Chapter Three

Impact of Grain Price Hikes on Poverty in Rural Ethiopia

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Abstract

This paper evaluates the impact of food prices inflation on consumption expenditure and poverty status using panel data of 1,078 rural households collected in 2004 and 2009 from four regional states in Ethiopia. The study revealed that the incidence of poverty was 37% in 2004 and increased to 54% in 2009 while the inflation rate between these two periods was 308.09%. The random effect regression results indicate that the use of fertilizer, livestock holding, participation in off-farm activities, family size and land size significantly determine poverty status. Controlling these factors, the level of poverty was also found to increase with the rise in prices of grains. The study also predicts that a one-per-cent rise in grain prices is expected to increase the incidence of poverty, the poverty gap and the severity of poverty by 0.25%, 0.13% and 0.08%, respectively. Also controlling for production related shocks, it was found that the rapid rise in the price of grains was responsible for the observed increase in poverty between the two periods. The policy implication is that the country's overriding objective of reducing poverty cannot be achieved without reducing the negative impact of rapidly rising grain prices.

Key words: Rural poverty; Consumption expenditure; Random effect model; Food prices inflation; Ethiopia

1. Introduction

By any standard measure, Ethiopia is one of the poorest countries in the world. GDP per capita is extremely low and most of the social and human development indicators, such as life expectancy, mortality, literacy, school enrolment and child malnutrition are among the worst in the world (Bevan, 2000; Dercon, 1999). There is therefore no doubt that poverty reduction should be the overriding objective of the country's development policies and strategies.

Since the Ethiopian People Republic Democratic Front (EPRDF) came to power in 1991, poverty reduction has remained a priority agenda in its development policies and strategies (Brown and Teshome, 2007). Particularly, poverty reduction was given top priority since the design of the Poverty Reduction Strategic Programme (PRSP)[1] in 2002. To this end, various projects focusing on the agricultural sector and rural areas have been implemented.

Despite various efforts made at reducing poverty, the phenomenon has remained the main feature of the country. Various studies (Gelaw, 2008; Brown and Teshome 2007; World Bank 2005 and Dercon and Krishnan, 1998) also provide evidence that poverty in Ethiopia remains high. Not only is poverty generally high in the country, but the observed levels have substantially varied from year to year. Moreover, studies (Gelaw, 2010; Brown and Teshome, 2007; World Bank 2005 and Abbi and McKay, 2003) clearly show that the levels of poverty in Ethiopia have been volatile with no sign of decline in the level observed in the past two decades.

The fact that about 84% of Ethiopia's population live in rural areas (CSA, 2007) where poverty is generally high and livelihoods are derived mainly from agriculture (Aredo et al., 2011; World Bank, 2005; Baleher and Yirsaw, 2003 and Dercon, 1999) suggests that the level of poverty in any particular year will depend to a great extent on the performance of the agricultural sector. Micro evidence also shows that households in most rural parts of the country are highly vulnerable to poverty and since a majority of the rural population derive their livelihood from agriculture that is rainfall dependant and highly erratic, it is no surprise that the country's rural population would be vulnerable to poverty. Evidence from studies (Dercon and Christiaensen, 2007 and Dercon and Krishnan, 1998) also prove that rainfall had a significant impact on household poverty and food security in the country. In the years when the rain fails to provide sufficient moisture for crop and forage production, even those households that are relatively well endowed with resources face transient food shortages. In addition to natural calamities such as drought, pest hazard, frost, and

1. Two successive Poverty Reduction Strategic Papers (PRSP), i.e., the Sustainable Development and Poverty Reduction Program (SDPRP) launched in 2002 and the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) were instituted in 2005. The two broad strategies of PASDEP is to reduce poverty by stimulating rural growth through agriculture and rural development, and to strengthen public institutions to deliver services.

flooding other macroeconomic shocks such as volatile input and output prices could play an important role in affecting the vulnerability of rural households to poverty. Although poverty is generally high among rural households, there are still differences in the incidence of poverty across the rural areas. Owing to differences in access to resources, infrastructure, technologies, institutions and geographic suitability, there are wide variations in the level and vulnerability of poverty across rural locations (Gelaw, 2010; Bevan, 2000 and Dercon and Krishnan 1998). While poverty is an annual occurrence in some parts of the country, it is only a bad-weather-year phenomenon in others.

Poverty in Ethiopia remains high and pervasive and the majority of the population remains vulnerable to poverty. As the country approaches the 2015 set date when one of the Millennium Development Goals (MDGs) – halving the proportion of people in the world suffering from hunger – is expected to have been accomplished and looking at the efforts made by the country at reducing poverty, it is doubtful that the country could attain this MDG condition by the 2015 target date.

