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Inflation - Growth Nexus in Ethiopia: Evidence from Threshold Auto Regressive Model[1]

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Abstract

Achieving high economic growth with stable and low inflation level has long been the macroeconomic policy objective of Ethiopia. The Ethiopian economy, however, has gone through different paths of inflation and growth relationship over the last four decades. Before 2003, Ethiopia was well-known as a low inflation country with marginal economic growth. After 2004, however, the country had been in general hovering around double digit inflation. During the same period economic growth averaged 10.7%. This seems to suggest that the two variables are positively related. Quite a large number of theoretical and empirical researches, however, suggest that there is a threshold effect in the relationship between inflation and growth such that high inflation has an adverse effect on economic growth. Against this background, this paper investigates whether there is a threshold effect between the two variables in Ethiopia for the period 1971 to 2013 using annual data and Hansen's Threshold Autoregressive (TAR) model. The empirical result does not support the existence of threshold effect between the two variables in the period. The possible reason for the non-existence of non-linearity might be related to the absence of the absence market led economic system and the low financial sector development of the study period mainly in first 25 years. As a result the informational friction that interferes with the efficiency of the financial system which finally inhibits long-run growth might be absent in the study period. Due to the small number of observations, however, this result should be interpreted with caution.

Key words: Inflation, growth and threshold autoregressive.
JEL Classification: E31, O40.

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1. Introduction

Over the last four decades, the Ethiopian economy has gone through different paths of inflation and growth relationship. In general, before 2003, Ethiopian was distinguished as a low inflation country with small economic growth. During this period the average inflation was 7.5% while the average growth rate was 2.6%. Consequently, inflation was not an issue during this period. This was mainly explained by prudent government budgets and a restrictive monetary policy. After 2004, except in 2009, and 2013, when inflation was at a single digit level, inflation was beyond the comfort zone policy makers and the country had been hovering around double digit inflation. During the same period, however, Ethiopia's economic growth, which is mainly driven by public investment in main infrastructure projects, averaged 10.7% (World Bank, 2014). This pace of growth is the fastest that the country has ever experienced and it also exceeds what was achieved by low-income and Sub-Saharan African countries in that period (World Bank, 2015). This marks not only a break from the country's past economic development trajectory, but a preeminent economic growth performance even by the standards of the fast-growing countries in African. These conditions seem to suggest that the two variables are positively related in Ethiopia.

The debate on the growth-inflation nexus has been central in the monetary policy setting. Monetary policy that ensures inflation remains low and stable over time contributes to long-run economic growth and financial stability (Bernanke, 2011). Many economists would agree that inflation has distortional effects on long-term economic growth if it gets "too high". But how high is too high? For industrialized countries, there has been an increasing consensus on inflation targets that centre around 2%. Recent empirical work by Goncalves and Salles (2008) and Lin and Ye (2009) suggest that inflation targeting in developing countries can lead to significant improvements in terms of inflation and output volatility. Many monetary authorities in developing and emerging economies are also moving towards inflation targeting. However; the appropriate level of inflation target for developing countries is still under debate. For instance, Bruno and Easterly (1998) in a cross-country regression showed that the effect of inflation on

growth increases if it exceeds a critical level of 40% while Khan and Senhadji (2001) suggested the inflation threshold for developing countries is between 11 and 12 percent. Moreover, the right level of inflation may vary depending on the specific macroeconomic environment of a given country.

Despite the above facts and the availability of many empirical researches on the threshold level on inflation in the relation between inflation and economic growth, studies which focus on this issue in Ethiopia are negligible. The only study, which I am aware of, on this issue for Ethiopia was undertaken by Emerta (2012) using Khan and Senhadji (2001) approach. In theirempirical model, Khan and Senhadji (2001) interacted the indicator variables with the difference of log inflation threshold and inflation (log (π^*) -log (π_{it})). The subtraction of log (π^*) from log (π_{it}) is to make the relationship between growth and inflation continuous at the threshold level of inflation, π^*. According to Drukker *et al.* (2005), however, Khan and Senhadji's specification does not directly fit into the (Hansen 1999, Hansen 2000) framework. Moreover, the study did not show whether there is only one threshold level or not, and nor how the relationship between inflation and growth switches in different regimes.

This paper, therefore, investigates whether there is a threshold level in the inflation and economic growth nexus using Hansen's (2000) Threshold Auto Regressive (TAR) model for Ethiopia for the period 1971 – 2013. This model assumes all regressors are exogenous. Moreover, unlike Khan and Senhadji's model the empirical specification I estimate is discontinuous in inflation at the threshold point(s). This discontinuity implies that small changes in inflation in a neighbourhood of the threshold point may have different effects depending on whether initial inflation is above or below the threshold level of inflation. In addition, the study documents the historical development of the two variables in the period 1971 to 2013.

The empirical evidence does not support the existence of threshold effect between the two variables in the period. This result contradicts the findings of Emerta (2012). The possible reason for the non-existence of non-linearity during the study period in Ethiopia might be related to the absence

informational friction which interferes with the efficiency of the financial system and inhibits long-run growth is missing in the study period. This might intern be attributed to lack of market led economic system and the low financial sector development in the study period mainly in first 25 years. Due to the small number of observations, however, this result should be interpreted with caution.

The paper is organized as follows: Section two overviews the trend of inflation and growth in the period 1971 to 2013. Section three presents both theoretical and empirical literature reviews. Section four discusses the data issues and describes the variables used. The methodology used is explained in Section five. Section six presents the empirical findings of the study. Finally, Section seven concludes and highlights policy implications of the findings.

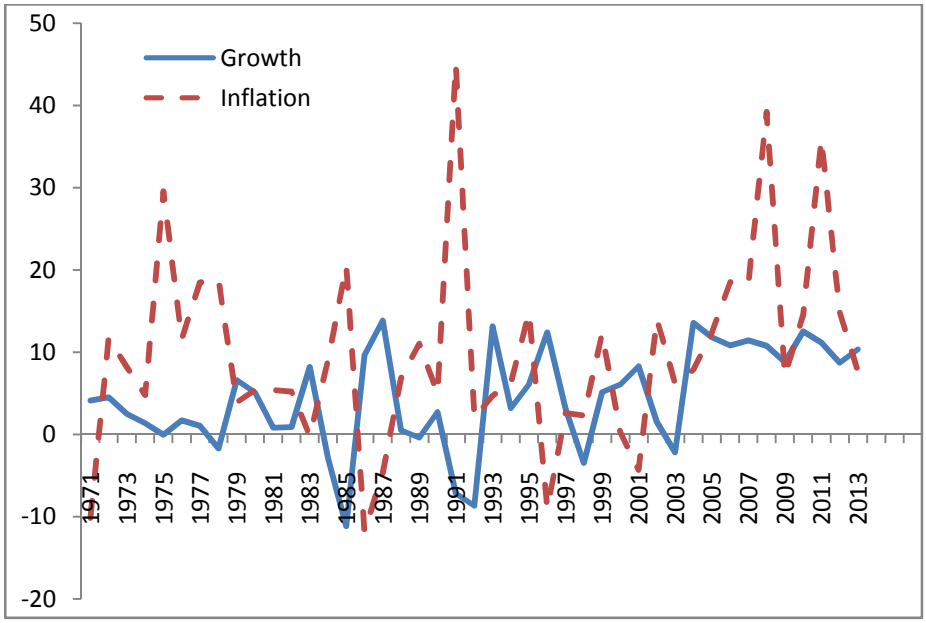
2. Trend of Inflation and Growth in Ethiopia

Examination of the historical developments of inflation and growth in Ethiopia rivals that over the last four decades the Ethiopian economy has gone through diverse phases of inflation and economic growth. These changes associated to the underplaying changes in economic policies and reaction in economic agents. Before 2003, except in the years of supply shocks and war, Ethiopia was characterized as a low inflation country with an inflation rate of single digit level. For instance, from 1971 – 2003, the inflation averaged 7.5%. In this period the highest inflation of 45% was registered in 1991, the year which marks the end of the civil war and the incumbents the Ethiopian People's Revolutionary Democratic Front took power.

During the same period, the average growth rate was 2.7%. From 2004 to 2014, however, inflation started to rise rapidly and average inflation in this period rose to 17.7% with the highest inflation rate of 39.5% registered in 2008. Despite this high inflation, the average growth rate during the same period was 10.7%. Factors attributed to this high inflation during this period include accommodating monetary policy, agricultural supply shock and imported inflation due to the rise in international prices, (Durevall el. al., 2013).

An examination of inflation and growth year by year from 1971 to 2013 in general indicates that almost each inflation peak (bottom) is often followed by growth bottom (peak) indicating that inflation and growth are negatively related during the period (Figure 1) A close examination of these variables in the sub - periods 1971 -1990 and 1991 -2011, however, reveals a different picture, particularly in the second period. Irrespective of the change in inflation between 1972 and 1979, growth was continuously declining and even became negative in the year 1978. This may be attributed to the lack of political stability due to the takeover of power by the military regime and the resulting loss of business confidence which is important for economic growth. After 1979, the relationship becomes negative and continues till 2003.In the period between 2003 and 2008; the two variables are positively related. After 2009, however, growth seems to be less sensitive to inflation as it remains more or less stable though inflation is accelerating (Figure 1).

Figure 1: Inflation and Growth (1971 -2013)



Source: Authors' calculation.

3. Literature Review

3.1 Theoretical Literature Review

The study of inflation and economic growth has attracted extensive literature. Theoretical studies on the relationship between inflation and economic growth reached at different conclusions regarding the impact of inflation on economic growth. Nevertheless, it is widely accepted that stable macroeconomic condition is important for sustained economic growth Gregorio (1993). In the classical growth theory, economic growth depends on the stock of capital, the labour force, land and the level of technology. Though the theory does not explicitly incorporate inflation in its model, it postulated that inflation affects growth negatively. This is because inflation reduces saving and the capital accumulation process by driving up wage costs because of competition and reducing firms' profit.

Early neo-classical (Solow, 1956) believed that there exists no relationship between inflation and growth as growth was assumed to be exogenously determined. Mundell (1963) provided a mechanism through which inflation and economic growth are related. He believed that when inflation rises, it reduces the wealth of the people as the return on real money balances falls. As a result people switch other assets which raise their price and pulls down the interest rate. This boosts up the investment in the economy and growth takes place. Similarly, Tobin (1965) extended the conventional exogenous growth model with monetary framework and predicted a positive correlation between the rate of inflation and the rate of capital accumulation. He argued that an increase in the growth rate of the money supply results in higher inflation and hence in an increase in the opportunity cost of holding cash balances. This results in a reallocation of saving from money into capital and an increase in the stock of capital per worker. This change in the structure of portfolio brings a decline in the real interest rate and an increase in capital accumulation that would result in higher rate of growth.

Stockman (1981) analyzed a neoclassical growth model with inelastic labour supply and showed that the rate of money growth has only transitional effects on the growth of per-capita income if money is held to satisfy a cash-

in-advance (CIA) constraint for consumption. If the cash-in-advance constraint applies to investment, he indicated that increased money growth has negative long run effects. The prediction is that when inflation rate rises it erodes the purchasing power of money. This forces firms to reduce their purchases of both cash goods and capital, resulting in a fall in the steady-state level of output. Therefore, according to Stockman (1981), money is super neutral in the long run if only consumption is subject to the (CIA). Contrary to Stockman's (1981) conclusion, Zeria (1991) found that even CIA constraint hold for consumption. According to Zeria's CIA model, higher rate of inflation raises the amount of inflation tax firms pay as firms hold money because of delayed deposit. This in turn reduces profitability; and slows down capital accumulation and growth.

Monetarists believe that the inflation has a neutral effect. It only affects the nominal variables. Thus they believed that if in an economy the prices double, nominal wages also double, thus keeping the real wages constant. Same is true for all real variables. In this way, they supported the argument money does not have any real effects. Early monetary growth models by Sidrausky (1967) and Brock (1975) investigate a similar problem in the context of a fully optimizing general equilibrium framework and introducing money in the utility function. They found that money is super neutral. In the steady states, the stock of capital per worker is independent of the growth rate of the money supply. With elastic labour supply, the Sidrausky-Brock model implies that although capital per worker (and hence the real interest rate) is independent of the growth rate of the money supply, the supply of labour is not.

Various endogenous growth models also indicate that inflation has a negative effect on economic growth. Gregorio (1993) constructs endogenous growth models that illustrate different channels through which inflation affects growth. The first model focuses on the role of money in firms' operation and its effect on the investment rate. In this model, firms use money to buy new equipment. When inflation increases, firms will be induced to economize in real balances, thereby increasing transaction costs. The increase in transaction costs will raise the shadow value of installed

capital and will depress investment. In the new equilibrium, the return to capital, the rate of investment, and the rate of growth decline.

The second model emphasizes the effects of inflation on the productivity of capital and households' behaviour. The intuition for the negative effects of inflation on employment is that on the firms' side inflation increases labour costs, reducing labour demand with a consequent fall in employment and the marginal product of capital and on the households' side inflation induces substitution from consumption to leisure, reducing labour supply.

Similarly, Jones and Manuelli (1995) developed two endogenous growth models which differ in their formulation of the supply of effective labour offered to firms by workers. In the first, there is no human capital and, as a result, labour supply is zero asymptotically. In this version of the model, inflation rate has no impact on the limiting rate of interest paid on capital income and the asymptotic rate of growth of the economy but on level of economic growth. When nominally a denominated depreciation allowance is included in the tax code, the effective real marginal tax rate on investment income is altered by a change in the rate of monetary expansion. In this case, the simple model of endogenous growth predicts that different rates of monetary expansion are associated with different after tax real rates of return on investment, which in turn affects equilibrium investment decisions and growth. In the second model of endogenous growth, Jones and Manuelli (1995) showed that the steady state level of effort (i.e., number of hours supplied to the market) is determined by the relative prices of consumption and leisure and this margin is distorted by inflation. This has a direct impact on the long-run growth rate of the economy, through an effect on the marginal product of capital.

Some other theoretical studies also argued that depending on its level, inflation can either promote or harm economic growth indicating the existence of non-linearity in growth-inflation association. That is, at lower rates of inflation, the relationship is not significant or even positive; but at higher rates, inflation has a significantly negative effect on growth. In this class of models, Choi, *et al.* (1996) and Bose (2002) showed that financial

market efficiency is affected by various informational asymmetries. In these models, high rates of inflation typically exacerbate informational frictions in the financial market. This friction in turn might result in credit rationing due to adverse selection and thus limit the availability of investment capital and reduce the efficiency of the allocation of savings to investment projects (the efficiency of investment). This interferes with the efficiency of the financial system and finally inhibits long-run growth. At low level of inflation Choi *et al.* (1996) models appears to possess Mundell-Tobin effect by suggesting that financial market frictions are potentially innocuous at low rates of inflation. Thus, in low inflationary environments, credit rationing might not emerge at all, and the negative link between inflation and capital accumulation vanishes.

3.2 Empirical Literature Review

Most of the empirical studies on inflation – growth nexus have used cross country regression and reached at various conclusions. Using a regression analog of growth accounting for cross-sectional and panel regressions for a set of developed and developing counties Fisher (1993) found a non-linear negative relationship between inflation and growth. In the following years many empirical studies used a large panel data across countries to investigate the threshold level of inflation in the inflation- growth nexus.

Sarel (1996) used annual data from1970 to1990 for 87 countries and found that the threshold is at 8% below which the effect of inflation on growth is negligible (or slightly positive) but beyond 8% there is a significant, extremely powerful and robust negative effect on economic growth. On similar lines, Ghosh and Phillips (1998) used a large panel data set, covering IMF member countries over 1960–1996 and found a negative relationship between inflation and growth that is both statistically and economically significant. Khan and Senhadji (2001) examined the nonlinear relationship between inflation and growth using data that cover over 140 industrial and developing countries for the period of 39 years. The result strongly suggests the existence of a threshold beyond which inflation exerts a negative effect

on growth. The threshold is 1–3% and 11–12% for industrial and developing countries respectively.

Drukker *et al.* (2005) employed a non-dynamic, fixed - effects panel model and found two threshold levels of inflation for industrial countries, 2.6% and 12.6%, and one threshold value of 19.2% in non-industrial countries. Vaona and Schiavo (2007) also provided evidence about the nonlinear relationship between inflation and growth using non-parametric methods. Kremer *et al.* (2009) using a dynamic panel model with threshold for 124 countries during the period from 1950 to 2004found that for industrialized countries, the estimated inflation threshold is about 2.5%. For non-industrialized countries, however, inflation hampers growth if it exceeds 17%. Below this threshold, however, the impact of inflation on growth remains insignificant. Espinoza *et al.* (2010) estimate the inflation-growth nexus using a smooth transition regression model. They estimated a threshold of about 10% for all country groups above which inflation quickly becomes harmful to growth. However, for the advanced economies, threshold was much lower.

There has been also a surge in country specific studies of threshold level of inflation in developing countries. Mubarik (2005), for instance, estimates the threshold level of inflation for Pakistan using annual dataset from 1973 to 2000. The estimated model suggests 9 percent threshold inflation level above which inflation is inimical for economic growth. Lee and Wong (2005) estimated the threshold levels of inflation using TAR model for quarterly data set from the period between 1965- 2002 for Taiwan and 1970-2001 for Japan. Their estimation of the TAR models suggests that an inflation rate beyond 7.25% is detrimental for the economic growth of Taiwan. For Japan, however, they found two threshold levels, which are 2.52% and 9.66% suggesting that in the moderate inflation regime, between 2.52 and 9.66% inflation rate, inflation is favourable to economic growth and beyond this threshold value it is inimical for the economic growth.

Some country specific studies were also undertaken in some African countries. Salami and Kelikume (2010) uses annual data spread over two periods 1970-2008 and 1980-2008 to determine the threshold level of inflation for Nigeria

and to examine whether there is significant change in the threshold level for the two periods. They established an inflation threshold of 8% and 7% for Nigeria over the first and second sample period respectively; but the latter fail the test of significance. The study by Phiri (2010) investigates the level at which inflation is least detrimental towards finance-growth activity in South Africa and the least adverse effects of inflation on finance-growth activity are established at an inflation level of 8%.

Using quarterly data for the period of 1997 to 2011, Mohanty *et al.* (2011) suggests that the structural break in the relationship between output growth and inflation in India occurred between 4.0 and 5.5% of inflation above which inflation retards growth. Below this threshold level, however, there is a statistically significant positive relationship. Frimpong and Oteng-Abayie (2010) estimated the threshold effect of inflation on economic growth in Ghana for the period 1960-2008 using threshold regression and found inflation threshold level of 11% at which inflation starts to significantly hurt economic growth in Ghana. Below the 11% level, inflation is likely to have a mild effect on economic activities.

4. Estimation Methodology

The econometric model I used is based on various empirical cross country analysis of inflation-growth nexus (See: for instance: Kormendi and Meguire, 1985 and Barro 1991; 1995. This approach can be extended to country specific time series analysis as follows:

$$gdp_t = \alpha + \beta_i X_i + \varepsilon_t \ldots \quad \textbf{(1)}$$

Where gdp_t is the growth rate of real GDP ($\Delta \log Y$) and ε_t is iid distributed error term with $(0, \sigma 2)$. X_i is a matrix that denotes explanatory variables discussed above including inflation. The empirical model of equation (1) represents the conventional linear growth model. As stated in the literature review, however, the relationship between inflation and economic growth may exhibit a non-linear relationship. I, therefore, used a TAR model suggested by Hansen's (1996, 2000). In the TAR model, the classification of the variable

across regimes is based on an estimate of the time series behaviour that is consistent with reaching the threshold that separates the regimes.

Consider a two-regime TAR model proposed by Hansen (1999, 2000):

$$gdp_t = \theta_1' X_t + u_t, \quad \text{if } q_t \leq \gamma \qquad \textbf{(2)}$$

$$gdp_t = \theta_2' X_t + u_t, \quad \text{if } q_t > \gamma \qquad \textbf{(3)}$$

Where, q_t denotes the threshold variable, inflation, splitting all the observed values into two regimes, γ is the threshold level of inflation. If I knew γ the model would be easily estimated by OLS. Since the threshold is unknown a *priori* so it should be estimated in addition to other parameters. When the inflation is smaller than the threshold parameter, the model estimates equation (2). Similarly, when inflation is larger than the threshold parameter, the model estimates equation (3). Let $I_t(\gamma) = \{q_t \leq \gamma\}$ and {.} as an indicator function with I = 1 if occurs $q_t \leq \gamma$, or I = 0 otherwise. Moreover, when I let $X_t(\gamma) = X_t\, I(\gamma)$, then Equations (2) and (3) can be revised as follows:

$$gdp_t = \theta' X_t + \delta_n' X_t(\gamma) + e \quad e_t \sim \text{i.i.d.}\ (0, \delta_t^2) \qquad \textbf{(4)}$$

Where, $\theta = \theta_2$, $\delta = \theta_1 - \theta_2$, and θ, δ, and γ are the regression parameters to be estimated. Equation (4) allows all the regression coefficients to differ between the regimes. The resulting sum of squared error as a result of estimating these parameters θ, δ, and γ can be expressed as follows:

$$S_1(\gamma) = \hat{e}_t(\gamma)' \, \hat{e}_t(\gamma) \qquad \textbf{(5)}$$

Hansen (1999; 2000) recommends estimating γ by least squares technique. The easiest way to implement this procedure is through minimization of the sum of squared residuals as a function of expected threshold value. Therefore, the optimal threshold value is given by:

$$\hat{\gamma} = \text{argmin} S_1(\gamma) \qquad \textbf{(6)}$$

Once the threshold level of inflation is obtained, the vectors of the slope coefficient estimated are $\hat{\theta} = \hat{\theta}(\hat{\gamma})$ and $\hat{\delta} = \hat{\delta}(\hat{\gamma})$. According to the foregoing

process, the linear Equations, Equation (2) and (3), can be expressed as a nonlinear equation under a two-regime TAR model as follows:

$$gdp_t = \theta_0' + \theta_1' X_t I(q_t \leq \gamma) + \theta_2' X_t I(q_t > \gamma) + \varepsilon_t^* \qquad \textbf{(7)}$$

Where, q_t denotes the threshold variable, inflation, splitting all the observed values into two regimes, γ is the threshold level of inflation. *I (·)* is the indicator function indicating the regime defined by the threshold variable q_t, and the threshold level *γ*. The threshold value is determined by searching the threshold value of inflation that minimizes the sum of the squared error given by equation (6) through the estimating equation (7). The main question in equation (7) is whether or not there is a threshold effect, i.e., to determine whether the estimate is statistically significant. This requires the examination between the linear model (equation 1) vis-à-vis the two-regime model (equation 7). That means, once the threshold value γ is determined through the grid search by estimating equation (7), the null hypothesis of no threshold effect, equation (1), is tested against its alternative hypothesis threshold effect, equation (7), exists, using the maximum likelihood ratio test. The null hypothesis of no threshold effect and its alternative by estimating equation (7) are:

H_0: $\theta_{1i}' = \theta_{2i}'$, and
H_1: $\theta_{1i}' \neq \theta_{2i}'$, where $i = 0,\ldots,n$) **(8)**

To accomplish this test whether the coefficients in the two regimes are the same or not will be undertaken using the F-test based on:

$$F_1 = \frac{S_0 - s_1(\gamma))}{\hat{\sigma}^2} \qquad \textbf{(9)}$$

Where S_0 and s_1 are the residual sum of squares under the nullhypothesis of no threshold effect and alternative discussed above, respectively and $\hat{\sigma}^2$ is the estimated residual variance from the estimated threshold model. Since the threshold parameter γ is unknown under the null hypothesis of no threshold effect exits, the traditional F - test will have non-standard distributions and strictly dominates the Chi-square distribution, and thereby

cannot be applied (Hansen, 1999). Therefore, as suggested by Hansen (1999) the study uses a standard Lagrange Multiplier (*LM*) fixed bootstrap method to calculate the asymptotic critical value and the p-value. The bootstrap sampling produces asymptotically valid p-values Hansen (1996). The null hypothesis is rejected when the statistic F_1 is greater than the critical value at standard significance level.

Once the existence of threshold is known, the next question is whether or not the estimate can be known precisely. When there is a threshold effect ($\theta_{1t}^{'} = \theta_{2t}^{'}$) Hansen (2000) have shown that the threshold estimate, $\hat{\gamma}$, is consistent for the true value of γ, say γ_0. However, the asymptotic distribution of the least square estimate of the threshold parameter, $\hat{\gamma}$, is highly non-standard. Therefore, Hansen (2000) uses the likelihood ratio (LR) statistic to form confidence intervals for the estimated threshold values, $\hat{\gamma}$. The null hypothesis of the threshold value is H_0: $\gamma = \hat{\gamma}$ and the likelihood ratio statistic is given by:

$$LR_1(\gamma) = \frac{S_1(\gamma) - s_1(\hat{\gamma})}{\hat{\sigma}^2} \qquad \textbf{(10)}$$

Where $S_1(\gamma)$ and $S_1(\hat{\gamma})$ are the sums of the squared residuals from equation (7) given the true and estimated value, respectively. The no-rejection region, c(α), α is a given asymptotic level (1 – α is no rejection region confidence level) is the set of values of γ such that , $LR_1(\gamma) \leq c(\alpha)$ where $c(\alpha) = -2\ln(1-\sqrt{1-\alpha})$. This is easiest to find by plotting $LR_1(\gamma)$ against q_t and drawing flat line at c (α) Hansen (1999).

5. Data Issues and Description of Variables

The study used annual time series data for the period of forty three years, 1971 – 2013, obtained from various international and domestic sources. These sources include World Bank World Development Indicator (WDI) for real GDP and Gross Investment in 2011 constant local currency prices, Central Statistical Agency (CSA) for CPI and population, National Metrological Agency (NMA for annual average rainfall data and NBE for private sector credit.

The control variables in the model are based on empirical literature. Kremer *et al.* (2009) suggested that any empirical analysis of the impact of inflation on economic growth has to control for the influence of other economic variables that are correlated with the rate of inflation. Thus, following Khan and Senhadji (2001) and Drukker *et al.* (2005) and Kremer *et al.* (2009), the explanatory variables in the model includes inflation (*inf*) which is based on CPI, investment as a share of GDP growth *(igdp*), the growth rate of population (*pop*) and the annual percentage change in the terms of trade (*tot*) measured as exports divided by imports. In addition to the above variables, I include rainfall, *rain*, real private sector credit growth, *pcg*, second lag of inflation, *l2inf*; and first lag of real GDP growth, *lgdp* in the model. This is because first, the Ethiopian economy is highly dependent on agriculture, which is in turn depends on rainfall. For instance in 2012/13 fiscal year, agriculture constituted more that 47% of GDP, of which crop production accounts 30 percent of GDP (World Bank, 2014).

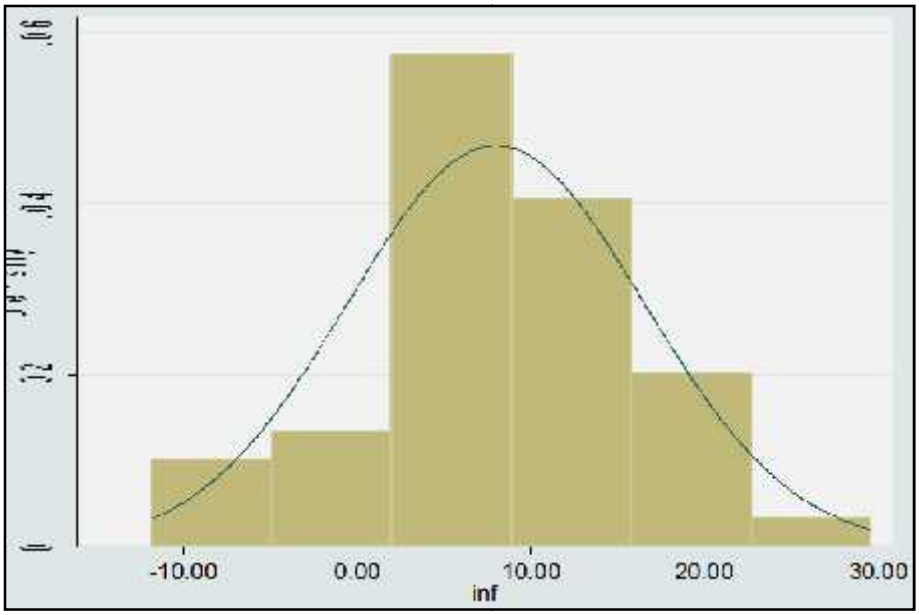
Second, empirical and theoretical literature suggests that financial markets play an important role in the growth process. Changes in inflation do affect activity in financial markets. High inflation exacerbates informational frictions in the financial market that would lead to credit rationing due to adverse selection. This in turn reduces the availability of investment capital and the efficient allocation of savings to investment projects. This interferes with the efficiency of the financial system and finally inhibits long-run growth. Thus, and real domestic credit growth is included as a measure financial sector development[3]. Finally, the second lag of inflation, *l2inf*, and the first lag of real GDP growth, *lgdp, was* included in the model due to the presence of Granger Causality and to account for possible serial correlation and omitted variable bias.

The question now is should the level or log of inflation be related to growth. A regression of real GDP growth on the level of inflation would give much weight to the extreme inflation observations, even though the bulk of the observations may correspond to low and medium inflation rates (Khan and

[3]There is no a single indicator of financial development. In the estimation, I tried to use real domestic credit and broad money growth as a proxy for financial sector development. But they led to the misspecification of the model. So, I used real private sector credit growth (ratio of claim on other sectors to GDP growth).

Senhadji, 2001). Sarel (1996) suggested that the log transformation avoids the extreme observations that distort the regression results and produces symmetrical distribution in inflation. Thus, I first examined the distribution of inflation for the period 1971 – 2013. As indicated in the Figure 2 below, the examination of the distribution of inflation appears to be normal. The statistical test also shows the same.[4] The log transformation, Figure 3, however, failed to produce a normal distribution of inflation. Therefore, I used the level of inflation in the regression analysis.

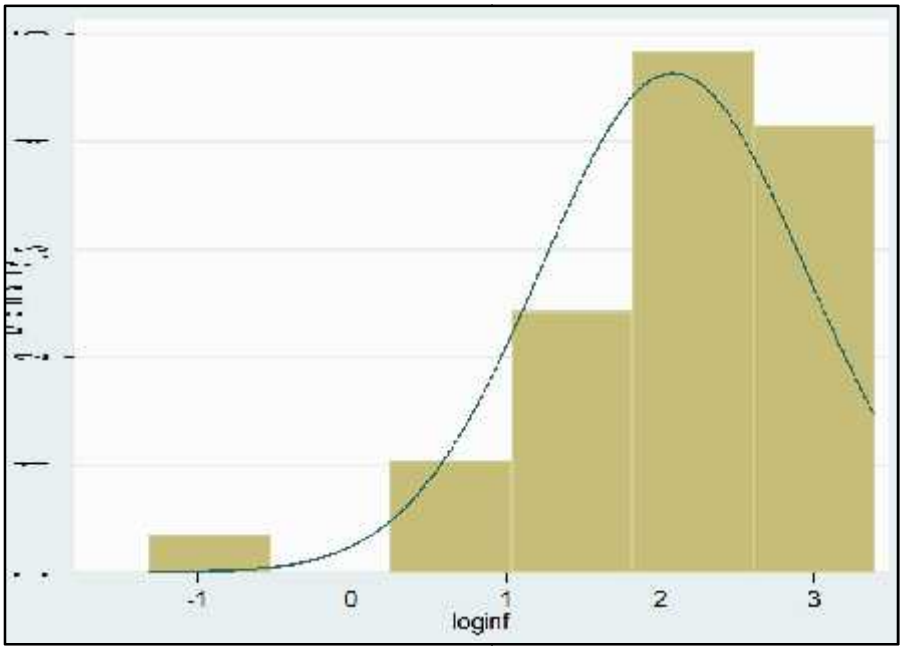
Figure 2: Distribution of Inflation



Source: Author's calculation.

