# Do the Poor Pay More for Maize in Malawi?

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**Abstract**

The paper uses data from the Third Integrated Household Survey to examine whether or not the poor pay more for maize in Malawi. Two approaches are adopted; an indirect approach which is based on quantity discounting, and a direct approach which is based the relationship between an expensiveness variable and household consumption expenditure. The paper finds that the poor in rural and urban areas pay more for maize. This evidence of a poverty penalty in the maize market is not sensitive to method used. It is found that the poor pay more for maize irrespective of when the maize is purchased. Thus, seasonality does not seem to be behind the observed poverty penalty. The paper also finds that the poverty penalty varies with seasonality.The poverty penalty is significantly more pronounced in the postharvest period when maize is in abundance; it is however reduced in the lean season.

**Keywords:** Poverty penalty; quantity discounting; Malawi

## 1 Introduction

In certain markets, the poor may face relatively higher costs when compared to the non-poor. This is referred to as a poverty penalty (Mendoza, 2011). A number of studies (e.g. Attanasio and Frayne, 2006; Beatty, 2010; Gibson and Kim, 2013) have found evidence of a poverty penalty with respect to food. One of the reasons for this penalty is that the poor do not enjoy quantity discounts due to the fact they may face greater liquidity constraints, and as a result may buy food in small quantities leading to higher unit prices (Rao, 2000; Beatty, 2010). The poor may thus face second degree price discrimination. The most important food item in Malawi is maize, a staple food. Its significance is best captured by Smale (1995) who says "maize is life" in Malawi. Maize is also a staple food in Southern Africa, however, as is shown in more detail in Section 2, Malawi has the highest per capita consumption of maize in the region. Consequently, maize prices take on a special political, social, and economic significance.

Do the poor pay more for maize in Malawi even after netting out seasonal effects? Is there evidence of quantity discounts or nonlinear pricing in Malawi? Does the poverty penalty vary across seasons or areas? This paper provides answers to these questions. To

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the best of my knowledge, no study has looked at the possibility of a poverty penalty with respect to maize in Malawi. In addition to closing this gap in knowledge, understanding whether the poor in Malawi pay more for maize has significant distributional and nutritional policy implications.

Regressive prices for a necessity may lead to undesirable distributional consequences (Rao, 2000; Beatty, 2010). This is especially the case for food because according the Engel's Law, the poor's food budget share is higher than the nonpoor's, and therefore the inequality worsening effect of the poverty penalty may even be more pronounced in a context where the majority are poor, and the diet is not diversified as is the case in Malawi. In addition to the possible distributional consequences arising from the poor paying more for maize, maize price movements could also have implications on food security, nutrition, and micronutrient deficiencies. Evidence that a poverty penalty exists in the maize market would suggest that poor Malawians face a self-reinforcing triple tragedy, in that they are poor, they pay more for maize, and as a result they face nutritional deficiencies.

Nutritional deficiencies -which may in part arise from a poverty penalty- in children may lead to permanent effects and to their having diminished health capital later in life as adults. Alderman et al. (2006) find that improvements in nutrition in pre-schoolers are associated with increased height as a young adult, and the number of grades of schooling completed. Case and Paxson (2006) argue that the relationship between early-life nutritional deprivation and poor educational and socioeconomic outcomes works in two ways; a) through impairments of cognitive ability due to early-life malnutrition that harms school success and, subsequently, labor market outcomes, and, b) through early life malnutrition which translates into poor child health which in turn reduces both school attendance and attainment. This in turn worsens adult socioeconomic outcomes. These negative consequences of child malnutrition entail that efforts to reduce the poverty penalty with respect to maize are vital for the social-economic development of Malawi.

The remainder of the paper is organized as follows. Section 2 provides the context of maize consumption in Malawi. In Section 3 the methodology is presented, and the variables used are discussed. This is followed by the empirical results in Section 4. Policy implications of the results are discussed in Section 5. Finally, Section 6 concludes.

## 2 Maize Consumption in Malawi

This section discusses trends, patterns, and the policy context of maize consumption in Malawi. Maize is the main staple food in Malawi; it accounts for more than 60% of total food production, 60% of energy, 48% of protein consumption, and more than two-thirds of caloric availability. Besides, maize is also a source of micronutrients and vitamins: it is a source for 67% of iron, 65% of zinc, and 56-72% of the less ramified B vitamins (Ecker & Qaim, 2011). Figure 1 shows the evolution of per capita maize consumption for the period 1974-2009. It is evident that the steepest decrease in maize consumption happened in the 1970s and early 1990s. Maize consumption was 165.3 kg/per person in 1974, and declined to 139 kg/per person in 1994, before slowing down to 133.1 kg/per person in 2009. This declining trend suggests an increase in dietary diversity overtime.

Although maize consumption has been declining overtime, it is still very high compared to neighbouring countries. Figure 2 shows the most recent (for 2009) maize consumption patterns in selected Southern African countries. The figure shows that Malawi is way ahead of her neighbours, with a per capita consumption of 133.1 kg/per person in 2009. For instance, Malawi's consumption is 2.5 times that of Mozambique, and 2.3 times that of Tanzania. Only Zimbabwe (110.4 kg/per person) and Zambia (110.2 kg/per person) are the closest to Malawi. It can thus be concluded that food consumption is less diversified in Malawi compared to neighbouring countries. As a result of this low food diversification, national food security continues to be defined in terms of access to maize. NSO (2012) found that 85% of households in Malawi cultivated maize (69% in urban areas, and 88% in rural areas). Despite its importance as a staple crop, maize productivity is low, and on-farm storage losses are high. This problem is further compounded by liquidity constraints whereby households have cash needs, and may have no other means by which to finance these expenses except to sell their maize (World Bank, 2007). Consequently, even those households that grow maize do not have enough to last the entire year, and are therefore forced to purchase maize at some point during the year, usually at higher prices.