In the past, vulnerability to poverty in rural areas was largely associated with bad weather and natural disasters. Recently, however, inflation seems to have become another important factor making people more vulnerable to poverty. The dramatic increases in prices of food and non-food items observed since 2008 could have reduced many people to poverty. Although the food price hike in the years 2007/2008 seemed to be a world phenomenon, the magnitude was exceptionally high in Ethiopia (Jema and Gelaw, 2010). Since 2005, the rise in food prices has been tremendous in Ethiopia. According to CSA reports, the rise in prices was 15.1% in 2006, 28.0% in 2007, 57.4% in 2008 and 36.4% in 2009. Even if prices of food and non-food items have been rising since 2000, the rapid rise in prices of especially agricultural grains has been historically high since 2005. Given that about 57% of the consumption expenditure of households is spent on food (CSA, 2004), such rises in prices could have a substantial impact on the welfare of society. According to Engel's law, poor people spend a large proportion of their income on food. Unless this is followed by a pro-poor growth strategy, such rise in prices disproportionately affect the poor more than it does the non-poor. In response to these rises in prices, the government took frantic measures such as threatening traders to not raise prices, setting ceiling prices on some food items, banning the export of food grains, and other monetary measures. Despite these efforts of the government, prices continued to rise.

Traditional economic theory asserts that inflation will have a redistributive effect by imposing an "inflation tax" and can hurt particularly the lower income groups and those people whose income is relatively less flexible. The impact of food inflation on poverty could depend on various factors such as the source of income of the rural community, the relative magnitude of the rise in prices of the various consumption goods and production inputs, and the proportion of the net food buyers in the community. Generally it could be expected that net food seller households should benefit from a rise in the price of grains they supply to the market. Yet such

households may not even benefit from the rise in grain prices if the rise in production costs is higher than the rise in the price of the grains. For instance, the World Bank's database shows that the rise in the price of fertilizers (the key purchased input for grain producers) was even higher than the rise in the price of grains in the year 2008. Owing to such factors as the depreciation of the Ethiopian Birr, higher prices observed in fertilizers and fuels in the world markets and the inefficiency of the domestic input market prices of fertilizer (Jema and Gelaw, 2010), the expectation is that production costs could even be higher if productivity declines for any reason. Moreover, the observed rise in the prices of grains may not fully transmit to small-scale farm households if the agricultural market is already constrained by considerable inefficiency.

A recent study by Jema and Gelaw (2010) showed that the magnitude of the rise in prices differs from region to region. The rise in prices in four regions of Ethiopia, namely Tigray, Amhara, Oromia and Somalia, was higher than in other regions in 2008. For instance, the rise in the price of cereals reached a maximum level of Birr300 in the Tigray and Somalia regions, while the rise in prices of meat products reached the highest level of about Birr150 (Jema and Gelaw, 2010). Empirical evidence shows that the aggregate impacts of rises in food prices on poverty are generally negative (see Ivanic et al., 2011; Ivanic and Martin, 2008; Wodon and Zaman, 2008 and Barrett and Dorosh, 1996). For example, in their extensive cross-country study of the impacts of the 2008 food crisis, Ivanic and Martin (2008) found that the price change from 2005–2008 increased the poverty level of poor countries by about an additional 105 million people. Yet, the effect of poverty on a specific community group could be diverse; the impact of poverty on a specific group can only be determined by looking at real-world data (Ivanic, et. al., 2011). Wodon and Zaman (2008) show that rising food prices are likely to lead to higher levels of poverty in sub-Saharan Africa as the negative impact on net food buyers outweighs the benefits to net food sellers.

According to Ivanic and Martin (2008), in many poor countries the increases in prices of staple foods in 2008 raised the real incomes of those selling food, many of whom are relatively poor, while hurting net food buyers, many of whom are also relatively poor. Their results show that the short-run impacts of higher staple food prices on poverty differ considerably by commodity and by country, but that poverty increases are much more frequent, and larger, than poverty reductions. Also, increases in the prices of all staple foods increase the poverty gap more in urban than in rural areas, and raise the national poverty rate (Ivanic and Martin, 2008).

Conversely, some analysts have suggested that in some contexts food price rises could be a positive thing for the rural poor, many of whom earn their living by growing and selling food crops. It is argued that poor households that are net sellers of food stand to benefit from higher prices, offering the possibility of improved livelihoods, with positive impacts on the income of farm households, as well as on the landless poor through increased job opportunities and disposable incomes (IFPRI, 2008).

However, the direction and magnitude of the effect of food price increases on poverty seem to depend on a number of factors. These include the distribution of net sellers and net buyers of food staples, the specific commodities for which prices increase, the magnitude of the rise in price of inputs vis-à-vis the prices of outputs, the ability of consumers to substitute other less expensive food items, the coping strategies available to households, and policy responses by governments to such rises in prices. The possible effects of increasing food prices on poverty can be diverse, and this creates an interest to assess the effects of the recent skyrocketing rise in prices of food and grains on poverty. The purpose of this study therefore is to assess the direction and magnitude of the effects of the recent rise in prices of grain on poverty in the rural areas of Ethiopia. The study focussed on disaggregating the overall levels of poverty across locations, assessing the relationship between grain price hikes and poverty by controlling the impacts of other related factors hypothesized to affect poverty in the rural areas, and establishing the effects of grain price hikes on the incidence of poverty and poverty gaps.