[4] The p-value of swilktest on inflation is 0.54297 indicating that inflation is normally distributed.

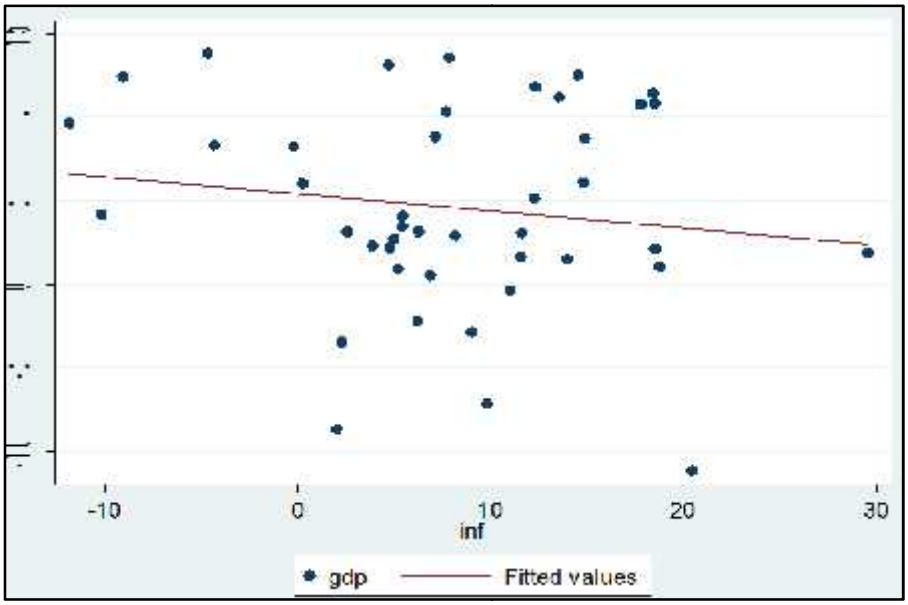
Figure 3: Distribution of Log of Inflation



Source: Author's calculation

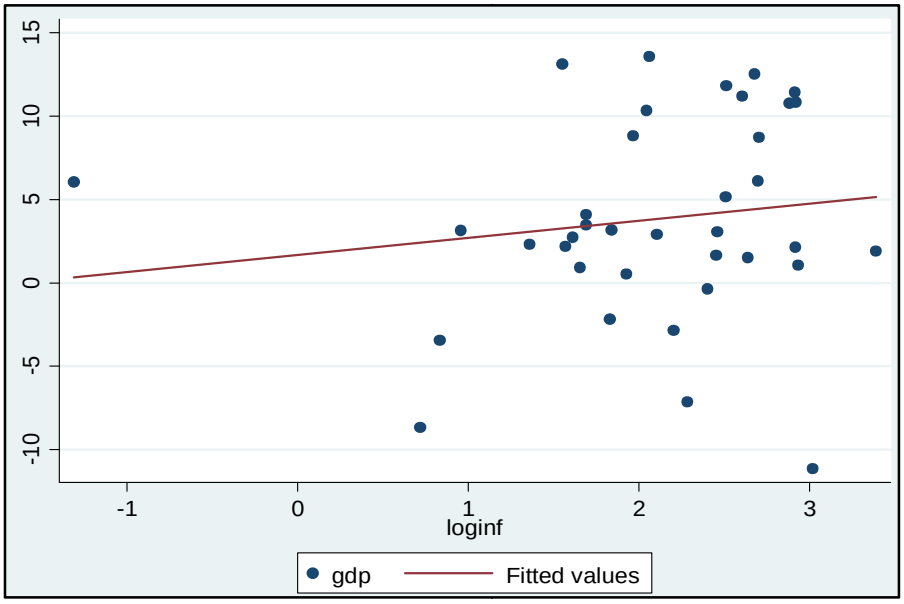
I also examined the simple relationship between inflation and economic growth using a line plot. Figure 4 shows that the relationship between real GDP growth and the level of inflation is negative for all levels of inflation. Looking at this relationship using the log of inflation, however, produces a positive relationship (Figure 5). This result contradicts with the findings of Ghosh and Phillips (1998), and Khan and Senhadji (2001) who found that the relationship between real GDP growth and the log of inflation is slightly positive for low levels of inflation and becomes negative for higher inflation levels. But this simple analysis may obscure the true relationship between the two variables.

Figure 4: Relationships between inflation and real GDP growth



Source: Author's calculation.

Figure 5: Relationship between log of inflation and real GDP growth



Source: Author's calculation.

6. Empirical Results

6.1 Linear Model

Before I undertake the simple linear relationship of inflation and growth, I investigated whether the variables used in the models are stationary or not to ensure consistency of results and avoid spurious regression. To this end, we employed the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) units root tests with "constant" and "constant and trend". The PP generalizes the ADF test and provides robust estimate in the presence of serial correlation, time dependent hetroskedasticity and structural break in time series. The results are presented in Table 1 below. The estimation results of ADF and PP unit root test show that the variables are stationary at 1%significance level except for *igdp* and *pop*. Since first differencing of these variables makes them stationary, I used their first difference, *igdpD1* and *pop.D1,* in the regression analysis.

Table 1: Unit root test results

Variables	ADF test		PP test	
	Constant	Constant and trend	Constant	Constant and trend
Gdp	-4.585*	-5.581*	-4.565*	-5.522*
Inf	-5.926*	-5.825*	-5.953*	-5.863*
igdp.D1	-4.462*	-5.546*	-4.510*	-5.585*
pop.D1	-2.618***	-2.597	-2.642***	-2.597
Tot	-6.830*	-6.924	-7.015*	-7.216*
rain	-4.468*	-4.568*	-4.509*	-4.588*
pcg	-4.997*	-5.109*	-4.927*	-5.038*
l2inf	-5.788*	-5.697*	-5.816*	-5.733*
lgdp	-4.617*	-5.51*	-4.588*	-5.452*

Source: Author's calculation.

Note: ***and * indicate significant at 1% and 10% levels respectively.

The t-statistics are computed using MacKinnon (1996).

To understanding the direction of causality between inflation and growth and to decide the number of lags of inflation to be included in the regression for

threshold inflation search, we used Granger-Causality test. Thus, Irun a VAR model in order to know whether inflation "Granger-causes" growth or vice versa. Inflation is said to Granger-cause growth if, given the past values of growth, past values of inflation are useful for predicting growth. As indicated in Table 2 the Wald test in the first equation is that the coefficients on the two lags of inflation that appear in the equation *gdp* are jointly zero. Therefore, the null hypothesis that inflation does not Granger-cause growth is rejected at 5% significant level. Similarly, in the second test the null hypothesis that growth does not Granger-cause inflation is rejected at 5% significant level indicating the existence of reverse causation from output growth to inflation.

Table 2: Granger causality Wald tests

Equation	Excluded	chi^2	Df	Prob>chi^2
gdp	**inf**	8.6077	2	0.014
Inf	**gdp**	8.5288	2	0.014

Source: Author's calculation.

Once the threshold value which minimizes the sum of squared residuals given by equation (6) is determined through the grid search, determining whether or not there is a threshold effect requires the comparison between the linear model vis-à-vis the two-regime model.

Thus, I first established the linear model for inflation and growth nexus for the period 1971 to 2013 by employing a general to specific modelling approach. For that, first I estimated a liner distributive lag growth model of equation (1) using the explanatory variables discussed above using OLS estimation technique[5]. Nevertheless, the model suffers from omitted variable bias and multicollinearity. Then, I removed the insignificant predictors with the highest variance inflation factor[6] one by one and re-estimated the model for the remaining regressors. When I drop the insignificant variables from

[5]But it should be noted that OLS estimation of a dynamic model such as this produces based estimate.

[6] First lag of inflation and second lag of real GDP growth were the one taken out of the model.

the mode step by step, the significance of some variables changed with a very small decline in the calculated value of R^2 for the overall regression. The final linear model estimated is presented in the Table 3 below[7].

Table 3: OLS Estimates Inflation - Growth

Dependent Variable: Real GDP Growth				
Variables	**Coefficient**	**Std. error**	**t-Statistic**	**Prob.**
Inf	-0.19	0.11	-1.79	0.08
igdp.D1	0.50	0.33	1.53	0.14
pop.D1	-0.44	7.05	-0.06	0.95
Tot	0.07	0.04	1.72	0.10
rain	2.95	15.39	0.19	0.85
pcg	-0.04	0.06	-0.69	0.50
l2inf	0.26	0.10	2.50	0.02
lgdp	0.26	0.17	1.57	0.13
_cons	-17.03	104.66	-0.16	0.87
Number of obs = 41		Breusch-Godfrey LM test: 1.001 (0.3171)		
Adj R-squared = 0.2710		Breusch-Pagan: 0.12 (0.7345)		
Ramsey RESET test: 1.74 (0.1802)				

Source: Author's calculation.

Note*:* The numbers in the brackets are t- statistics

6.2 Tests for the Existence of Inflationary Threshold Effect

After establishing the linear model, I proceed to the investigation of the inflationary threshold effect. The threshold value is determined by searching the value of inflation that minimizes the sum of the squared error (RSS) given by equation (7) through the estimating equation (9). I start the search for threshold level of inflation by estimating equation (9) for a range of inflation starting from 3% to 18%[8]and use the level of inflation as the threshold variable that minimizes RSS.

[7]The insignificance of rainfall might be due to the small sample size and the resulting low statistical power of the regression that prevents any potential association of reasonable size to be statistically significant.

[8] Because of the small number of observation and the resulting multicollinearity problem, it is not possible to look for a threshold level of inflation beyond 18% of inflation

To see the stability of the inflation level which minimizes the RSS, I started the search with the basic mode i.e., without *rain*, pcg, *lgdp and l2inf*. In this search, the minimum RSS found to be at inflation rate of 15%, 16% and 17%. When rainfall and real private sector credit growth added the model one by one, the threshold level of inflation remains the same. Adding *lgdp* further to the model, nonetheless, produces a threshold level of inflation at 14%. In the final model, which includes all variables, including *l2inf*, which appeared is part of the final linear model, the threshold level of inflation remains the same at 14%.Though the threshold level remains in the final two models remains at 14%, it happens to be in the range of 14% to 17%. This indicates the threshold level of inflation is unstable.

Having found the threshold level is 14%,I should test whether this threshold level is statistically significant or not. To do this, I need to test the null hypothesis that $\theta_{1t}^{'} = \theta_{2t}^{'}$. If the null hypothesis is true, it allows us to conclude a threshold exists in the inflation-growth relationship in Ethiopia for the period 1971 to 2013. The problem in testing the significance of a threshold is that the threshold γ is not identified under the null hypothesis. This implies that the classical tests do not have standard distributions and critical values cannot be read off standard distribution tables. Thus, I follow Hansen (1996) recommendation and used bootstrapping procedure to obtain the p-value for the test of a significant threshold. Table 4 below shows the result from bootstrapping procedure.

Table 4: Threshold effect test results for the period from 1971 to 2013

Test Hypothesis	F_1 test	Bootstrap p-value	Threshold Estimate (%)
Ho: No threshold Effect	5.60	0.35	14

Source: Author's calculation.

Note: Estimation period is 1971 to 2013. The threshold is obtained by the minimum of sum of squared residual.

The F-test and the asymptotic p-values obtained through 462bootstrap replications[9] to test the equality of the coefficients in the two regimes are reported in Table 4 above. The F- statistics of 5.60 for specification (7)

[9]The bootstrap replication was undertaken 1000 times. But, one or more parameters could not be estimated in 538 bootstrap replicates.

exceeds the critical values even at the 10% significant level, suggesting that coefficients in the two regimes are the same. Therefore, I fail to reject the hypothesis that there is no threshold effect in the relationship between inflation and growth in Ethiopia for the period 1971 - 2013[10].

Given the insignificance of the threshold estimate, the result is contrary to the result obtained by Emerta (2012), who found 11% inflation threshold for the period 1970-2011. The possible reasons for this difference might be related to the difference in model specification and the use of different explanatory variables. Emerta (2012) used Khan and Senhadji's (2001) model specification. But, as indicated in Drukker *et al.* (2005), this speciation does not directly fit into the (Hansen 1999, Hansen 2000) TAR framework. In addition, Emerta (2012) modelled drought using dummy variable. In the model, however, I modelled rainfall explicitly to see how rainfall affects growth.

The possible reasons for the non-existence of non-linearity in Ethiopia for the stated period might be due to the absence of market led economic system and the low financial sector development of the study period mainly in first 25 years. In the period 1971 to 1991, the financial sector was fully controlled by government. In this period, the allocation of credit was not based on price signal. Consequently, the public sector was favoured in loan provision while the private sector was disparaged to have access to credit. Though government monopoly of financial institution was ceased in the early 1990s[th] when NBE allowed private ownership of financial intuitions, the financial sector is at its early infancy stage. Bank deposit real interest rate does not respond to inflation and has long been negative (IMF, 2013).

The recent economic growth is driven by the heterodox public investment which is implemented over the national budget and through State Owned

[10]As a robustness check I estimated a quadratic specification of inflation as this method is used by many to find a threshold level of inflation in the inflation – growth nexus. Though this model speciation assumes the existence of non-linear relationship between the two variables, the result reveals the absence of this non-linear relationship between inflation and growth in Ethiopia in the period 1971 to 2013. The result for this can be available up on request.

Enterprises (SOEs) using domestic and external sources of financing (World Bank, 2016). The main sources of domestic finance include Treasury bill (T-bill), bond, and direct advances form NBE. The bond purchase is undertaken by state-owned banks to finance SOE projects at low interest rate, 6%. Given the dominance of state-owned banks which accounts more than three forth of banking system assets and loan and advances (World Bank, 2015), and credit rationing in the presence of negative real interest rates provides cheap sources of financing for public projects. This implies the existence of financial repression that kept interest rates and borrowing cost of the government low that.

Moreover, the private sectors which are identified as priority areas and expected to increase export performance and generate a large foreign exchange earnings and import substituting industries were given generous credit schemes (Mulu, 2013). As a result, Mulu mentioned that real interest rate was virtually negative over most of the years since 2002/03 as the interest rate was deliberately kept low even in the period of high inflation.

All these shows that market forces do not play a prominent role in the allocation of credit in Ethiopia. This may indicate that the credit rationing and reduction of credit availability due the information friction created by high inflation which in turn inhibits long-run growth may not take place properly in Ethiopia for the stated period.

7. Conclusions and Policy Implications

The conventional view advocated mostly by the short run Phillips Curve states that higher inflation tolerance could yield higher growth. However, substantial body of evidence suggests that sustained high rates of inflation can have adverse consequences for real economic growth in the long run. The classical growth theory and the early monetary growth models by Stockman (1981) and Zeria's (1991) postulate a negative relationship between inflation and growth. The neoclassical growth theory which is championed by Mundell (1963) and Tobin (1965), however, predicted a

positive correlation between the rate of inflation and the rate of capital accumulation.

The new class of endogenous growth models, however, shows that inflation and growth have non-linear relationship. In the theoretical models of Choi, *et al.* (1996) and Bose (2002) high rates of inflation exacerbate informational frictions in the financial market. This friction in turn might result in credit rationing due to adverse selection and thus limit the availability of investment capital and reduce the efficiency of the allocation of savings to investment projects (the efficiency of investment). This interferes with the efficiency of the financial system and finally inhibits long-run growth.

Quite large number of country and country specific empirical works also suggests the existence of non-linear relationship between inflation and growth. Therefore, this paper examines the existence of the non-linearity in the relationship between inflation and growth for Ethiopia. To this end, I used TAR econometric model developed by Hansen (1996, 2000). The investigation was undertaken using annual CPI growth rate, inflation, as a threshold variable for the periods 1971 to 2013. The estimation result for the period does not support the existence of non-linear relationship between the two variables. The possible reason for the absence of non-linearity during the study period in Ethiopia might be related to the absence informational friction which interferes with the efficiency of the financial system and inhibits long-run growth is missing in the study period. This might intern be attributed to lack of market led economic system and the low financial sector development in the study period mainly in first 25 years. Due to the small number of observations, however, this result should be interpreted with caution.

Even though there is no threshold level of inflation in the period 1971 to 2013, the empirical result from the linear model suggests that current inflation is negatively related to economic growth; and inflation has a long run positive impact for the economy in the sense that current inflation affects economic growth positively after two years. This might be due to the existence of financial repression which keeps borrowing cost low

irrespective of the change in inflation. Even so, it should be noted that inflation has a negative effect on standard of living and macroeconomic stability. Therefore, policy makers should balance this positive effect with its negative impact on the standard of living and poverty especially given the high level of poverty in country. The problem would be how to strike the balance. To this end, both monetary and fiscal authorities strengthen their coordination effort and continue to work together to avoid the setting of conflicting macroeconomic objectives. Moreover, continuous assessment of the inflation threshold in the inflation growth nexus using different models and other determinants of growth in addition to the one used by Khan and Senhadji (2001) is important. This would help to design more appropriate monetary and fiscal policy, and put the economy under sustainable development path.

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Appendix:

Appendix1: Correlation matrix of the variables

Variables	***gdp***	***inf***	***igdp.D1***	***pop.D1***	***tot***	***rain***	***pcg***	***l2inf***	***lgdp***
gdp	1.00								
Inf	-0.15	1.00							
igdp.D1	0.30	0.18	1.00						
pop.D1	-0.11	-0.05	-0.02	1.00					
Tot	0.31	0.01	0.00	-0.36	1.00				
rain	0.25	0.08	0.20	-0.04	0.08	1.00			
pcg	0.03	0.25	0.32	0.12	-0.02	0.19	1.00		
l2inf	0.42	0.07	0.21	0.05	0.05	0.24	0.05	1.00	
lgdp	0.30	0.22	0.28	-0.07	0.14	0.40	0.44	0.08	1.00

The Dynamics of Food Price Convergence in Ethiopia

Degye Goshu[1]

Abstract

This paper examines the dynamics of relative price convergence of nine agricultural commodities among regions in Ethiopia using a panel dataset of 18-year monthly prices collected by CSA in two periods (1996-2004 and 2005-2013). Panel unit root tests, fixe-effects, and half-life method were employed to estimate the rate and speed of relative price convergence of commodities. The findings markedly indicate low rate and speed of relative price convergence and considerably persistent relative price shocks unadjusted among regions, suggesting the need to design proactive market policy intervention in improving convergence of commodity prices in Ethiopia.

Keywords: Food price, commodity, price convergence, fixed-effects, Ethiopia.
JEL codes: Q11, Q13.

1. Introduction

The burgeoning literature on commodity price adjustment suggest the importance of spatial, temporal, vertical and intercommunity price integration for the presence of market efficiency. A priori economic theory suggests that spatially efficient markets increase supply and decrease price of goods and flow of goods and services in between food deficit and surplus areas, generating positive net welfare effects. Spatial food insecurity can be

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even be prevented before triggering famine if spatial arbitrage is efficient in distributing produces from surplus areas to deficit areas (Webb *et al.,* 1992; Tschirley, 1995).

Since grain trade liberalization in 1990, a number of short- and long-run policy measures including establishment of commodity exchange, banning of export of food stables like cereals following food price inflation, direct price setting (price ceilings) on some basic food items (oil, wheat flour, sugar), and privatization of many parastatals were implemented to improve domestic commodity market performance in Ethiopia..The most important question in this regard is whether or not these market reform measures and policies have resulted in domestic market performance in Ethiopia. One of the common indicators of the success of domestic market performance is price convergence. Price convergence shows the degree to which prices for goods in spatially differentiated markets, regions or countries have moved together, or converged towards unity (Susanto *et al.* 2008; Bukenya and Labys, 2005; Cecchetti, *et al.* 2002; Parsely and Wei, 1996). Price divergence, as opposed to this, shows the degree to which prices have moved apart as an indicator of poor internal market performance mainly attributable to inadequacy of market information, institutions and infrastructure. It is expected that increases in marketing infrastructure and globalization are broadly suggestive of relative commodity prices in spatially differentiated markets adjusting towards unity over time.

The primary focus of most previous studies in Ethiopia was, however, to measure the spatial, vertical or intercommunity price transmission among markets (se Webb *et al.,* 1992; Dercon,1995; Asfaw and Jayne, 1997, 1998;Gebremeskel *et al.,* 1998; Eleni,2001; Kindie *et al.,*2006; Kindie, 2007; Degye *et al.,*2009). They also have various limitations in terms of market coverage, methodology, and many empirical irregularities. The assumption of spatial price adjustment that commodities are homogenous is not testable and would frequently be unsatisfied. Commodity markets are different in terms of seasonality, geographical location, and other factors, which are difficult to be accounted for by such price adjustment models.

Because of these problems, there is still a wider gap of adequate and relevant empirical evidence on the Ethiopian commodity marketing system.

Multivariate price series models frequently employed for the purpose of spatial, vertical and inter-community price adjustment in Ethiopia have some common limitations and difficulties. The first limitations is that researchers are forced to focus on limited number of markets and commodities due to the fact that these methods are data-intensive, leading to model misspecification emanating from unavoidable omission of many important markets and commodities. Second, the existence of unobserved market-specific effects is ignored, and the assumption that markets are static is admitted. But the market-specific unobserved heterogeneities can contribute more towards the dynamics of price adjustment. The other most important limitation is that they are point estimates, unable to capture the dynamic pattern of price adjustment.

This paper employs rigorous dynamic panel data models which can account for non-time dependence, transportation costs, and unobserved quality differences of commodities. The presence of market or region fixed effects in the estimation also suggests the relative version of the law of one price (LOP), with an advantages over the absolute LOP, which assumes that transaction costs vary proportionately over time. The attempt to use wholesale and retail prices at supply and destination markers in multivariate forecasting models cannot capture these unobserved cross-section-dependent heterogeneities. Accordingly, this study was conducted to generate new and reliable empirical evidence on the dynamics of price convergence of major commodities traded and consumed in Ethiopia. Using an 18-year monthly price series of 9 commodities in 7 regions (including the benchmark region), the dynamic process of food price convergences was investigated over three periods (1996-2004, 2005-2013, and 1994-2013). The remaining part of the paper covers theoretical and empirical framework in Part 2, dataset and analytical methods in Part 3, and presentation and discussion of empirical findings in Part 4. Finally some concluding remarks are presented in Part 5.

2. Theoretical and Empirical Framework

2.1. Theoretical framework

Theoretical and empirical literature proposes many alterative models of univariate and multivariate time series forecasting. If two or more non-stationary time series follow a common longrun path, a test for cointegration would lead to a stationary linear combination of the time series (Engle and Granger, 1987; Johansen, 1988). Co-integration analysis is useful because estimated coefficients from cointegrated regressions will converge at a faster rate than normal, they are super consistent. The two widely employed models of multivariate time series are the vector autoregressive (VAR) and vector error correction (VEC) (Johansen, 1995). The VEC specification restricts the longrun behavior of endogenous price variables to converge to their longrun equilibrium relationships and allow the shortrun dynamics. Johansen proposes two different likelihood ratio tests of the significance of canonical correlations, the trace test and maximum eigenvalue test (Johansen and Juselius, 1990; Johansen, 1995). The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of k cointegrating vectors. The maximum eigenvalue test, on the other hand, tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of $r+1$ cointegrating vectors. Since the critical values used for the maximum eigenvalue and trace test statistics are based on a pure unit-root assumption, they will no longer be correct when the variables in the system are near-unit-root processes. Thus, the real question is how sensitive Johansen's procedures are to deviations from the pure-unit root assumption.

The very limitation of VAR and VEC model is that they both assume linear price adjustment, which might not be always true. Unlike models with linear price adjustments, the threshold vector error correction (TVEC) and Markov-switching vector error correction (MSVEC) models are appropriate candidates for estimation of short-run and long-run adjustment parameters under the presence of nonlinear price adjustments (e.g. Meyer, 2008; Tadesse *et al.* 2008; Reziti *et al.* 2008; Saghaian, 2008). A threshold introduces nonlinearities into the functional relationship and "specifies the operation modes of the system". The threshold principle is the local

approximation over the states, or the introduction of regimes via thresholds. Such regime-dependent parameter stability of some time series is usually referred to as threshold behavior (Tong, 1990). The TVEC model and the MSVEC models are the two regime-dependent econometric models for price transmission analysis. The assumptions regarding the nature of their regime-switching mechanisms are fundamentally different so that each model is suitable for a certain type of nonlinear price transmission (Ihle and Cramon-Taubadel, 2008).

However, all the above multivariate price series models have at least three common limitations and difficulties. First, they are data intensive which force researchers to focus on limited number of markets and commodities rather than including all important markets and commodities in their analyses. Second, they ignore the existence of unobserved market-specific effects. The market-specific unobserved heterogeneities can contribute more towards the dynamics of price adjustment. Finally, they are point estimators, unable to capture the dynamics of price adjustment process.

As evidenced by many scholars including Banerjee (1999), Maddala and Wu (1999), Hadri (2000), Levin *et al.* (2002), Im, *et al.* (2003), Pindyck (2004), and Bai and Ng (2010), panel estimators have methodological power to capture temporal and spatial dynamics of price convergence which cannot be accounted for by simple time series or simple cross sections. Panel estimators are powerful to any other estimators for the fact that they allow to control for individual or market-specific heterogeneity, better to study any dynamics of price adjustments, give time ordering of marketing events, and enable to solve omitted variable problems which are the major sources of divergent implications from previous studies in Ethiopia. The panel unit root test procedures are more relevant than are other methods if the panel is of moderate size (between 10 to 250 markets or regions) and large observation (25 to 250 per market or region) (Levin *et al.*, 2002; Goldberg and Verboven, 2005).

One of the first unit root tests developed for dynamic panel model is that of Levin, Lin, and Chu (LLC) (Levin *et al*., 2002). Their test is based on analysis of a simple autoregressive equation:

$$\Delta y_{i,t} = \sim_i + \text{¢}_i t + \text{a}_t + \text{°}_i y_{i,t-1} + \text{s}_{i,t}, \quad i = 1,\ldots,N,\ t = 1,\ldots,T \qquad \textbf{(1)}$$

This model allows for two–way fixed effects ($\sim$ and a) and market–specific time trends. The market–specific fixed effects (FE) are important sources of heterogeneity, since the coefficient of the lagged dependent variable is restricted to be homogeneous across all markets of the panel. The test involves the null hypothesis $H_0 : \text{°}_i = 0$ for all against the alternative $H_a : \text{°}_i < 0$ for all i with auxiliary assumptions under the null also being required about the coefficients relating to the deterministic components. The LLC test assumes that the individual units (or regions in this case) are cross-sectional independent[2].

The panel unit root tests by Im, Pesaran, and Shin (IPS) (Im *et al.,* 2003) extends the LLC framework to allow for heterogeneity in the value of °_i under the alternative hypothesis. Given the same equation, the null and alternative hypotheses are defined as:

$$H_0 : \text{°}_i = 0, \qquad H_a : \text{°}_i < 0, \quad i = 1,\ldots,N_1;\ i = N_1 + 1,\ N_1 + 2,\ldots,N. \qquad \textbf{(2)}$$

Under the null hypothesis, all series in the panel are non stationary processes; under the alternative, a fraction of the series in the panel is assumed to be stationary. This is in contrast to the LLC test, which presumes that all series are stationary under the alternative hypothesis. The errors, $\text{s}_{i,t}$,

[2] The LLC test may be viewed as a pooled Dickey–Fuller (FD) or ADF test, potentially with differing lag lengths across the units of the panel. It is applicable to small-large panels (small number of markets or regions and longer time series).

are assumed to be serially auto correlated, with different serial correlation properties and differing variances across units. IPS test proposes the use of a group–mean Lagrange multiplier (LM) statistic to test the null hypothesis. The ADF regressions can be computed for each unit, and a standardized statistic[3] computed as the average of the LM tests for each equation.

2.2. Empirical Evidence in Ethiopia

There have been different studies on commodity market performance in Ethiopia since the commodity market liberalization in 1990. Webb *et al.* (1992) have studied the spatial integration of cereal markets in Ethiopia to detect the spatial efficiency of local markets and their contributions in alleviating food shortage that has occurred because of drought in different geographical locations. Relatively better methods of analyzing market integration were used after Dercon (1995) who used cointegration technique to analyze market integration in Ethiopia and verified that most market prices were cointegrated with Addis Ababa price. After grain trade liberalization in Ethiopia, the major breakthrough in grain market efficiency studies was the one conducted by Grain Market Research Project (GMRP). With this project, Asfaw and Jayne (1997, 1998), Gebremeskel *et al.* (1998), and Eleni (2001) analyzed the response of Ethiopian grain markets to market liberalization policy and market structure, conduct, and performance of many grain markets. They estimated descriptive measures of market integration and identified many constraints in the grain marketing system.

Kindie *et al.* (2006) have analyzed the dynamics of six white wheat markets (Nazreth, Shashemenie, Jimma, Addis Ababa, Dire Dawa, and Mekelle) using vector autoregressive (VAR) model assuming the first three to be surplus and the last three to be deficit markets of wheat. They used the VAR model as a better alternative to address the simultaneous interaction of markets by identifying markets with common factors for policy intervention.

[3] Adjustment factors are used to derive a test statistic that is distributed standard normal under the null hypothesis. In the use of the IPS test a group–mean bar statistic, where the statistics from each ADF test are averaged across the panel are used. Im *et al.*(2003) demonstrate that their test has better finite sample performance than that of LLC.

They selected these markets as they were major supply and consumer markets. The monthly wholesale price levels were tested for causality using VEC mechanism (VECM) in which case Nazreth and Shashemenie were found to be price leaders while there was no exclusive price leadership of wheat markets in the country. This study was relatively more empirical than previous studies conducted in Ethiopia and the weak parameter estimates signify the considerations to be taken in sampling of relevant wheat markets to avoid risk of misspecification of price interdependence. Kindie (2007) analyzed the spatial integration of wheat markets between Ambo and Addis Ababa using autoregressive distributive lag (ARDL) approach to estimate the dynamics of price transmission and recommended that it was cost-effective to initiate price intervention measures in Addis Ababa rather than in local markets.

Degye *et al.* (2009) used a bivariate instrumental variables method to estimate shortrun and longrun dynamic adjustment coefficients between 10 markets of wheat (Addis Ababa, Nazreth, Adaba, Diksis, Ambo, Debre Birhan, Woliso, Shambu, Dessie, and Mekelle). They found that Nazreth was the dominant wheat market dictating price formation in the country which was in line with the results of Kindie *et al*. (2006). Kindie (2009) analyzed the price formation process for three cereal commodities (teff, wheat, and maize) in three markets (Addis Ababa, Nazreth, and Shashemene) using an ECM to identify a commodity which leads price formation in these three markets for cost-effective price stabilization measures. The results show that maize price plays a leadership role in the dynamics of teff and wheat prices at all market pairs except that of Addis Ababa teff market. For these three commodities, Rashid (2011) also analyzed the price leadership role by adding other three markets (Dire Dawa, Jimma, and Mekelle) but employed VAR and VEC models. He found the same result in that maize was the most significant in exacerbating price variability with respect to the persistence of shocks to itself and the two other cereals.

