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Working Paper 67

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Indaba Agricultural Policy Research Institute (IAPRI)
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The views expressed herein are solely the responsibility of the authors and do not necessarily reflect the opinions of IAPRI, MSU, USAID, or any other organization.

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EXECUTIVE SUMMARY

All governments require accurate information on how the economy functions in order to formulate and implement sound agricultural policies. Policies to ensure food security are no different. Efforts to keep food prices at tolerable levels require information about the competitiveness of the wholesaling, milling, and retailing stages of the food value chain. The main objective for this paper is to better inform policy discussions about the effects of alternative maize pricing and marketing policies on national food security and agricultural development.

In September 2011, the Government of Zambia started heavily subsidizing the price of maize held by the Food Reserve Agency (FRA) to maize millers. The expectation was that, by receiving maize at subsidized prices, millers would pass along the subsidy to Zambian consumers in the form of lower retail maize meal prices. This analysis determines the extent to which marketing margins for maize millers and retailers changed after the miller subsidies were implemented, and the extent to which subsidies to millers were passed along to consumers.

The authors examined the marketing margins between wholesale maize grain and retail maize meal in the four Zambian urban markets of Lusaka, Chipata, Ndola, and Kasama. The mill-to-retail margins were analyzed using a linear econometric model. The analysis differentiates between two phases. The first phase was from January 2000 to August 2011; during this period, millers purchased maize from the market or from the FRA at competitive prices. The second phase is from September 2011 to March 2012, when the Food Reserve Agency began subsidizing maize grain to millers at U.S. Dollars (US$)140 per tonne (equivalent to the Zambian Kwacha (ZMK)700,000 at an exchange rate of ZMK5000/US$), while it was purchasing maize at US$265 per tonne. The FRA even provided transport for this maize to the millers' factories, further subsidizing millers' acquisition price, such that the effective *ex depot* FRA price was in the range of US$80 or ZMK400,000 per metric tonne. By selling at a heavily subsidized price to millers, the government expected millers to accordingly reduce their selling prices of maize meal to retailers and ultimately to consumers. Did this happen?

Our analysis indicates that, over the eleven-year period from 2000 to 2011, inflation-adjusted retail prices for breakfast meal have declined. However, after the subsidy was conferred to millers in September 2011, the mill-to-retail marketing margins have increased significantly. Retail maize meal prices have remained virtually constant since September 2011. These findings indicate that very little of the treasury costs incurred in providing FRA grain to millers at below-market prices have benefited urban consumers.

Moreover, the FRA maize subsidies are only conferred to some millers, not all of the maize millers in Zambia. Millers that did not receive the FRA subsidized maize, in particular the informal and small/medium-scale millers were greatly disadvantaged because they could not acquire maize grain at as low a price as millers receiving subsidized maize from the FRA. This has led to an unbalanced playing field between the millers who benefited from the FRA subsidized maize grain and those who did not. We conclude that such an un-level playing field will negatively affect the future competitiveness and market structure of Zambia's maize milling industry.

The study highlights three main policy implications for the consideration of the Zambian government. First, because the FRA maize subsidies to millers have so far not been transmitted to Zambian consumers, policy makers might reconsider the policy of providing

maize to selected millers at highly subsidized prices, if the aim of doing so is to reduce the price of maize meal to consumers. Second, selective subsidies to particular millers disadvantage other millers plus many informal small-scale millers who are not able to receive the subsidy. Over time, this is likely to entrench the market share of the selected millers having access to subsidized maize supplies, force non-selected millers out of business, and adversely affect the degree of competitiveness within the milling industry. Third, for the Government to achieve its goal of lower maize meal prices to help poor urban consumers, policies should be considered that encourage rather than disadvantage the informal and small/medium-scale food millers and retailers, on whom a large share of Zambian consumers rely.

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ACRONYMS

AMIC	Agricultural Marketing Information Centre
CPI	Consumer Price Index
CSO	Central Statistical Office
FEWSNET	Famine Early Warning Systems Network
FRA	Food Reserve Agency
FSRP	Food Security Research Project
IAPRI	Indaba Agricultural Policy Research Institute
MAL	Ministry of Agriculture and Livestock
MSU	Michigan State University
SIDA	Swedish International Development Agency
USAID	United States Agency for International Development
US$	United States Dollars
ZCF	Zambia Cooperatives Federation
ZMK	Zambian Kwacha
ZNFU	Zambia National Farmers Union

1. INTRODUCTION

Sound government policy making depends on accurate information about the performance of the sector in question. In respect of agriculture and food security, appropriate policy decisions require an understanding of the competitiveness of the farm, wholesaling, milling, and retailing stages of the food value chain. If the system is fully competitive, then state subsidies conferred at one stage, e.g., milling, will be passed through to consumers. On the other hand, if the state intends to subsidize consumers by introducing subsidies at an uncompetitive stage in the value chain, theory would suggest that the subsidy might be captured by millers and not be fully passed along to consumers. In addition, when subsidies are not applied properly, the end results may be that government expenditures do not reach the intended beneficiaries.