2. Methodology

Data and collection

The research made use of both the Ethiopian Rural Household Survey (ERHS) panel data that spans eight periods, namely 1989, 1994a, 1994b, 1995, 1997, 1999, 2004 and 2009, and the Central Statistics Authority (CSA) retail and price data set. The ERHS data were collected from more than 1,400 rural households from 18 villages in 15 districts. This study used only the 2004 and 2009 ERHS panel data set because producer and retail price data at regional levels were collected in these periods only. However, due to the attrition of some households from one round to the next, the study used a balanced panel data set containing 1,078 rural households in 2004 and 2009. Whereas the ERHS price data set was used for computation of household income and expenditure, the monthly agricultural retail and producer prices data collected by CSA were used for the analysis of aggregate impacts. Spatial disaggregation was also done with the data set because of its importance, especially as consumption preferences and price changes vary systematically across regions. The Central Statistical Agency (CSA) of Ethiopia has been computing regional consumer and retail price indices since 2000. With respect to differences across regions in terms of consumption habits, the CSA had derived a regional CPI using a distinct basket of goods for each region. Accordingly, different poverty lines were constructed for each region using the prices of 1996 as reference prices.

Information generated from the panel data set was used, including household composition and characteristics, price level of each peasant association, food consumption, non-food consumption and total consumption expenditure, land size and area planted, livestock ownership, household size, use of fertilizer and irrigation, and household off-farm participation and shocks, which affect agricultural production and consumption.

Poverty measurement

Poverty measurement primarily requires a method of discriminating between the poor and non-poor. This is typically done by constructing a poverty line. The two commonly used objective methods for constructing a poverty line are the Cost of Basic Needs (CBN[2]) and the Food Energy Intake (FEI) methods (Ravallion and Bidani, 1993). While the CBN sets the poverty line by finding the actual expenditure on a consumption bundle deemed to be adequate for basic consumption needs, the FEI sets it by determining the consumption expenditure or income level at which a person's typical food energy intake is just sufficient to meet pre-determined food energy requirements. Once households are identified as poor or non-poor, then the poverty head-count index, poverty gap index and severity of poverty index can be measured using the Foster-Greer-Thorbecke (FGT) classes of poverty measures, which were developed by Foster, Greer and Thorbecke (1984). Hence:

$$\theta_{\alpha} = \int_0^z \frac{(z-x)^u}{z} f(x)dx, \ \ \alpha \geq 0 \qquad (1)$$

where θ_{α} is the poverty rate, α is the inequality aversion parameter; z is the poverty line, x is individual income, and $f(x)$ is the density function of income for each individual. If α=0, we will have poverty head-count index where the same weight is given to all people who have an income which is less than the poverty line. If α=1, each individual is weighted by their income shortfall from the poverty and it is called the poverty gap index. If α=2, each individual is weighted according to the square difference between their income and the poverty line, which is called the severity of poverty index. The poverty incidence, poverty gaps and severity of poverty were computed and disaggregated by household group and location. Accordingly, the impacts of price change on poverty and the poverty levels measured at current prices were compared with the poverty levels that existed using the reference prices.

The study computed the incidence of poverty, the poverty gap, and the poverty severity (the FGT poverty measures) for 1,078 rural households that have observations in both 2004 and 2009. It is important to note that poverty measures can be constructed using either income or consumption data. However, each of these has its advantages and disadvantages (see Deaton, 1997 and Duclos and Araar, 2006). In the context of rural Ethiopia, the diversity of income sources, the type of agricultural activities, and the subsistence nature of rural households make income data less reliable vis-à-vis consumption data. Most poverty studies conducted on rural households in Ethiopia used consumption data (see Bogale, 2011; Bogale et al., 2005; Dercon and Krishnan, 1998 and others). Some cross-country studies used income and a mixture of income

2This method was initially used by Rowntree (1901) in his seminal study of poverty in York in 1899 (cited in Ravallion and Bidani, 1993. Since then, a lot of improvements have been made by Ravallion and others.

and consumption data (e.g. Bigston and Shimeles, 2003; Iman, et al., 2010 and Iradian, 2005). In this study consumption data were used to construct the poverty measures.

Empirical model

Various studies on the impact of price change on poverty have been carried out (Aredo et al., 2011; Ivanic et al., 2011; Dessus et al., 2008; Ivanic and Martin, 2008; Abbi and McKay, 2003; Deaton, 1989 and Barrett and Dorosh, 1996) using different analytical methods such as non-parametric analysis, Compensating Variation (CV) and Computable General Equilibrium (CGE) models. For instance, Deaton (1989) used a variant of this concept in a non-parametric analysis of the effect of changing rice prices on the distribution of welfare in Thailand, both across geographical areas and along income distribution. A similar approach was used by Barrett and Dorosh (1996) in their study of rice price changes in Madagascar, which found that up to one-third of poor rice farmers could lose, in net terms, with higher prices.

Ivanic and Martin (2008) and Ivanic et al. (2011) estimated the impact of price changes on each household's real income by multiplying the price change experienced by the household by the quantity of the good produced and by the negative of the quantity consumed by the household.

Dessus et al. (2008) used the CV, introduced by Hicks and further developed by Deaton (1997), to measure the change in money income or expenditure needed to maintain a constant utility level after a change in price. Still others simulated the possible effects on poverty for different levels of rises in prices assuming no substitution effects, while Aredo et al. (2011) and Abbi and McKay (2003) used a CGE model based on the Social Accounting Matrix (SAM) developed by the Ethiopian Development Research Institute (EDRI) and International Food Policy Research Institute (IFPRI) to analyze the impact of prices on poverty.