Degye (2011) analyzed the consumer price risk involved in Addis Ababa market for seven commodities (wheat, horse beans, beef, cow milk, egg,

banana, and onions) selected from different commodity groups. After classical decomposition of the overall price risk involved into seasonality, predicable trends, and other unpredictable sources of price risk, he found that seasonality was the major source of consumer price risk.

3. Dataset and Empirical Models

3.1. The dataset

This paper utilizes monthly price series of commodities widely traded and consumed in the four major regions (Amhara, Tigray, Oromia and SNNP) and three urban centers (Addis Ababa, Dire Dawa and Harari) in Ethiopia for the period 1996 to 2013. It considers nine commodities in six regions (panels) surveyed for 211 rounds (monthly observations) per commodity. Construction of panel data of these regions and commodities allows estimation of relative price convergence of each commodity by a pooled sample of 1266per commodity.

Major commodities used in the analysis were selected by their weights in the consumption bundle used by Central Statistical Agency (CSA) to compute the consumer price index (CPI) at national and regional level. The weight of each group of commodities is indicated in Table 1. According to the 2013 estimation of the CPI by the CSA, food covers about 57% of the consumption bundle in Ethiopia (CSA, 2013).

Based on the weight of each commodity in the consumption bundle, nine commodities were selected for the analysis. Three cereals (teff, wheat, maize), livestock and livestock products (beef, sheep), fruits (banana, orange), and vegetable and tuber crops (onions, potato) were the major commodities widely traded and consumed in these regions of Ethiopia. To conduct the price and consumption survey in these regions, CSA has used 100 markets and a maximum of 193 commodities (CSA, 2013). The CSA aggregates the market level monthly average prices to regional and national levels in order to compute the national and regional CPI by commodities and commodity groups. But to minimize problems related to aggregation and to

secure reliability of the aggregation process in this study, monthly prices were aggregated to regional and national levels by the author.

Table 1: Major food groups and their weights from consumption expenditure

No.	Major group	Weights (2006 base year)
1.	**Food**	0.570
1.1.	Cereal, un-milled	0.112
1.2.	Milk, cheese and egg	0.095
1.3.	Food taken away from home	0.054
1.4.	Pasta, bread etc.	0.040
1.5.	Coffee and tea leaves	0.040
1.6.	Oils and fats	0.036
1.7.	Meat	0.032
1.8.	Pulses	0.030
1.9.	Vegetables and fruits	0.020
1.10.	All other food items	0.111
2.	**Non-Food**	0.430
2.1.	House rent, construction materials, water and fuel and power	0.187
2.2.	Clothing and footwear	0.120
2.3.	Furniture, furnishing, household equipment and operation	0.070
2.4.	All other non-food items	0.053
	Total	1.000

Source: Adapted from CSA (2013).

To investigate the dynamics of relative price convergence of commodities among regions, the 18-year monthly price data was divided into two periods, nine years each (1996-2004 and 2005-2013). The first period is characterized by depressed commodity prices and the second by skyrocketing food prices exhibited since 2004/05 in Ethiopia. The point estimates from each period were compared between each other as well as to the pooled data (1996-2013). The changes in the speed and rate of price convergence were used to report on the rate and speed of relative price convergence of the commodities among regions in Ethiopia.

3.2. Benchmark price

Relative prices of all regions were computed as a ratio of the benchmark price in Addis Ababa. Selection of a benchmark region and price requires adequate information on the supply chain channels, origin and destination markets, and commodities traded and consumed in each region. The benchmark region is assumed to have the supply of and the demand for all commodities under consideration. Addis Ababa is the best candidate benchmark market in Ethiopia since it has trade relationships with all regions either by supplying to or receiving from the regions. This is partly verified by the relative prices computed by selecting Addis Ababa price as a benchmark (Table 2). Moreover, Addis Ababa is the best candidate because it is geographically separated from all regions except Oromia. There is no any other region satisfying the assumption of geographical separation in spatial price convergence and integration.

Table 2: Mean values of monthly relative prices of commodities by regions (1996-2013)

Region	Teff	Wheat	Maize	Beef	Sheep	Banana	Orange	Onions	Potato
Tigray	0.94	1.06	1.07	0.89	0.80	1.24	1.11	1.38	1.75
Amhara	0.78	0.93	0.92	0.81	0.67	1.03	0.82	1.22	1.06
Oromia	0.83	0.89	0.82	0.89	0.66	0.81	0.77	1.26	1.03
SNNP	0.82	0.88	0.75	0.85	0.54	0.50	0.49	1.39	0.94
Harari	1.03	1.18	1.11	1.12	0.99	1.17	1.06	1.23	1.28
Dire Dawa	1.06	1.15	1.11	1.18	0.99	1.07	0.91	1.14	1.21
Mean value	0.93	1.04	0.92	0.92	0.69	0.96	0.85	1.36	1.34
Standard deviation									
Between	0.12	0.13	0.16	0.15	0.16	0.27	0.22	0.10	0.29
Within	0.07	0.12	0.14	0.11	0.14	0.20	0.18	0.27	0.28
Overall	0.13	0.17	0.20	0.18	0.20	0.32	0.27	0.29	0.39

Source: Author's computation.

Regions with relative prices of commodities less than unity are expected to be suppliers of those commodities while those with relative prices greater than unity are destination markets of commodities supplied from Addis

Ababa[4]. It indicates the trade relationships of all regions with Addis Ababa for all commodities under study. The computed relative prices are as expected in the real trade relationships among regions in Ethiopia.

Teff is supplied to Addis Ababa from all regions with the exception of Harari and Dire Dawa (destination regions). Addis Ababa supplies wheat received from other regions to Tigray, Harari and Dire Dawa. Maize is supplied by Addis Ababa to deficit regions (Tigray, Harari and Dire Dawa). The relative price of beef in Harari and Dire Dawa was greater than unity, which was not supported by reversed trade relationships with Addis Ababa since there was no evidence of such trade reversal. This was so because beef in these regions was supplied by other regions not included in this analysis, like Somali region. The case for beef also holds true for live animal trade like sheep. Relative prices of sheep were less than unity for all regions possibly because there were interregional trade relationships which influence price levels directly and indirectly.

3.3. Empirical model of price convergence

Using point estimates of price adjustment, results from previous studies suggest the existence of market integration across markets in Ethiopia (Kindie *et al.,* 2009; Degye *et al*., 2009; Rashid and Negassa, 2011). However, there is no empirical evidence generated so far on both absolute and relative price convergence of commodities among markets and regions in the country. Moreover, many markets and regions and commodities are not yet analyzed due to methodological and data problems discussed earlier. This study differs from previous studies in that it employs the panel unit root tests, fixed-effects, and half-life methods to examine the rate and speed of relative price convergence of major commodities traded and consumed among the major regions and cities in the country. These procedures are

[4] Relative price greater than or less than unity may not necessarily be an indicator of supply or destination regions. Relative prices of regions might be greater than or less than unity without trade relationships of the commodities if there are other interregional trade relationships. Price could also be indirectly related through the reference market in the absence of direct trade relationships.

considered more powerful than the conventional unit root tests and models of simple time series and simple cross-sections. At the minimum, the methodologies improve the power of unit root tests because they provide a larger number of data points and use the variation across regions to improve estimation efficiency (Susanto *et al.,* 2008). The empirical knowledge on the speed and rate of relative price convergence of commodities among regions has a paramount importance in designing and implementing market intervention policies.

To apply the methods of panel unit root tests on monthly prices, Addis Ababa was selected to compute the relative prices of all other regions following the method used by Parsley and Wei, (1996), Susanto *et al.*(2008), Cecchetti *et al.*(2002), and Goldberg and Verboven (2005).

The general dynamic panel model employed is specified as (Levin *et al.,* 2002)

$$\Delta RP_{i,t} = \sim_i + \alpha_t + \beta_i RP_{i,t-1} + \sum_{h=1}^{h=k} \gamma_h \Delta RP_{i,t-h} + \varepsilon_{i,t} \qquad \textbf{(3)}$$

Where $RP_{i,t}$ is the log of relative prices (the log of the price level of region i relative to the price level of benchmark[5] market j at time t: $RP_{i,t} = \ln\left(\frac{P_{i,t}}{P_{j,t}}\right)$.

In equation (3), $\sim_i$ is a region-specific constant to control for non-time-dependent heterogeneity across regions, Δ is the first difference operator, α_i is a common time effect in market i, γ_h is the historical effect of the relative price, k is the lag length, and $\varepsilon_{i,t}$ is the white noise error term. The lag structure $h$can be routinely determined on a variety of information criteria as in a univariate Dickey- Fuller (DF) or Augmented Dickey-Fuller (ADF) test to account for possible serial correlation (Dickey and Pantula, 1987; Dickey and Fuller, 1979).

[5] The natural benchmark for $RP_{i,t}$ is zero. Identification of benchmark market requires the knowledge on supply and terminal markets for each type of commodity traded.

The interest in equation (3) is the coefficient on the lagged relative price, $_i$, which represents the rate of convergence[6]. Under the null of no price convergence, $_i$ is equal to zero $(H_0: \ _i = 0 \ \ for \ \ all \ \ i)$, suggesting that a shock to $RP_{i,t}$ is permanent. That is, the LLC test specifies the null hypothesis of H_0 against the alternative hypothesis of $H_a: \ _i = \ < 0$, where is the normalized adjustment coefficient. The major limitation of the LLC test is that $_i$ is the same for all observations. To relax this assumption, Im *et al.* (2003) proposed an extension of the LLC procedure by allowing $_i$ to differ across groups. They tested the null hypothesis $H_0: \ _i = 0$ against the alternative that $H_a: \ _i < 0$ for at least one market.

To conduct the LLC test, several steps are performed. The first task is to remove the influences of time effects by subtracting the cross-sectional averages from the data:

$$\overline{RP}_{i,t} = RP_{i,t} - \frac{1}{N}\sum_{i=1}^{i=N} RP_{i,t} \qquad \textbf{(4)}$$

Second, for each market, the first difference of relative prices $(\Delta RP_{i,t})$ is regressed on its lagged values $(\Delta RP_{i,t-h})$, a constant $(\sim_i)$, and a trend $(^{a}_i)$ and save the residuals from equation (1) as $\hat{e}_{i,t}$. Third, the lag of relative prices $(RP_{i,t-1})$ is regressed on the same variables in the second step to obtain the residuals $\left(\hat{v}_{i,t-1}\right)$. Fourth, the residuals $\hat{e}_{i,t}$ is regressed on $\left(\hat{v}_{i,t-1}\right)$ without a constant. If we denote the residuals from the final

[6] The closer the rate of convergence to zero, the longer is the estimated half-life of a shock.

regression as $\hat{\varepsilon}_{i,t}$, the regression standard error obtained from this regression can be defined as

$$\hat{\sigma}_{\varepsilon_i} = \sqrt{(T - k - 1)^{-1} \sum_{t=h_i+2}^{T} \hat{\varepsilon}_{i,t}^{2}} \,. \qquad \textbf{(5)}$$

This estimate of the standard error will be used to normalize the residuals from the contemporaneous and lagged auxiliary regressions, $\hat{e}_{i,t}$ and $\hat{v}_{i,t-1}$, for controlling heterogeneity across individual regions. The normalized values of the residuals from the two auxiliary regressions are:

$$\tilde{e}_{i,t} = \frac{\hat{e}_{i,t}}{\hat{\sigma}_{\varepsilon_i}} \text{ and } \tilde{v}_{i,t-1} = \frac{\hat{v}_{i,t-1}}{\hat{\sigma}_{\varepsilon_i}} \qquad \textbf{(6)}$$

Finally, the panel OLS of the normalized residuals will be run to obtain the adjustment estimates (Levin *et al*., 2002; Susanto, *et al.,* 2008)[7]:

$$\tilde{e}_{i,t} = \tilde{v}_{i,t-1} + \tilde{\varepsilon}_{i,t} \qquad \textbf{(7)}$$

The IPS model is a unit root test for heterogeneous dynamic panels based on the mean-group approach. This approach is similar to the LLC model, in that it allows for heterogeneity across sectional units. Instead of pooling the data, the IPS model uses separate unit root tests for the N cross-section units

[7] Under the null hypothesis H_0 : $= 0$, the regression statistic (t) has a standard normal limiting distribution for the model that does not include both an individual specific mean and a time trend; however, it diverges to negative infinity for the model having an individual-specific mean, but does not contain a time trend and the model that contains both an individual-specific mean and time trend. To obtain a standard normal distribution, the *t* statistic can be adjusted (denoted as *t-star*: t^*) using the ratio of longrun and shortrun standard deviations computed by the procedures of adjusting standard normal distribution for the LLC model (Levin *et al.,* 2002).

(regions). The *t* statistic (denoted as, $\bar{t}$, t-bar) is the average of *t* statistics for all N regions. Let $t_{i,T}$ denote the t statistics for testing unit roots, and let $E(t_{i,T}) = «$ and $V(t_{i,T}) = \pm^2$, then

$$\sqrt{N}\left(\frac{\bar{t}_{N,T} - «}{\pm}\right) \sim N(0.1), \text{ where } \bar{t}_{N,T} = \frac{1}{N}\left(\sum_{i=1}^{i=N} t_{i,T}\right) \quad \textbf{(8)}$$

The problem of the above equation is computing the mean, «, and the variance, $\pm^2$. Assuming that the cross sections (regions in this case) are independent, the standardization of the t-bar statistics, using the means and variances of $t_{i,t}$ evaluated under $=0$, denoted as w-t $(\bar{t}^*_¤)$ bar statistic is given by (Im *et al.*, 2003):

$$\bar{t}^*_¤ = \frac{\sqrt{N}\left(\bar{t}_{N,T} - E\left(\bar{t}_{N,T}\right)\right)}{\sqrt{\text{var}\left(\bar{t}_{N,T}\right)}} \quad \textbf{(9)}$$

where $\bar{t}_{N,T}$ is the average *t* statistic for each region or individual unit, and $E\left(\bar{t}_{N,T}\right)$ and

$ar\left(\bar{t}_{N,T}\right)$, respectively, are its mean and variance, respectively.

4. Empirical Results

4.1 Patterns of price convergence

The purpose of this study is to analyze the rate and speed of relative food price convergence of commodities in Ethiopia. It considers 18-year monthly data of consumer prices of 9 commodities widely consumed and traded among the seven regions and markets in Ethiopia (including the benchmark market). In order to investigate the rate and speed of relative price

convergence of these commodities, the study period was classified into three as period 1 (1996-2004), period 2 (2005-2013), and the full period (1996-2013). As a preliminary investigation of the pattern of price convergence to unity, the mean values of relative prices of commodities during the two periods were tested for the presence of significant difference. As reported in Table 3, the tests for five commodities (cereals, banana, and potato) suggest the presence of mean relative price difference between the two periods. The null hypothesis that there is no mean difference between the two periods was rejected at one percent level. But there is not significant relative mean price difference for the other commodities. This preliminary test leads to further investigation of the expectations with more rigorous methods.

Table 3: Two-sample mean-comparison test of relative prices between the two periods

Commodity	Mean value			t-value
	1996-2004	2005-2013	1996-2013	
Teff white	0.88	0.94	0.91	-8.23***
Wheat white	1.05	0.98	1.01	7.86***
Maize	1.02	0.90	0.96	11.52***
Beef	0.95	0.96	0.96	-0.83
Sheep 10-15 kg	0.72	0.71	0.72	0.66
Banana	0.86	1.08	0.97	-13.47***
Orange	0.85	0.87	0.86	-1.10
Onion	1.27	1.27	1.27	-0.40
Potato	1.23	1.19	1.21	1.87**
Number of observations	642	624	1266	

Notes: *** indicates 1% significance level.
Source: Author's computation.

4.2 Panel unit root tests

Before estimating the rate and speed of monthly price convergence of commodities among regions in Ethiopia, the panel dataset was tested for the presence of unit roots (Table 4). The study employs two widely applied methods of unit root tests in balanced and heterogeneous panels, the IM-

Pesaran-Shin (IPS) and the Levin-Lin-Chu (LLC). The use of IPS panel unit root test in panel data accounts for the limitations of LLC method, which could only be employed in a strongly balanced data. The lag structure in the ADF regression was routinely identified by Akaike's Information Criteria (AIC).

The results from the two methods of panel unit root tests were consistent. As shown in table, all point estimates were negative, as expected, and strongly significant at one percent level. Therefore, the null that panels contain unit roots was rejected and the alternative that panels are stationary was accepted in the LLC tests. Similarly, the IPS test rejects the null hypothesis of unit roots regardless of the sample periods. Both tests confirm that the panel dataset of the relative prices were stationary at their first differences suggesting that linear panel estimators could be employed to estimate rate of price convergence of commodities among the regions.

Table 4: LLC and IPS tests of panel unit roots for monthly relative price changes in Ethiopia

Percentage change in relative prices	LLC test (adjusted t*): Ho: Panels contain unit roots: Ha: Panels are stationary			IPS test (W-t-bar): Ho: All panels contain unit roots; Ha: Some panels are stationary		
	1996-2004	2005-2013	1996-2013	1996-2004	2005-2013	1996-2013
Teff	-29.3***	-11.6***	-7.4***	-28.8***	-19.7***	-2.0***
Wheat	-21.8***	-22.4***	-12.6***	-23.5***	-25.4***	-25.3***
Maize	-26.0***	-8.6***	-13.4***	-27.6***	-18.9***	-26.4***
Beef	-2.8***	-10.1***	-4.7***	-17.5***	-18.5***	-23.9***
Sheep	-12.8***	-13.1***	-3.6***	-21.6***	-21.3***	-25.6***
Banana	-23.5***	-28.3***	-1.5***	-27.2***	-27.2**	-25.1***
Orange	-16.4***	-25.3***	-17.6***	-22.3***	-25.6***	-27.4***
Onion	-11.4***	-3.8***	-14.2***	-19.5***	-16.0***	-26.6***
Potato	-11.3***	-12.9***	-2.7***	-20.5	-21.7***	-25.4***

Notes: *** indicates 1% significance level.
Source: Author's computation.

4.3 Rate of price convergence

The magnitude or rate of relative price convergence of commodities among the regions was measured by parameter estimates for lagged percentage relative price changes. The general dynamic panel model of relative price convergence (%) is a function of previous-month relative price (log) and the cumulative effects of its own lagged differences. The rate of convergence in this paper is defined as the effect of previous-month relative price (%) on the contemporaneous percentage relative price changes of a commodity over the years (months) and across regions. The model was estimated by the FE method since the inter-temporal price difference in each region has fixed-effects on the percentage relative price changes. Table 5 summarizes the FE estimation of rate of relative price convergence of commodities among regions in Ethiopia. The rates of convergence of relative price changes for the nine commodities are comparatively reported over the three periods.

Table 5: Fixed-effects estimation of rate of price convergence (%) among regions

Change in annual relative prices (%)	1996-2004		2005-2013		1996-2013	
	Convergence rate	Standard error	Convergence rate	Standard error	Convergence rate	Standard error
Teff	-0.27***	0.03	-0.19***	0.03	-0.13***	0.02
Wheat	-0.37***	0.04	-0.32***	0.04	-0.21***	0.02
Maize	-0.35***	0.03	-0.57***	0.05	-0.26***	0.03
Beef	-0.24***	0.04	-0.26***	0.04	-0.17***	0.02
Sheep	-0.43***	0.05	-0.29***	0.04	-0.34***	0.03
Banana	-0.21***	0.03	-0.32***	0.04	-0.07***	0.01
Orange	-0.43***	0.04	-0.45***	0.03	-0.32***	0.03
Onion	-0.04	0.04	0.02	0.02	-0.04	0.03
Potato	-0.50***	0.05	-0.44***	0.04	-0.36***	0.03

Notes: The optimum lag lengths routinely identified by AIC for each commodity and period are rounded off to their positive integers in order to be used in the estimation of convergence rate in the FE model.

*** and ** indicate significance level at 1% and 5%, respectively.

Source: Author's commutation

As shown, all the coefficients, with the exception of onion, were negatively and strongly significant and the signs of all parameter estimates were as expected. The rate of relative price convergence among regions in the 18-year period was generally low for all commodities. The maximum and the minimum convergence rate estimated for the whole period was 36 percent for potato and 7 percent for banana, relatively more perishable. A unit percentage shock of relative prices of potato in previous-year had only 0.5 percent change in the current-year relative price convergence with the benchmark market (Addis Ababa). It is generally evidenced that the rate of convergence was very low (7%-36% for the whole period) because greater proportion of the price shocks were unadjusted among regions. Low or nearer-to-zero rates of convergence are indications of permanent shocks which could not be adjusted among regions. Food items covering about 57 percent of the consumption expenditure in Ethiopia have exhibited very low rates of relative price convergence which would deplete the welfare effects expected from spatial and temporal arbitrage (CSA, 2013).

Under the null of no price convergence, the adjustment coefficient for onion was equal to zero, suggesting that the price shock to the relative price was permanent. Due to its perishable nature, there was no significant convergence in the relative prices of onion over the 18-year period and across regions. This evidence is supported by previous studies which verify that marketing agents involved in the production and marketing of onion, particularly onion producers, have used to face exceptionally high price risk in Ethiopia (Degye, 2011).

Some food commodities have undergone increased rate of monthly relative price convergence in the 18-year period. The maximum change in the rate of convergence from the first to the second period was for maize (22%) followed by banana (11%) and potato (5%). This is a good indication of improved domestic market performance favoring the prices of these commodities. However, there are some commodities with significant price divergence as an indication of poor market performance. The relative prices of teff, wheat and sheep were rather diverging at a rate of 8 percent, 5 percent and 14 percent, respectively. The findings point out that the market

intervention measures implemented in the country had both negative and positive repercussions. This down turn of price performance of some commodities is possibly explained by the supply of and the demand for the commodities among regions, and the price stabilization measures related to direct price setting (price ceilings) by the government.

4.4 Speed of price convergence

The average speed at which commodity prices move toward parity price is commonly measured by half-life method. Speed of relative price convergence of commodities among regions in this study is measured by half-life of relative price shocks. Half-life of a shock may be defined as a period in which the marginal change in the stationary component of the response becomes half of the initial response. The closer the rate of convergence to zero, the longer is the estimated half-life of a shock. It is computed as $-\ln(2)/\ln(Rho)$ where rho is the correlation of errors (within and between) panels. The estimated half-life of commodities is reported in Table 6.

Speeds of relative price convergence of five commodities under consideration were fairly long in the first period and short in the second period, indicating increased responsiveness of markets in the regions. In the first period, regions tended to slowly and partially respond to relative price shocks of these commodities. In the second period, they required a few days to adjust to half of the relative price shocks with the benchmark market. For instance, the time required to adjust to half of the shocks was reduced by about 38 percent (11.5 days) for potato, 31 percent (9.4 days) for wheat, 30 percent (9.2 days) for teff, and 25 percent (7.6 days) for orange. The findings markedly show that some commodities have experienced considerable improvement in the speed of their price convergence. The computed half-life[8] of relative price shocks was adjusted among regions and over time as

[8] The half-life method estimates only the time required to adjust to half of the initial relative price shock. The remaining half of the shock persists as a permanent shock which might not be adjusted among regions.

rapidly as possible. On the other hand, banana and maize were characterized by price divergence at a rate of 41% percent and one percent, respectively.

Table 6: Estimated half-life of shocks as a measure of speed of relative price convergence

Commodity	1996-2004		2005-2013		1996-2013	
	Half-life	Days	Half-life	Days	Half-life	Days
Teff	0.69	20.8	0.39	11.6	0.30	9.0
Wheat	0.73	21.9	0.42	12.5	0.32	9.7
Maize	0.62	18.5	0.63	18.8	0.34	10.3
Beef	0.42	12.7	0.40	12.1	0.29	8.7
Sheep	0.49	14.7	0.44	13.3	0.43	13.0
Banana	0.76	22.8	1.17	35.0	0.25	7.4
Orange	0.90	27.1	0.65	19.5	0.50	15.0
Potato	0.72	21.6	0.34	10.1	0.37	11.1

Notes: The speed of relative price convergence can be converted to days by changing the (unit rate or percentage) half-life into 30 days rate (i.e., half-life multiplied by 30 and the product divided by the rate, 1 or 100).
Source: Author's commutation.

The attempt to categorize the 18-year period into two using relatively observable market and policy events has generally resulted in some meaningful implications on the patterns of rate and speed of food convergence among regions and cities in Ethiopia. Market policy measures initiated in Ethiopia before and after 2004 have some positive and negative implications on the performance of commodity markets and prices across regions and cities in Ethiopia.

5. Concluding Remarks

This paper investigates the dynamics of monthly relative price convergence of major commodities consumed and traded in seven regions and cities of Ethiopia. It utilizes monthly consumer prices of nine commodities in these regions and cities. A pane dataset comprising the regions (panels) over 211

months with 1266 data points was constructed for each commodity. Relative price levels and changes were computed based on the benchmark price in Addis Ababa.

Panel unit root tests were conducted by employing two widely used techniques, the LLC and IPS unit root tests. Rate and speed of relative price convergence of commodities among regions were measured by dynamic adjustment parameter estimates and half-life of relative price shocks, respectively. The empirical results indicate that the panel datasets of the log-normalized relative prices were stationary at their first differences. The estimated rates of relative price convergence of commodities among regions were generally low. The speed of relative price convergence of commodities measured by the half-life method was, however, mixed. There was significant improvement in the rate and speed of relative price convergence of some food commodities among regions during the 18-year period.

The findings generally suggest the need to initiate and implement marketing policies designed to optimize the net welfare effects emanating from domestic market performance and interventions. Improving marketing infrastructure, information and institutional arrangement and marketing policies will improve market performance by improving the responsiveness of actors to price shocks. Interventions related to value-adding activities, particularly for perishable commodities, will improve convergence to unitary price among region of Ethiopia. It is also a policy imperative to promote sustained supply-side intervention in order to increase production and productivity of agricultural commodities characterized by low or declining relative price convergence.

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Appendix Table 1: Optimum lags (month) specified by AIC in the ADF regression of panel unit root tests

Percentage change in relative prices	Periods		
	1996-2004	2005-2013	2005-2013
Teff	0.83	2.50	3.50
Wheat	1.33	1.50	2.83
Maize	0.83	2.50	2.83
Beef	3.00	2.50	3.50
Sheep	2.00	2.00	3.67
Banana	1.17	1.17	3.50
Orange	1.67	0.67	2.50
Onion	2.50	4.50	3.00
Potato	2.50	2.33	4.50

Source: Authors' computation.

Economic Growth - Quality of Life Nexus in Ethiopia: Time Series Analysis

Esubalew Asmare Sahilea[1]

Abstract

This study investigates the nexus between economic growth and quality of life (QoL) in Ethiopia by using objective indicators of QoL-variables from economic, social and political aspects by employing descriptive and time series analysis methods. The results from the descriptive analysis confirmed an increasing trend in all objective indicators. Where, education enrolment and consumption expenditure are showing strong correlation with economic growth. The co-integration and VECM results revealed that economic growth positively and significantly influences consumption expenditure and education enrolment in the SR and more strongly in the LR. However, it has shown a negative impact on political rights in the LR unlike in the SR where the impact is insignificant. The study also identified the existence of considerable relationship among the indicators. Urbanization is oppressing education enrolment and political rights in the SR unlike the LR case. Adjustments to the SR path of urbanization through timely provision of social services in rapidly urbanizing areas are suggested for circular improvement of QoL.

Keywords: Quality of life, Economic growth, indicators of QoL, Cointegration and Error correction model, Ethiopia

JEL Classification: D60, I31, N37

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1. Introduction

Every rational individual is striving to have a better life. The ultimate goal of every person is getting satisfaction and achieving better quality of life[2]. The principle of rationality in Economics points out that people behave in a way that maximizes their satisfaction. People tend to work more, they innovate, increase their productivity and production in order to achieve happiness. Many economic policy specialists, public policy experts and others focus their attention on finding a way to increase the output, to raise economic activity that can be observed as economic growth[3].

The problem is whether this economic growth is improving QoL or not? A mere economic growth without improvement in the QoL is less relevant. Many scholars starting with great philosophers like Aristotle up to political economists like Adam Smith, Karl Marks, Joan Stuart Mill and others had argued that human beings should be the end of development not a mere means. Conceicao and Bandura (2010) argues that, while it is often asserted that economists are primarily concerned with gross domestic product (GDP) levels and growth, it is important to step back a little and remember that what matters most as an "objective function" is people's wellbeing.

Clearly, there are numerous benefits from economic growth; it helps to deal with problem of poverty, food crisis, lack of basic and luxury products, homelessness, and so forth. Traditionally, it has been used to measure the level of wellbeing, based on the assumption that growth in GDP leads to more consumption that ultimately improves wellbeing (Conceicao and Bandura, 2010).The same authors however, indicated that there is a disagreement on how consumption alone can improve the wellbeing of the society, due to the fact that wellbeing is a multi-dimensional concept. Its measurement has to encompass the social, political and economic aspects in

[2] Though there are different ways of defining QoL, most of them are about welfare, happiness, comfort, sense of freedom, security, and related issues demanded by individuals.

[3] In the study, economic growth is defined as the average growth in the per capita real GDP over time.

both objective and subjective indicators. According to Paris and Wiesbaden (2010), GDP has many flaws and gaps as an indicator of material wellbeing such that it does not capture all the aspects of human life.

There are even some cases where economic growth contributes to deterioration of wellbeing (QoL). It can cause many social and environmental inconveniences mostly regarding pollution and health problems. This does not say that economic growth is doomed to bring improvement in wellbeing. The challenge is to harness the potential of economic growth to make sure it really does increase sustainable welfare improvements.

Consequently, there is no well-established relationship between economic growth and QoL. In most definitions and measurements of QoL, economic growth is considered as one variable among the determinants of QoL, but empirical studies show mixed results on its impact on QoL. It is a common result for studies based on time series analysis and for countries at different levels of development (Esterline, 2007; Conceicao and Bandura, 2010). Hence, to successfully transfer a rise in economy into improvement of the QoL, the concerned body has to have clearer understanding of the relationship between economic growth and QoL.

Concerning Ethiopia, it has been reported and publicized that the country is experiencing a continuous and fast economic growth. Many national and international sources, discloses beginning from the last two decades the economy is in its growth path.

According to the ministry of finance and economic development (MoFED, 2011), in contrary to the previous three and four decades, starting from 1990s the economy is in its fast growth trend. The African development bank group, World Bank, and IMF are having similar conclusions in their report on the performance of the Ethiopian economy.

However, to the best knowledge of the researcher, there is no sufficient study and evidence, that indicates if this economic growth is resulting

improvements in the QoL or not. Even related studies by Aklilu and Dessalegne (2000) and Habtamu W. (2005) are a mere definition of what wellbeing is, and emphasis only on inequality and psychological issues of QoL, not at relating QoL with EG. This study however, is designed to examine the impact of the recent economic growth on enhancing the QoL in Ethiopia. It tries to through a light on the nexus between EG and QOL.

Moreover, many studies, and development policy makers, worried not for a mere economic growth they focused rather on the general wellbeing of the people. Therefore, Policies designed to bring economic growth needs to take in to account that the ultimate goal that needs to be achieved is not the mere production but improvement of wellbeing of people in general. Hence, it calls detailed empirical assessment of the association between economic growth and QoL.