The twin problems of low maize productivity and low food diversification are recognized in the Malawi Growth and Development Strategy (MGDS), an overarching medium term national development framework. The MGDS has a number of strategies aimed at solving the two problems over the period 2011-2016. Interestingly, despite acknowledging the two problems, efforts to increase maize productivity have taken more prominence, with little being done on dietary diversification. The most significant productivity enhancing policy intervention in recent years has been the Farm Input Subsidy Program (FISP), which provides low-cost fertilizer and improved maize seeds to poor smallholders. Implementation of the FISP started in the 2005/6 cropping season, and in the 2012/13 financial year, the programme represented 4.6% of GDP or 11.5% of the total national budget (World Bank, 2013).

# 3 Empirical Strategy

There are two approaches in the literature which seeks to investigate whether or not poor households pay more for food. The first approach is an indirect one, and is based on establishing the existence of quantity discounts (bulk discounts). If quantity discounts are present, one then concludes that the poor more for food. This is premised on the possibility that due to liquidity constraints, the poor cannot accord to buy food items in bulk. The second approach is a direct one; here one directly tests for a negative relationship between the ratio of food prices to average food prices and income. These two approaches can sometimes give contradictory evidence (Beatty, 2010). In this paper, I adopt both approaches.

## 3.1 Indirect Approach

To test for quantity discounting or nonlinear pricing, I modify a modelling framework used by Beatty (2010), which is an adaptation of earlier methods proposed by Rao (2000), and generalized by Attanasio and Frayne (2006). Maize grain is milled into flour, and this is the most common form in which maize is consumed. A household either buys the flour from the market or buys maize grain from the market, and then pays to have it milled. In both cases, the final price paid by a household for maize therefore includes the cost of buying the maize grain, and the cost of milling the grain. In order to examine possible rural-urban differences, the analysis is disaggregated by area of residence. Consider household $i \in I$ in community (cluster) $j \in J$ which faces a maize price schedule $p_{ijg}$ that depends on quantity $q_{ijg}$, and a vector of other supply shifters $W^s_{ijg}$ as follows

$$\ln p_{ijg} = \eta \ln q_{ijg} + \beta' W^s_{ijg} + \varepsilon^s_{ijg} \tag{1}$$

where; $g = rural, urban$, $\beta$ are coefficients of supply shifters, and $\varepsilon^s_{ijg}$ is a household-specific idiosyncratic error term assumed to be uncorrelated across households, and uncorrelated with covariates. $\eta$ is a quantity discount elasticity; if quantity discounting is present, the elasticity has a negative sign. I use region dummies as supply shifters. More details about these variables are presented in Table 3. The above specification suffers from the so called unit value problem, which is that prices are generally considered unobservable in household expenditure data (Crawford et al., 2003; Dong and Kaiser, 2005). What is observed instead are unit values which are calculated as expenditure on a food item divided by quantity purchased. Following Deaton (1988, 1997), the unit values $\nu_{ijg}$ faced by a household can be decomposed as follows

$$\ln \nu_{ijg} = \ln p_{ijg} + \ln m_{ijg} \tag{2}$$

where $m_{ijg}$ is a measure of quality. The absence of quality effects (i.e. $m_{ijg} = 1$) implies that unit values are equal to prices. Quality effects might occur if higher observed unit values are not reflective of higher prices but rather the purchase of goods of higher quality (Attanasio and Frayne, 2006). According to Deaton (1988, 1997), the demand for quality depends on total household consumption expenditure $x_{ijg}$, and a vector of quality demand shifters $W^q_{ijg}$ as follows

$$\ln \pi_{ijg} = \delta' W^q_{ijg} + \alpha \ln x_{ijg} + \varepsilon^q_{ijg} \tag{3}$$

where $\delta$ is a vector of parameters for the quality demand shifters, $\alpha$ is an expenditure elasticity of quality, and $\varepsilon^q_{ijg}$ is a well behaved error term. I use sex, age, and schooling of the household head as quality of demand shifters. Summary statistics of these variables are provided in Table 3. Substituting the supply equation (1), and the demand for quality equation (3) into the unit value identity (equation (2), and augmenting it with a vector of seasonal dummies and community random effects (random intercepts) $u_{jg}$, gives the price schedule in terms of unit values

$$\ln \nu_{ijg} = \eta \ln q_{ijg} + \alpha \ln x_{ijg} + \sum_{l=2}^{4} \pi_l S_{ijgl} + \beta' W^s_{ijg} + \delta' W^q_{ijg} + u_{jg} + \varepsilon^s_{ijg} + \varepsilon^q_{ijg} \tag{4}$$

The inclusion of seasonal dummies is motivated by the fact that production of maize is seasonal, and consequently maize prices are also seasonal. I control for this seasonality by including four farming season dummies namely: $S_{ijg1,}$ March-April (harvesting season) as the excluded category; $S_{ijg2,}$ May-August (post-harvesting/ marketing season); $S_{ijg3,}$September-November (pre-planting season), and $S_{ijg4,}$ December-February (farming and lean season).