Although the aforementioned studies provide different alternative techniques to analyze the impact of inflation on poverty, this study will take a different approach: a random effect model is specified to meet the research objectives, one of which is to analyse the impact of rising prices of major food grains on poverty. Given the household panel data, an attempt was also made to isolate the impact of inflation on poverty from other factors that could also have a bearing on poverty using a two-period random effect model.

In a multiple-period setting, fixed effect models are important as they can help to control for not only the unobserved time-invariant heterogeneity, but also observed time invariant characteristics (Shahidur et al., 2010). With two time periods, an estimation of such fixed effect model is equivalent to the difference-in-differences estimation, controlling for the time invariant covariates. The standard errors, however, may need to be corrected for serial correlation (Bertrand et al., 2004).

Equations 2 and 3 are traditional models of fixed and random effects linear

regression, respectively:

$$y_{it} = \beta_{xi} x_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

$$y_{it} = \beta_{xi} x_{it} + \alpha_i z_i + \mu_i + \varepsilon_{it} \quad (3)$$

Where y_{it} is the value of the dependent variable for the ith case in the sample at the tth time period; x_{it} is the vector of time-varying covariates for the ith case at the tth time period; β_{xi} are the row vectors of coefficients that give the impact of x_{it} on y_{it} at time t; z_i is the vector of observed time-invariant covariates for the ith case with α_i its row vector; μ_i is a scalar of all other latent time-invariant variables that influence y_{it}, and ε_{it} is the random disturbance (idiosyncratic error) for the ith case at the tth time period with $E(\varepsilon_{it}) = 0$ and $E(\varepsilon^2_{it}) = \sigma_{\varepsilon i}^2$. It is also assumed that ε_{it} is uncorrelated with x_{it}, z_i and μ_i.

In this study, y_{it} represents the poverty (expressed in terms of poverty incidence, poverty gaps and severity of poverty) of individual i at time t, x_{it} consists of time-varying variables that influence the poverty level for individual i at time t and z_i consists of time-invariant observed variables, while μ contains all other time-invariant unobserved and observed variables that influence poverty, but are not explicitly measured in the model. In addition, grain prices were considered as one of the time-varying explanatory variables (β_{xi}) in Equation 2 that will capture the (average) effect of price hikes on poverty incidence, poverty gaps and the severity of poverty.

The most obvious difference between the fixed effect and the random effect models is the absence of the $\alpha_i z_i$ term. These are the time-invariant observed variables and their coefficients. The traditional fixed effects model does not include these variables, but rather folds them into μ_i, the latent time-invariant variable term. The reason is because the fixed effects model allows μ_i to correlate with x_{it} and if we were to include time-invariant observed variables (z_i), these would be perfectly collinear with μ_i and would not yield separate estimates of the effects of μ_i and z_i. Hence, we allow μ_i to include z_i as well as latent time-invariant variables. The fact that a researcher may not be interested in the specific effects of the time-invariant variables does not render the fixed effect model disadvantageous since the potentially confounding effects of all time-invariant variables would have been controlled for (Kenneth and Jennie, 2010).

Four regressions were specified and analyzed in this study, with different random effects. First is the random effect logistic regression which was used to analyse the impact of food prices on poverty incidence measured by head count index (in this case the dependent variable was dichotomous). The advantage of this model is that it only captures the number of observations that shifts from poor to non-poor or from non-poor to poor. On the other hand, to identify the impact of food prices on the poverty gap index, severity of poverty index and real per capita consumption expenditure per month, the

study employed random effect and regression models for continuous dependent variables.

The actual model and the variables considered in the random effect regression together with the definition of the variables are presented as follows:

$$y_{it} = \beta_{xi} x_{it} + \alpha_i z_i + \mu_i + \varepsilon_{it} \qquad (4)$$

According to Galiani et al. (2005), a common method of controlling for time-invariant unobserved heterogeneity that could correlate with poverty is by using panel data. This is because many location specific (unobservable) characteristics that are random over time could explain poverty differentials observed across location and these variables need to be controlled for using appropriate panel data models.

Table 1: Variables specified for analysis and their measures

No.	Variables	Variable measure
	Independent variables	
1	Family size (hhsize)	Number of persons living under the same roof
2	Land holding (land)	Total size of land in hectare
3	Livestock holding (tlu)	Tropical Livestock Unit (TLU)
4	Participation in off-farm activities (offarm)	Dummy variable 1= member of HH has been involved in off-farm activities and 0 otherwise
5	Extension contact (excontact)	Contact with the development agent during last cropping season measured in number of days
6	Credit use (loan)	Dummy variable 1= if HH received loan and 0 otherwise
7	Production shock (shock)	Dummy variable 1= any shock that affected production and 0 otherwise
8	Use of fertilizer (fertiz)	Dummy variable 1= if HH used fertilizer in the last cropping season and 0 otherwise
9	Use of irrigation (irriga)	Dummy variable 1= if HH used irrigation in the last cropping season and 0 otherwise
10	Grain prices(pricehike)	Grain price index of selected major food crops (teff, barley, wheat, sorghum, maize, khat, coffee, and inset)
	Dependent variables	
1	Poverty incidence	Poverty head count index
2	Poverty gap	Poverty gap index
3	Severity of poverty	Severity of poverty index
4	Household consumption level	Real per capita consumption expenditure per month in Ethiopian currency (birr)

In addition to the random effect estimation, the study also simulated how poverty level responds to changes in prices. Consequently, a 10, 20 and 30% change in prices of grains was considered to see their effects on the three measures of poverty.