The main purpose of this study is therefore, to find out the nexus between economic growth in terms of per capita real GDP and QoL through its objective indicators in Ethiopia over the period 1981 to 2011. It aims to examine how much the recent economic growth in Ethiopia is contributing to improvement in the QoL and scrutinize the multidirectional connections among the indicators. The focus is on testing the existence of improvements on the basic objective indicators of QoL- variables from social, economic and political aspects including consumption spending, urbanization, education enrolment and political freedom –newly developed indicators.

In line with this, the study has used both the descriptive and econometric methods of analysis to capture the trend and correlation among variables and the econometric analysis methods that employ the co-integration and the vector error correction method to identify the LR and SR relationship among Qol indicators and economic growth.

The descriptive analysis confirmed that all indicators of QoL have shown increasing trend overtime and found strong correlation between consumption spending and education enrolment between each other and with economic growth. Political rights and education enrolment are significantly correlated

with each other and with the level of urbanization. Moreover, the empirical results indicated that economic growth influences consumption spending and education enrolment positively and significantly in the LR but negatively to polity composite index. In the SR, economic growth impacts consumption spending and education enrolment significantly and positively but has no significant impact to polity composite index. Urbanization is found to be an exogenous variable that negatively affects consumption spending and positively affects education enrolment and polity composite index in the LR and negatively influences education and polity composite index in the SR.

2. Review of the Literature

2.1 Definition and indices of quality of life

There are numerous attempts of individuals and groups of scholars to define and construct indices to measure QoL. Most of them like Landsman (1986); Edgerton (1990); Brock (1993); Felce & Perry (1995); (Diener and Suh, 1997); Veenhoven (2000); (Esterlin, 2007) define it from the perspective what is needed to have a good life in terms of quality. For most of them, QoL is addressing the question of satisfying life requirements. They define QoL as multi-dimensional concept concerned with satisfying the overall wellbeing of people at the individual and society level. Moreover, they underlined that measurement of QoL needs to consider both the subjective and objective aspects of life measured through indicators.

On the other hand, a theory called *the integrated quality of life theory* defines QoL as a good life where different aspects of life are satisfied on the high level. It asserts, aspects in QoL can range from the subjective to the objective features of good life. The subjective QoL explains how each individual feels and evaluate his definition of good life. Whether individuals content of life makes him/her happy are aspects that reflect the subjective QoL. The objective QoL defines how one's life is perceived by the outside world, which can be influenced by the culture in which people live and reveals itself in a person's ability to adapt to the values of that culture, this features doesn't say much about person's life. It is concerned with the

external world and conditions of life that are easily established which means they can be rated identically by the observers.

2.2 Empirical Literature

Most of the studies regarding this topic are made in USA, Europe and Latin America. One of the possible reasons is the availability of the data in these countries. The results obtained from these studies are consistent for objective indicators in cross sectional studies unlike time series studies. Time series studies on objective indicators and all the studies on subjective indicators show mixed results in terms of nexus between economic growth and QoL.

A study made by Easterlin, Angelescu, and Laura (2007) combines both cross sectional and time serious analysis. In cross sectional analysis they conclude that a rise in per capita GDP results in advancement in objective indicators of QoL unlike in the time series analysis which presents mixed results. Brown, Bowling and Flynn (2004) indicate that higher levels of wellbeing are associated with higher incomes and socioeconomic status. In contrary to these, Headey and Wearing (1992), in their review of the literature, found no significant difference in indicators of QoL between the deprived and more affluent societies in the USA, where people report higher level of wellbeing regardless of economic circumstances. However, this type of studies is almost not existent in African countries, in comparison with developed countries.

Most of the studies on happiness have been centred on industrialized countries, as the data is readily available ... For developing countries long run series ... are inexistent. (Conceicao and Bandura, 2010 pp.16).

Even though data collection is showing some progress in recent times, it is not sufficient. African studies date from 2000, and even if it is not a long time series, it is important because African economies are showing increasing growth trend from 2000 onwards. This fact underlines the need for new studies that are examining the nexus between economic growth and QoL.

In case of Ethiopia, QoL is not studied at satisfactory level, though there are attempts to relate it with poverty and inequality. Aklilu and Dessalegn, (2000) define QoL as something to do with the availability and achievements of resources and material needs. It is narrow definition only from point of view related with having farmland, cattle, farm implements and a house in rural settings. It is having some job (employment) or business (some income) in the urban setting.

From the view of determinants of QoL in Ethiopia, Habtamu (2005) has underline factors involving economic, political and social issues. These includes economic and material condition - commodities, state of health, nutritional, job, work, employment, political situation-freedom, human rights and liberties, education, relationships, family, religion, beliefs, etc.

In summary, we show that the nexus between economic growth and QoL depends on type of data used and level of development of a nation. Moreover, absence of sufficient studies in Ethiopia, where the economy is rising prompts the study to contribute in the area.

3. Data and Methodology

3.1 Data

Different Approaches of measuring QoL by most scholars and institutions can be broadly categorized in to objective and subjective indicators (McGillivray and Clarke 2006; van Hoorn 2007). However, due to reasons of inexistence and insufficiency of data and based on insights of the literature, this study relayed only on objective indicators- variables from the social, economic and political aspects. In view of that, the study incorporates per capita household final consumption expenditure (PCHHFC), urbanization (UR), Gross education enrolment (EDU), and polity composite index (PCI) as described below.

Consumption: Private Consumption expenditure per Capita (constant 2000US$) includes the expenditures of nonprofits institutions serving households, as defined by the WB is taken.

Urbanization: Percentage of population in urban areas over time is taken. Even if there are opposite arguments whether urbanization of population would improve QoL or not, analysts praise the benefits of urban life that this study follows proponents on the ground of benefits and availability of more living facilities in urban areas than rural counterparts.

Education: Gross enrolment ratio given by dividing the number of students enrolled in educational sector of different levels - 'Primary ','secondary' and 'tertiary' level by the population of school age children of these levels is considered.

Polity Composite index (PCI): The relevance of political democracy to QoL is illustrated here in terms of the "polity composite index". This index is calculated from the Polity IV dataset as the difference between democracy and autocracy measures, both of which range from 0 to 10 (Marshall and Jaggers 2004). The Polity IV democracy index is derived from the coding by knowledgeable scholars of a country's situation with regard to the following: competitiveness of political participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive.

The Polity IV autocracy index is similarly based on scoring countries according to competitiveness of political participation, the regulation of participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive. The PCI is normalized to lie between 0 and 1, with 1 being the highest rating on political democracy.

Both national and international sources including the WB, central statistics agency, Ethiopian economics association and polity IV project were investigated for data collection purpose. The change in PCGDP and PCHHFC is measured in logarithmic form, to have a sharper insight into the data and to deal with the concept of elasticity.

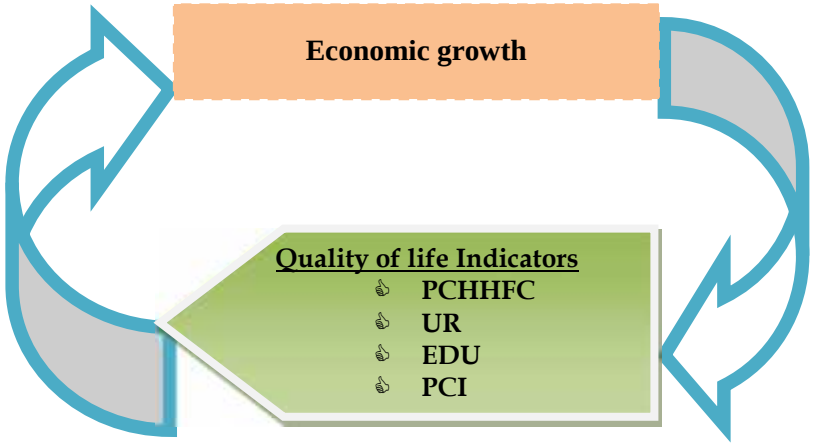
3.2 Model Specification

Conceptual framework

Based on insights from literatures, and to show an easy way of interaction among variables of interest, theoretically the model of interaction between economic growth and QoL can be constructed as follows.

The model represents the interaction of economic growth and QoL indicators. It signifies economic growth directly affects consumption expenditure, urbanization, education enrolment and polity composite index. The change in these variables is also assumed to affect economic growth by the reverse impact.

Figure 1: Model of interaction of economic growth and QoL (objective indicators)



Source: Own construction

Econometric model

The econometric model is based on modelling the nexus between economic growth (EG) and QoL through its indicators. In equation form, the structural equations can be expressed by explaining each QoL indicators by EG and other indicator as follows:

C = fc(UR, EDU, PCI, EG)\ **1**

UR = fur(C, EDU, PCI, EG) **2**

EDU=fedu(C, UR, PCI, EG) **3**

PCI = fpci(C, UR, EDU, EG) **4**

In this case of multivariate time series, VAR is selected as appropriate for it superficially resembles simultaneous equation modelling in that we consider several endogenous variables together. Besides, the model may be more parsimonious and includes fewer lags, and that more accurate forecasting is possible. To boot, the distinction between endogenous and exogenous variables does not have to be made a priori.[4]

The vector of the VAR model, therefore, incorporates PCHHFC, UR, EDU, PCI, and PCGDP. Hence, the econometric model based on Johansen and Juselius formulation (1990) and by assuming the variables are endogenous and by using matrix notation denoted by $Y_{t,,}$ VAR of order P can be expressed as;

$$Y_t = A_o + A_1 Y_{t-1} + A_2 Y_{t-2} + A_3 Y_{t-3} + \ldots + A_p Y_{t-p} + U_t. \quad \textbf{(5),}$$

where,

Y_t = ($PCHHFC_t$, $PCGDP_t$, UR_t, EDU_t, PCI_t)' is a vector process (5×1) of variables

A_o = is a (5x1) vector of deterministic terms like trends and intercepts

A_1 A_P = are (5×5) matrix of coefficients for dependent variables.

Ut_s = are a (5x1) vector of error terms and are iid (0, ∑), with Σ representing the contemporaneous covariance matrix.

Estimating a VAR is very easy. As the conventional one, it is appropriate to estimate equation 5 in which the same regressors appear in every equation, by ordinary least squares (OLS). In such cases, OLS is like both the efficient

[4] These does not ignore the fact, that VAR method has limitations related to selecting optima lag and differencing to keep stationary may make the result unsatisfactory.

generalized least square estimator and the maximum likelihood estimator under the assumption of multivariate normal errors.

3.3 Method of Analysis

Stationarity: To get ride from the problem on consistency of estimation, misleading estimators, and testing and inferential problems, stationarity of variables is tested by the use of unit root test-using Augmented Dickey-Fuller (ADF).

Cointegration: with the pre assumption of non-stationarity, the possibility of existence of co integration is identified by the use of Johanson method for it can capture more than one co integrating relationships over others. The appropriate lag order (P) of the VAR was determined using standard model selection criteria (data dependent rule), by the use of a well known information criterion approaches including the Akaike information criteria (AIC),the modified LR statistics test, the Final prediction error (FPE), Shewarz Information criteria (SIC) and Hannan Quinn information criterion (HQ).

Vector error correction model (VECM): following co-integration among variables, the SR dynamics of these variables was determined by estimating the vector error correction method.

Diagnostic check: the robustness of models has to be checked to have efficient and correctly specified estimators and to determine if a data set is well modelled by a normal distribution. Hence, serial auto correlation test, hetrosckedasticity test and normality test were implemented to check.

4. Results and Discussion

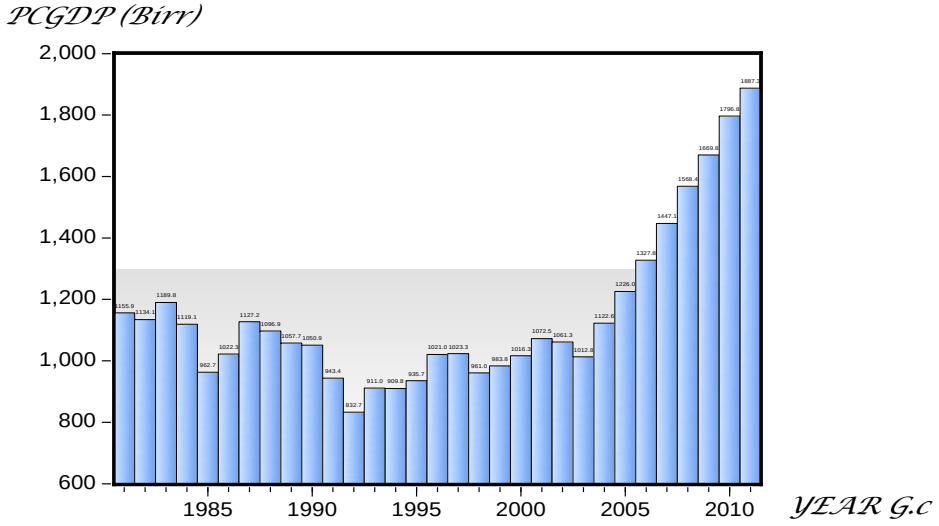
4.1 Descriptive Result

Trend analysis

For the period studied, all indicators have shown an increasing trend on average, though at different rate. Particularly, PCGDP, has shown a steep

rise starting from early 1990s (Figure 2). According to MoFED (2011), it is due to nation's successive development plans of SDPRP (2002/3- 2004/5), PASSDEP (2005/6- 2009/10), and GTP of (2009/10-2014/15).

Figure 2: Trend of per capita real GDP (1981-2011)



Source: Authors computation based on WB (2011) data

Similarly, consumption spending, percentage of population with access to improved water and sanitation facilities as well as use of new products like mobile phone subscribers and internet users have shown an increment trend. Consumption of bads in terms of emission of CO_2 from different sources has been increasing over time that has a bad consequence to the environment and health of the people. This implies the positive impact of greater consumption on QoL however, is offset to some extent by negative effects brought about by that consumption, such as new environmental and health problems. Education enrolment, urbanization, and the polity composite index (insignificantly) have also shows an improvement over time with PCGDP.

This may indicate with increase in income, households' expenditure on food, cloth, shelter and other expenditures of non profit institutions have been raising. Besides, rise in urbanization may be associated with the availability of job opportunities, population growth, access to services and facilities in

the urban areas and the like. Moreover, an improvement in education enrolment can be justified as the rising PCGDP increases the demand and accessibility for education.

Correlation analysis

Correlation analysis is conducted among all the indicators to obtain strength and significance of association among them. As shown in Table 1, LNPCHHFC and EDU are significantly correlated with each other and with level of LNPCGDP. As well, PCI and EDU also significantly correlated with each other and with the level of UR. These are consistent results with the econometric analysis. However, it should be noted that these are a mere linear relationship among the variables and are not strong for policy prescriptions.[5].

Table 1: Correlation analysis of variables

CORRELATION	LNPCHHFC	PCI	EDU	UR	LNPCGDP
LNPCHHFC	1.000000				
PCI	0.1580 (0.3960)	1.000000			
EDU	0.8513 (0.0000)	0.4842 (0.0058)	1.00000 0		
UR	0.2620 (0.1545)	0.7283 (0.0000)	0.6534 (0.0001)	1.00000 0	
LNPCGDP	0.9751 (0.0000)	0.1486 0.4249	0.8695 (0.0000)	0.2753 (0.1338)	1.000000

4.2 Econometric Result

Unit root test:

The result from ADF test in Table 2 demonstrate at level all variables are non stationary or I(1) at 1 percent level of significance for all the test statistic assumptions. At first difference, however, all variables except EDU (stationary at 5%) are stationary at 1percent level.

[5] consistent result and more explanation is give in the econometrics result

Table 2: Augmented Dickey-Fuller Stationarity Test Result

Variable	Test Statistic Under Different Assumptions			Order of Integration
	Intercept	Trend and Intercept	no trend no intercept	
LNPCGDP	0.984440	-0.422609	1.029899	I(1)
D(LNPCGDP)	-3.948227	-4.789869	-3.814597*	
LNPCHHFC	0.550591	-0.794663	1.064274	I(1)
D(LNPCHHFC)	-5.722701	-7.388921*	-5.555452*	
UR	-1.518161	-0.732845	0.161031	I(1)
D(UR)	-5.364024*	2.042752	-5.446484*	
EDU	0.410458	-1.643902	1.362417	I(1)
D(EDU)	-2.853999	-3.501137	-2.504240**	
PCI	-1.258004	-1.519822	-1.592705	I(1)
D(PCI)	-5.379131*	-5.338267*	-5.291503*	

N.B.: 1. Lag length are decided based on Schwarz information criterion
2. Prefix 'D' stands for first difference operator.
3. Mackinnon (1996) one-sided critical values for rejection of a unit root are used
* Significant at 1 percent **significant at 5 percent,

Optimal lag length for endogenous variables

Following non-stationarity of variables at level, testing co-integration among variables requires determination of optimal lag length to get away from problems in parameters. Table 3 reveals LR, FPE, AIC and HQ select an optimal lag length of 2 at 5 percent level of significance.

Table 3: VAR Optimal lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-153.5877	NA	0.057181	11.32769	11.56559	11.40042
1	-51.69794	160.1125	0.000244	5.835567	7.262929*	6.271926
2	-14.08546	45.67230*	0.000120*	4.934675*	7.551506	5.734667*
3	6.906854	17.99341	0.000278	5.220939	9.027238	6.384562

Lag exclusion test is also carried out by the use of the $\chi 2$ (Wald) statistics for the joint significance of all endogenous variables at the selected lag. It confirms lag order of 1 and 2 are significant both jointly and individually.

The Johansen Cointegration Test Result

Using optimal lag of two and assuming all the series have a stochastic trend, the Johnson test result is displayed in Table 4. The trace statistics identifies three co-integration relationships, while, the maximum Eigen value identifies only one co-integration equation both at 5 percent level of significance. As a result, three co-integration equations are more sensible and acceptable for the model and objective of the study. Besides, it is argued that in a small sample simulation (like this study) trace statistics tends to have more heavily distorted sizes whereas their performance is superior to that of maximum Eigen value competitors.[6]

Table 4: Unrestricted co-integration rank test

Test	Null Hypothesis	Alternative Hypothesis	Eigenvalue	Cointegration Test Statistic	Critical Value (5%)
Trace Statistic	H0: r = 0 *	HA: 0<r≤5	0.759596	95.45541	69.81889
	H0: r ≤ 1*	HA: 1<r≤ 5	0.590360	55.54322	47.85613
	H0: r ≤ 2*	HA: 2<r≤ 5	0.492991	30.55385	29.79707
	H0: r ≤ 3	HA: 3<r≤5	0.253245	11.53553	15.49471
	H0: r ≤ 4	HA: 4<r≤5	0.113048	3.359018	3.841466
Maximum Eigen value	H0 : r = 0*	HA: r = 1	0.759596	39.91219	33.87687
	H0: r =1	HA: r = 2	0.590360	24.98936	27.58434
	H0: r = 2	HA: r = 3	0.492991	19.01833	21.13162
	H0: r = 3	HA: r = 4	0.253245	8.176507	14.26460
	H0: r = 4	H0: r = 5	0.113048	3.359018	3.841466

* denotes the rejection of the null hypothesis at the 0.05 level

[6] In case of discrepant results from two tests one should analyze the obtained relationships from their interpretability and sensibility perspective and make final selection based on that (University of Warsaw Faculty of economic science, 2010)

Weak Exogeneity test: After determining the number of co-integrating equations, the next task is identifying endogenous and exogenous variables based on weak Exogeneity test. Table 5 indicates LNPCGDP and UR are weakly exogenous variables leave others endogenous.

Table 5: Weak Exogeneity test

Variable	Chi-sq	Probability	Conclusion
LNPCHHFC	17.39200	0.0263	endogenous
EDU	22.68208	0.0038	endogenous
UR	12.70395	0.1224	weakly exogenous
PCI	14.39086	0.0721	endogenous
LNPCGDP	9.811680	0.2785	Weakly exogenous

Discussion of Econometric results

Based on weak Exogeneity test and significance of β coefficients, the following LR models are obtained.

4.2.1 Long Run Relationships (Co-integration Analysis)

Estimated long run model for per capita consumption expenditure (LNPHHFC)

LNPCHHFC - 1.234594LNPCGDP (-1)** + 0.031677UR* = 0 (0.09573) (0.00933)
Where; the standard errors are in parenthesis.
* - significance at 5%, ** - significance at 1%

The model shows economic growth positively influences consumption expenditure at 1percent level of significance. Empirically, a percentage increase in economic growth lead 1.23 percentage increase in consumption spending in the LR. It is consistent with theories of consumption and shows that the lion share of income of the people is devoted to consumption purpose.

On the other hand, the model signifies the coefficient of urbanization is negative and statistically significant at 5 percent level. The result suggests in

the LR, a unit change in urbanization lead consumption expenditure to respond negatively by approximately 3.2 percent.

It can be attributed to more economies of scale adaptation, stability in living conditions, and accessibility of financial institutions with saving facilities and other in urban areas in the LR. Moreover, according to Delisle (1990), there are wider disparities in access to food and other resources within the urban population than the rural population. In many ways, the food and nutrition situation of the urban poor may be worse than that of their rural counterparts. It is because of a lack of in kind income, dependence on the market economy, adverse environmental conditions and time constraints of women contributes to minimal food expenditure in the urban areas in the LR.

A study by Guush, *et al*. (2011) found Per capita intake of calories is higher in rural Ethiopia than their urban counterpart attributed to disparities in the availability of food, which may partly cause consumption expenditure to decrease in the urban areas.

Estimated long run model for Education enrolment (EDU)

EDU - 127.3020LNPCGDP (-1)** - 14.77601UR* = 0 (12.8323) (1.25117)
Where the standard errors are in parenthesis
* - significance at 5%, ** - significance at 1%

The model signifies economic growth has positive outcome on education enrolment at 1percent level of significance[7]. Empirically, a percentage increase in per capita GDP helps education enrolment to increase by 1.27 percent in the LR. Clearly, when income increases, it pushes the demand for education upward. It is because it can relax constraints on education expenditure both at individual and national level. An increase in income helps parents to send their child to the school. On the other way, economic

[7] Note that; it is the finding on the reverse impact of growth on human capital accumulation unlike most literatures, which deals on the role of human capital investment on economic growth.

growth leads the government to expend more on education sectors and encourage for enrolment.

This result is consistent with the findings of Kakar, Khan and Khilji (2011) in their study of the relationship between economic growth and education. Using a time series analysis, their finding confirms education has a LR relationship with economic growth but not in the SR. It is also in line with the findings of Tariq S., Wadud M., and Qamarullah B. (2007) indicating education and GDP growth have a bidirectional causality of each other.

On the other hand, the model shows urbanization has a positive contribution to education enrolment in the LR at 5% level of significance. Empirically, a unit increase (decrease) in urbanization leads an increases (decreases) education enrolment by 14.77 percent respectively. Clearly, the availability of more education facilities in the urban areas can make education enrolment high.

Estimated long run model for polity composite index (PCI)

PCI + 45.92284LNPCGDP ** - 0.408372UR* = 0 (0.81622) (0.78159)

Where; the standard errors are in parenthesis.

* - significance at 5%, ** - significance at 1%

From the model, economic growth has negative and significant influences on polity composite index in the LR. Empirically, a unit increase in LNPCGDP, leads to 0.45 unit decreases in polity[8] score in the LR. Implying economic growth in terms of per capita GDP significantly affects the determination of political system to be less competitive.

The result is unlike to the "Lipset hypothesis" Lipset (1959), which states that, "The more well-to-do a nation, the greater the chances that it will sustain democracy." However, it is consistent with most literatures. As recently noted by G. Fayad, *et al*. (2011), various Studies found a negative relationship and attribute it to issue of political unrest and the power of the government during economic slowdown. Alesina and Perrotti (1994) argue that "transitions from dictatorship to democracy, being associated with socio

[8] It is the unit of measurement of political freedom.

political instability, should typically be periods of low growth." Burke and Leigh (2010) also, presents a game theoretic model in which output contractions can encourage democratization by reducing the citizens' opportunity cost of demonstrating for a better government. This increases the political power of citizens relative to ruling elites, and thus the pressures for democratic change. Strong growth, however, strengthens the legitimacy of autocratic governments and reduces the citizens' incentives to protest. Moreover, by constraining government expenditure possibilities, growth Slowdowns reduce the bargaining power of autocratic regimes (Haggard and Kaufman, 1997) and their ability to coerce important stakeholders (Geddes, 1999), this increasing the likelihood of democratic change.

Concerning Ethiopia, in addition to the above possible mechanisms, it can also be associated to the political economy of the country. The developmental state (dominantly considered as a trait to democracy) is viewed as one of the two pillars of the "national renaissance." Coupled with the other pillar (democratic federalism), " where developmental state is characterized by traits of, economic nationalism, large government bureaucracy, skepticism about neo liberalism and the 'Washington Consensus', prioritization of economic growth over political reform (UNDP, 2012). Besides, Omano E., (2007) argues that the repressive nature of the state as one of the factors that enhanced its developmental capacity. Hence those characteristics as a requirement to achieve level of development, can lead the deterioration of political environment.

Moreover, from the sphere of democratization, developmental states face challenges unlike their effort (case in East Asian Tigers). It needs to overcome the legacy of authoritarianism, ethnocracy, neo liberalism, fostering a meritocratic public sector, stemming public staff turnover, confronting challenges of balancing the rights of business with the needs of majority, and challenge of governing in accordance with popular wishes while transforming the structure of the economy which are observed in Ethiopia could challenge the political situation (UNDP, 2012).

Concerning urbanization, it influences polity composite index positively at 5 percent level of significance. The result suggests a percentage increase in urbanization improves polity composite index by 0.4 polity level in the LR. It is due to the fact more institutions with the aim of protecting political rights are based in urban areas relative to their counterpart in rural areas. Further, in the LR more communication associated with more population and technology makes people in the urban areas to unit and resist for their rights.

In summary, Economic growth is found to have a positive and significant impact on consumption expenditure and education enrolment and a negative impact on polity composite index at 1 percent level of significance in the LR. Urbanization on the other hand has a negative impact on per capita consumption expenditure and positive impact on education enrolment and polity composite index all at 5 percent level of significance.

4.2.2 Short Run Relationships (Vector Error Correction Models (VECM))

The VECM will tell us about the SR behaviour prevail among the variables by restricting the LR behaviour of endogenous variables to converge to their co-integrating relationships while allowing for SR adjustment dynamics. Based on test of significance of coefficient[9], the parsimonious error correction models are given below.

In the model (Table 6), both consumption and economic growth have significant role in the SR dynamics of consumption expenditure. Consumption expenditure at one period before has a negative and significant impact on the current consumption. Empirically, a 10 % increase in consumption at time t-1 leads to decrease in consumption at time t by 7.5percent. On the other hand, economic growth has positive impact on consumption in the SR at 5 percent level of significance. A 10 percent rise in economic growth leads for a rise of consumption expenditure by 9.3 percent that is consistent with the LR case.

[9] The test is fund in Appendix I

The coefficient of the error correction term (ECM1) guarantees that although the actual consumption expenditure may temporarily deviate from its LR equilibrium value, it would gradually converge to its equilibrium. It shows that 78.33 percent of the deviation of the actual per capita consumption expenditure from its equilibrium value is eliminated every year. Hence, full adjustment would require a period of less than one and half year for per capita consumption expenditure to reach its LR value.

Table 6: Parsimonious Error Correction Model for consumption expenditure

Dependent Variable: D (LNPCHHFCt)

Variable	Coefficient	Std. Error	t-Statistic	P- Value
DLNPCHHFC(-1)	-0.748196 ***	0.277934	-2.691995	0.0083
DLNPCGDPT (-1)	0.925131**	0.422655	2.188853	0.0309
ECM1	-0.783322***	0.278475	-2.812895	0.0062

** Significance at 5% , *** significant at 1%

The result from Table 7 suggests that, the SR dynamics of education enrolment is positively influenced by the previous year education enrolment and economic growth at 10 % and 1 percent level of significance respectively. A percentage increase in education enrolment at time t-1 contributes to 0.3 percentage increase in education enrolment at time t. It is due to the fact more education helps people to recognize the value of education to human wellbeing as confirmed by (Oketch & Ngware, 2012). It should also be noted that, school repetition and readmission could also contribute for increasing of education enrolment in the latter periods. Similarly, a percentage increase in economic growth results approximately 0.5 percentage increase in education enrolment in the SR, which is consistent with the LR result.

Urbanization has negative and significant impact on SR fluctuation of education enrolment unlike its LR case. The result reveals a percentage

increase in urbanization leads approximately 7 percent decrease in education enrolment in the SR. It can be associated with rapid urbanization in the country through the rural urban migration that lead to the prevalence of a significant number of illiterate persons in the cities Golini (2001). According to this study, In the Ethiopian history, urban population growth in the last fifteen years of the last century was very fast with the rates over 5 percent and a peak in the quinquennium 1985-1990, when the annual rate of change reached 5.93 percent. This rapid urbanization resulted for severe overcrowding, and shortage of social services. It is also evident that a significant proportion of males and girls who migrate with families or friends and who are expected to get education do not attend school (Erulkar *et al*., 2006, P. 368).

According to Oketch & Ngware (2012), rapid urbanization can lead to great urban inequalities that mask national education statistics. For example, a significant proportion of the residents in urban areas live in the slums where access to public services is of either very deplorable quality or nonexistent. Further, huge rural-urban migration decreases enrolment in the rural areas and because of negative impact of rapid urbanization on education provisions in the urban areas, the immigrants will left out of school in the SR (Oketch & Ngware, 2012).

However, it should be noted despite the fact in the SR, urbanization has a positive contribution for LR dynamics of education enrolment. This implies challenges of educational provisions and inequalities are eliminated and positive contributions of urbanization will outweigh in the LR. This was confirmed by Golini, (2001) that Ethiopian further urbanization can contribute and provide better services to its people because they can benefit from the economies of scale.

The coefficient of error correction term for education enrolment (ECM2) (-0.286714) shows that approximately 29 percent of the deviation of the actual education enrolment from its equilibrium is eliminated every year. This result ensures that education convergences to its LR equilibrium with a minimum approximate to three years period.

The coefficient of ECM3 (-0.801359) is the error correction term which is the speed of adjustment to the LR equilibrium of education enrolment periodically transmitted from the disequilibrium in polity composite index. It shows that approximately only 0.8 percent of the deviation of actual education enrolment from its equilibrium attributed to the disequilibrium in polity composite index is eliminated every year, indicating that long period of time is required for full adjustment which is a sensible result given it is disequilibrium is from political situation.

Table 7: Parsimonious Error Correction Model for education enrolment
Dependent Variable: D (EDUt)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM2	-0.286714*	0.004037	-1.834038	0.0704
ECM3	-0.801359**	0.365940	-2.189866	0.0309
D(EDU(-1))	0.303127*	0.17257	1.756589	0.0820
D(UR(-1))	-7.138697**	3.377270	-2.113748	0.0370
D(LNPCGDP(-1))	49.12680***	15.57660	3.153885	0.0021
Constant	1.281496*	0.661870	1.936174	0.0557

** Significance at 10 % ** significance at 5%, *** significant at 1%*

The model in Table 8 signifies that, the SR dynamics of PCI is influenced only by urbanization. The SR impact of urbanization on polity composite index is negative and significant at 5 percent. A percentage increase in urbanization results approximately 3.8 units' decrease in polity score in the SR, which is contrary to the LR relationship.