Quantity purchased of a product is potentially endogenous. This endogeniety arises from the fact that $\ln q_{ijg}$ could be quantity supplied or quantity demanded. In order to identify the supply schedule, we need variables (i.e. exclusion restrictions) that affect quantity demanded but do not directly affect the price schedule faced by a given household. Following Beatty (2010), I use the following household composition variables as my instruments: log of total household size, share of members below the age of 5, share of members between the ages of 5 and 17, the share of members above the age of 60. Total household expenditure might also be endogenous due to measurement error. However, Durbin-Wu-Hausman tests of the endogeniety of quantity and expenditure showed that only quantity is endogenous for both commodities[1]. The presence of endogeniety can lead to inconsistent results, and in order to address this problem, I use error components two stage least squares (EC2SLS) by Baltagi (1981). Preliminary estimations using the Balestra and Varadharajan-Krishnakumar (1987) generalized two-stage least squares (G2SLS) gave qualitatively similar results in terms of statistical significance and signs of the coefficients. I however report EC2SLS results because they give better goodness of fit measures. The EC2SLS can easily be adapted to the two level mixed effects model that I am using in this paper, because it is similar to the standard panel data framework for which it was intended. In the two level model, households vary within clusters

[1] I used ownership of a fridge and ownership of a bicycle by a household as instruments for the log of total expenditure.

(communities) while in a panel, time would vary across households.

To test whether quantity discounts on maize are different between periods of maize shortages and periods of maize abundance, I allow $\eta$ to depend on the seasonal dummy variables as follows $\eta_{ijg} = \eta + \sum_{l=1}^{3} S_{ijgl}\kappa_l$. This leads to the following model with interaction variables

$$\begin{aligned} \ln \nu_{ijg} &= \eta \ln q_{ijg} + \alpha \ln x_{ijg} + \sum_{l=2}^{4} \pi_l S_{ijgl} + \sum_{l=2}^{4} \kappa_l S_{ijgl} \ln q_{ijgl} \\ &\quad + \beta' W_{ijg}^{s} + \delta' W_{ijg}^{q} + u_{jg} + \varepsilon_{ijg}^{s} + \varepsilon_{ijg}^{q} \end{aligned} \tag{5}$$

The signs and statistical significance of the coefficients $\kappa_l$ show whether quantity discounts are seasonal. A priori one would expect quantity discounts to be more evident in a period when the supply of maize is in abundance and demand is low. Since $\ln q_{ijg}$ is potentially endogenous as noted earlier, the interaction variables $S_{ijgl} \ln q_{ijg}$ are also potentially endogenous. I therefore use EC2SLS to estimate equation (5); where the interaction variables are instrumented by the interactions of $S_{ijg}$, and the household composition variables.

## 3.2 Direct Approach

To directly check for evidence that the poor pay more for maize, I adapt an approach developed by Aguiar and Hurst (2007). Their approach is based on a regression of an expensiveness index on income, and other socio-demographic variables. Instead of generating a composite index of expensiveness as in Aguiar and Hurst (2007), I derive a variable which captures the expensiveness of maize. The expensiveness variable shows how much more or less than the average a household pays for maize. The expensiveness variable is constructed as follows. I construct an area level (rural or urban) average unit value where the average is weighted by total quantity purchased of maize in the area as follows

$$\bar{\nu}_g = \sum_{i \in I, g \in G} \nu_{ig} \left( \frac{q_{ijg}}{\bar{q}_g} \right) \tag{6}$$

where, $\bar{q}_g = \sum_{i \in I, g \in G} q_{ig}$ is the total quantity of maize purchased by all households in an area $g$. The expensiveness of maize is then calculated as the ratio of the actual unit value to the average unit value

$$\tilde{E}_{ijg} = \frac{\nu_{ijg}}{\bar{\nu}_g} \tag{7}$$

To ensure that the expensiveness variable is centered around one, I normalise it by the average of the expensiveness variable in an area

$$E_{ijg} = \frac{\tilde{E}_{ijg}}{\bar{E}_g} \tag{8}$$

where $\bar{E}_g = \frac{1}{G}\sum_{i\in I,g\in G}\tilde{E}_{ijg}$. The interpretation of the expensiveness variable is as follows: values greater than one suggest that a household paid more than average for maize, and values less than one imply that the household paid less than the average.

In order to test whether the poor pay more for maize, the following regression is then estimated

$$\ln E_{ijg} = \tau \ln x_{ijg} + \lambda' Z_{ijg} + \sum_{l=2}^{4} \theta_l S_{ijgl} + \psi_{jg} + \omega_{ijg} \tag{9}$$

where, $\lambda$ and $\theta_l$ are parameters, $x_{ijg}$ and $S_{ijgl}$ are defined as before, $Z_{ijg}$ is a vector of socio-demographic characteristics of a household, $\psi_{jg}$ is a community random effect, and $\omega_{ijg}$ is a well-behaved error term. If the poor pay more for maize, then the elasticity $\tau$ will be negative. In order to test whether there is a relationship between the poor paying more for maize and seasonality, model (9) is re-estimated with total household expenditure-seasonal dummy interaction variables, $S_{ijgl} \ln x_{ijg}$.

## 3.3 Data and descriptives

The data used in the paper come from the Third Integrated Household Survey (IHS3). It is statistically designed to be representative at both national, district, urban and rural levels. The survey was conducted by the National Statistical Office from March 2010 to March 2011. The survey collected information from a sample of 12271 households; 2233 (representing 18.2%) are urban households, and 10038 (representing 81.8%) are rural households. A total of 768 communities (clusters) were selected across the country. In each district, a minimum of 24 communities were interviewed while in each community a total of 16 households were interviewed. The survey also collected socio-economic and demographic information on households, and household members such as sex, age, education, and household ownership of assets. The IHS3 records information on food consumption at the household level using the last seven days as the recall period. It collects data on 124 items, which are organized in eleven categories: cereals, grains and cereals products; roots, tubers and plantains; nuts and pulses; vegetables; meat, fish and animal products; fruits; cooked food from vendors; milk and milk products; sugar, fats and oil; beverages; and spices and miscellaneous. Quantity unit codes, ranging from standard units such as kilograms and litres to non- standard units such as heaps, pails, plates, cups and basins are converted into grams by using conversion factors. After data cleaning, I end up with 3448 rural households, and 1646 urban households with complete information on maize consumption.