3. Results and Discussion

Description of variables

Tables 2–6 summarize the explanatory and dependent variables considered in the random effect regression models. It is hypothesized that these variables, together with grain price hikes, could be responsible for the observed changes in poverty between the two periods.

The summary statistics of the continuous explanatory variables provided in Table 2 shows that non-food consumption, food consumption, real per capita consumption

expenditure, livestock holding, grain prices and extension contact were significantly different between the year 2004 and 2009. On the other hand, there was no significant difference in the mean values of total land size and family size between the two years.

Table 2: Descriptive statistics of selected continuous variables used in estimations

Characteristics	2004 N=1078 Mean	sta. dev	2009 N=1078 Mean	sta.dev	t-value
Family size	5.85	2.514	5.72	2.55	1.15
Household non-food consumption per month	107.03	154.26	245.21	352.78	-11.78***
Household food consumption per month	428.65	425.72	837.26	701.94	-16.34***
Grain prices (grain price index)	100.00	.00	308.09	74.44	-91.77***
Real per capita consumption per month	89.05	92.45	57.36	41.50	10.26***
Livestock holding (TLU)	2.87	3.11	4.86	5.50	-10.32**
Land holding (ha)	1.50	1.82	1.49	1.39	0.09
Extension contact (days)	0.95	4.21	1.35	2.34	-2.72***

Note: Statistical significance at the 1% (***), 5% (**) and 10% (*) significance levels.

In the study, consumption expenditure components were categorized according to two main categories, including food consumption expenditure, which constituted food grains, livestock product, vegetables and other food items including beverages, and the non-food consumption items which were restricted to direct consumables (matches, soap, linen and clothes), and excluding school and health expenditure, as well as taxes and extraordinary contributions (Dercon and Hoddinott, 2004). The poverty line was constructed based on the real per capita consumption (by deflating for the change in prices) of both food and non-food consumption expenditures. The rate of increase in grain price was calculated for each peasant association and the overall average increase in grain prices between the two periods was calculated as 308.09%.

On average, non-food expenditures per month in 2004 and 2009 were Birr107.03 and Birr245.21, respectively, while food consumption expenditures in the same years were Birr428.65 and Birr837.26, respectively.[2] The result indicated that both nominal expenditures of households significantly increased between the two periods. However, the average real per capita consumption per month declined from Birr89.05 to Birr57.36 from year 2004 to 2009. The indications are that while the nominal consumption levels in the year 2009 doubled when compared to the levels in 2004, the real value moved in the opposite direction. This partly indicates the importance of considering inflation in measuring household welfare. For this reason, the poverty lines were calculated by deflating the nominal prices of both periods while using 1996 prices as a reference.

Table 3 summarizes the frequency distribution of discrete explanatory variables. The table shows that the proportion of households that received loans and used fertilizer significantly increased between the two periods. Similarly, the proportion of households that faced production-related shocks significantly increased between the two periods. While the former potentially contributed to

poverty reduction by positively contributing to household production, the latter could counteract the effect of the former. The increase in incidence of shock, coupled with the decline in irrigation use, could contribute to an increase in poverty.

Table 3: Descriptive summary of selected discrete variables used in estimations

Characteristics	**2004** N=1078 Mean	sta. dev	**2009** N=1078 Mean	χ^2-value st.dev	
Shock	0.26	0.43	0.69	0.46	407.30***
Use of fertilizer	0.35	0.47	0.50	0.50	47.89***
Use of irrigation	0.27	0.44	0.13	0.33	67.06***
Participation of off-farm	0.48	0.50	0.49	0.50	0.67
Received loan	0.54	0.49	0.64	0.48	19.58***

Note: Statistical significance at the 1% (***), 5% (**) and 10% (*) significance levels.

In subsistent rural households, a consumption level in any particular year depends largely on the production status of households in that period. Incidences of any production-related shocks will have a direct and immediate effect on the current level of consumption and it could even have a bearing on the consumption level of households for some successive periods. The results in Table 3 show that, while only 26% of the respondents faced crop and livestock production shocks in 2004, the level significantly increased to 69% in 2009. Although the vulnerability to such production-related shocks may differ across households and locations Dercon et al. (2005), using ERHS data, emphasize the importance of such shocks on poverty. Given the fact that Ethiopia is a shock-prone country, fluctuations in the levels of poverty could be attributed to incidences of production-related shocks such as drought, illness, disease and pest, and floods.

As shown in Table 4, the rise in the prices of grain in all four regions was high in 2009 compared to 2004 (which is the reference period). Except in the Oromia region, prices rose by more than 300% in the other three regions. Apart from regional differences, the rises in the price of grain also differed across sampled woredas. The rise in grain prices usually has a direct impact on the prices of seeds, and the magnitude of the rise in seed prices will be even higher when the seeds are of an improved variety. It was observed that the costs of inputs used for the productions of grains were unusually high in the year 2008. This may have contributed to the observed increase in poverty levels by reducing the net incremental income of grain producers.