Usually, it is associated with the consequences of rapid urbanization. At the times of rapid urbanization, changes occur hand-in-hand with the arrival of immigrants. Problems that resulted from overcrowded cities, and problems with the civil service commission, are just some of the side effects that urbanization and immigration results. These and other consequences can expose the society for insecurity in their political and civil rights in the SR. Concerning Ethiopia, it is indicated above that, the country has experienced rapid urbanization in the last fifteen years of the last century, which resulted

for severe overcrowding, and shortage of social services that ultimately can lead to problems with political and civil rights. Besides, Golini (2001) indicated that, 1970s and 80s was a period of urban crises everywhere in Africa and more sever in Ethiopia which could be associated with political crisis, drought and long economic crisis.

Furthermore, it may be associated that it takes time to establish institutions with the aim of protecting political rights and civil liberties and start effective actions. Hence, in the SR, rapid urbanization can create challenges in administration and protecting rights. In contrast to these, in the LR, urbanization has a positive role for political rights indicate the elimination of problems that would exist in the SR.

The coefficient of error correction term for polity composite index (ECM3) (-0.457194) shows PCI has the speed of adjustment of more than 45 percent per year for any disequilibrium originates from itself indicate full adjustment needs more than two years.

Table 8: Parsimonious Error Correction Model for polity composite index

Dependent Variable: D (PCI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM2	- 0.312775**	0.121005	-2.584807	0.0112
ECM3	-0.457194**	0.182922	-2.499395	0.0141
D(UR(-1))	-3.794023**	1.688193	-2.247387	0.0268
Constant	0.596088*	0.330849	1.801695	0.0746

* Significance at 10% ** significance at 5%

In summary, economic growth have a positive and significant influence on per capita consumption expenditure and education enrolment in the SR, but have not impact to polity composite index. Urbanization on the other hand, influences political and social representative variables significantly and negatively in the SR unlike the LR case.

4.3 Diagnostic checks

In the study, different post estimation diagnostic tests were performed to guarantee the robustness of models obtained. Table 9 reveals that we fail to reject the null hypothesis of jointly normal distribution, no serial correlation and no hetrosckedasticity with the specified VECM.

Table 9: Diagnostic checks for VECM

Test	Statistic		P-Value
	Lag	Chi-sq	
Residual Vector Serial Correlation LM 25df	1	17.69339	0.8551
	2	31.62740	0.1691
	3	22.85114	0.5863
	4	11.17369	0.9921
Residual vector Normality (Jarque-Bera) 10 Df	Joint test	17.59487	0.0622
Residual Vector Hetrosckedasticity 240df	Joint test	240.9426	0.4707

5. Conclusion and Suggestions

5.1 Conclusion

Following the rising of the Ethiopian economy, this study investigated the possible nexus that can exist between this economic growth and QoL. The trend analysis shows on average a rising trend for all objective indicators though at a different rate. The correlation analysis verifies consumption expenditure and education enrolment significantly correlated with each other and with economic growth. In addition to this, polity composite index and education enrolment are significantly correlated with each other and with the level of urbanization.

The result from co-integration analysis discloses, in the LR, economic growth have a significant and positive impact on consumption expenditure and education enrolment and negative impact on polity composite index. The VECM reveals economic growth positively and significantly influences

consumption expenditure and education enrolment in the SR, unlike its impact on polity composite index. In general, models indicate, economic growth influence to Qol tends to be stronger in the LR compared to the SR impact.

5.2 Suggestions

To benefit from economic growth in improving QoL in both LR and SR, it needs to be accelerated with caution to its effect on political rights in the LR. In light of that, it requires to make sure the benefits of the economy are appropriately used not to repress political rights but, should be designed where the outputs of the economy can be used to foster those political rights.

Besides, the VECM analysis identifies rapid urbanization through its (overcrowding effect) has a negative impact on education and polity composite index in the SR unlike its LR case. Hence, it requires adjustment mechanisms on the SR path of urbanization, which may include early establishment of institutions like independent courts and ombudsman and/or its branches and expand and facilitate educational provisions in these rapidly urbanizing areas.

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***Appendix I*: Tests on the significance of VECM Coefficients**

Dependent Variable: D(LNPCHHFC)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
ECM1	-0.783322	0.278475	-2.812895	0.0062
ECM2	0.001721	0.006568	0.261943	0.7939
ECM3	0.005192	0.009929	0.522856	0.6022
D(LNPCHHFC(-1))	-0.748196	0.277934	-2.691995	0.0083
D(EDU(-1))	-0.000421	0.004682	-0.089976	0.9285
D(PCI(-1))	-0.011522	0.010924	-1.054720	0.2941
D(UR(-1))	0.043868	0.091639	0.478706	0.6332
D(LNPCGDP(-1))	0.925131	0.422655	2.188853	0.0309
C	0.020418	0.017959	1.136939	0.2583

Dependent variable: D(EDU)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
ECM2	-0.007404	0.004037	-1.834038	0.0704
ECM3	-0.801359	0.365940	-2.189866	0.0309
D(LNPCHHFC(-1))	-16.93907	10.24301	-1.653720	0.1013
D(EDU(-1))	0.303127	0.172566	1.756589	0.0820
D(PCI(-1))	-0.066460	0.402591	-0.165080	0.8692
D(UR(-1))	-7.138697	3.377270	-2.113748	0.0370
D(LNPCGDP(-1))	49.12680	15.57660	3.153885	0.0021
C	1.281496	0.661870	1.936174	0.0557

Dependent Variable: D(PCI)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
ECM1	0.317708	5.391656	0.058926	0.9531
ECM2	-0.312775	0.121005	-2.584807	0.0112
ECM3	-0.457194	0.182922	-2.499395	0.0141
D(LNPCHHFC(-1))	-2.172939	5.120165	-0.424388	0.6722
D(EDU(-1))	-0.040960	0.086260	-0.474844	0.6359
D(PCI(-1))	0.052899	0.201243	0.262859	0.7932
D(UR(-1))	-3.794023	1.688193	-2.247387	0.0268
D(LNPCGDP(-1))	-7.401460	7.786262	-0.950579	0.3441
C	0.596088	0.330849	1.801695	0.0746

Transactions Costs and Spatial Integration of Vegetable and Fruit Market in Ethiopia

Tadesse Kuma Worako[1]

Abstract

This paper analyzes transaction costs and spatial market integration of vegetable and fruit markets between major surplus producing zones and the Addis Ababa retail market taking onions, potatoes, and tomatoes from vegetables and root crops and bananas from fruits. Monthly retail price data from the Central Statistical Agency (CSA) from October 2008 to August 2015 was considered for the research. All retail price series from Addis Ababa and 21 zonal retail markets were transformed into natural logarithms in order to mitigate the fluctuation of individual series and to ease interpretation of the coefficients. The presence of long run relationship between two groups of markets is examined using a test for cointegration based on maximum likelihood approach developed by Johansen and Jesulus (1990). The dynamics of short-run price responses are explored using the vector error correction model (VECM). The result indicated that there is strong support for the presence of long run relationship between the surplus producing zonal vegetables and fruit markets and the Addis Ababa market. Although these markets responded positively for the long-run cointegrating relationship, the speed of price adjustment was found to the modest. A shock in Addis Ababa retail market took, on average, between 3 to 7 months to be fully absorbed in the surplus producing zonal markets. To increase the efficiency of vegetable and fruit markets, there is therefore a need to focus on reducing transaction costs related to transport, improving market information flow, removal of any sort of entry barriers, and introducing enhanced processing and storage technologies to extend shelf life and ensure producers to obtain a reasonable share of retail prices.

Key Words: Transaction costs, vegetable and fruit, retail markets, spatial integration
JEL Classification: M31

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1. Introduction

Markets play a dominant role in the process of any national economic development in general and agricultural sector transformation in particular through facilitating the exchange of goods and services and enhancing welfare for actors engaged in the chain. Markets provide signals about the true cost of resources and guide allocation to their best use. In addition to signals about the value of resources, the market influences the direction of decisions of production to more profitable choices. Integrated markets could help in equalizing the value of a resource across space after accounting for transfer costs between markets (Baulch, 1997).

Markets are said to be integrated when a price increase or decrease (shocks) transmitted to vertically or spatially connected distinct markets. Price transmission is the degree to which market shocks are transmitted up and down in the marketing chain. This phenomenon has long been considered as an important indicator of market performance. In other words, the extent to which a price shock in one market affects a price in another market can broadly indicate whether efficient arbitrage exists in the space that exists between the two points. As indicated by theories of market integration, there are two extremes, namely a full transmission of price shocks indicating the presence of a frictionless and well-functioning market, and at the other end an assumption of total absence of price transmission or market segmentation that may make the very existence of market integration questionable. In most cases, the reality lies somewhere in between. Therefore, the degree of price transmission can provide at least a broad picture of the extent to which markets are functioning in a predictable way and price signals are passing through consistently between different markets (Rapsomanikis, Hallam & Conforti, 2004). This means that market integration helps buffer spatial and temporal surpluses and deficits between different markets and thus benefits consumers and producers, increases the efficiency of spatial and temporal production resource allocation, and mitigates production risks across regions.

In most cases, agricultural markets in developing countries are not well integrated due to lack of well-developed infrastructure mainly because of

high transportation costs, non-existent or weak market institutions that facilitate the flow of goods and information between markets, policy barriers or distortion, and high transaction costs. All these cumulatively result in a reduction in the price information available to economic agents and consequently may lead to decisions that contribute to inefficient outcomes. The majority of rural agricultural markets in Ethiopia usually share this feature, as it is common in many developing countries. Under such circumstances, rural markets may not be able to make quick adjustments to price shocks occurring in neighbouring markets. For this very reason, the analysis of spatial price transmission has attracted a considerable amount of theoretical and empirical work in the context of the "Law of one price". It assumes that if two markets are linked by trade in an efficient market, the movement of price in one market will be equalized with the movement of other markets in the long-run while allowing for deviations in the short-run (Margarido *et al*., 2007). Understanding the extent to which spatial prices are transmitted is a useful guide to take policy measures aimed at improving efficiency of vegetable and fruit markets.

Ethiopia has exhibited sustained economic growth[2] together with a high rate of urbanization and population growth which are expected to bring change in the pattern of food consumption. As some anecdotal evidence indicates, there is a certain degree of transition from the consumption of staple foods to High Value Products (HVVPs) such as meat, fruits, vegetables, and dairy products (Worako, 2008). This increasing demand for HVPs is bound to create market opportunities if smallholder farmers' production systems respond to new market openings. In light of this, the country has also put in place a conducive policy environment for the production of vegetables and fruits including a favourable agricultural development policy and strategies supporting the development of the horticulture sector, which encourages vegetable production, processing, marketing locally for exporting. Creation of a number of supporting institutions and improving infrastructure development such as small to medium scale irrigation schemes, road networks and communication infrastructure coupled with urbanization, increasing public awareness on the importance of vegetables and fruits for

[2]According to Ministry of Finance and Economic Cooperation (2014), the country has registered more than 10 percent real GDP growth over 2004-2014 periods.

health depict the potentials for expanding vegetable and fruit production Ethiopia (WB, 2004).

Vegetable and fruit production and marketing has become lucrative venture in the recent years because the prices of these items have increased considerably together with other food products. This would offer a great opportunity for smallholder producers, if their production system is linked with markets. However, the extent of the benefits accruing to smallholder in turn depends on the efficiency of markets and how they operate. Farmers engaged in the production of fruits and vegetables often earn higher net farm incomes than farmers who focused on the production of cereal crops alone. Studies from developing countries frequently show higher average net farm income per household member among producers of fruits and vegetables. A study conducted in Kenya showed that farmers who produced vegetables and fruits for the export market were found to have farm incomes five times higher per family member compared to smallholder farmers who did not grow horticultural crops (Joosten *et al*, 2015).

Apparently, vegetable production is more profitable than cereals in terms of cropping days since the growing period of vegetables is usually less than that of cereals. Thus, the production of vegetables has a comparative advantage particularly under conditions where cultivable land is scarce while labour is abundant, for which Ethiopia is a good example. In terms of employment and poverty alleviation, production of fruits and vegetables offers ample opportunities because it is usually more labour intensive than the production of staple crops. The research of Huong *et al.* (2013) in the Red River Delta shows that permanent vegetable cultivation requires more labour than the traditional cropping systems with rice followed by seasonal vegetables (Joosten *et al.*, 2015). It also offers greater post-harvest opportunities to add value. Today, packing and processing services such as washing, chopping, and mixing, as well as bagging, branding, and applying bar codes are often out sourced rather than being done at the end-market destination. These processes have created considerable new employment opportunities in developing countries (Fernandez-Stark *et al.*, 2011).

However, the success or failure of the sector's performance depends on the extent of transaction costs facing actors in the marketing chain, mainly

producers. They are price takers and have little bargaining power. This begs the question of what they can do to get a higher price. Producers have limited possibility of selling their produce directly to wholesalers or even retailers because of the intertwined nature of the market structure. Their only contact is often with the collectors/rural traders who either work as agents for wholesalers or own private business. Rural traders/assemblers usually offer prices much lower (Meijerink, 2002) in view of limited competition. In order to overcome these problems, most of trading firms tend to establish long-term relationships with other firms with which they have developed trust. However, relational contracting makes it costly for firms to switch partners (Fafchamps, 1996). Finding another trading partner involves transaction costs and may not lead to obtain a higher price until they have established a good relationship. That is, it is not always easy for new entrants and producers to get immediate buyers. Hence, farmers mostly sell to the collector with whom they have an established contact, leading to at least to a more or less assured better price (IDE, 2006).

Although most of the fruits and vegetables trade is executed through spot markets, the transaction costs in these markets are very high. Transaction costs are high because fruits and vegetables are perishable products, and therefore cannot be stored until sufficient information on qualitative and quantitative demand has been obtained. Moreover, the products are also bulky and costly to move from production sites to marketing centres. This nature of the products, provides an upper hand to traders. As a result, markets are thin and prices are volatile and uncertain. Farmers can supply only in very small quantities and lack the market power to determine the terms of the contract. Traders, on the other hand, are hesitant to commit to prices and quantities in advance due to volatility and uncertainty of market forces.

In addition to the thin market structure, market and institutional problems like high transportation costs due to poor road networks, information asymmetry and market imperfections are detrimental for smallholders' market integration. High transaction costs in the form of information and search, bargaining and negotiation, as well as monitoring and contract enforcement are likely to influence smallholders´ marketing behaviour. This

in turn precludes the price signal transmission and goods movement from low price to high price areas, ultimately segmenting markets. This inefficiency in the marketing chain consequently affects producers from obtaining a reasonable share of the final price.

In Ethiopia, while there has been several market integration studies on cereals and cash crops, there is hardly any research conducted to indicate price transmission and market integration for vegetable and fruit markets. Apparently, it is obscure to what extent the price of major production and consumption area markets are interlinked. Thus, this paper aims at analyzing spatial market integration of four major vegetables and a fruit (i.e., onions, tomatoes, potatoes and banana) between major production zonal and central retail markets.

2. Production and Price Trends of Vegetables, Fruits and Root Crops

2.1 Production Trends

Ethiopia produces a variety of vegetable and fruit crops in its different agro-ecological zones through commercial as well as smallholder farmers. Their production in many parts of the country varies in scale from cultivating a few plants in the backyards for home consumption up to a large-scale commercial production for domestic and export markets (Dawit *et al.*, 2004). It is apparent that the importance of horticulture production is well recognized. It plays a significant role both in generating income and improving nutritional status. In addition, it helps in maintaining ecological balance since horticultural crops species are varied and diverse. Further, the sector provides employment opportunities, as its management system is labour intensive.

Ethiopia is a country endowed with a great variety of climate and soil types in which diverse and distinct horticultural crops can grow for home consumption as well as domestic and foreign markets. Regions with the highest potential for horticultural production include the following: (1) Oromia: areas around Addis Ababa (Eastern Shewa, Northern Shewa,

Western Shewa), including some of the major floriculture production areas; (2) Amhara: Lake Tana catchment areas (Bahir Dar Zuria, West Gojam and South Gonder); (3) Tigray: the Raya Valley to the south of Mekele (South Tigray) and Adwa-Axum (Central Tigray) and (4) Southern Nation Nationalities People's Regional State (SNNPR): Hawassa (Sidama), Arbaminch and Chencha highlands (Northern Omo) Adugna (2009). The majority of the horticultural crops come from smallholder farming households. They contribute the lion's share of total national production. As available data shows, 95% of fresh vegetable production and supply is made by them although there is understandably no processing of vegetables at the smallholder level.

The major vegetables produced for domestic consumption are lettuce, head cabbage, Ethiopian cabbage, tomatoes, green peppers, red peppers, and Swiss chard. Compared with fruits and vegetables, the production volume of root crops is the highest (Table 1). The major domestically produced root crops include beetroot, carrot, onions, potatoes, garlic, taro/*godere*, and sweet potatoes. The principal types of fruits for which high volumes of production were recorded are avocados, bananas, guavas, lemons, mangoes, oranges, papayas and pineapples (CSA, 2008). Over 2003 to 2014, on average 3.1 million tons of vegetables, fruits and root crops per annum were produced in the country. The production of bananas, mangoes, papaya and orange was 55.3%, 12.8%, 12.5%, and 8.4%, , respectively.

Table 1 below shows area cultivated (ha), volume of production (ton) and yield (ton) for vegetables, fruits and root crops over the period 2003 to 2014. During this period, total area covered with vegetables increased from 82.3 thousand in 2003 to 192.5 thousand hectares in 2012 and then declined to 132 thousand in 2014. Its area grew by 133% in between 2003 and 2012 with an annual average growth rate of13.3%. Vegetable production grew from 388 to 852.3 thousand tons in the same period with an annual average growth rate of 12%. The growth in supply is mainly accounted for expansion of land under cultivation rather than productivity growth. This can be witnessed from the productivity growth figure which is more or less the same for 2003/2004 and 2015. Root crops and fruits on the other hand

registered consistent productivity growth, on average 11 and 8 tons/ha, over the 2003 to 2014 period, respectively. Average yield for vegetables, however, was around 4tons per hectare over the same period.

Table1: Area and volume of production for vegetables[3] , fruits, and root crops (2003-2014).

	Total area (ha)			Total production (ton)			Yield (ton/ha)		
Year	Fruits	Vegetables	Root crops	Fruits	Vegetables	Root crops	Fruits	Vegetables	Root crops
2003	44,338	82,333	158,731	249,590	387,947	1,605,525	5.6	4.7	10.1
2004	46,464	94,334	156,205	263,402	432,004	1,615,204	5.7	4.6	10.3
2005	45,043	117,650	169,343	428,301	450,200	1,337,468	9.5	3.8	7.9
2006	50,073	95,266	189,424	459,985	345,131	1,409,546	9.2	3.6	7.4
2007	62,731	119,091	184,329	462,148	471,966	1,530,949	7.4	4.0	8.3
2008	47,990	162,125	145742	351,259	598,857	1,213,604	7.3	3.7	8.3
2009	53,086	138,393	212,208	408,912	557,357	1,806,378	7.7	4.0	8.5
2010	54,647	126,675	228,716	486,276	675,606	1,915,561	8.9	5.3	8.4
2011	61,473	160,050	199,900	539,339	755,778	1,671,030	8.8	4.7	8.4
2012	61,973	192,555	203,958	479,336	852,308	1,629,862	7.7	4.4	8.0
2013	71,507	161,488	209,879	499,184	722,894	4,160,872	7.0	4.5	19.8
2014	90,071	139717	216,971	706,649	595,400	5,461,554	7.8	4.3	25.2
AVG	57,450	132,473	189,617	444,532	570,454	2,113,129	8	4	11

Source: CSA data, 2012/13

Three of these commodities showed positive progress in terms of productivity in between 2003 and 2014. This productivity of crops is however relatively very low compared to the potential yield obtained at the research centres, magnifying the existence of a wide divergence between

[3]Vegetables are broadly defined as the edible portions of a plant (excluding fruit and seeds) such as the roots, tubers, stems and leaves.

actual and potential production levels. For instance, the productivity of onions and tomatoes were about 9 and 7 tons per hectare, respectively, compared to the potential yield of 40 and 35 tons per hectare in that order in research centres which implies a wide divergence between potential and actual production.

Low vegetable yield is attributed to shortage of seeds/planting materials, diseases and insect pests, poor post harvest handling and weak linkage with markets and market information. This is further exacerbated by inadequate seed regulatory framework and supply of poor quality seeds, and low capacity for policy implementation as well as unregulated vegetable seed supply. There is also limited capacity for breeding such important vegetable crops like kale, Ethiopian mustard, and pumpkin. Moreover, there is no systemic seed importation system to access seeds regularly. The vegetables seed provision system in the country is at infant stage, primarily depending on the informal, community-based seed production and distribution and on unregulated seed import (Emana *et al*., 2014).

2.1.1 Onion production

Onion is one of the most important vegetables in the Ethiopian consumption basket. It is a vital complementary ingredient for cooking Ethiopian traditional sauce or *wot*, which is consumed together with *enjera*. It accounted for about 10.5 and 4.2 percent of area and quantity of root crops production, respectively (CSA, 2014/15).

Onion is produced and consumed all over the country. However, there are particular areas which contribute the lion's share to the national supply. As average production data for the period 2008 to 2014/15 indicates the following zones made significant contribution to the national production: North Shoa (24.4%), Arsi (13.3%), West Hararge (9.6%), East Shoa (8.4%) and East Hararge (3.5%) (Table 2). The five zones together, on average, accounted for 61.2% of national production. Between 2008 and 2014, the national production of onion grew from 148,855 to 221,846 tons or 21.3% growth per annum. This sustained growth in production may be accounted

for by price incentives to producers, increased urbanization, changing consumption habits and per capita income growth in recent years.

Table 2: Onion production (tons) by major producing zones (2008-2014)

Zone Name	2008	2009	2010	2011	2012	2013	2014	Average (MT/Ha	Share (%)
Arssi	14,572	22,465	42,254	58,043	20,564	30,807	18,227	29,562	13.3
West Harerghe	28,401	14,421	29,000	20,933	22,021	16,893	17,113	21,255	9.6
North Shewa	23,176	18,966	46,612	104,851	48,401	70,012	67469	54,212	24.4
East Shewa	15,064	24,008	11,607	18,158	17,209	26,578	18388	18,716	8.4
East Harerghe	6,268	20,130	2,168	3,559	8,031	8472	5558	7,741	3.5
Top five zones contribution	87,48	99,99	131,64	205,54	131,16	14208	15260	135,78	61.2
National aggregate	148,85	169,31	236,92	328,15	219,18	219,73	230,74	221,84	100

Source: CSA, 2008-2014

2.1.2 Potatoes Production

Potato is a leading vegetable/tuber crop in the country. It plays a major role in terms of nutrition, national food security and poverty alleviation, income generation and provision of employment through its production processing and marketing. Potato is the fastest growing food crop in Sub-Saharan Africa (SSA) and total production in some countries more than doubled during the last 15 years. This is similar to the developments in Asia (China and India) where area and yield greatly increased (FAO, 2013).

Furthermore, potatoes provide considerably more energy and protein than cereals. One of the reasons for this is its high harvest index, i.e., high proportion of all dry matter produced is edible as no straw is made. An added advantage of the crop is that, long before crop maturity, the tubers can be eaten. As the Ethiopian population grows rapidly, potatoes offer opportunities to be one of their main staple foods. In the urban setting, potato is one of the commodities consumed in different meals. It also serves as a

raw material for different food processing industries, being of immense importance in terms of value-addition in food processing industries.

Table 3 depicts trends of potato production at national level and in the top six potato producing zones in the country. These six zones account for 40.7 percent of total national potato production with the following breakdown: Kelem Wollega (16.2%), West Gojam (8.3%), East Gojam (7.4%), Gamo Gofa (6.7%), North Gonder (6.3%) and South Gonder (5.8%). Over the period 2008 to 2014, potato production increased from 384 thousand tons to 912 thousand tons, showing a rate of growth of 34.3 percent per annum.

Table 3: Potatoes production (ton) by major producing zones (2008-2014)

Zone Name	2008	2009	2010	2011	2012	2013	2014	Average	Share (%)
Kelem Wellega	38,702	108,608	93,175	109,411	103731	102,106	*	103,406	16.2
South Gonder	67,227	45,126	49,860	44,297	21989	32,987	27,537	36,966	5.8
West Gojam	44,531	52,095	32,823	24,646	71772	78,134	57,148	52,770	8.3
East Gojam	28,869	54,480	40,929	48,767	54100	57,292	25,964	46,922	7.4
North Gondar	24,829	21,531	24,213	26,905	86520	42,850	39,309	40,221	6.3
Gamo Gofa	27,867	40,532	19,504	23,844	86520	42,849	43,179	42,738	6.7
Top six zones contribution	232,025	322,372	260,505	277,870	320,901	254,112	149,958	259,678	40.7
National aggregate	384,046	572,333	447,334	487,130	863,348	784,993	921,832	637,288	100

Source: CSA, 2008-2014.

2.1.3 Tomato Production

The introduction of cultivated tomato into Ethiopian agriculture dates back to the late 1930s (Samuel *et al.*, 2009). The first record of commercial tomato cultivation was started in the 1980s in the Upper Awash by Merti Agro-industry for both domestic and export markets (Lemma, 2006). According to the CSA statistics, the total area increased to 833 ha by 1993 and to 7,256 ha in 2012 and volume of production grew from 41 to 82 thousand tons in between 2008 and 2011 but dropped later. Currently tomato is one of the national horticulture export crops of the country (Joosten *et al.*, 2015).

Table 4: Tomato production (ton) by major producing zones (2008-2014)

Major production Zones	2008	2009	2010	2011	2012	2013	2014	Average	Share (%)
East Shewa	11,290	3,258	7,306	32,314	*	*	*	13,542	27.4
South West Shewa	6,064	7,919	391	96	*	*	*	3,618	7.3
South Western Tigray	1,249	1,270	926	1,118	*	*	*	1,141	2.3
KembataTembaro	1,196	995	1,609	2,230	*	*	*	1,508	3.1
Hadiya	1,665	6,389	1,336	2,326			1808	2,929	5.9
Arssi	6,329	231	1,724	7,819	*	*	*	4,026	8.2
Top five zones contribution	29,482	20,070	24,351	46,187	*	*	*	30,023	60.8
Total national production	41,815	40,426	55,635	81,978	55,514	39,373	30,700	49,349	100

Source: CSA, 2008-2014

Tomato is a widely grown vegetable crop in Ethiopia. It is consumed in every household in different modes. It is an important co-staple food item mainly in the urban areas. Although its year -to-year quantity of production has remained volatile, the top six tomato producing administrative zones

contributed, on average, 60.8 % of total national supply between 2008 and 2014. These zones include East Shewa, Arsi, Hadiya, Kambata Tambaro, South West Tigray and South West Shoa (CSA, 2012), (Table 4). According to the evidence from Ambecha *et al.* (2011), about 36% of the growers use supplementary irrigation in most of the production zones to sustain commercially viable tomato production.

2.1.4 Banana Production

Banana is among the most widely produced and consumed fruits in Ethiopia. The country is considered to have the potential to expand its production and trade gains from the sector because of diverse agro-climatic advantages, existence of cheap and surplus labour, irrigation opportunities and proximity to the Middle East and the major European markets. However, it should be noted that the production and marketing practices of fruits and vegetables in general and banana in particular by smallholders in the major producing areas are predominantly traditional. It suffers from marketing and production bottlenecks which inevitably result in low yield and low quality products with negative consequences on farmers' income.

Table 5 below depicts five major producing zones and their respective shares in total national production. Gamo Gofa is the top producer accounting on average for 24% of national production over the 2008-2014 years. Sidama zone is the second most important banana producer accounting for 16.2 percent. The other three zones together account for 20 percent. In terms of the total national production, banana has in particular recorded tremendous growth in the last 10 years. Albeit its sale is mainly limited to the domestic markets, banana production increased from 194 thousand tons in 2008 to 478 thousand tons and recorded a 35.2 percent annual average growth. During the same period the area cultivated increased from 29 to 53.9 thousand hectares, registering a 26.5 percent annual growth. However, it is not clear how-strongly these producing zones are integrated with the major markets like the Addis Ababa city.

Most of previous studies showed that marketing constraints of smallholders are diverse and intertwined (Woldie, 2009; Haji, 2008). Among others, (1) lack of integration of smallholders with regional and export markets, (2) weak bargaining power, (3) absence of large number of market participants (buyers) which makes the market more competitive, (4) entry barriers to new entrants both into the regional and central markets, (5) price information asymmetry between the central and the regional traders; and between the regional traders and the producers, (6) a stagnant and buyer determined farm gate price, and (7) high transaction costs are the major marketing impediments. Indeed these problems are not specific to banana marketing. More or less, all other fruits and vegetable markets also share the same problems.

Table 5: Banana production (ton) by major producing zones(2008-2014)

Major production zones	2008	2009	2010	2011	2012	2013	2014	Average	Share (%)
Gamo Gofa	57916	42461	73562	55491	69319	80923	113824	70499	23.7
Sidama	22782	29201	25475	37678	39658	60292	121727	48116	16.2
Jimma	13537	8894	22063	24813	23665	25179	25049	20457	6.9
Wolayta	8516	16476	20949	23951	20278	24164	40176	22073	7.4
Hadiya	7604	11569	20238	23243	15265	16014	27784	17388	5.8
Sub total of 5 zones	110355	108601	162288	165175	168186	206571	328559	178534	60.0
National aggregate	194307	208536	270571	299754	291258	340013	478251	297527	100.0

Source: CSA, 2008-2014.

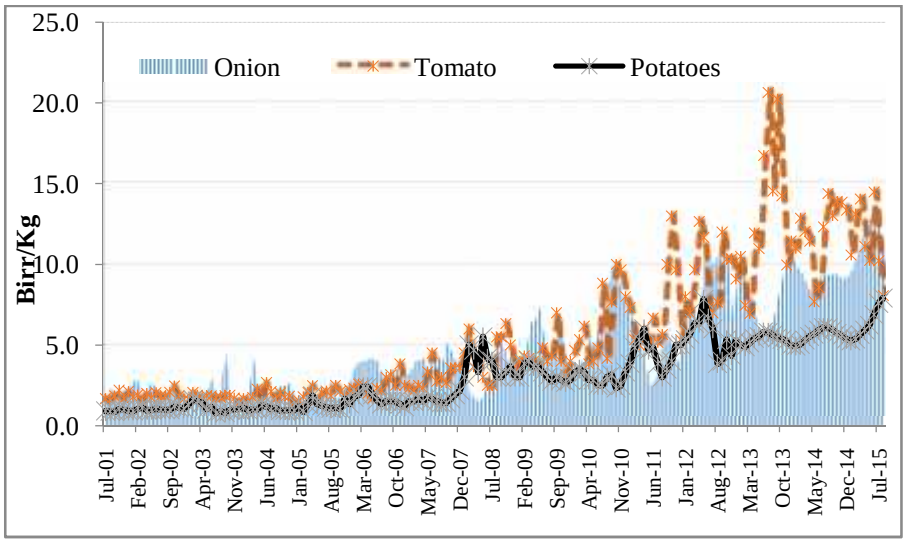
The post-harvest loss of vegetables from the point of production to consumption is on average estimated at 25-35%. The purpose of packing, transport and storage is to mitigate the post-harvest loss gap between producer and consumer, and/or reduce the time interval between harvesting and consumption. The farmers, however, do not have storage facilities at their disposal to speculate for better prices and the products they harvest are usually exposed to the influence of the weather until they are collected by

the end users. The trade practice does not either provide any intermediate storage system to mitigate the adverse effects of weather and fetch fair market prices.