Total quantity of maize consumed by a household is a sum of purchased maize, maize from own production, and maize gifts. Table 1 shows the shares of the three components of maize consumed by per capita consumption expenditure quintile, and area of residence. There are notable differences in the shares across all quintiles between rural and urban households; for rural households, maize from own production comprises the largest share of maize consumed, while for urban households most of the maize consumed is purchased. In both, areas, the shares of own produced and purchased maize are lowest for the poorest households and highest for the wealthiest households. In addition, for both rural and urban households, maize received as gifts constitutes a tiny fraction of total maize consumed; thus most of the maize is either from own production or from the market. Since this paper seeks to investigate the existence of a poverty penalty with respect to maize, I restrict the analysis to that maize component acquired through the market. Table 2 presents quintile-specific shares of household expenditure on maize in total food expenditure for rural and urban households. Two things are noteworthy from the results: first, the share of expenditure on maize is highest for the poorest households, 53.9% for rural households, and 34.5% for urban households, and the share is lowest for the wealthiest households, 19.6% for rural households, and 10.3% for urban households. Second, across all quintiles, the expenditure shares on maize for urban households are lower than those for rural households.

Table 3 presents summary statistics of the variables used in the study. The results indicate that the averages of the log of maize price per gram are -3.234 and -3.186 for urban and rural households respectively. The corresponding standard deviations are 0.550 and 0.780 for urban and rural households respectively. These results imply that urban households face higher, and more unstable maize prices than rural households. In terms of quantity of maize purchased, the results show that urban households buy slightly less maize per gram compared to their rural counterparts. This perhaps reflects the fact that rural households are on average larger than urban households; the log of household size is 1.4 and 1.3 for rural and urban areas respectively. The averages of the log of the expensiveness variable are -0.027 and -0.012 for urban and rural households respectively; implying that in both areas, households pay less than the average price of maize in their area. Besides, the results suggest that although urban and rural households pay below the average price of maize, rural households compared to urban households pay more relative to their area average prices.

# 4 Econometric results

## 4.1 Indirect Approach Results

Table 4 reports EC2SLS results on whether or not rural and urban households face quantity discounting with respect to their purchase of maize. For each area, there are two sets of results; one does not control for seasonality, and the other does. In addition to controlling for the endogeniety of the quantity of maize purchased, the results control for community level random effects which capture community specific observed and unobserved factors which influence maize prices. The results also include the sex, age, and highest qualification of the household head, and regional dummies as controls. All independent variables included in the different models are jointly significant with Chi-square values ranging from 668.93 to 1304.96. For rural and urban households, the quality elasticities as captured by the coefficient on the log of per capita expenditure are not only statistically significant but they are also quantitatively substantial. This means that for both areas, there are significant quality effects, and that unit values of maize, and maize prices do not coincide. The existence of significant effects also implies that if the quality effects had not been controlled for, the extent of quantity discounting would be underestimated (Attanasio and Frayne, 2006). Interestingly, the results indicate that quality effects are larger in rural areas than in urban areas. Thus, even though the maize consumed by rural and urban households is not homogenous in terms of quality, it is far less so in rural areas.

Is there quantity discounting when it comes to maize purchases in Malawi? The results in Table 4 answer this question. For each area, I first focus on the results without seasonal effects. The quantity discount elasticities are all negative and statistically significant for both areas. Further to that, the results show that the quantity discount elasticities are economically significant. Specifically, holding other things constant, a 1% increase in quantity leads to a 0.342% and 0.581% reduction in unit values of maize faced by rural and urban households respectively. These results suggest that regardless of location, maize purchases in Malawi are subject to quantity or bulk discounting, in other words, households that buy maize in large quantities enjoy lower prices. Interestingly, the quantity discount elasticity for urban households is larger than that for rural households. The difference is 0.239, and it is statistically significant with a t-statistic (p-value) of 9.92 (0.00). This means that relative to rural households, urban households benefit more from large purchases of maize.

Most of the maize consumed in Malawi is rainfed, and rainfall is unimodal in the sense that there is only one rain season. Consequently, the production and availability of maize reflects this seasonal pattern, and this entails that maize prices are also seasonal. Are the above results confounded by seasonal effects? The next set of regression results in Table 4 control for seasonality by including seasonal dummies. For both areas, Wald test results at the bottom of the table indicate that the seasonal dummies are statistically jointly significant, implying that seasonal effects are present. Even after allowing for seasonal effects, the results indicate that quantity discounting in the purchase of maize exists for both rural and urban households. Additionally, the inclusion of seasonal dummies leaves the magnitudes of the quantity discount elasticities virtually unchanged. This is interesting because it means that bulk purchases of maize induce lower prices regardless of when the purchases were made. The presence of significant quantity discounting in maize purchases, together with the fact that the poor cannot afford to buy maize in large quantities due to liquidity constraints, leads to the conclusion that the poor pay more for maize. Thus, the poor in Malawi face a poverty penalty with respect to maize purchases which is robust to the presence of seasonal effects.