Table 4: Inflation levels across regions and woredas

Region	Woreda	N	Mean
Tigray	Tsibi Wonberat	73	351.9
	Saesi Tsaedamba	53	258.0
	Regional level	126	312.4
Amhara	Ankober	66	406.4
	Enemay	42	262.7
	Bugna	88	273.6
	Basona Worena	115	325.1
	Regional level	311	319.4
Oromia	Adaa	54	154.8
	Kersa	75	154.8
	Dodota	82	260.4
	Shashemene Zuria	84	343.8
	Regional level	295	238.0
SNNP	Cheha	58	337.0
	Kedida Gamela	66	297.8
	Bule	93	424.3
	Boloso	81	339.0
	Daramalo	48	356.9
	Regional level	345	356.2

The poverty levels result as measured by the three FGT measures of poverty – incidence of poverty, poverty gap, and poverty severity – provided in Table 5, indicated that the incidence of poverty rose from 37% in 2004 to 54% in 2009. The result revealed that there was a significant increase in the level of poverty between the periods under consideration. It needs to be assessed whether this increase in poverty incidence was due to inflation or other factors. Similarly, poverty levels measured by poverty gap and severity also significantly increased between the two periods.

Table 5: Summary statistics of FGT measures of poverty

	2004 N=1078		2009 N=1078		χ^2-value
Characteristics	Mean	sta. dev	Mean	sta.dev	
Poverty head count index	0.37	0.48	0.54	0.49	-7.71***
Poverty gap	0.13	0.22	0.21	0.26	-7.24***
Severity of poverty	0.07	0.15	0.11	0.18	-5.97***

The summary statistics and test in Table 5 show that levels of poverty of house-

holds increased significantly in 2009, which coincided with an increase in prices of grains. However, since an increase in the price of grain is endogenous, it will be wrong to attribute increases in poverty levels between the periods to the observed hike in grain prices. This can only be true if differences in household characteristics and resource endowments are controlled. To isolate the impact of price hikes, it is necessary to take into account other time-varying variables. To achieve this, a random effect model was estimated to identify factors contributing to the changes in poverty levels between periods. Another objective of this study was to disaggregate the overall poverty levels across locations, which is presented in Table 6. The figures from the table indicate that, exception for the Oromia region, all regions' poverty level (poverty head count, poverty gap and severity of poverty) increased in 2009 compared to 2004. However, in the Oromia region (where farmers produce cash crops), the poverty level improved in 2009 compared to 2004.

Table 6: Poverty level across the region before and during inflation

Region	Poverty Head count		Poverty gap		Severity of poverty	
	2004	2009	2004	2009	2004	2009
Tigray	0.375	0.943	0.15	0.473	0.079	0.281
Amhara	0.163	0.351	0.038	0.091	0.013	0.024
Oromia	0.367	0.270	0.125	0.080	0.063	0.037
South Nation and Nationality	0.502	0.708	0.209	0.315	0.112	0.173
Total	0.373	0.537	0.138	0.215	0.071	0.114

Empirical results

In this section, the impact of grain price hikes on poverty levels and real per capita consumption expenditure was analyzed. Four outcome variables were used in the analysis, namely headcount index, poverty gap index, severity index and real per capita consumption expenditure. The result of the analysis is provided in Table 7.

The table shows that household size significantly ($p<0.01$) influenced all three measures of poverty – incidence of poverty, poverty gap and severity of poverty. The net effect, however, is that any increase in household size further increases the level of poverty of households in the study areas. While it can be said that household size can determine poverty by directly reducing the share of each member in the total household consumption, it can also potentially play an indirect role on poverty by increasing household production. Whether production contributes to poverty reduction or not depends on the marginal productivity of household members and the extent to which household production determines household income and consumption, which

could be the outcome of many interacting variables. The use of fertilizer was found to significantly ($p< 0.01$) reduce the level of poverty of households. This may be because the use of fertilizer potentially contributes to an increase in household production.

Livestock holding was also found to significantly ($p< 0.01$) determine the probability of being poor, albeit indirectly, with all three poverty measures. This indicates that livestock holding contributes significantly to reducing the poverty incidence gap and severity among households. The reason for this may be that livestock, besides its contribution to the subsistence need, nutritional requirements, and crop production by provision of manure, also serves as accumulation of wealth that may be disposed of in times of need, especially when food stock in the household is near depletion.

Off-farm activity has long been recognized as an absorber of consumption shocks by providing additional income, especially in times of crop and livestock production failure. The result also shows that the participation of households in off-farm activities significantly reduces poverty incidence and poverty gaps in sample households. The effect of land size on poverty is rather straightforward in that an increase in land size increases the production and consumption of households, and hence contributes to poverty reduction. Although there had been no land redistribution between the two periods, households acquire land through crop-sharing. In addition, land previously used for other purposes such as grazing was ploughed and used for grain production.

Other variables that were hypothesized to affect poverty levels in one way or another were extension contact, credit use, irrigation use and incidence of production-related shocks. They were, however, found to be insignificant in determining poverty levels. Contrary to our result Dercon and Krishnan (2004), using the same data source of previous rounds, found that experiencing a drought at least once in the previous five years lowers per capita consumption by about 20% and experiencing an illness reduces per capita consumption by approximately 9%.