2.2 Price Trends

In recent years Ethiopia has experienced a historically high level of general inflation where food prices of most commodities increased by three fold in the last 10 years. The graph below indicates nominal price trends of onions, tomatoes and potatoes from 2001 to 2015 for Addis Ababa (*Markato*) vegetable and fruit market. Their prices remained highly volatile mainly in the later periods. This may be accounted for the shorter span of shelf life because producers as well as traders have limited room to speculate for better prices keeping the products longer because of their perishable nature.

Figure 1: Addis Ababa retail price trends of onions, tomatoes and potatoes (Birr/kg)



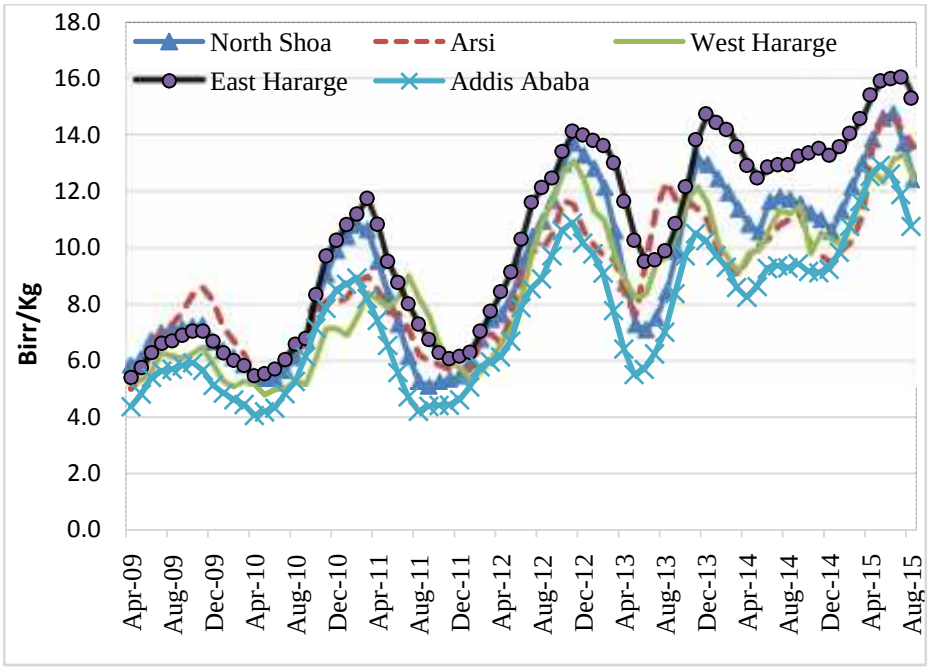
Source: CSA, 2001-2012

Due to the dominance of rain-fed production system, supply of vegetables and fruits is subjected to high fluctuation with variability of weather condition and consequently prices. Its supply declines during the main rainy season between June and mid-September. As a result, prices are usually high during these

months. Conversely, between October and January there is a moderate supply of fresh vegetables but starts to rise in February and reaches its peak level in April and May when prices are relatively lower (Figure 1 above).

Figure 2 below shows onion retail price trends (on the basis of a six month Moving Average price[2]) for the six major producing zones as reported in the CSA production statistics. We observe three major facts from the graph: (1) despite the geographic divergence in the production zones, all prices converged to each other; (2) prices were highly volatile. In 2013 it hiked to a historically highest level (Birr 18/kg) and dropped in the subsequent year. In April 2014 it approached the lowest level ever and started to peak again and dropped; (3) Onion price in Western Tigray was the highest compared to all other zones, which may be accounted for by either a high demand compared to supply and/or cross-border trade.

Figure 2: Onion retail price trends (six month moving average price)

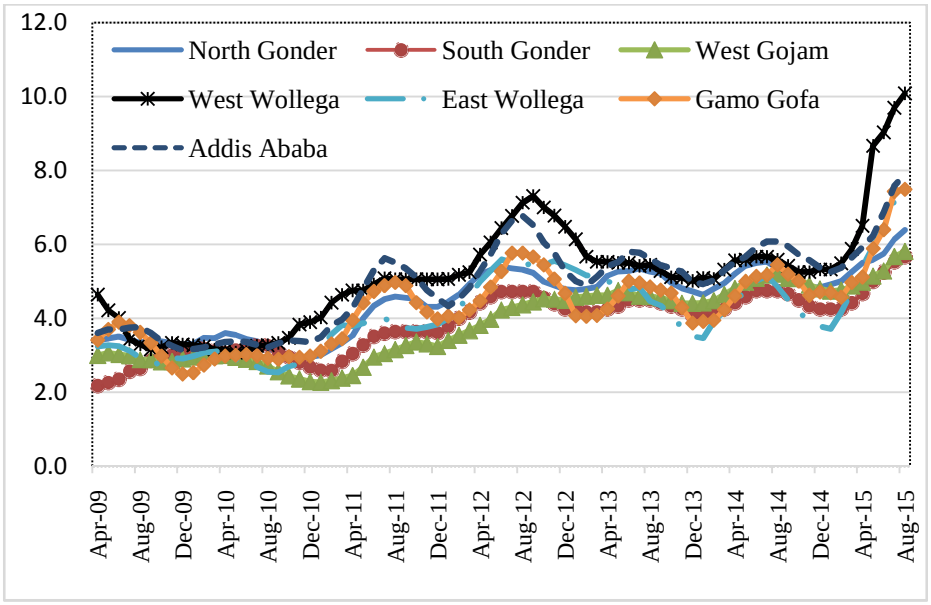


Source: CSA Retail Price, 2015

We applied a six month Simple Moving Price (SMP) to filter out the "noise" from random price fluctuations. A moving average (MA) is a trend-following or lagging indicator because it is based on past prices.

Figure 3 shows potato price trends (six month SMA price) for the six major producing zones and for Addis Ababa. Prices of all zones converged to each other. Only West Wollega price slightly drifted away from other zones. There was no visible price divergence between producing and consuming zones. The correlation coefficient between Addis Ababa and the major producing zones was 0.87, implying a high correlation. Standard Deviation (SD) of price is high only for West Wollega and Addis Ababa prices. All the rest more or less have the same price movement.

Figure 3: Potatoes retail price trends (six months moving average price)

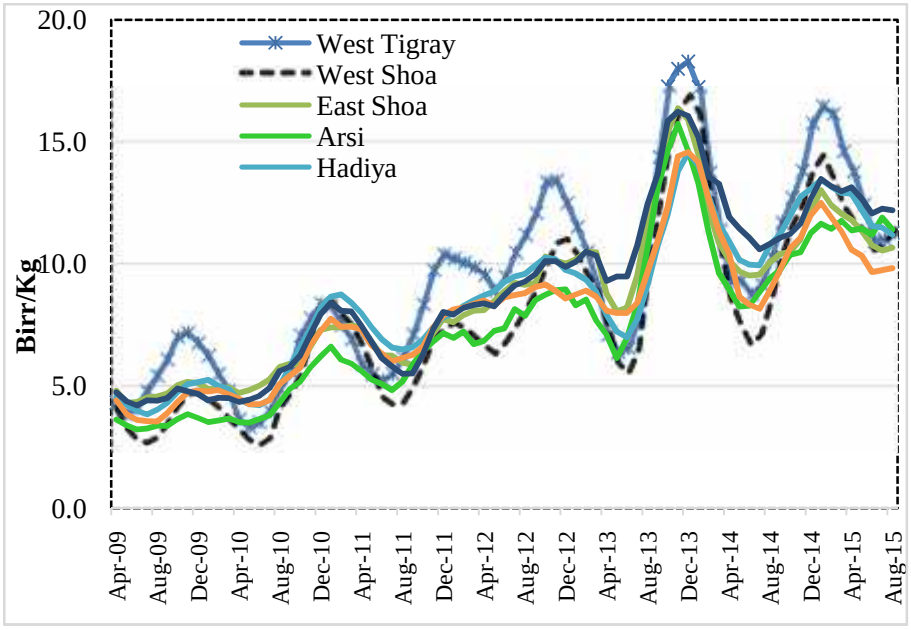


Source: CSA Retail Price, 2015

Figure 4 below posts trends of retail prices for tomato in five major retail markets. As discussed earlier, all selected zonal retail prices exhibited an upward co-movement. All zonal retail prices were highly correlated with the Addis Ababa price (correlation coefficient 0.87). Price of tomatoes for

Western Tigray was constantly higher by 11 percent compared to average prices for all others. Tomatoes from Hadiya relatively fetched the lowest price compared to others, which may be attributed to its quality level and market imperfection. Standard Deviation for Western Tigray and West Shoa were relatively higher compared to the others.

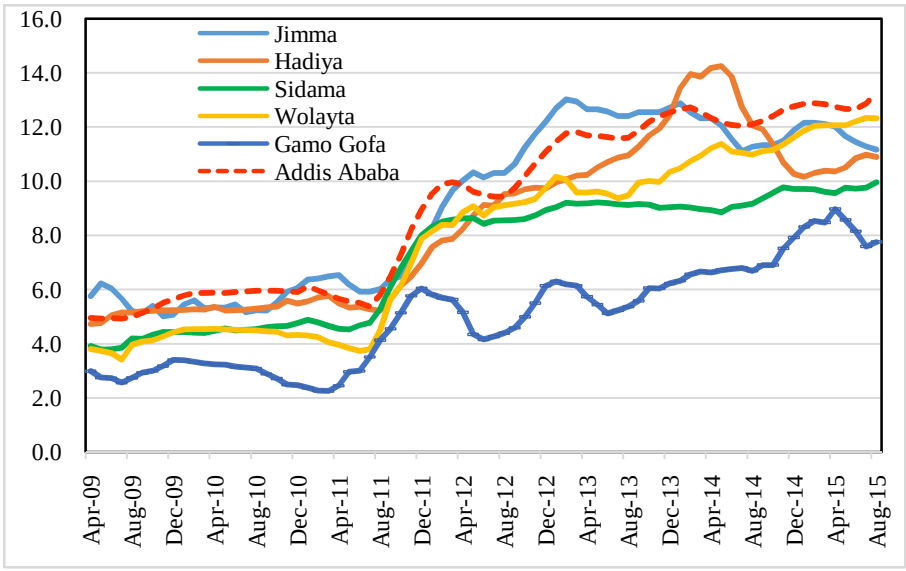
Figure 4: Tomato retail price trends (six months moving average price)



Source: Retail price, 2015

Figure 5 below shows banana retail price trends for Jimma, Sidama, Gamo Gofa, Hadiya, Wolayta and Addis Ababa markets based on retail price data from CSA. The retail prices between 2009 and 2012 for zones other than Gamo Gofa exhibited co-movement. However, over the two years, 2013 to 2015, retail prices of all zones drifted from each other. Retail price of Gamo Gofa remained far below. Its overall price for the whole period was about 50 percent of Addis Ababa retail price. Sidama price was also lower by more than 20 percent from the Addis Ababa price. What accounts for such huge retail price difference between major markets is of paramount importance and section 2.5 addresses this issue.

Figure 5: Banana retail price trends (six months moving average price)



Source: CSA, 2014

2.3 Spot Marketing of Vegetables and Fruits

The spot market is the default marketing option for vegetable and fruit farmers. The spot market for vegetable and fruits function in the absence of well-established institutional environment without formal rules and regulations. Contracts between farmers and rural traders are informal, based on verbal agreements. In the case of a conflict, the transaction costs of resorting to formal institutions (such as the police, courts) are usually higher than the costs involved in the informal mediation.

In such a situation, traders know that farmers have little room to influence their price setting. Besides, the traders have established personal relations for decades so that no trader wants to violate the decision of another. These conditions together with lack of financial system to support producers to invest more on their production, farmers are precluded from motivation and investment on innovative technologies. Therefore, the future of the sector hinges on strengthening producers' organizations (POs) and building their capacities to collectively bargain and secure a proper share of market prices.

Lack of a strong institutional arrangement to guide the behaviours of market participants in the market is an added challenge. Holloway *et al.* (2000) and Staal *et al.* (1997) found a positive effect of organizations of collective action, such as cooperatives, in reducing transaction costs. These benefits accrue to both producers and buyers as cooperatives reduce the costs of information for both sides and take advantage of economies of scale in collection and transport.

An efficient and integrated marketing system may greatly contribute to increase in the marketable surplus by scaling down the losses arising from inefficient processing, storage, and transportation. It guarantees better prices to farmers for their products and induces them to invest their net surpluses for the purchase of modern inputs to increase productivity (Khols & Uhl, 1998). For perishable commodities, the imperfection is more apparent as intermediaries have the opportunity to exploit the inelastic nature of short-run supply to mark-up prices in excess of marginal cost (Sexton, Zhang & Chalfant, 2005).

2.4 Transaction and Marketing Costs

Fruits and vegetables from the production zones are supplied to one or more of the domestic and export markets. Domestic markets include central markets, local nearby markets, and village markets. Djibouti is the only export destination for a limited volume of some of the fruit types like Banana and Mango. Markets where smallholders sell their products include farm gates, village markets and some local markets. As a study by IDE (2006) depicts, about 76 and 13percent of vegetable and fruit farmers in Arbaminch and Chencha areas sell at farm gates and village/nearby local markets, respectively. There is no individual or farmers organization to directly supply to central or regional markets. Bulkiness fruits and vegetables to transport, high transport cost and barrier to enter main markets as supplier are major causes for sales of the lion's share at farm gates. The buyers of the produces from the smallholders at these markets include cooperatives regional traders, local market traders, village market traders/assemblers and sometimes direct consumers. Unions usually have

only one customer, the Ethiopian Fruits Marketing Enterprise (Et-Fruit). Unions do not either have their own trucks to collect from every site, pay less per seedling compared to private buyers.

Smallholders right from the farm gate through private regional traders, mainly supply bananas to the different central markets. The largest share of the produce of smallholders in the area is supplied through this channel. The regional traders collect from smallholder growers at farm gates either directly or through their agents/assemblers. They, then bulk and transport to the different marketing centres (mostly to the Addis Ababa fruits and vegetables central market located at *Piassa*) and sell to wholesalers in central markets. The central market wholesale traders then prepare the crop (keeping the stock under warm condition for about three days) for later sale to central market retailers, private business organizations, and rarely for export to Djibouti.

As a large number of market assessments reveal, the structure of marketing fruits and vegetables through Addis Ababa vegetables and fruits central market (AVFM) revealed that the structure is found to be non-competitive, both at the central markets and the farm gates for a number of reasons (International Development Enterprise, IDE, 2006).

First, the number of central market wholesale traders is limited mainly because of limited/fixed central market places in each of the major cities. Second, the existing wholesale traders use different mechanisms/agreements or collude to avoid competition on issues such as volume to be purchased daily and purchase prices. For example, a wholesale trader from the central market is not allowed to buy from regional traders other than his/her client thus regional traders have limited or no option to have competitive prices. The other mechanism is jointly establishing quality classes and determining prices for each of the quality classes. The third reason for non-competitiveness is absence of free entry into the central market wholesale trading and regional trading. The limited central market places are monopolized, with no room for new entrants. Moreover, the existing central market wholesale traders and regional traders jointly put different entry

barriers. The central traders and regional traders have some sort of established agreement between them that enables them to avoid a new entry to both the central market and to regional trading. On the basis of such an agreement, the regional traders do not want to sell for any new/strange entrants to the central wholesale trading market and also the central traders do not buy from any new/strange regional trader.

Not only the central market but also farm gate market is non-competitive. There is only a limited number of regional traders as a result of the reasons discussed above. Every regional trader has its own client smallholder supplier such that no regional trader is allowed to buy from a client other than his own. Moreover, the regional traders jointly determine farm gate prices.

Another characteristic of marketing through this channel is the prevalence of several marketing costs. Marketing costs to regional traders, for example include: brokers' fees, labour costs-loading and packing on trucks, transport costs, accommodation costs, parking fees, weight loss because of excessive garbage removal in the central markets and because of loss of moisture content during transportation, etc. Assessments made regarding wholesale prices in the Addis Ababa central market revealed that the prevalence of three sets of prices depending on the quality of the banana supplied (first grade, second grade and third grade).

The quality class is simply set by wholesalers based on the size of the fruit and whether it is separated from the head or not are the criteria used for grading the produce. Accordingly, those that are not separated from the head and with bigger sizes are classified as grade one, while those with smaller sizes are classified as grade two and those that are separated from the head are classified as grade three. The majority (about more than 80 percent) of the banana fruit marketed in the Addis Ababa central markets is of first grade, about 18 percent is of second grade and about 2 percent is of third grade, based on personal observation. The price difference between producer and wholesaler is excessively high. Anecdotal evidence from IDE (2006) revealed the prevalence of excessive weight cheatings by the regional traders

in buying from smallholder growers. Though there is a need to compensate the potential weight losses due to excessive garbage removal and moisture loss while transporting to the Addis Ababa central market, in reality unaccounted for weight is so high that it can be considered as a special type of cheating.

3. Empirical Model

3.1 Data Sources

The study is based on secondary data on price, production and consumption obtained mainly from the Central Statistical Agency (CSA) for the period 2008 – 2014. All the zones producing onions, tomatoes, potatoes and bananas were ranked from top to down on the basis of their average contribution to total production for the same period. Having done this, the top four to six production zones were selected for each commodity on the basis of their contribution to national production. Monthly average retail prices for selected zones was compiled for the period stated above and analyzed together with the Addis Ababa retail prices. The Addis Ababa retail market was selected as central or reference market, which depends on supply of commodities from surplus producing areas. In other words, the aim of the study is to assess the extent of co-integration between producing (surplus) and consuming (deficit) markets. This secondary data was reinforced with information obtained from some key informants, exhaustive literature survey and casual visit to the fruit and vegetable market in Addis Ababa, *Piassa* (i.e., *atekilittera*). The scope of the work is also limited to a few selected commodities, namely, tomatoes from vegetables, potatoes and onions from root crops and bananas from fruits as representatives for each group. Indeed, these crops as a group and individually account for substantial shares of area and production of their respective groups.

3.2 Method of Analysis

Earlier studies on cointegration (e.g. Richardson, 1978) mainly relied on simple correlation between prices on pairs of markets. Later, Stigler and Sherwin (1985) considered the correlation of price differences. Gupta and

Mueller (1982) also employed Granger causality tests to measure the price relationship between markets, while Delgado (1986) used a variance decomposition approach to evaluate integration between markets. The seminal work by Ravallian (1986) is considered the most prominent innovation and progress in time series modelling (Barret, 1996). Co-integration together with an Error-Correction Model (ECM) of Engle and Granger (1987) has received important recognition for the specification and estimations of dynamic economic models. The error correction representation enables us to differentiate between long-run and short-run relationships of time series variables. Once the series is found to have a long-run relationship, the next step of Engle and Granger is making use of the estimated error correction term to investigate further the short-run dynamics or market integration. In other words, it explores how price changes in one market will be "immediately" passed onto another market. ECM also provides a framework for testing for asymmetric and nonlinear adjustment to a long-term equilibrium. Granger and Lee (1989) proposed an asymmetric error correction model (AECM) where the speed of the adjustment of the endogenous variable depends on whether the deviation from the long run equilibrium is positive or negative.

Following the Engle and Granger approach, an ECM model was chosen for this study. The model captures the speed of adjustment of local prices in response to changes in terminal or world market prices[4]. The statistical advantage of co-integration analysis is that it allows to estimate existence of stationary linear combinations of non-stationary variables (i.e., time dependent mean and variance) using differencing techniques. Cointegrated prices do no drift apart in the long-run and tend to move towards a shared

[4]In theory, spatial price determination models suggest that if two markets are linked by trade in a free market regime, excess demand or supply shocks in one market will have an equal impact on price in both markets. The implementation of import tariffs, in general, will allow international price changes to be fully transmitted to domestic markets in relative terms. Thus, a proportional increase in the international price will result in an equal proportional increase in the domestic price, at all points in time provided that tariff levels remain unchanged.

equilibrium path; thus cointegration analysis mainly tests for long-run market integration[5].

In addition to ECM, descriptive trend analysis, Granger causality tests and Johansen cointegration tests have been employed to analyze the co-movement, and causal effects of change in one market on another. Granger causality tests assess the presence of at least unidirectional or bi-directional causality since each market uses information from the other when forming its own price expectations. It also depicts about leader-follower relationships in terms of price adjustments (Gupta and Mueller, 1982).

In this specific case, we selected Addis Ababa, the central market of Ethiopia as a reference market for national price setting. Thus we assumed all price decisions in all other vegetable and fruit crops producing zones influenced by what happens in the Addis Ababa retail market. Hence, the Addis Ababa market considered as an independent market and is represented by "X" and all other zonal markets are considered as dependent markets represented by "Y". In other words, Addis Ababa retail price of tomatoes, oranges, potatoes and bananas (i.e., APT, APO, APP and APB)[6]are represented by 'X' or as independent variables. The specification of a long-run relation can thus be stated as follows:

$$Y_t = \alpha + \beta_1 X_t + \mu_t \qquad \textbf{(1)}$$

However, since the long run relation between zonal and Addis Ababa retail prices might depend not only on the current but also on lagged prices, Equation 2 and 3 allow for this price lags.

$$Y_t = \alpha + {}_1X_t + {}_2X_{t-1} + \mu_t \qquad \textbf{(2)}$$

[5] However, cointegration technique does not solve the limitations of the methods derived from the exclusion of transfer costs which begs for use of a new approach. Nevertheless, where no reliable and periodic data on the transaction costs and trade flows existing methods which are based on prevailing market prices are appropriate.

[6] The abbreviations represent: APT - Addis Ababa retail price of tomatoes; APO - Addis Ababa retail price of orange; APP - Addis Ababa retail price of potato and APB - Addis Ababa retail price of banana

The low Akaike Info Criterion (AIC) used to select the appropriate empirical model among different distributed[7] lags to determine the optimal lag length.

According to Engle and Granger's two-step approach to cointegration analysis, two non-stationary I(1) variables are said to be cointegrated if both series integrated of the same order and their linear combination yield a disturbance term that is stationary *I*(0). In the first stage, the methodology applies an OLS estimation of the long-run equilibrium relationship of two or more non-stationary variables as

$$Y_t = \sim + \ _1X_t + \ _3X_{t-1} + Y_{t-1} \ldots + \ _nX_{nt} + U_t \quad \textbf{(3)}$$

where Y_{it} *and* x_t are the individual *I*(1) price components, $_i$'s are the parameters vectors to be estimated, and U_t is the error term. In order to conclude that the price series are co-integrated, the residuals from OLS have to obey stationary process. That is, if the residual errors are stationary then the linear combination of the two price series is stationary (i.e., two markets are cointegrated).

The second-step focuses on the OLS estimation of $\circ$ in the regression equation of the error terms from Equation 4 that is considered to be temporary deviation from the long-run equilibrium and specified as follows:

$$\Delta U_t = \circ U_{t-1} + e_t \quad \textbf{(4)}$$

Where e_t is a white noise disturbance term. The magnitude of coefficients in (5) informs about the speed of adjustment[8] with which the process gets back to its equilibrium after an exogenous shock.

[7]If a model contains both the current and past (lagged) values of the explanatory it is said to be distributed lag model

[8] The speed of adjustment is the coefficient of one period lagged residuals in an error correction model.

According to the Granger representation theorem, coefficients are different from zero ($'S \neq 0$) implies the existence of an error-correction representation of variables or short term dynamics among prices of differentiated markets specified as stated below [9]:

$$\Delta Y_{it} = {}_1\Delta X_{it-1} + {}_2\Delta X_{it-n} + {}_{20}\Delta X_{jt-1} + \cdots\cdots + {}^{a}{}_{2n}\Delta X_{jn-1} + (X_{it-1} - {}_0 - \hat{X}_{jt-1}) + £_t \quad (5)$$

Where ${}_i{}'S$ are estimated short-run counterparts for long-run solution, n represents the lag length of the time, λ represents speed of adjustment and et is stationary random process that captures other information not contained in the lagged values of ΔYt and ΔXt.

Johannsen's cointegration test has been employed to determine whether or not all national prices are jointly co-integrated with the national market. The global prices are expressed in local currency to remove the effect of exchange rate depreciation of the domestic currency vis-a-vis the US dollar. Moreover, the domestic prices have been deflated with constant prices in order to account for inflationary pressure.

4. Results and Interpretations

4.1 Results of Unit Root Tests

For our analysis, the 20 zonal retail market centres of surplus producing areas were selected as representative of the zones and the Addis Ababa retail market is considered as the central market. The presence of spatial integration analysis for onion markets was done taking into consideration Addis Ababa, Asela, Asebe Teferi, Debre Berhan, Shashemene and Harar towns/zonal onion retail markets. In the case of potato, Addis Ababa, Debere Tabor, Bahir Dar, Debere Markos, Gonder, Arbaminch and Asela markets are chosen to be the representative markets. For tomatoes, Addis Ababa, Shashemene, Welisoe, Maychew, Alaba, Hosaena, and Ambo markets were

9 Although a fully specified ECM constitutes also the dynamic terms that contribute to the current changes in the dependent variable, the specification here constitutes only the lagged dis-equilibrium.

selected. Finally, for banana, Addis Ababa, Arbaminch, Awassa, Jimma, Soddo and Hosaena zonal markets were considered for analysis. These markets are selected on the basis of their contribution to national production (see Table 2-5).

In this paper, we used a monthly price data series from September 2008 to August 2015. Moreover, in the analysis we transformed all data into natural logarithmic form to reduce the influence of extreme values and ease of interpretation. Before going to the detailed analysis, the presence of unit root was tested using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for each series and a number of lags were chosen using Akaike Information Criteria (AIC). The presence of cointegration was checked using Johansen's trace statistic and maximum eigenvalue statistics, hypothesizing that there is no cointegrating vector among the series under the null hypothesis. Finally, by normalizing all markets with respect to Addis Ababa we calculated the cointegration relationship and the short-run dynamics using the vector error correction model (VECM).

In the first instances, we tested for the presence of unit root at level and first differences for the series in the selected vegetable retail markets. The retail price series for all commodities for the representative markets failed to reject the presence of unit root at level for ADF and PP tests, which imply that the series are non-stationary at level, i.e., the variables follow a random walk (Table 6). However, first differencing proves the series to be stationary, depicting that the price series are integrated with degree of order one, I(1).

Having observed that all the price series are integrated of the same order I(1), the presence of spatial integration between the market pairs was undertaken taking Addis Ababa as the central market[10]. This was also tested using Johansen's cointegration test.

[10] As ADF test result indicates, onion price for Addis Ababa and Shashemene is significant in level at 10% significance level. However, this result is not confirmed by PP test that not considered as robust.

Table 6: Results of ADF and PP Unit Root Tests on Monthly Retail Price Data

Commodity	Markets	ADF Test		PP Test	
		Level	1st Difference	Level	1st Difference
Onion	Addis Ababa	-2.69	-10.36**	-2.92	-21.02**
	Asebe Teferi	-1.75	-7.86**	-3.35	-38.05**
	Asela	-1.31	-7.59**	-2.30	-29.27**
	Debre Berhan	-1.25	-9.42**	-2.26	-14.43**
	Harar	-0.90	-9.06**	-1.31	-22.98**
	Shashemene	-2.36	-7.71**	-1.91	-22.08**
Potato	Addis Ababa	-1.56	-12.90**	-1.44	-13.05**
	Arbaminche	-1.48	-9.74**	-2.84	-21.41**
	Asela	-1.96	-11.48**	-2.28	-23.32**
	Bahir Dar	-0.47	-11.34**	-0.55	-16.34**
	Debre Markos	-1.62	-18.02**	-1.97	-25.80**
	Debre Tabor	-1.12	-10.68**	-1.30	-19.11**
	Gonder	-1.66	-18.10**	-2.00	-24.01**
Tomato	Addis Ababa	-0.45	-9.32**	-2.23	-35.98**
	Ambo	-1.42	-7.14**	-3.53	-17.34**
	Asela	-2.32	-7.57**	-4.45	-27.44**
	Mychew	-1.51	-9.12**	-3.46	-27.74**
	Shashemene	-0.39	-8.12**	-1.84	-44.97**
Banana	Jimma	-1.33	-13.66**	-1.74	-15.48**
	Hadiya	-1.15	-9.59**	-1.22	-12.01**
	Sidama	-1.19	-12.70**	-0.90	-13.04**
	Wolayta	-0.20	-9.03**	-0.60	-14.12**
	Gamo Gofa	-2.17	-12.40**	-2.77	-14.16**
	Addis Ababa	0.04	-7.45**	-0.21	-7.50**

The asterisks ** denote the rejection of the null hypothesis of presence of unit root in the series at the 1% significance level. The critical values at the 1% significance level are -3.48 for both ADF and PP tests.

4.2 Results of Spatial Integration

The result of cointegration test between market pairs is given in Table 7 below. Each of the zonal retail markets are tested for their relationship with

Addis Ababa. As exhibited in Table 7, Johansen's trace and maximum eigenvalue test statistics disclose the existence of one cointegration relationship between the market pairs at 5% significance level except in the case of Addis Ababa - Debre Markos potato market; Addis Ababa-Hosaena, Addis Ababa-Jimma, and Addis Ababa-Hawassa banana retail markets lack integration. The trace and maximal eigenvalue statistics indicate that the absence of co-integration between Addis Ababa and these markets. In general, results are mixed; existence of long run co-movement of prices is seen between the surplus producing retail markets for some of commodities with Addis Ababa retail market (i.e., for potato, tomatoes, and onion). However, in the case of banana, the strength of long run co-movement of retail prices was found to be weak except for Addis Ababa-Soddo and Addis Ababa-Arbaminch.

Prices were expressed in terms of logarithms, and hence the co-integrating vectors tell the long run elasticity of the Addis Ababa prices with respect to surplus producing market prices. For onion the long run elasticity of price transmission ranged between 0.75 in the case of Harar to 0.88 for Asebe Teferi. For potato, the long run price elasticity ranged from 0.82 in the case of Asela to 1.15 in Bahir Dar market. For tomato market, higher long run price elasticity is revealed relative to onion. For the banana market, the long run price elasticity ranged from 1.2 in Hawassa to 0.9 in Hosaena. Hence, these high long-run elasticity results imply that a higher proportional price change in the Addis Ababa market will be transmitted to surplus producing vegetable and fruit markets in the long-run.

The error correction coefficient which reflects speed of adjustment for short run dynamics is indicated in the column 6 of Table 7. In the case of onion markets, the speed of adjustment is faster in Shashemene relative to other surplus producing retail markets. 36 percent of the disequilibrium that exists in the long run relationship between two markets is corrected every period; in other words it takes about 3 months to fully correct the deviation existing in the long run relationship of the pair wise onion price. However, the lowest speed of adjustment was noted in the Addis Ababa-Asebe Teferi market taking about six months to fully correct the deviation existing in the long run

relationship. This may be accounted for the relatively longer distance and transportation costs. For the rest of the markets, the disequilibria were adjusted in 3 to 4 months' period.

In the case of the potato market, the error correction terms ranged between -0.14 to -0.29. This indicates that about 14 to 29 percent of the deviation that exists in the long run relationship with the central market is corrected in one month's time. Surprisingly, the slowest speed of adjustment was witnessed in the case of Debre Tabor (i.e, 7 months) and the fastest speed of adjustment in the case of Gonder, taking 3.5[11] months for adjusting deviation with the central market. For the rest of the representative potato surplus producing retail markets, the deviation from the long run relationship to the central market is corrected in a span of 4 to 5 months.