I now turn to an assessment of whether the poverty penalty depends on the season. It is quite plausible to expect quantity discounting to be more pronounced in times when maize is in abundance than during times of maize shortages. Table 5 shows results with log of quantity-seasonal dummy interaction variables. The results conform to apriori expectations. For both rural and urban households, the magnitude and sign of quantity discount elasticities depend on the season. There is a statistically and economically significant negative interaction between quantity discounting and the postharvest season. The quantity discount elasticities for rural and urban households in the postharvest season are -0.123 and -0.405 lower than those for the harvesting period (the base category). This means that quantity discounting is more evident in times when maize is in excess supply. The results also show that the discount elasticities are positive for rural and urban households, implying that nonlinear pricing is less pronounced in the lean season when there are maize shortages.

## 4.2 Direct Approach Results

The preceding indirect approach results have shown that rural and urban households face a downward sloping price schedule when it comes to maize purchases. The inference from this has been that the poor in Malawi face a poverty penalty in the maize market. How robust is this finding to choice of method? Table 6 presents results of the direct approach which regresses the log of the expensiveness variable on the log of consumption expenditure, a measure of a household's economic status. Like before, there are two sets of results for each area; one with seasonal dummies, and one without. The results also control for community level random effects which capture community specific observed and unobserved factors which influence maize prices. I also control for the sex, age, and highest qualification of the household head, log of total household size, share of household members below the age of 5, share of household members between the ages of 5 and 17, the share of household members above the age of 60, and regional fixed effects by including regional dummies. The results indicate all the variables in the different models are jointly significant with Chi-square values varying from 80.27 to 196.66.

In summary, the direct approach results are consistent with the indirect approach results. The coefficients on the log of expenditure are all negative and statistically significant for the rural and urban regressions. The results also show that the elasticities of expensiveness with respect to consumption expenditure are also quantitatively large. Holding other factors constant, a 1% increase in consumption expenditure for rural and urban households respectively is associated with a 0.083% and 0.053% decrease in the price of maize relative to the cost of maize at area-specific average prices. Wald test results at the bottom of the table indicate that in both areas, there are statistically significant seasonal effects, and controlling for seasonality only marginally changes the magnitudes of the elasticities but does change their signs. This implies that the negative relationship between how much a household pays for maize, and household economic status is not confounded by seasonal effects. The direct evidence therefore suggests that poor rural and urban households pay more for maize in Malawi. The observed rural-urban difference in the size of the elasticities further implies that poverty reduction efforts would have a larger impact in reducing the poverty penalty in rural areas than in urban areas. Crucially, these direct approach results together with the indirect approach results discussed earlier mean that the finding that there is a poverty penalty when it comes to maize purchases is insensitive to the method one uses.

I now turn to a re-examination of the relationship between the poverty penalty, and seasonality using the direct approach. Table 7 contains results for the interaction between log of expenditure and seasonal dummies. The pattern and nature of the interaction effects is qualitatively similar to the one observed under the indirect approach. The results show that the poverty penalty is significantly more pronounced in the postharvest period; the coefficients on the log of expenditure for the postharvest season are -0.173 and -0.096 for rural and urban households respectively. Besides, the interaction effects for the lean period are all positive and statistically significant; suggesting that the poverty penalty is diminished in the lean period.

# 5 Policy Discussion

The results in this paper indicate that the price schedule for maize is downward sloping, and that poor rural and urban households pay more for maize in Malawi. These findings have useful policy relevance. First, the existence of significant quantity discounting in maize purchases means that the poor do not benefit from quantity discounts because they face greater liquidity constraints which make them buy maize in small quantities leading to higher unit prices. Thus, policy interventions such as consumption loans, and group buying schemes would enable the poor to relax their liquidity constraints, and capture bulk discounts. Second, improving the functioning of maize markets would lead to a double dividend of increased efficiency and equity (Muller, 2002). These twin benefits arising from improved maize market performance may be due to the fact that as the prices paid by the poor converge to the prices paid by everyone else, real inequality would fall while at the same time resources would be more efficiently allocated (Gibson and Kim, 2013).

Third, given the importance of maize in Malawi as shown earlier, the existence of a poverty penalty in maize purchases has implications on the measurement of income inequality, poverty, and propoorness of growth. Income inequality maybe mismeasured when a poverty penalty exists in the sense that real inequality and nominal inequality may not coincide. In the presence of regressive maize prices, nominal income inequality may underestimate the extent of income inequality. For instance, Rao (2000) finds that food prices are income dependent in India, and that after adjustment for this effect, the Gini coefficient for real income is from 12% to 23% higher than the Gini for nominal income. Since official inequality measures in Malawi do not control for the fact that maize prices are income dependent, they may be underestimating the extent of income inequality. Income dependent maize prices may also affect the measurement of poverty. The official measurement of poverty in Malawi is based on a regional deflation of household consumption expenditures. As has been shown by Muller (2008), this kind of aggregated deflation which ignores the fact that prices vary across individual households, and locales may lead to considerable differences in measured poverty. This inaccurate deflation of living standards data in turn implies that poverty monitoring and anti-poverty targeting can be badly affected. The presence of a poverty penalty can also affect the assessment of whether economic growth has been propoor. Failure to account for regressive maize prices may lead to biased conclusions. Günther and Grimm (2007) find that ignoring inflation inequality in pro-poor growth measurements can severely bias assessments of pro-poor growth.