Another important variable to note is the grain price hike measured by the grain index. The variable was found to have a positive significant ($p<0.01$) influence on poverty incidence, depth and severity (see Table 7). Furthermore, the calculated odd ratio of the parameters of inflations on the three measures of poverty shows that a one-per-cent rise in grain prices increases poverty incidence by 0.25%, 0.13% and 0.08%, respectively. The observed grain price hike did not only increase the proportion of poor households, but also worsened the relative position of the poor by increasing their poverty gap. Similarly, grain prices were found to have a negative and significant effect on the level of per capita consumption expenditure. The implication is that a unit percentage change in grain prices led to a decrease in real per capita consumption expenditure by Birr0.151 in 2009, compared to the base year 2004. This result is consistent with Tomoki (2011), who found a negative and significant impact of inflation on poverty in

Table 7: Random effect model estimates for the impact of inflation on poverty and consumption expenditure

variables	Poverty incidence			Poverty gap			Severity of poverty			Real per capita consumption per month		
	Coef.	Std. Err.	z	Coef.	Std. Err.	t-ratio	Coef.	Std. Err.	t-ratio	Coef.	Std. Err.	t-ratio
Hhsize	0.118	0.009	12.83***	0.062	0.004	14.44***	0.041	0.003	13.78***	-8.433	1.394	-6.05***
Livestock	-0.053	0.006	-9.13***	-0.032	0.003	-11.43***	-0.022	0.002	-11.31***	-0.874	0.743	-1.18
excontact	-0.011	0.008	-1.41	-0.006	0.004	-1.61	-0.004	0.003	-1.69	-0.363	0.579	-0.63
Fertiz	-0.350	0.048	-7.36***	-0.156	0.022	-7.08***	-0.096	0.015	-6.29***	20.950	5.346	3.92***
Irriga	0.096	0.055	1.75*	0.039	0.025	1.54	0.024	0.017	1.39*	-3.295	5.164	-0.64
Offarm	-0.039	0.043	-0.91	-0.018	0.020	-0.9	-0.012	0.014	-0.88	7.464	4.244	1.76*
Loan	0.004	0.044	0.09	0.004	0.021	0.18	0.001	0.014	0.08	3.448	4.638	0.74
Land	-0.025	0.013	-1.92**	-0.020	0.006	-3.26***	-0.013	0.004	-3.12***	0.414	1.272	0.33
Shock	0.027	0.046	0.58^{ns}	0.016	0.021	0.76	0.009	0.015	0.63	-0.938	4.172	-0.22
Pricehike	0.003	0.000	12.75***	0.001	0.000	13.99***	0.001	0.000	13.21***	**-0.151**	**0.016**	**-9.36*** **
_cons	-0.772	0.079	-9.81***	-0.429	0.036	-11.78***	-0.319	0.025	-12.61***	142.457	9.210	15.47***
Sigma_u	0.242	0.061	3.95***	0.141	0.022	6.36***	0.093	0.016	5.88***		[b]18.49*	
Sigma_e	0.826	0.027	30.26***	0.366	0.012	30.63***	0.251	0.008	30.8***		[c]0.12	
Rho	0.079	0.040		0.130	0.040		0.121	0.040				
Log likelihood	-1982.38		[a]393.60***	-1143.01		[a]494.95***	-721.53		[a]449.09***			
N	2156			2156				2156.00			2156.00	

Note: *** significant at 1% level of significance. ** significant at 5% level of significance. * significant at 10%

[a] chi-square test; [b] F-test; [c] R-square

the Philippines. The rise of grain prices could have a direct implication for households' consumption and, hence, poverty levels. Its impact, however, would depend on whether the rise in prices affects consumption more than the income of households. Also, the effect of the increase in grain prices on households' poverty may depend on whether the households are majority net buyers or net sellers of the grains. The absence of

production-related shocks in poverty determination may indicate that either there was no significant shift of sample households from net selling to net buying between the two periods (2004 and 2009), or that the shift was not sufficient to explain poverty.

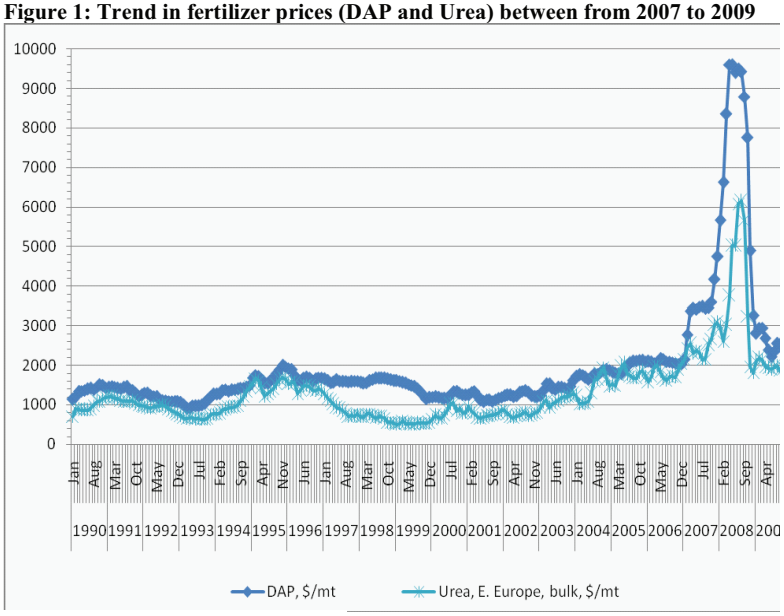
The other factor that may have a bearing pertaining to grain prices in explaining poverty is the relative magnitude of the rise in prices of grains vis-à-vis the prices of non-grain consumption items. The magnitude of the rise in prices of grains relative to the rises in the prices of non-grain food products could also be an important factor in determining the direction of the effect of grain price hikes on poverty levels. The study revealed that prices of grains in 2009 were much higher than those of non-grain food products, except for oil crop products.