In the case of the tomato markets, the error correction coefficients were found to be statistically insignificant for Ambo, Asela and Mychew with the exception of Addis Ababa–Shashemene pair wise market[12]. Tomato is highly perishable and movement from production to consumption centre costly in terms of transportation and storage facilities. This may be accounted for weak short term dynamics observed from the result.

[11] Speed of adjustment is number of months required to adjust deviation from the equilibrium which calculated by multiplying speed of adjustment coefficient by twelve months.

[12] However, it has wrong sign

Table 7: Johansen's Co-integration Test Statistics, long run and speed of adjustments between markets

Commodity	Market Pairs	Trace Statistic	Max-Eigen Statistic	Long run Elasticity (t –stat in [])	Speed of Adjustment coefficients (t stat in[])
Onion	Addis Ababa – Asebe Teferi	28.65**	24.67**	0.88 [9.42]	-0.17[-2.01]
	Addis Ababa-Asela	24.64**	20.78**	0.79 [8.65]	-0.28[-3.31]
	Addis Ababa – Debre Berhan	20.75**	17.23*	0.86 [11.89]	-0.23[-2.49]
	Addis Ababa - Harar	16.96**	15.39**	0.75 [8.87]	0.31[-2.67]
	Addis Ababa - Shashemene	34.13**	30.13**	0.84 [15.10]	-0.36 [-2.96]
	Addis Ababa - Arbaminche	38.08**	36.34**	0.98 [-19.33]	-0.21[-2.89]
Potato	Addis Ababa-Asela	40.38**	37.74**	0.82 [-26.36]	-0.23 [-2.36]
	Addis Ababa –Bahir Dar	29.06**	28.44**	1.15 [-16.17]	-0.20 [-2.54]
	Addis Ababa - Debre Markos	15.48	13.99	*	*
	Addis Ababa –Debre Tabor	15.83**	14.73**	0.84 [8.81]	-0.14[-2.51]
	Addis Ababa -Gonder	27.01**	25.28**	1.06 [-16.13]	-0.29[-3.99]
	Addis Ababa -Ambo	46.89**	44.94**	0.94 [13.53]	-0.03[-0.63]
Tomato	Addis Ababa-Asela	22.41**	20.80**	1.45 [-9.90]	-0.01 [-0.25]
	Addis Ababa -Mychew	31.23**	29.49**	1.50 [-10.96]	-0.01[-0.21]
	Addis Ababa - Shashemene	28.13**	27.16**	1.12 [-26.48]	-0.56 [-2.98]
Banana	Addis Ababa - Arbaminch	11.49**	11.49**	0.92 [23.21]	0.59 [2.20]
	Addis Ababa - Hosaena	6.59	6.49	0.90 [19.66]	0.23 [0.94]
	Addis Ababa - Jimma	6.59	6.49	0.93[29.46]	0.41 [1.71]
	Addis Ababa - Hawassa	7.54	6.38	1.21 [27.45]	0.27 [1.61]
	Addis Ababa - Soddo	18.59**	18.49**	0.92 [23.21]	-0.67 [-2.66]

The asterisks ** denote the rejection of the null hypothesis of no cointegration at 5% significance levels. The 5 % significance level is 15.49 and 14.26 for trace statistic and maximum eigenvalue statistic, respectively. Numbers in the square bracket are t-statistics of estimated parameters .The 5% critical value is 1.96, and 1% critical value is 2.576 for t test in each case.

Finally, the long run cointegrating relationship between the Addis Ababa and major banana producing zonal retail market centres was found either weak or non-existent as the trace and maximal eigenvalue statistics shows. No cointegration relationship was observed between Addis Ababa-Hosaena, Addis Ababa-Jimma, and Addis Ababa-Hawassa for the banana market. Addis Ababa and Soddo market only exhibited faster speed of price adjustment (about 67% of deviation in a month).Addis Ababa – Arbaminch market has wrong signs that are difficult to explain. This lack of integration between pairs of retail markets may be accounted for both high transaction costs of banana marketing plus low price difference in some cases between reference and local markets. Since demand for banana is very high in the local markets of the producing centres like in Jimma and Hawassa towns, traders may have limited interest to transport the product to the reference market, due to low price margins.

4.3 Results of Granger Causality Test

Table 8 discusses results of bivariate Granger causality test or direct Granger test to know direction of causality as well as its presence between Addis Ababa and 20 zonal retail markets. The Granger causality test is carried out by regressing each variable on its own lags and lagged values all other explanatory variables, and then testing the joint statistical significance of the coefficients of all lagged values of all explanatory variables. Accordingly, we carried out Granger causality test for the stated vegetables and fruits market pairs using retail price transformed into natural logarithmic form.

As results indicate, out of 20 market pairs, for the 17 cases, the null hypothesis which state “Addis Ababa market does not Granger Cause other retail market” was rejected implying that Addis Ababa retail market is the most important market for most regional vegetable and fruit markets; serves as a reference market from price signal flow, that is, uni-directional causality runs from Addis Ababa to almost all zonal markets (see Table 8).

On the other hand, when we consider existence of bi-directional causality between Addis Ababa and 20 retail markets, it was exhibited in the two

banana retail markets (i.e., between Addis Ababa and Arbaminch and Addis Ababa and Soddo). For potatoes markets, we found bi-directional causality between Addis Ababa and all other retail markets. Similarly, for tomato markets also we found similar causality between Asela and Addis Ababa markets. In these cases any retail price change in pairs of markets affect each other. These findings are consistency with long-run cointegration results.

Finally, the long run cointegrating relationship between the Addis Ababa and major banana producing zonal retail market centres was found either weak or non-existent as the trace and maximal eigenvalue statistics shows. No cointegration relationship was observed between Addis Ababa-Hosaena, Addis Ababa-Jimma, and Addis Ababa-Hawassa for the banana market. Addis Ababa and Soddo market only exhibited faster speed of price adjustment (about 67% of deviation in a month).Addis Ababa – Arbaminch market has wrong signs that are difficult to explain. This lack of integration between pairs of retail markets may be accounted for both high transaction costs of banana marketing plus low price difference in some cases between reference and local markets. Since demand for banana is very high in the local markets of the producing centres like in Jimma and Hawassa towns, traders may have limited interest to transport the product to the reference market, due to low price margins.

Table 8: Grange Causality Test

V&F	Null Hypothesis:	F-Statistic	Prob.
	Arbaminch banana market does not Granger Cause Addis Ababa	5.6067***	0.0054
	Addis Ababa market does not Granger Cause Arbaminch	3.2013**	0.0463
1. Banana	Hosaena market does not Granger Cause Addis Ababa	0.5996	0.5516
	Addis Ababa market does not Granger Cause Hosaena	10.6553***	0.0000
	Jimma market does not Granger Cause Addis Ababa	0.3537	0.7032
	Addis Ababa market does not Granger Cause BANJM	8.5659***	0.0004
	Hawassa market does not Granger Cause Addis Ababa market	5.2921***	0.0071
	Addis Ababa market does not Granger Cause Hawassa	1.8033	0.1717
	Soddo market does not Granger Cause Addis Ababa market	3.10435**	0.0506
	Addis Ababa market does not Granger Cause Soddo market	14.5374***	0.0000
	Asela market does not Granger Cause Addis Ababa market	0.29168	0.7478
2. Onion	Addis Ababa market does not Granger Cause Asela	10.578***	0.0000
	East Hararge market does not Granger Cause Addis Ababa market	0.8753	0.4209
	Addis Ababa market does not Granger Cause East Hararge	21.9554***	0.0000
	North Shoa market does not Granger Cause Addis Ababa market	1.8005	0.1722
	Addis Ababa market does not Granger Cause North Shoa	26.3455***	0.0000
	West Hararge does not Granger Cause Addis Ababa market	1.6067	0.2073
	Addis Ababa market does not Granger Cause West Hararge	8.8850***	0.0003
	Nekemt market does not Granger Cause Addis Ababa market	6.0927***	0.0035
	Addis Ababa market does not Granger Cause	2.9799*	0.0568

	Nekemt		
3. Potatoes	Arbaminch market does not Granger Cause Addis Ababa market	6.6056***	0.0023
	Addis Ababa market does not Granger Cause Arbaminch	14.48***	0.0000
	Gonder market does not Granger Cause Addis Ababa market	6.68303***	0.0021
	Addis Ababa market does not Granger Cause Gonder market	11.9842***	0.0000
	Debre Tabore market does not Granger Cause Addis Ababa	7.902***	0.0008
	Addis Ababa market does not Granger Cause Debre Tabore	1.5687	0.2150
	Bahir Dar market does not Granger Cause Addis Ababa market	2.9762*	0.0570
	Addis Ababa market does not Granger Cause Bahir Dar	4.0941**	0.0205
	Asela does not Granger Cause Addis Ababa market	7.2511***	0.0013
	Addis Ababa market does not Granger Cause Asela	7.6164***	0.0010
	Shashemene does not Granger Cause Addis Ababa market	0.1526	0.8587
	Addis Ababa market does not Granger Cause Shashemene	7.7276***	0.0009
4. Tomatoes	Hosaena market does not Granger Cause Addis Ababa market	1.50444	0.2287
	Addis Ababa market does not Granger Cause Hosaena	12.3605***	0.0000
	Durame market does not Granger Cause Addis Ababa market	0.29906	0.7424
	Addis Ababa market does not Granger Cause Durame	6.8466***	0.0018
	Ziway market does not Granger Cause Addis Ababa market	0.46843	0.6278
	Addis Ababa market does not Granger Cause Ziway market	4.1445**	0.0196
	Maychew does not Granger Cause Addis Ababa market	1.04876	0.3554
	Addis Ababa market does not Granger Cause Maychew	1.91119	0.1549

Source: Authors analysis based on retail price data from CSA

From the above results, we can deduce that the Addis Ababa retail market is a very important or leader market while all others are follower markets in terms of price adjustments for most of vegetables and fruits. The salient implication of this finding is that any market imperfection occurring in the Addis Ababa retail market, can affect negatively all other markets which have established connection that correction of all imperfection of Addis Ababa retail market has great implications for future vegetable and fruit market development in Ethiopia.

5. Conclusion and Policy Implications

This paper investigated spatial market integration between Addis Ababa and top 20 vegetables and fruits producing zonal retail markets using average monthly retail price data from 2008 to 2015. Onions, tomatoes, potatoes and bananas were selected as representative for vegetables and fruits. We employed both descriptive and empirical tools to analyze.

As some of the most important results from descriptive analysis indicate that:

- Smallholders engaged in the production and marketing of vegetables and fruits are found to be constrained by both supply and demand side barriers. Supply of fruits and vegetables is highly constrained by lack of water to engage in sustainable production. Though there is abundant surface water there is limited capacity to use it effectively. Only a limited number of farmers make maximum gains from the sector. Irrigation is commonly practiced both to supplement rainwater shortages and for production under irrigation during dry seasons. However, most smallholder fruits and vegetables growers do not have access to different water resources and control over water to produce under irrigation. Lack of access to quality seedlings, infestation of pests and disease, limited use of improved production practices, soil infertility, lack of appropriate credit facilities are found to be the major constraints limiting the performance of the sector.
- On the demand side, smallholders also lack markets to sell what is produced given limited access to potential marketing centres because of

high transportation costs for moving the products. This in turn spoils their motivation to embark on additional investment in the sub-sector. On the other hand, as retail price analysis indicates farmers are still unable to receive fair prices for their products. For instance, the retail price for bananas in Gamo Gofa has remained far below Addis Ababa price. Producers obtained about 50 percent less than the Addis Ababa retail price on average, during 2008-2015. Producers prices in Sidama were also 20 percent lower from Addis Ababa retail price over the same period.

- Market power is controlled by a few wholesale and retail market traders who manipulate prices using their strong network from farm gate to retail markets. Lack of strong and functional institutional arrangement for the sub-sector further exasperate the situation.

As salient results from empirical analysis indicate that:

- All price series data considered in the analysis was tested for stationarity. The results of Augmented Dickey Fuller test (ADF test) indicated that price series considered in the analysis were found to be integrated of order one, I(1) with a few exceptions. The study also utilized the Johanen's cointegration test which is based on Maximum Likelihood (ML) approach. Using this method, we found that the Addis Ababa the vegetable market is integrated with the surplus producing markets of potatoes, tomatoes and onions but no clear cointegration was observed for banana markets except for Soddo.
- Albeit the pace of adjustment was uniformly moderate for onions and potatoes a shock in the price of the central market, on average, takes between 3 to 7 months to be fully adjusted in major producing markets. In the case of tomatoes, the Addis Ababa - Shashemene market showed a faster speed of adjustment, taking about 2 months for Addis Ababa market to fully absorb the shock that happened in Shashemene. For the rest of the markets the speed of adjustment took long periods. This might be attributed to the degree of perishability of tomatoes relative to onions and potatoes. For the pair wise vegetable markets with Addis Ababa, the delays in the speed of adjustment suggests that the market was

experiencing various structural as well as price rigidities. The main causes for this phenomenon might be attributed to the oligopolistic behaviour of traders at the central or Addis Ababa market, asymmetric information and lack of facilities including transport, storage and processing which could have reduced risk and price volatility related to vegetable and fruit markets.

- As results of Ganger causality test shows, out of 20 pairs of retail markets, for 17pairs unidirectional causality run from Addis Ababa to other zonal retail markets was exhibited– implying the power of Addis Ababa market as the most important leading market for price adjustment. Thus, any imperfection in Addis Ababa wholesales market has a direct effect on regional prices.

Spatial market integration has an important implication for growth in the agricultural sector. Although there has been substantial progress in the recent years in terms of achieving infrastructure development by the Government, various institutional arrangements which could potentially lower transaction costs and raise bargaining the powers of producers are missing mainly at producer level. To mention some: lack of market information, high marketing and transaction costs due to collusion of central and regional traders, and high perishability and seasonality of the production system weakened market power of producers. Hence, it is important to strengthen either the existing or establish new Producer Organization (PO) to facilitate flow of goods, information, and enforce existing rules and regulations of vegetable and fruit markets to benefit producers through securing a proper share of the final prices.

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The Characteristics and Determinants of Entrepreneurship in Ethiopia

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Abstract

Using Global Entrepreneurship Monitor (GEM) approach, the study analyzes the characteristics and determinants of entrepreneurship in Ethiopia. Primary data are collected through the Adult Population Survey (APS) and analyzed using Probit model. To overcome the hetroscedasticity problem, which is prevalent in cross-section studies, robust standard errors were employed. The findings of the study reveal that about 53% of the adults in Ethiopia are potential entrepreneurs. The perceived opportunity rate in Ethiopia (65%) is above the average for factor-driven economies (63%); while the perceived capabilities rate (69%) is below the average for factor-driven economies (71%). Ethiopia's rate of entrepreneurial intention (22%), early-stage entrepreneurial activity rate (12.2%), and established business activity rate (8.3%) are below the average for both factor-driven economies and Sub-Saharan African countries. The econometric analysis indicates that demographic variables such as age, level of education, societal attitude towards entrepreneurship, and social networks (knowing someone in business) are significant in influencing potential entrepreneurship and entrepreneurial intensions in Ethiopia. In early-stage entrepreneurial activity (TEA),"Fear of failure" is found to have a negative and statistically significant effect. On the other hand, the probability of engaging in TEA significantly differs between those living in urban and rural areas. Furthermore, the results provide basic data to develop national entrepreneurship strategy, consistent with the MSE development strategy and other macro and sectoral level strategies. Thus, the low rate of TEA and

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established business in Ethiopia can be improved by expanding the quantity and quality of support services. Moreover, there is also a need to develop region-specific entrepreneurial development plan to reduce region to region or urban-rural differences.

Keywords: Global Entrepreneurship Monitor (GEM), Perceived Opportunities and Capabilities, Total Early-Stage Entrepreneurial Activity (TEA)
JEL codes: L26.

1. Introduction

The government of Ethiopia has developed a five-year Growth and Transformation Plan (GTP) (2010/11 - 2014/15), which aims at maintaining a two-digit economic growth per year that has been achieved over the past seven years. The GTP focuses on: (i) equitable or inclusive economic growth; (ii) support the development of agriculture to serve as a major source of growth; and (iii) promotion of women and youth employment. As part of GTP, the government has implemented the five-year Micro and Small Enterprise (MSE) Development Strategy (2010/11-2014/15), which emphasizes on expanding youth employment in urban areas. To this end, the government has been providing support services to MSE operators in five major areas: (a) providing production and marketing space; (b) skill and business development services; (c) technology support; (d) market development and linkage; and (e) financial access.

Although the government has been committed and spent huge resources to implement the mega-MSE development program, interventions to improve the entrepreneurial ability and capabilities of MSE operators were hardly given any focus in the strategy. With the exception of a small entrepreneurship development program implemented recently, supported by UNDP, there have not been any tailored support programs by government and others to promote entrepreneurship in the country. Moreover, there is hardly any evidence and baseline survey to show the current status, characteristics and determinants of entrepreneurship in Ethiopia, which would assist policymakers to make informed decisions and formulate a strategy or program to promote entrepreneurship. This is a modest attempt to

fill the research gap by applying the approach and methodology of the Global Entrepreneurship Monitor (GEM), which uses standard and similar questionnaire for the adult population survey and the national expert survey in all the 69 countries, participating in GEM surveys.

The present study is related to the broad literature on determinants of entrepreneurship. Early empirical studies identified liquidity constraints as a crucial factor affecting the probability of starting a business (Evans and Jovanovic 1989; Evans and Leighton 1989). Thus, lack of institutions that can provide the necessary start-up restrain entrepreneurship (Nykvist, 2008). Institutions also influence entrepreneurial activity through the legal system, which affects investor protection laws and private property development (Stephen *et al.*, 2005). In addition, socio-political variables are shown to be vital in enhancing social entrepreneurship (Griffiths *et al.*, 2013).

Even though, previous studies documented certain factors that can stimulate or impede the emergence of entrepreneurship, little is known about the state of entrepreneurship and its determinants in Ethiopia. Besides, the influence of the entrepreneurial activity depends on a county's level of development (Stephen *et al.*, 2005). Using GEM 2012 data set, the present study makes an attempt to contribute to the literature by exploring the characteristics and determinants of entrepreneurship in Ethiopia.

The Global Entrepreneurship Monitor (GEM) is a research program which was initiated in 1997 as a joint venture between London Business School and Babson College, with the aim of obtaining an internationally comparable high quality data on entrepreneurial activity. The academic research consortium made its first survey in 1999 with 10 participating countries and continued to increase the number of participating countries every year. While the first GEM reports included high-income countries only, the ambition has always been to include as many countries as possible in order to support policymakers in their efforts to stimulate economic development through entrepreneurial activities. In 2012, the number of countries participating in GEM rose to 69, where Ethiopia was included as one of the participating countries.

The aim of GEM is to investigate the role of entrepreneurship in the economic growth of a nation. GEM defines entrepreneurship as "any attempt at new business or new venture creation, such as self-employment, a new business organization, or the expansion of an existing business, by an individual, a team of individuals, or an established business" (Global GEM report, 2012). Furthermore, GEM captures both informal and formal activity that encompasses those in the process of starting as well as those running new and established businesses which have a comprehensive account of business activities. Traditional analyses of economic growth and competitiveness have tended to neglect the role played by new and small firms in national economies. In contrast, GEM takes a comprehensive approach and considers the degree of involvement in entrepreneurial activity within a country, identifying different types and phases of entrepreneurship.

1.1 Objectives of the Study

The main objective of this paper is to analyze the status, characteristics and determinants of entrepreneurship in Ethiopia by applying the GEM approach and comparing the results with the rest of the world. The specific objectives include:

(i) providing baseline information on the status of entrepreneurship in Ethiopia;
(ii) studying the characteristics of entrepreneurial activity in Ethiopia and compare the results with countries participating in GEM surveys;
(iii) identifying factors which encourage and/or hinder entrepreneurial activity; and
(iv) contribute towards the formulation of effective and targeted policies aimed at stimulating entrepreneurship in Ethiopia.

1.2 Sampling and Method of Data Collection

One of the key purposes of GEM is to provide reliable data on entrepreneurship which will be useful in making meaningful comparisons overtime, both internally and between economies. For this reason, all participating economies make use of standard research instruments. The data for this study are collected through the Adult Population Survey (APS).The Ethiopian team conducted the Adult Population Survey (APS) using a random representative sample of 3,005(18 to 64-yearoldage cohort adults) from all regions. The survey was conducted using a standardized questionnaire developed by the GEM consortium. The raw data were sent directly to the GEM data team for inspection and uniform statistical calculations before being made available to the Ethiopian team for analysis and interpretation, and, ultimately, compilation of the annual national report.

1.3 GEM's Conceptual and Empirical Framework to Study Entrepreneurship

The GEM approach views entrepreneurship as a process comprising different phases, from intending to start a business, to just starting, running new or established enterprises and even discontinuing a business. To this end, data are collected across several phases of entrepreneurship. Since individuals may respond differently to policy interventions depending on the specific position in the entrepreneurship process, a dynamic approach of analyzing entrepreneurship activities provides valuable information to policymakers. For example, it might be the case that substantial awareness for entrepreneurship as a career choice exists within a country and that many people expect to start a business within the next few years. In that same country, however, low rates of nascent entrepreneurship may exist as compared to countries with similar level of economic development. Such a discrepancy in entrepreneurship involvement rates across several phases may call for targeted policy interventions to ameliorate the transformation between phases, from intentions to actual steps to start a new business. According to the 2012GEM report, the entrepreneurship process and framework of GEM’s approach are defined as follows:

Potential entrepreneurs**:** potential entrepreneurs are individuals who have not yet taken steps to start a business, but they have the beliefs and abilities to start a business. In other words, individuals are considered to be potential entrepreneurs when they believe they have the knowledge and skills to start a business and/or when they see opportunities for setting up a business in the area where they live in. Furthermore, potential entrepreneurs should not be afraid of business failure. It should also be emphasized that any support provided to potential entrepreneurs should not have high expectation on success rates.

Entrepreneurial intent**:** potential entrepreneurship is followed by entrepreneurial intent. This phase includes individuals who have actual intentions, alone or together with other individuals, to start a new business within the next three years.

Total early-stage entrepreneurial activity**:** GEM's primary measure of entrepreneurship is total early-stage entrepreneurial activity (TEA), which consists of nascent entrepreneurs and new business owners. Nascent entrepreneurs include individuals who are actively involved in setting up a business they will own or co-own; and this business has no paid salaries, wages, or any other payments to the owners for more than three months. On the other hand, new business entrepreneurship refers to individuals who are currently owner-managers of new businesses, i.e. owning and managing a running business that has paid salaries, wages, or any other payments for more than three months, but not more than 42 months.

Established entrepreneurship**:** the early-stage entrepreneurial activity (TEA) is followed by established business ownership. Owners of established business entrepreneurs are individuals who are currently owner-managers of established businesses, i.e. owning and managing a running business that has paid salaries, wages, or any other payments for more than 42 months.

Business discontinuance: this includes individuals who have, in the past 12 months, discontinued a business, either by selling, shutting down, or

otherwise discontinuing an owner/management relationship with the business. However, this is not a measure of business failure.

GEM approach takes a comprehensive snapshot of entrepreneurs around the world, measuring the attitudes of a population and the activities and attributes of individuals participating in various phases of this activity. The approach also considers the aspirations of these entrepreneurs regarding their businesses, along with other key features of their ventures. GEM's Total Early-stage Entrepreneurial Activity (TEA) index gauges the level of dynamic entrepreneurial activity in an economy by considering the incidence of start-up businesses (nascent entrepreneurs) and new firms (up to3.5 years old) owned by the adult population (i.e. individuals aged18–64 years).

Another important feature of GEM's approach is the distinction it makes between different types of entrepreneurship and how these contribute to economic growth and job creation. Individuals who start businesses in response to a lack of other options for earning an income are deemed to be necessity-driven entrepreneurs, while those who start businesses with the intention of exploiting an opportunity are identified as opportunity-driven entrepreneurs. The latter may include individuals whose aim is to maintain or improve their income, or to enhance their independence.

Since economic development and entrepreneurship differs along the different phases of economic development, the GEM experts categorized the participating countries into three groups: factor-driven, efficiency-driven and innovation-driven economies. Moreover, productivity and competitiveness are influenced by various factors and the intensity of their effect depends on the country's stage of economic development.

Factor-driven economies: countries in this phase are dominated by subsistence agriculture and extraction businesses, with a heavy reliance on (unskilled) labor and natural resources. The factor-driven economies are countries with less than 2,000 USD GDP per capita, while those in transition from factor to efficiency-driven countries have a GDP per capita, ranging from 2,000 to 2,999 USD (World Economic Forum's *Global*

Competitiveness Report 2012/13).Countries in this phase are characterized by massive unemployment which forces individuals into self-employment so as to make a living, which creates necessity-driven entrepreneurship. The focus of factor-driven economies is geared towards building a sufficient foundation for basic requirements such as infrastructure, health and primary education, institutional development and macroeconomic stability. Ethiopia is classified as a factor-driven economy.

Efficiency-driven economies: *c*ountries in this phase are more competitive with further development accompanied by industrialization and an increased reliance on economies of scale, with more dominant large organizations which are capital-intensive. The efficiency-driven economies have a GDP per capita, ranging between 3,000 and 8,999 USD, while those in transition towards innovation-driven have a GDP per capita ranging from 9,000 to 17,000 USD (World Economic Forum's *Global Competitiveness Report 2012/13)*. This phase is generally accompanied by improved (and improving) basic requirements, and attention is then directed towards developing higher education and training, financial market, labor and goods market efficiency, technological readiness and market size.

Innovation-driven economies: these countries are characterized by more knowledge intensive and expanded businesses. The innovation-driven economies have a GDP per capita of more than 17,000 USD (World Economic Forum's *Global Competitiveness Report 2012/13)*. The key focus for innovation-driven economies is business sophistication and innovation. Business sophistication consists of two elements that are intricately linked: the quality of a country's overall business networks and the quality of individual firms' operations and strategies. Innovation, on the other hand, includes sufficient investment in Research and Development (R&D), presence of high-quality scientific research institutions which deliver new technologies and protection of intellectual property rights.

2. Entrepreneurial Characteristics of the Adult Population in Ethiopia

This section focuses on the analysis of entrepreneurial perceptions and intentions among the Ethiopian sample adult population. Attempts are also made to compare the results of the survey with the averages of the 13 factor-driven economies and 10 Sub-Saharan African countries which serve as benchmarks. The analysis of entrepreneurial perceptions indicates whether individuals perceive entrepreneurial opportunities in their environment, how they perceive their own entrepreneurial ability, and what their perception is towards business failure. The entrepreneurial intentions are expected to provide concrete dynamic measures of entrepreneurial activity in Ethiopia. To this end, individuals were asked about their intentions to start a business within the next three years. Attempts are also made to assess the characteristics of adults, who are in the process of starting a new business or running an existing new business, which is measured using the rate of Early-stage Total Entrepreneurial Activity (TEA). The whole objective is to investigate the prevalence rate of TEA in different demographic categories of the early-stage entrepreneurs.

2.1 Potential Entrepreneurs in Ethiopia

Individuals in the survey are considered to be potential entrepreneurs when they perceive that they have good opportunities in their living area for setting up a business, and when they have the required capabilities to start a business. The first step in the entrepreneurship process occurs when people perceive favorable business opportunities in their area. Business opportunities originate as perceptions on what individuals believe can be done to earn a profit. Opportunities are therefore both real and subjective (Lewin, 2012). Perceived capabilities refer to the percentage of individuals who believe they have the required skills, knowledge and experience to start a new business.

Table 1 indicatesthat65% of the adult population perceives a good business opportunity to start a business in the next six months. Ethiopia's perceived

opportunity rates are higher compared to factor-driven economies (63%) but it is lower when compared with the average for Sub-Saharan economies involved in GEM surveys (70%). On the other hand, individuals in Sub-Saharan African countries are likely to believe that they have the skills and knowledge necessary to start businesses (76%). Of the sample adult population in the Ethiopia, 69% of the respondents believe that they have the skills to pursue a business opportunity. Nevertheless, Ethiopia's perceived capability rate is lower as compared with the average for both factor-driven economies and Sub-Saharan African countries. In terms gender differentiation, the rate of perceived opportunities for female respondents (62%) in Ethiopia is lower compared to their male counterpart (68%), and regarding the belief on one's entrepreneurial capability to pursue a business, the rates for female respondents (65%) are lower as compared with their male counterparts (72%).

Table 1: Perceived opportunities and capabilities of the adult population in Ethiopia and other economies

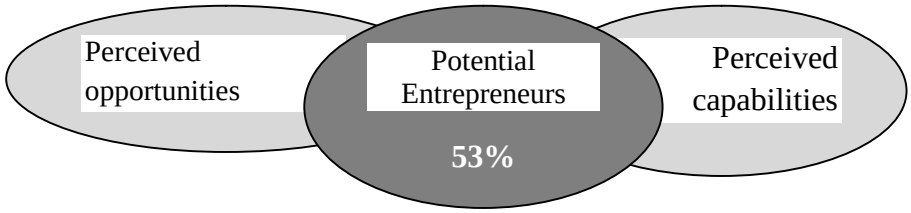
Phase of economic development	Perceived opportunities	Perceived capabilities
Factor-driven economies: averages	63%*	71%
Ethiopia (as factor-driven economy)	65%	69%
Efficiency-driven economies: averages	41%	52%
Innovation-driven economies: averages	31%	36%
Sub-Saharan Average	70%	76%

* Read as: On average factor-driven economies have a perceived opportunity rate of 63%.

As depicted in Figure 1, cross-tabulating the number of adults who perceive that there is good business opportunities (65%) with those who believe that they have entrepreneurial capabilities(69%) shows that there is a clear overlap of the two responses (53%). This constitutes the size of Ethiopia's pool of potential entrepreneurs, meaning the pool of those who see enough opportunities in their living area for setting up a business and believe that they have entrepreneurial capabilities to start a business. In other words, entrepreneurial perception rates are high suggesting that individuals are

willing to act on the opportunities they perceive by applying their entrepreneurship capabilities to start businesses. However, since this is based entirely on self-reported perceptions, there is a need to compare it with the reality. It should be noted that believing that one has the skills to start a business and actually having them are two different things.

Figure 1: Ethiopia's pool of potential entrepreneurs



The quality of the educational system in a factor-driven economy, such as Ethiopia, affects the quality and characteristics of entrepreneurship. The result of the adult population survey indicates that the perceived entrepreneurial capability increases as one's education level increases. All of the adults with a second degree believed that they are capable of pursuing new business; whereas only half of the individuals with pre-primary education believed that they have the skill to pursue a new business (53%). It should be noted that Ethiopia's primary education net enrolment is among the lowest in the world, 122 out of 144 countries (World Economic Forum's *Global Competitiveness Report 2012/13)*, which contributed to low entrepreneurial quality. For Ethiopia, as being a factor-driven economy, meeting basic access to health services and primary education is one of the criteria to improve entrepreneurship.