Fourth, the results suggest that poor Malawians face a self-reinforcing triple tragedy, in that they are poor, they pay more for maize relative to the nonpoor, and as a result they face nutritional deficiencies. This means that the poor may relative to the nonpoor be facing nutritional deficiencies because they face higher maize prices. Ecker and Qaim (2011) find that there is a negative relationship between maize prices and the consumption of calories, protein, iron, zinc, and the low ramified B vitamins from maize, and a positive relationship between maize prices and calcium, vitamin A, C, B12, and folate consumption from maize. What this means is that maize consumer subsidies- a popular policy intervention in Malawi- which seek to improve food and nutrition security can be a double-edged sword; decreasing protein-energy malnutrition, while simultaneously worsening the vitamin status of households. In terms of policy interventions, this means that income-related policies which would free households from the poverty penalty through for example the enjoyment of bulk discounts are better suited than price policies to improve nutritional status.

Finally, and related to the above, the paper has shown that the poverty penalty is more pronounced in times of abundant maize supply. This has important implications on two factors namely; liquidity constraints and storage facilities. Due to binding liquidity constraints and lack of storage facilities, or a combination of both, maize producers in Malawi often sell cheaply a part of their production after harvesting - a time when maize is in excess supply- but end up buying maize at higher prices during the lean season

(World Bank, 2007). The non-poor owing to the fact that they are not liquidity constrained and/or they can afford better storage for their maize, may purchase the maize in bulk for consumption later. All this means that the poverty penalty exacerbates nutrition inequalities in Malawi; policy interventions to address this problem include the promotion of improved storage facilities or the relaxation of liquidity constraints through interventions pointed out earlier. The seasonal nature of the liquidity constraints further suggests that the loosening of the constraints should vary directly with seasons to enable households smoothen cash availability throughout the year.

# 6 Concluding Comments

The paper has used data from the Third Integrated Household Survey to examine whether or not the poor pay more for maize in Malawi. Two approaches have been adopted; an indirect approach which is based on quantity discounting, and a direct approach which is based the relationship between an expensiveness variable and household consumption expenditure. It has been found that the poor in rural and urban areas pay more for maize. This evidence of a poverty penalty in the maize market is not sensitive to method used. It has also been shown that the poor pay more for maize irrespective of when the maize is purchased. Thus, seasonality does not seem to be behind the observed poverty penalty. The paper has found that the poverty penalty varies with seasonality. The poverty penalty is significantly more pronounced in the postharvest period when maize is in abundance; it is however reduced in the lean season.

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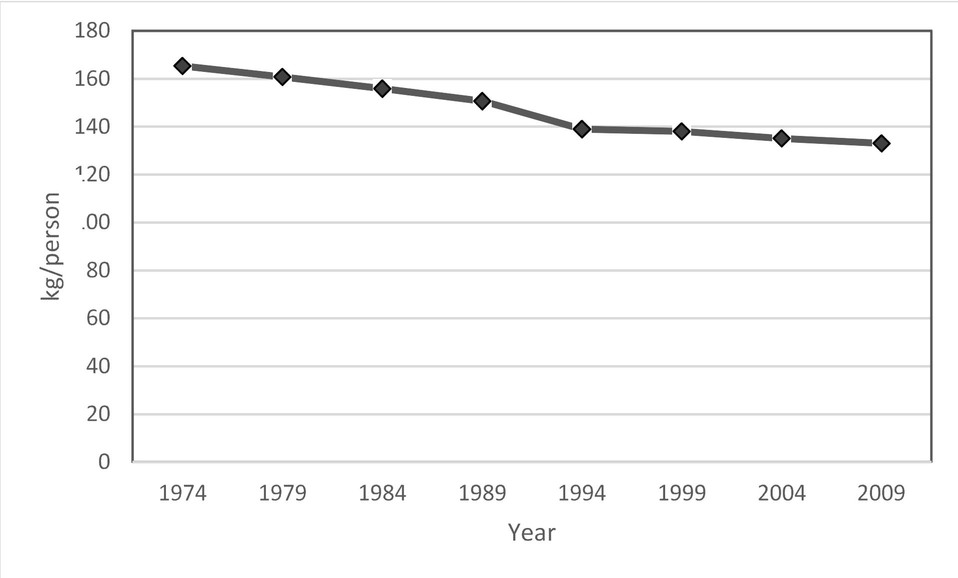
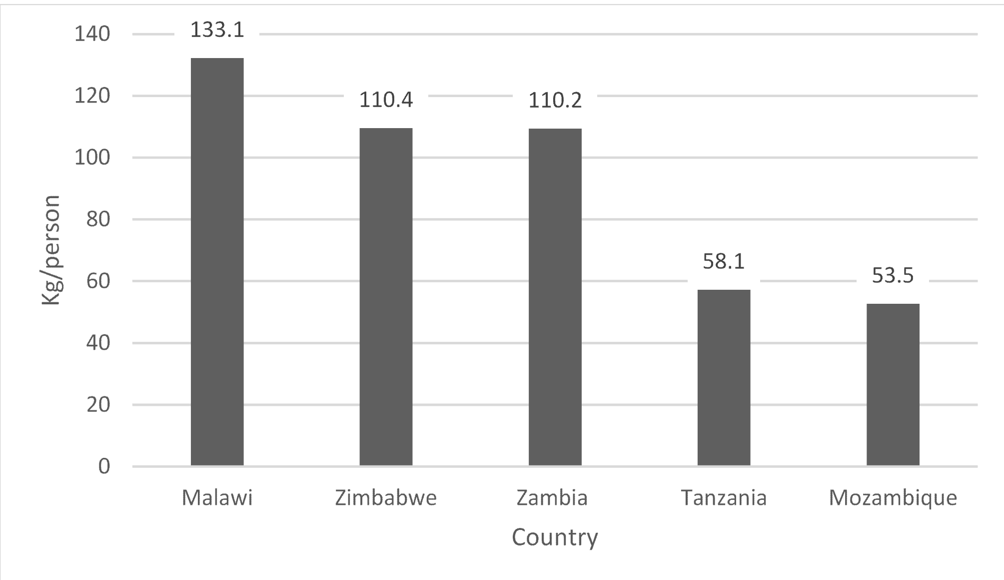
Figure 1: Per capita maize consumption for Malawi,1974-2009