Another important factor was the relative magnitude of prices of grains to prices of inputs (e.g. fertilizers, seeds, herbicides and pesticides). The assumption is that a more significant increase in prices of these inputs relative to the prices of grains could increase the cost of grain production and thereby lead to poverty as a result of the reduction in producers' net income. In Ethiopia, the price of fertilizer used by grain producers in particular has shown a dramatic increase over the past few years. The increase, however, may not be directly translated to higher production due to the rapidly declining soil fertility observed in the country. Moreover, the rise in prices of fertilizer is particularly important because the amount of fertilizer used in the country is almost entirely consumed in order to produce the major grains considered in this study for the calculation of the grain price hike. The fertilizer industry is no exception in that it has had a historically high price in the early autumn of 2008 as other agriculture related commodities and fuel oil, followed by a large decline almost immediately afterwards (Boland, 2009).

In addition, country reports show that the price of fertilizer reached its historical peak in 2008 and substantially declined in 2009 (see Figure 1). Since the effect of fertilizer price on production and consumption lags at least by one production season, it was the prices observed in 2008 that had greater implication on the production and consumption levels that was observed in the year 2009.

Table 8 presents the simulation results of the impacts of grain prices on poverty. The

Figure 1: Trend in fertilizer prices (DAP and Urea) between from 2007 to 2009



Source: World Bank database, 2010

result indicates that a 10, 20, 30 and 50% rise in prices of grains lead to an increased poverty incidence of 2.6%, 5.1%, 7.7% and 12.8%, respectively. The corresponding increase in the poverty gap is 1.5%, 2.9%, 4.4% and 7.3%. A similar increase was observed in poverty severity for the simulated changes in grain prices. In general, these results confirmed that the increase in poverty levels as a result of changes in prices of grains was substantial. The implication is that the country's overriding objective of reducing poverty cannot be achieved without reducing the rapidly rising prices of grains.

Table 8: Impact of food prices on poverty at different levels of increasing food prices

Poverty measure	Estimated odds ratio	Simulated changes in prices of grains (Grain Price Index)			
		10%	20%	30%	50%
Poverty head count	0.0026	2.6	5.1	7. 7	12.8
Poverty gap	0.0015	1. 5	2.9	4.4	7.3
Severity of poverty	0.0008-	0.8	1.7	2.5	4.2

4. Conclusion and Policy Implications

Various studies in the past have revealed that poverty in Ethiopia remains high and

pervasive while the majority of the population remain vulnerable to poverty. Although prices in the country (agricultural and non-agricultural products) had remained relatively stable in the years before 2004, they have been rising rapidly since 2005. This study assessed the impact of the dramatic increases in prices of grains on poverty since 2005. The study showed that poverty in 2009 was much higher than in 2004. This result is rather disturbing and, given the fact that countries worldwide should have halved the proportion of hungry people by 2015 according to the MDG condition, it is doubtful if Ethiopia will ever attain this within the few years leading up to 2015. The study also revealed that poverty was higher in all regions but one (Oromia region) in 2009, compared to 2004. The impact of grain price hikes on poverty was found to depend on various factors such as the source of income of the poor, the relative magnitude of the rise in prices of various food and non-food items and prices of production inputs, the proportion of net food buyers to net food sellers, the efficiency of the market in transmitting such price hikes to producer farmers, the capacity of rural households in absorbing price shocks, and the presence of alternative sources of income.

Using a random effect model, the study found that household size, livestock holding, fertilizer use, land use and grain price hikes significantly determined the poverty levels as measured by poverty incidence, poverty gap and severity of poverty. Whereas household size and grain price hikes were found to be positively related to the levels of poverty, other variables were found to be negatively related. In addition, livestock holding, use of fertilizer and size of land holding were found to be negatively associated with the levels of poverty, thus suggesting that additional use of any of these resources contributes to poverty reduction.

Grain price hike, an important variable in this study, was found to be negatively and significantly related to the observed poverty changes between the two periods. The calculated odd ratio of the parameters of inflation on the three measures of poverty shows that a one-per-cent rise in grain price would increase poverty incidence, the poverty gap and the severity of poverty by 0.25%, 0.13% and 0.08%, respectively. The simulation result confirmed that the effects of rises in the price of grains on poverty levels should not be underestimated. The rapidly rising prices of fertilizers also might have contributed to the observed rising levels of inflation.

In the past, vulnerability to poverty in rural areas was largely associated with bad weather and natural disasters. However, having controlled for the production-related shocks between the two periods, it was found that the rapid rise in prices of grains was responsible for the observed increase in poverty between the two periods. The policy implication is that the country's overriding objective of reducing poverty cannot be achieved without reducing the negative impacts of rapidly rising grain prices. The observed rises in the price of fertilizer and seeds to their historical peak deserve further policy attention.

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