2.2 Entrepreneurial Intentions of Adults in Ethiopia

Once a potential entrepreneur expresses his/her intention to start a new business in the foreseeable future, understanding the entrepreneurial intentions of respondents provide valuable information about the dynamics of entrepreneurial activity in Ethiopia. To this end, respondents were asked whether they intend to start a business, alone or with others, in the coming

three years. As per the survey results (Table 2), Ethiopia's rate of entrepreneurial intention is found to be 22%, which is much lower than the average rate for factor-driven economies (49%) and the average rate for Sub-Saharan African countries (53%).Although Ethiopia has relatively the highest perception in entrepreneurial opportunities and capabilities, the intention to start a new business is relatively very low.

The result of the adult population survey in Ethiopia indicates that female respondents (19%) have relatively lower entrepreneurial intensions compared to male respondents (24%). However, given the socio-cultural and other barriers of women in Ethiopia, one would have expected much lower rate of entrepreneurial intentions, perceived opportunities and capabilities. With regard to regional differences, the survey result indicates that the adult population in Gambela region has the highest entrepreneurial intentions (82%), followed by Dire Dawa (50%), Addis Ababa (28.6%), Oromia (25.2%), Amhara (18.6%), and Tigray (17.5%). The adult populations of Harari and Somali regions have the lowest entrepreneurial intensions compared to other regions.

Table 2: Entrepreneurial intentions in Ethiopia and other economies, 2012

Phase of economic development	Entrepreneurial intentions
Factor-driven economies: averages	49%*
Ethiopia (as factor-driven economy)	22%
Efficiency-driven economies: averages	27%
Innovation-driven economies: averages	13%
Sub-Saharan Africa: Average	53%

* Read as: On average factor-driven economies have an entrepreneurial intention rate of 49%.

According to the 2012 GEM report of South Africa, an individual's entrepreneurial intention is influenced firstly by the perception of the extent to which it is desirable (attractive and credible) to become an entrepreneur. Secondly, it is influenced by perceptions of feasibility, which focus on the

individual's ability to adopt entrepreneurial behavior.GEM distinguishes between three entrepreneurial attitudes: individuals' opinions about entrepreneurship being a desirable career option, individuals' opinions about the level of respect and status that entrepreneurs have, and respondents' assessments of the media attention on successful entrepreneurs. The three attitudinal measurements assess societal impressions and the visibility and attractiveness of entrepreneurship in a specific community. Positive views on these measures can influence not only the willingness of individuals to become entrepreneurs, but also the likelihood that others in society will support their efforts, with some, possibly, becoming stakeholders such as investors, suppliers, customers and advisors.

Table 3 shows the entrepreneurial attitudes of the Ethiopian sample adult population by comparing the results with Sub-Saharan Africa and other GEM participating countries. As per the survey results, entrepreneurship is considered as a desirable career option for 74% of the adults in Ethiopia, which is slightly lower than the average for factor-driven economies (76%) and Sub-Saharan Africa countries (76%). Moreover, about 91% of the adult population believes that the society gives a high status to successful entrepreneurs, which is much greater than the averages for factor-driven economies (80%) and Sub-Saharan Africa countries (80%). About 72% of the respondents have a positive attitude towards media attention for entrepreneurs, which is higher than the average for factor-driven economies (68%) but less than the Sub-Saharan Africa average (77%).

Even though society's attitude towards entrepreneurship is positive in Ethiopia, only 22% of the respondents intend to engage in business, whenever they have opportunities. Potential entrepreneurs may not be encouraged to take risk and start a new business if they fear humiliation by their peers, in the event of business failure. The findings of the adult population survey in Ethiopia prove that fear of failure is a disincentive to start a new business. Out of the 65% who perceive that there are good business opportunities, 35% fear failure, and only 22% of the respondents reported that they have entrepreneurial intentions.

Table 3: Entrepreneurial attitudes in Ethiopia and other economies, 2012

Phase of economic development	Entrepreneurship as good career choice	High status to successful entrepreneurs	Media attention for entrepreneurship
Factor-driven economies: averages	76%*	80%	68%
Ethiopia (as factor-driven economy)	74%	91%	72%
Efficiency-driven economies: averages	70%	69%	60%
Innovation-driven economies: averages	55%	70%	56%
Sub-Saharan Africa: Average	76%	80%	77%

* Read as: On average 76% of individuals in factor-driven economies considered Entrepreneurship as good career choice

The result of the survey depicts that entrepreneurial intention of the adult population in Ethiopia increases with the level of education. Adults with a second degree have a higher entrepreneurial intention rate of 50% whereas individuals with a pre-primary education have only 5% rate of entrepreneurial intention. However, the entrepreneurial intention rate for respondents, who have secondary and preparatory level of education, is higher (38%) than the respondents with technical and vocational level (23%), which could be partly the result of inadequate awareness regarding entrepreneurship in technical and vocational schools.

2.3. Entrepreneurial Activity in Ethiopia

GEM studies have attempted to study the relationship between economic growth, measured in terms of GDP per capita, and the level and nature of entrepreneurial activity in an economy. According to 2012 GEM report, economies with low GDP per capita tend to have high TEA rates with a relatively high proportion of necessity-motivated entrepreneurship. However, as the GDP per capita increases, economies tend to have more established firms and lower TEA rates. Table 4 shows that the three measures of entrepreneurial activity decrease as the stage of economic development increases. Since Ethiopia has a low GDP per capita, one would

expect higher level of entrepreneurial activity. However, Ethiopia's TEA rate of 12.2% is far below compared to the average for factor-driven economies (23.7%). The average rates of the adult population, who are taking steps to start a business or nascent businesses (5.6%), and those engaged in businesses for less than 3.5 years or new business owners (6.8%) are lower compared to the average for factor-driven economies, which are 11.8% and 12.7%, respectively.

Entrepreneurs may have different motivations for starting a business. Some people may be pushed into starting a business because they have no other work options and need a source of income which GEM classifies as necessity-driven entrepreneurs. Others start their own business primarily to take the advantage of the good opportunity, which GEM identifies as opportunity-driven entrepreneurs. Furthermore, others may desire greater independence in their work or seek to maintain or improve their income, which GEM identifies as improvement-driven entrepreneurs. The relative prevalence of opportunity-motivated versus necessity-motivated entrepreneurial activity can provide useful insights into the quality of early-stage entrepreneurial activity in Ethiopia.

Table 4: Nascent, new entrepreneurship and TEA rates in Ethiopia and other economies

Phase of economic development	Nascent entrepreneurship	New entrepreneurship	TEA
Factor-driven economies: averages	11.8%	12.7%	23.7%
Ethiopia (as factor-driven economy)	5.6%	6.8%	12.2%
Efficiency-driven economies: averages	7.8%	5.6%	13.1%
Innovation-driven economies: averages	4.2%	3.0%	7.1%

The percentage of Ethiopian adult population that starts a business out of opportunity has outnumbered the percentage of adults that start out of necessity. It is encouraging enough that 61% of early-stage entrepreneurs in Ethiopia are driven by business opportunity, while 29% are driven by necessity. This could be partly the result of the mega-program of the

government, which has been providing diverse support (working place, skill training, extension support, market development, technology support, and access to finance) for MSE operators, particularly in urban areas. The importance of opportunity-driven entrepreneurship in Ethiopia can be assessed by considering the number of jobs that have been created, in comparison to those that have been created by necessity-driven businesses. Table 5 shows that about 52% of the jobs were created through opportunity-driven businesses. On the other hand, 40% of the jobs were created by necessity-driven businesses.

The result of the adult population survey portrays that about 71% of adults with pre-primary education are driven into business by opportunity. However, the percentage of adults involved in opportunity-driven businesses declines as the level of education goes up to the first cycle primary education (52%) and second cycle primary education (48%). The results of the survey also reveal that there is a positive correlation between opportunity-driven business and higher educational attainment - completing secondary and preparatory school (69.7%), technical and vocational education (72.7%), and first degree (70.6%).

Table 5: Percentage of jobs created by opportunity- and necessity-driven businesses in the early-stage entrepreneurial activity (TEA) in Ethiopia, 2012

Number of current jobs	Opportunity-driven businesses	Necessity-driven businesses
No employees	47.73%*	59.68
1 – 5 employees	47.73%	35.48
6 – 19 employees	3.03%	3.23%
20+ employees	1.52%	1.61%
Total	100.00%	100.00%

The findings of the adult population survey in Ethiopia shows that male adults are more likely to engage in the early-stage entrepreneurial activity (opportunity and necessity-driven businesses) than the female adults. Out of

the total adult population engaged in TEA, about 53% of the respondents are male and the remaining 47% are female adults. On the other hand, female adults are more likely to be motivated into entrepreneurship by opportunity compared to their male counterparts. Of the total female adults involved in TEA, about 62% of them are motivated by business opportunity, while 29% of them are motivated by necessity. On the other hand, 59% of male adults in TEA are driven by business opportunity and 27% of them are motivated by necessity.

Table 6 shows the number of jobs which were created by early-stage male and female entrepreneurs in Ethiopia. The early-stage male entrepreneurs (73%) have created a higher number of jobs than the early-stage female entrepreneurs (64%), which is consistent with the GEM findings in other countries over the years. Thus, policies and programs which increase employment access to female adults and their involvement in entrepreneurship should focus on the development of skills to exploit high growth opportunities.

Table 6: Jobs created in the early-stage entrepreneurial activity in Ethiopia by gender, 2012

Number of current jobs	Male early-stage entrepreneurs	Female early-stage entrepreneurs
No employees	27.32%*	36.05%
1 – 5 employees	24.74%	25.00%
6 – 19 employees	3.09%	1.16%
20+ employees	44.85%	37.79%
Total	100.00%	100.00%

The GEM results entails that entrepreneurial endeavors can be started at any time in a person's life, although entrepreneurial activity is mostly prevalent among persons in the 25–34 years age group. These individuals are likely to have had some time to develop their skills and knowledge through education and work experience. The result of the survey indicates that the highest entrepreneurship rates in Ethiopia occur among the 25–34 years age group,

with TEA rate of about 15%. The second highest participation occurs in the age group of 18-24 years with 14% TEA rate. The prevalence of early-stage entrepreneurial activity tends to be relatively low in the 55-64 years cohort (4.5% TEA rate) followed by 45-54 age group (6.9% TEA rate). The findings of the survey show that the relatively higher rate of TEA by the youth is encouraging which might help to reduce the unemployment challenge in the country.

The result of the survey indicates that Dire Dawa has the highest percentage of early-stage entrepreneurs (43%),out of which about 80% is driven by business opportunity and 20% by necessity. Addis Ababa has a TEA rate of 32%, out of which, about 72% and 12% are opportunity-driven and necessity-driven entrepreneurs, respectively. Tigray, SNNP, Oromia and Amhara regions have TEA rates of 19.3%, 16.5%, 10.6%, and 7.1%, respectively. About 55% to 62% of the new businesses created in the four large regions are opportunity-driven. However, Gambela region has the lowest rate of early-stage entrepreneurs. Though Somali region has one of the lowest TEA rates, about 83% of the early-stage entrepreneurs are driven by business opportunity which is the highest compared to the rest of the regions.

The result of adult population survey also shows the positive correlation between level of education of adults and their involvement in early-stage entrepreneurial activities. For example, out of the adult population in Ethiopia with pre-primary level of education, only 3% are involved in early-stage entrepreneurship activities. On the other hand, about 29% of the adults with first degree are likely to be involved in early-stage entrepreneurial activities.

2.4 Established Business Ownership in Ethiopia

Established business ownership refers to the percentage of 18-64-year-old people, who are owner-managers of established businesses, i.e. owning and managing a running business that has paid salaries, wages, or any other payments for more than 42 months. As indicated in Table 7, Ethiopia's

established business activity rate is 8.3%, which is lower compared to the average for factor-driven countries (11%) and the average for Sub-Saharan Africa participating in GEM (12.8%). Moreover, Ethiopia's rate of business discontinuity is 3%.

Table 7: The rate of established business ownership in Ethiopia and other economies

Phase of economic development	Established Business ownership
Factor-driven economies: averages	11.4%*
Ethiopia (as factor-driven economy)	8.3%
Efficiency-driven economies: averages	7.8%
Innovation-driven economies: averages	6.7%
Sub-Saharan Africa: averages	12.8%

The results of the adult population survey reveal that about 8.6% of male and 7.9% of female adults are involved in established businesses. The rate of established business is consistent with the rate of early-stage entrepreneurial activity of male and female adults. However, the rates of established businesses for the adult population vary from region to region.

3. Determinants of Entrepreneurship in Ethiopia

3.1 The Model

Examining the factors that affect potential entrepreneurs (entrepreneurial intentions and capabilities) and early-stage entrepreneurial activity provides a useful insight in identifying tailored interventions aiming at promoting entrepreneurship in Ethiopia. The analysis is also expected to predict the conditional probability that an adult in Ethiopia will be a potential entrepreneur, has entrepreneurial intention and capability to start his/her own business or involve in early-stage entrepreneurial activity. This is analyzed using binary choice models, where the dependent variable has two responses: whether an adult is a potential entrepreneur, has an entrepreneurial intention, or engaged in early-stage entrepreneurial activity. The latent variable potential entrepreneurship level (y*) is the outcome of

the model which depends on a vector of regressors or explanatory variables X. Since we cannot observe full level of entrepreneurship, the probability that an individual is entrepreneur (Pr (y_i=1) has to be defined and as the scale of probability is not identified, a normalization on the distribution of $£_i$ is required. Let our model is given by:

$$y_i = x'\beta + \varepsilon_i$$

Where the dependent variable y_i is a dichotomous taking values 0 or 1. Given this one can consider three models: the Linear Probability Model (LPM), the Probit model and the Logit model. The first model, LPM, is estimated using the OLS regression and works like a normal linear regression except interpretations change as y_i is binary. However, one of the major problems of LPM is that the predicted probability {Pr $(y_i|x) = x'\beta$}can go below 0 or above 1, which is logically inconsistent with the theory of probability. Besides, as the Var$(y_i|x) = x'\beta(1 - x'\beta)$, the regression has variances which varywith the observations and hence the linear probability model violates the assumptionof homoscedasticity. Due to these problems, it is better to resort to Logit or Probit models, which yields similar results but based on different distributional assumptions. And in the current paper, the Probit model is considered.

Our binary choice model (Probit model) used in our paper is described as follows.

$$y^*_i = x'_i + £_i, \qquad £_i \sim NID(0,1)$$
$$y_i = 1 \text{ if } y_i^* > 0$$
$$y_i = 0 \text{ if } y_i^* \le 0$$

Where the $£_i$s are independent of all x_i. The parameters in Probit models is estimated by the method of maximum likelihood. Consequently, the probability that an individual is entrepreneur (Pr(y_i=1)) is defined as:

$$P\{y_i=1\}=P\{y^*_i>0\}=P\{x'_i + £_i>0\}=P\{£_i>-x'_i\}=P\{£_i\le x'_i\}=\Phi(x'_i),$$

Where Φ denotes the Standard Normal distribution function of $-£_i$, or, in the common case of a symmetric distribution, the distribution function of $£_i$

.

Since the model is non-linear in parameters, the partial effect of explanatory variables are derived as $\frac{\partial\Phi(x'_i\ )}{\partial x_{ik}} = ¤(x'_i\ )_k$ for contentious explanatory variables and $\Phi(x'_i \mid x_k = 1) - \Phi(x'_i \mid x_k = 0)$ for discrete (dummy explanatory variables).

3.2 Estimation Results

The data used in this study are obtained from the Adult Population Survey (APS) conducted using a random representative sample of 3,005 (18 to 64 years old age) from all regions and a standardized questionnaire developed by the GEM consortium. A probit model is employed to analyze the data. The regressions on the determinants of potential entrepreneurship, entrepreneurial intention and TEA are carried out by taking dummy variables for the three measures of entrepreneurship as dependent variables. The most common problem in cross-section data is heteroscedasticity of the error terms and it results in inefficient estimates. In the current study, an attempt is made to correct for heteroscedasticity by using robust standard errors.

The regression results of potential entrepreneurship along with the marginal effects are presented in Table 8. The coefficients of age and age squared are significant but only at 10% level of significance. The difference in potential entrepreneurship among male and female adults in the survey is statistically insignificant. On the other hand, proxies that were used to measure the societal attitude towards entrepreneurship such as media attention given to successful entrepreneurs and whether the society considers entrepreneurship as a preferred carrier choice or not, have a significant and positive effect on the likelihood of an adult becoming a potential entrepreneur.

Adults who know someone already engaged in a business, have a higher probability of being potential entrepreneurs than those who do not. Similarly,

individuals living in urban areas have 0.07 higher probability of being potential entrepreneurs than adults living in rural areas. Except for adults with pre-primary schooling and traditional education, the likelihood that an individual becomes a potential entrepreneur decreases as the level of education increases. For instance, adults with first cycle primary level of education have 0.12 higher probability of being potential entrepreneurs than those that have degree and above level of education. One can further notice that the probability an adult becomes potential entrepreneur varies among regions in Ethiopia.

Table 8: Probit regression results: determinants of potential entrepreneurship

	Coefficient estimates	Marginal effect
Age in years	0.0252*	-0.00126
	(0.0149)	(0.000892)
Age squared	-0.000438**	
	(0.000191)	
Male dummy	0.0848	0.0241
	(0.0552)	(0.0157)
Dummy for media attention given to successful entrepreneurs	0.257***	0.0750***
	(0.0656)	(0.0196)
Dummy for considering entrepreneurship as a good career choice	0.688***	0.204***
	(0.0678)	(0.0198)
Dummy for knowing someone in the business	0.962***	0.311***
	(0.0602)	(0.0196)
Urban dummy	0.235***	0.0666***
	(0.0862)	(0.0244)
Dummy for pre-primary education	-0.227	-0.0649
	(0.167)	(0.0480)
Dummy for first cycle primary education	0.426***	0.118***
	(0.150)	(0.0402)
Dummy for second cycle primary education	0.241*	0.0676*
	(0.142)	(0.0393)
Dummy for secondary and preparatory school	0.320**	0.0903**
	(0.136)	(0.0378)
Dummy for technical and vocational training	0.427**	0.117**
	(0.180)	(0.0473)
Dummy for traditional/religious school	0.112	0.0315
	(0.156)	(0.0434)

	Coefficient estimates	Marginal effect
Region dummy for Tigray	1.002***	0.284***
	(0.176)	(0.0490)
Region dummy for Afar	0.119	0.0337
	(0.277)	(0.0783)
Region dummy for Amhara	-0.275*	-0.0777*
	(0.142)	(0.0402)
Region dummy for Oromia	0.371***	0.105***
	(0.138)	(0.0390)
Region dummy for Somalia	1.217***	0.345***
	(0.192)	(0.0535)
Region dummy for SNNP	0.571***	0.162***
	(0.148)	(0.0415)
Region dummy for Benishangul Gumuz	-0.0104	-0.00295
	(0.241)	(0.0682)
Region dummy for Harari	1.008*	0.285*
	(0.567)	(0.161)
Region dummy for Dire Dawa	-	-
Constant	-2.047***	
	(0.326)	
Number of observations	2,852	2,852
Pseudo R2	0.274	

Robust standard errors in parentheses
The standard errors of the marginal effects are calculated using Delta method.
**** p<0.01, ** p<0.05, * p<0.1*

The results in Table 9 show that demographic variables such as age, age squared, gender and urban dummy were found to have insignificant effect on the entrepreneurial intention of adults. The variables which were taken as proxies for societal attitudes: media attentions given to entrepreneurs and society's attitude on entrepreneurship as a preferred carrier choice have a positive impact on the entrepreneurial intention of the adult population. Similarly, knowing someone who started a business has a positive effect on inculcating entrepreneurial intentions in the adult population. In other words, adults who know someone involved in business have 0.035 higher probability of entrepreneurial intention than those who do not know anyone in business. The results in Table 9 also indicate there is no significant difference among the regions in terms of entrepreneurial intention except for SNNP.

The coefficients of all education variables were negative and significant compared to individuals having degree and above level of education, implying that the probability of having entrepreneurial intention increases as education level increases. Surprisingly, the probability of having entrepreneurial intention for adults with annual combined household income of less than 5,000 and from 5, 0001 to 10,000 Birr is higher than people with annual income of more than 100,000 Birr. In other words, as the annual household income declines the probability of having entrepreneurial intention increases.

Table 9: Probit Regression results: Determinants of entrepreneurial intention

	Coefficient estimates	Marginal effect
Age in years	0.00622	-0.00171**
	(0.0183)	(0.000852)
Age squared	-0.000231	
	(0.000243)	
Male dummy	0.00453	0.000925
	(0.0654)	(0.0133)
Dummy for media attention given to successful entrepreneurs	0.168**	0.0331**
	(0.0784)	(0.0149)
Dummy for considering entrepreneurship as a good career choice	0.271***	0.0516***
	(0.0803)	(0.0143)
Dummy for knowing someone in the business	0.173**	0.0352**
	(0.0709)	(0.0144)
Urban dummy	-0.147	-0.0287
	(0.0998)	(0.0188)
Dummy for pre-primary education	-1.086***	-0.141***
	(0.204)	(0.0155)
Dummy for first cycle primary education	-0.582***	-0.0998***
	(0.163)	(0.0233)
Dummy for second cycle primary education	-0.460***	-0.0833***
	(0.155)	(0.0249)
Dummy for secondary and preparatory school	-0.244*	-0.0465*
	(0.145)	(0.0257)
Dummy for technical and vocational training	-0.681***	-0.100***
	(0.211)	(0.0206)
Dummy for traditional/religious school	-0.649***	-0.108***
	(0.177)	(0.0237)
Dummy for individuals in the income group 0 to 5,000	0.856***	0.223***
	(0.274)	(0.0832)
Dummy for individuals in the income group 5,001 to 10,000	0.698***	0.164**
	(0.269)	(0.0707)

	Coefficient estimates	Marginal effect
Dummy for individuals in the income group 10,001 to 20,000	0.451*	0.0982
	(0.268)	(0.0619)
Dummy for individuals in the income group 20,001 to 40,000	0.444	0.103
	(0.270)	(0.0698)
Dummy for individuals in the income group 40,001 to 100,000	0.214	0.0476
	(0.287)	(0.0689)
Region dummy for Tigray	-0.252	-0.0515
	(0.219)	(0.0447)
Region dummy for Afar	0.397	0.0810
	(0.305)	(0.0622)
Region dummy for Amhara	0.222	0.0453
	(0.179)	(0.0365)
Region dummy for Oromia	0.287	0.0585
	(0.177)	(0.0361)
Region dummy for Somalia	-	-
Region dummy for SNNP	-0.618***	-0.126***
	(0.196)	(0.0399)
Region dummy for Benishangul Gumuz	-0.327	-0.0667
	(0.394)	(0.0804)
Region dummy for Harari	-	-
Region dummy for Dire Dawa	-0.451	-0.0921
	(0.536)	(0.109)
Constant	-1.540***	
	(0.447)	
Number of observations	2,671	2,671
Pseudo R2	0.094	

Robust standard errors in parentheses.
The standard errors of the marginal effects are calculated using Delta method.
**** p<0.01, ** p<0.05, * p<0.1*

Table 10 presents the probit estimation results for TEA and indicates that age has a positive effect on the early-stage entrepreneurial activity of adults but only at 10% significance level. As age increases by 1 year, the probability that an individual will be involved in early-stage entrepreneurial activity, on average, decreases by0.0013. Although male adults have a higher probability of being involved in TEA or new businesses, the difference is found to be statistically insignificant. It is expected that society's attitude on entrepreneurship as a preferred carrier choice and media attention on the success of the early-stage entrepreneurial activities have a positive effect on involvement of the adult population in TEA. However, the regression results indicate that media attention and society's attitude towards entrepreneurship as a preferred carrier choice were found to be statistically insignificant in affecting TEA.

On the other hand, the probability that adults with fear of failure will be engaging in TEA or new businesses is lower than those who stated that fear of failure will not prevent them from starting a new business by 0.03. Adults, who know individuals involved in business activities, have 0.08 higher probability of being engaged in TEA than those who do not know anyone. Moreover, individuals living in urban areas were found to have 0.12higher probability of being engaged in TEA or new business than individuals living in rural areas.

Table 10: Probit Regression result: determinants of total early stage entrepreneurship (TEA)

	Coefficient estimates	Marginal effect
Age in years	0.0419*	-0.00139*
	(0.0220)	(0.000712)
Age squared	-0.000788**	
	(0.000306)	
Male dummy	0.0382	0.00659
	(0.0684)	(0.0118)
Dummy for media attention given to successful entrepreneurs	0.0486	0.00837
	(0.0875)	(0.0151)
Dummy for considering entrepreneurship as a good career choice	-0.0264	-0.00455
	(0.0796)	(0.0137)
Dummy for knowing someone in the business	0.485***	0.0837***
	(0.0808)	(0.0139)
Urban dummy	0.677***	0.117***
	(0.0905)	(0.0152)
Dummy for pre-primary education	-0.434**	-0.0749**
	(0.201)	(0.0347)
Dummy for first cycle primary education	-0.0108	-0.00187
	(0.155)	(0.0267)
Dummy for second cycle primary education	0.0620	0.0107
	(0.142)	(0.0245)
Dummy for secondary and preparatory school	0.0726	0.0125
	(0.131)	(0.0227)
Dummy for technical and vocational training	-0.00756	-0.00130
	(0.188)	(0.0324)
Dummy for traditional/religious school	-0.133	-0.0230
	(0.174)	(0.0301)
Dummy for individuals in the income group 0 to 5,000	0.0781	0.0135
	(0.205)	(0.0354)
Dummy for individuals in the income group 5,001 to 10,000	0.0553	0.00954
	(0.195)	(0.0336)
Dummy for individuals in the income group 10,001 to 20,000	0.111	0.0192
	(0.192)	(0.0331)

	Coefficient estimates	Marginal effect
Dummy for individuals in the income group 20,001 to 40,000	0.147	0.0253
	(0.194)	(0.0335)
Dummy for individuals in the income group 40,001 to 100,000	0.373*	0.0643*
	(0.198)	(0.0342)
Region dummy for Tigray	0.350*	0.0604*
	(0.183)	(0.0314)
Region dummy for Afar	0.522*	0.0899*
	(0.309)	(0.0532)
Region dummy for Amhara	-0.239	-0.0412
	(0.161)	(0.0276)
Region dummy for Oromia	-0.126	-0.0218
	(0.149)	(0.0258)
Region dummy for Somalia	-0.568**	-0.0980**
	(0.227)	(0.0393)
Region dummy for SNNP	0.0658	0.0113
	(0.155)	(0.0267)
Region dummy for Benishangul Gumuz	-0.535	-0.0922
	(0.371)	(0.0642)
Region dummy for Harari	-0.712	-0.123
	(0.635)	(0.109)
Region dummy for Dire Dawa	0.225	0.0388
	(0.369)	(0.0636)
Dummy for fear of failure	-0.182***	-0.0306***
	(0.0701)	(0.0115)
Constant	-2.107***	
	(0.442)	
Number of observations	2,827	
Pseudo R2	0.167	

Robust standard errors in parentheses
The standard errors of the marginal effects are calculated using Delta method.
**** p<0.01, ** p<0.05, * p<0.1*

4. Conclusions

The findings of the study reveal that about 53% of the adults in Ethiopia are potential entrepreneurs. The perceived opportunity rate in Ethiopia (65%) is above the average for factor-driven economies (63%); while the perceived capabilities rate (69%) is below the average for factor-driven economies (71%). Ethiopia's rate of entrepreneurial intention (22%) is much lower than the average rate for factor-driven economies (49%) and Sub-Saharan African countries (53%). The early-stage entrepreneurial activity rate (12.2%) is also far below the average for factor-driven economies (23.7%). Similarly, the established business activity rate (8.3%) is below the average for factor-driven countries (11%) and for Sub-Saharan Africa(12.8%).Furthermore, demographic variables such as age, level of education, societal attitude towards entrepreneurship, and social networks (knowing someone in business) are significant in influencing potential entrepreneurship and entrepreneurial intensions in Ethiopia. Besides, adults living in urban areas are found to have a higher probability of being engaged in early-stage entrepreneurial activity (TEA) than individuals living in rural areas. "Fear of failure" is found to have a negative and statistically significant effect on early-stage entrepreneurial activity (TEA).

The low rate of perceived capabilities, entrepreneurial intension and higher percentage of adults who fear a failure in starting and running business can be partly addressed by revisiting and developing tailored interventions in the educational system as a whole. There is also a need to promote entrepreneurial education in order to change the attitude of the entire society. The low rate of early-stage entrepreneurial activity (TEA) and established business in Ethiopia can be improved by expanding the quantity and quality of support services, such as: training (technical and business development services); extension and mentoring services; production and marketing services; infrastructure support; backward and forward market linkages; access to sub-contracting; technological support; one-stop-shop services; access to finance; creating an enabling policy and regulatory environment; and developing incentive mechanisms to small and new businesses. Since the rate of potential entrepreneurship, early-stage entrepreneurial activity, and established businesses vary from region to region or between urban and rural areas, there is a need to develop region-specific entrepreneurial

development plan. Moreover, the study provides a unique data base (the first of its kind) on the characteristics and determinants of entrepreneurship in Ethiopia, which can be used to develop national entrepreneurship strategy, consistent with the MSE development strategy and other macro and sectoral level strategies.

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Annex1: Summary statistics of the dependent and independent variables

Variable	No. Obs	Mean	Std. Dev.	Min	Max
Entrepreneurial intention Dummy	3005	0.1291	0.3354	0	1
Potential Entrepreneurship Dummy	3005	0.5255	0.4994	0	1
TEA	3005	0.1218	0.3271	0	1
Age in years	2997	34.6627	11.8442	18	64
Age squared	2997	1341.7380	922.7240	324	4096
Male dummy	3005	0.4955	0.5001	0	1
Dummy for media attention given to successful entrepreneurs	2992	0.7206	0.4488	0	1
Dummy for considering entrepreneurship as a good career choice	2962	0.7549	0.4302	0	1
Dummy for knowing someone in the business	2991	0.5433	0.4982	0	1
Urban dummy	3005	0.2093	0.4069	0	1
Dummy for pre-primary education	2929	0.1588	0.3655	0	1
Dummy for first cycle primary education	2929	0.1731	0.3784	0	1
Dummy for second cycle primary education	2929	0.2120	0.4088	0	1
Dummy for secondary and preparatory school	2929	0.2031	0.4024	0	1
Dummy for technical and vocational training	2929	0.0369	0.1885	0	1
Dummy for traditional/religious school	2929	0.1656	0.3718	0	1
Dummy for individuals in the income group 0 to 5,000	2992	0.1447	0.3519	0	1
Dummy for individuals in the income group 5,001 to 10,000	2992	0.2620	0.4398	0	1

Dummy for individuals in the income group 10,001 to 20,000	2992	0.3132	0.4639	0	1
Dummy for individuals in the income group 20,001 to 40,000	2992	0.1668	0.3728	0	1
Dummy for individuals in the income group 40,001 to 100,000	2992	0.0876	0.2827	0	1
Region dummy for Tigray	3005	0.0586	0.2349	0	1
Region dummy for Afar	3005	0.0196	0.1388	0	1
Region dummy for Amhara	3005	0.2346	0.4238	0	1
Region dummy for Oromia	3005	0.3651	0.4815	0	1
Region dummy for Somalia	3005	0.0606	0.2386	0	1
Region dummy for SNNP	3005	0.2023	0.4018	0	1
Region dummy for Benishangul Gumuz	3005	0.0106	0.1027	0	1
Region dummy for Harari	3005	0.0027	0.0515	0	1
Region dummy for Dire Dawa	3005	0.0047	0.0681	0	1