Source: Author's computation using FAOSTAT database

Figure 2: Per capita maize consumption for selected Southern African countries, 2009




Source: Author's computation using FAOSTAT database

Table 1: Quantity shares of maize consumed by source and quintile

| Quintile/source | rural | urban |
|---|---|---|
| 1 | | |
| purchased | 0.407 | 0.633 |
| own production | 0.551 | 0.306 |
| gift | 0.042 | 0.061 |
| 2 | | |
| purchased | 0.320 | 0.616 |
| own production | 0.640 | 0.355 |
| gift | 0.040 | 0.028 |
| 3 | | |
| purchased | 0.258 | 0.660 |
| own production | 0.709 | 0.313 |
| gift | 0.033 | 0.027 |
| 4 | | |
| purchased | 0.228 | 0.696 |
| own production | 0.729 | 0.270 |
| gift | 0.043 | 0.034 |
| 5 | | |
| purchased | 0.298 | 0.678 |
| own production | 0.644 | 0.282 |
| gift | 0.057 | 0.040 |
| Total | | |
| purchased | 0.305 | 0.672 |
| own production | 0.653 | 0.291 |
| gift | 0.042 | 0.037 |

Table 2: Share of expenditure on maize in total food expenditure by quintile

| Quintile | rural | urban |
|---|---|---|
| 1 | 0.539 | 0.345 |
| 2 | 0.432 | 0.255 |
| 3 | 0.360 | 0.197 |
| 4 | 0.294 | 0.153 |
| 5 | 0.196 | 0.103 |
| Total | 0.402 | 0.150 |

Table 3: Descriptive statistics of regressors

| Variable | Description | Rural | | Urban | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| log of price | Unit of measurement: Malawi kwacha per gram | -3.234 | 0.550 | -3.186 | 0.780 |
| log of quantity | Unit of measurement: grams | 9.226 | 0.536 | 9.131 | 0.825 |
| age of head | Years | 40.460 | 15.244 | 36.834 | 11.944 |
| male headed | Dummy (1 if head is male, 0 otherwise) | 0.753 | 0.431 | 0.830 | 0.376 |
| none | Dummy (1 if head has no education, 0 otherwise) | 0.521 | 0.500 | 0.285 | 0.452 |
| pslc | Dummy (1 if head's highest qualification is pslc, 0 otherwise) | 0.084 | 0.278 | 0.117 | 0.322 |
| jce | Dummy (1 if head's highest qualification is jce, 0 otherwise) | 0.075 | 0.264 | 0.187 | 0.390 |
| msce | Dummy (1 if head's highest qualification is msce, 0 otherwise) | 0.047 | 0.211 | 0.238 | 0.426 |
| postsecondary | Dummy (1 if head has a tertiary qualification, 0 otherwise) | 0.014 | 0.116 | 0.110 | 0.313 |
| log of expenditure | Log of per capita household expenditure | 10.484 | 0.719 | 11.413 | 0.823 |
| log of household size | Log of household size | 1.398 | 0.550 | 1.334 | 0.579 |
| share under 5 | Share in a household of members aged below 5 | 0.041 | 0.067 | 0.026 | 0.055 |
| share 5-17 | Share in a household of members aged 5-17 | 0.077 | 0.090 | 0.062 | 0.083 |
| share above 60 | Share in a household of members aged above 60 | 0.008 | 0.045 | 0.003 | 0.026 |
| owns a fridge | Dummy (1 if household owns a fridge, 0 otherwise) | 0.012 | 0.111 | 0.169 | 0.375 |
| owns a bicycle | Dummy (1 if household owns a bicycle, 0 otherwise) | 0.359 | 0.480 | 0.251 | 0.434 |
| season1=harvesting | Dummy (1 if household was interviewed in March-April, 0 otherwise) | 0.222 | 0.416 | 0.199 | 0.399 |
| season2=lean | Dummy (1 if household was interviewed in December-February, 0 otherwise) | 0.147 | 0.354 | 0.198 | 0.399 |
| season3=preplanting | Dummy (1 if household was interviewed in September-November, 0 otherwise) | 0.276 | 0.447 | 0.303 | 0.460 |
| season4=postharvest | Dummy (1 if household was interviewed May-August, 0 otherwise) | 0.355 | 0.479 | 0.300 | 0.458 |
| North | Dummy (1 if household resides in the northern region, 0 otherwise) | 0.122 | 0.327 | 0.242 | 0.428 |
| Centre | Dummy (1 if household resides in the central region, 0 otherwise) | 0.224 | 0.417 | 0.309 | 0.462 |
| South | Dummy (1 if household resides in the southern region, 0 otherwise) | 0.654 | 0.476 | 0.449 | 0.498 |
| log expensiveness index | Log of the expensiveness index | -0.012 | 0.186 | -0.027 | 0.241 |
| Observations | | 3448 | | 1646 | |

