*Male*		*Female*	
Obs.		Freq	Percent	Freq	Perc.	Freq	Perc.	Freq	Perc.	Freq	Perc.	Freq	Perc.	Freq	Perc.	Freq	Perc.
City	Addis	68	57.4%	103	55.3%	250	50%	275	56.7%	147	36.1%	125	36.8%	509	14.9%	382	14.7%
	Awassa	6	66.7%	7	42.9%	19	36.8%	23	47.8%	9	55.6%	11	18.2%	43	2.3%	40	?
	Dessie	4	50%	8	12.5%	15	33.3%	12	50%	5		5	40%	45	6.7%	38	10.5%
	Mekelle	3	66.7%	2	50%	6	50%	10	20%	6		5	?	30	6.7%	34	8.8%

Table A7: Correlation matrix (unemployment)

	unemp04	Male	age15_19	age20_24	age25_29	married	primary	junsec	second~y	tertiary	addis	hawassa	dessie
unemp04	1.0000												
Male	-0.0523	1.0000											
age15_19	0.1488	-0.0674	1.0000										
age20_24	0.2541	-0.0473	-0.1672	1.0000									
age25_29	0.0293	0.0124	-0.1114	-0.2139	1.0000								
Married	-0.2357	0.1549	-0.1556	-0.2366	-0.0990	1.0000							
Primary	-0.1194	-0.0098	0.0266	-0.0735	-0.0349	0.1268	1.0000						
Junsec	0.0770	0.0171	0.0856	0.0753	0.0321	-0.0272	-0.2441	1.0000					
secondary	0.2049	0.0543	-0.0307	0.0750	0.0599	-0.1395	-0.3610	-0.4035	1.0000				
Tertiary	-0.1504	0.0454	-0.0827	-0.0570	0.0165	0.0327	-0.1676	-0.1873	-0.2770	1.0000			
Addis	0.1198	0.0282	0.0155	0.0447	0.0382	-0.1235	-0.0415	0.0541	0.0669	0.0412	1.0000		
Awassa	-0.0505	-0.0157	-0.0072	-0.0046	-0.0103	0.0214	0.0368	-0.0308	-0.0145	-0.0014	-0.6128	1.0000	
Dessie	-0.0630	-0.0083	0.0061	-0.0266	-0.0381	0.0966	-0.0307	-0.0365	-0.0093	-0.0425	-0.5350	-0.0666	1.0000