Table 4: Indirect approach with and without seasonal effects

| Variable | Rural | Rural | Urban | Urban |
|---|---|---|---|---|
| log of quantity | -0.342*** | -0.341*** | -0.581*** | -0.581*** |
| | (0.016) | (0.016) | (0.018) | (0.018) |
| log of expenditure | 0.135*** | 0.133*** | 0.057*** | 0.054*** |
| | (0.014) | (0.014) | (0.020) | (0.020) |
| season2 | | -0.048 | | -0.066 |
| | | (0.044) | | (0.063) |
| season3 | | -0.148*** | | -0.241*** |
| | | (0.038) | | (0.059) |
| season4 | | -0.171*** | | -0.263*** |
| | | (0.037) | | (0.060) |
| Constant | -1.496*** | -1.372*** | 1.319*** | 1.519*** |
| | (0.218) | (0.220) | (0.303) | (0.302) |
| controls included | yes | yes | yes | yes |
| Chi2 (regression) | 668.93 | 701.81 | 1215.34 | 1304.96 |
| P-value of Chi2 | 0.00 | 0.00 | 0.00 | 0.00 |
| Chi2 (significance of seasonal effects) | | 27.75 | | 29.04 |
| P-value of Chi2 | | 0.00 | | 0.00 |
| Observations | 3448 | 3448 | 1646 | 1646 |

Notes: season2= postharvest, season3=preplanting, season4= lean. Controls included are: sex, age, and highest qualification of the household head, and regional dummies. Standard errors in parentheses. *** indicates significant at 1%; ** at 5%; and, * at 10%.

Table 5: Indirect approach with quantity-seasonal interactions

| Variable | Rural | Urban |
|---|---|---|
| log of quantity | -0.320*** | -0.405*** |
| | (0.034) | (0.048) |
| log of expenditure | 0.132*** | 0.060*** |
| | (0.014) | (0.020) |
| season2 | 1.077** | 1.189** |
| | (0.466) | (0.541) |
| season3 | 0.322 | 2.354*** |
| | (0.419) | (0.492) |
| season4 | -0.527 | 0.775 |
| | (0.399) | (0.540) |
| season2 x log of quantity | -0.123** | -0.138** |
| | (0.050) | (0.060) |
| season3 x log of quantity | -0.051 | -0.284*** |
| | (0.045) | (0.054) |
| season4 x log of quantity | 0.088*** | 0.115* |
| | (0.013) | (0.059) |
| Constant | -1.562*** | -0.121 |
| | (0.350) | (0.501) |
| controls included | yes | Yes |
| Chi2 | 718.10 | 1422.73 |
| Observations | 3448 | 1646 |

Notes: season2= postharvest, season3=preplanting, season4= lean. Controls included are: sex, age, and highest qualification of the household head, and regional dummies. Standard errors in parentheses. *** indicates significant at 1%; ** at 5%; and, * at 10%.

Table 6: Direct approach with and without seasonal effects

| Variable | Rural | Rural | Urban | Urban |
|---|---|---|---|---|
| log of expenditure | -0.058*** | -0.057*** | -0.055*** | -0.053*** |
| | (0.005) | (0.005) | (0.008) | (0.008) |
| season2 | | 0.003 | | 0.001 |
| | | (0.016) | | (0.029) |
| season3 | | 0.049*** | | 0.087*** |
| | | (0.014) | | (0.027) |
| season4 | | 0.063*** | | 0.102*** |
| | | (0.014) | | (0.028) |
| Constant | 0.557*** | 0.515*** | 0.517*** | 0.443*** |
| | (0.052) | (0.053) | (0.099) | (0.101) |
| controls included | yes | yes | yes | yes |
| Chi2 (regression) | 164.51 | 196.66 | 80.27 | 111.37 |
| P-value of Chi2 | 0.00 | 0.00 | 0.00 | 0.00 |
| Chi2 (significance of seasonal effects) | | 25.19 | | 29.62 |
| P-value of Chi2 | | 0.00 | | 0.00 |
| Observations | 3448 | 3448 | 1646 | 1646 |

Notes: season2= postharvest, season3=preplanting, season4= lean. Controls included are: sex, age, and highest qualification of the household head, log of total household size, share of members below the age of 5, share of members between the ages of 5 and 17, the share of members above the age of 60, and regional dummies. Standard errors in parentheses. *** indicates significant at 1%; ** at 5%; and, * at 10%.

Table 7: Direct approach with per capita expenditure-seasonal interactions

| Variable | Rural | Urban |
|---|---|---|
| log of expenditure | -0.083*** | -0.053*** |
| | (0.010) | (0.016) |
| season2 | -0.101 | 0.498* |
| | (0.155) | (0.261) |
| season3 | -0.439*** | 0.019 |
| | (0.137) | (0.233) |
| season4 | -0.318** | -0.142 |
| | (0.133) | (0.235) |
| season2 x log of expenditure | -0.090*** | -0.043* |
| | (0.015) | (0.023) |
| season3 x log of expenditure | -0.016 | 0.006 |
| | (0.013) | (0.020) |
| season4 x log of expenditure | 0.036*** | 0.081*** |
| | (0.013) | (0.020) |
| Constant | 0.794*** | 0.439** |
| | (0.105) | (0.185) |
| controls included | yes | yes |
| Chi2 | 213.65 | 122.69 |
| Observations | 3448 | 1646 |

Notes: season2= postharvest, season3=preplanting, season4= lean. Controls included are: sex, age, and highest qualification of the household head, log of total household size, share of members below the age of 5, share of members between the ages of 5 and 17, the share of members above the age of 60, and regional dummies. Standard errors in parentheses. *** indicates significant at 1%; ** at 5%; and, * at 10%.