In 2010 and 2011, Zambia achieved record maize harvests of 2,795,483 and 3,020,380 metric tons respectively (Nkonde et al. 2011). Towards the year of elections (2011), the FRA purchased roughly 1.5 million metric tons of maize that it could not fully store, mainly due to inadequate storage facilities. Further, the state could not sell its surplus maize profitably, either in the region or in international markets due to the high price at which it purchased maize locally (Mason and Myers 2011). Moreover, regional transport capacity constraints have limited the volumes that Zambia could export even at a financial loss. Hence, in mid-2011, and leading into national elections later in the year, the country faced the dilemma of how to offload the large and partially deteriorating maize stocks from the 2010 harvest to make room for incoming maize purchases from the 2011 harvest.

Starting in September 2011, the government via FRA offloaded maize to millers at US$140 per metric tonne (roughly 35,000 kwacha per 50kg bag). After accounting for the FRA's marketing costs and storage losses on top of the 65,000 kwacha per 50kg bag purchase price, it is likely that the FRA lost at least 85,000 kwacha ($340 per tonne) on every bag traded during this period. Further, the government continued to subsidize maize exports within the SADC region at a loss despite the country having to incur high production costs. Thus, while the FRA was spending K65,000 (roughly US$260 per metric tonne) to purchase maize from farmers and incurring additional marketing and storage costs of at least $100 per tonne, it was selling the same maize to other countries within the region at a cost of not more than US$170 per tonne (Lusaka Times 2012).

However, it should be noted that the subsidized FRA sale price to millers was intended to provide important food security benefits. By selling at a heavily subsidized price to millers, the government expected millers to accordingly reduce their selling prices of maize meal to retailers and ultimately to consumers. The basic question to be answered is whether the government has achieved its intended objectives through this form of food price subsidization, and if so, to what extent.

There has been little effort to date to understand the extent to which the subsidized FRA maize price to millers has been passed on to Zambian consumers. The purpose of this paper is to address this question; by doing so, we also draw inferences about the degree of competitiveness of Zambia's maize milling and retailing sectors. The findings of this analysis can assist policy makers in designing appropriate food security policies in the future.

2. OBJECTIVES

This paper analyzes changes in the marketing margins between wholesale maize grain and maize meal for four selected urban markets of Zambia from January 2000 to March 2012. By comparing marketing margins between the near-term baseline period (January 2000 – August 2011) and the period during which maize acquisition prices by millers was reduced substantially (September 2011 – March 2012), we can assess whether milling/retailing margins stayed roughly constant during this period, which would be indicated by a commensurate decline in the retail prices of mealie meal. If retail maize meal prices dropped by a roughly similar extent to the maize subsidy, this would imply reasonable competitiveness of the milling/retailing sector. Alternatively, if the lower grain acquisition price to millers had little impact on retail mealie meal prices, then this would imply that the government subsidy was absorbed in the form of larger milling and/or retailing margins. Our ultimate objective is to better inform policy discussions about the effects of alternative maize pricing and marketing policies on national food security and agricultural development.

3. DATA AND METHODS

We use AMIC data for 2000 - 2012 to analyze maize grain and maize meal price trends. AMIC, which is situated within the Ministry of Agriculture and Livestock, collects these data on a monthly basis since January 1994. To accommodate comparisons across years, we use the consumer price index (CPI) data from the Central Statistical Office of the Republic of Zambia to deflate our prices to 2011 price levels. Our analysis is in two phases. The first phase runs from January 2000 to August 2011. The second phase covers a period between September 2011 and March 2012 when FRA began offloading maize to millers at US$140/tonne, delivered to the mill gate, in a bid to lower mealie meal prices to consumers and create more storage space for the next harvest season. By agreeing on a price of $140 per tonne delivered to the mill gate instead of *ex FRA depot* as was the case for other buyers, the government was further subsidizing millers' transport costs (which were roughly $60 per tonne on average between outlying depots and provincial town centres[1]), such that the effective *ex FRA depot* price was in the range of US$80 per metric tonne.

We now turn to testing for changes in the mill-to-retail margins between the two periods with a structural break. We start with a standard spline function as in equation (1).

$$Mktmargin_{it} = \alpha_1 + \alpha_2 * D2011_t + \beta_1 month_t + \beta_2 (D2011_t * month_t) + \varepsilon_t \quad (1)$$

where $Mktmargin_{it}$ is mill-to-retail market margin between wholesale maize grain and retail breakfast meal in selected urban market; $month_t$ is time measured in months; $D2011_t$ is a dummy variable taking a value of 1 for observations between September 2011 and March 2012 and equaling zero for all prior months; α_2 is the differential intercept; β_2 is the differential slope coefficient or slope shifter which indicates by how much the slope coefficient of the second period's (dummy value = 1) market margin function differs from that of the first period, thus β_2 estimates the difference in the effect of time in months on $Mktmargin_{it}$ between the second and first market phases; the subscript *i* refers to selected urban market at time *t*, and ε_t is the random variation at time *t* not explained by the model.

During the pre-September 2011 period, the dummy variable *D2011* equals zero and hence equation 1 reduces to:

$$Mktmargin_{it} = \alpha_1 + \beta_1 month_t + \varepsilon_t$$

After the initiation of the subsidies to millers in September 2011, *D2011* equals one and equation 1 can be reformatted as:

$$Mktmargin_{it} = (\alpha_1 + \alpha_2) + (\beta_1 + \beta_2) * month_t + \varepsilon_t$$

Joint significance tests on α_2 and β_2 determine whether both the level and trend in marketing margins have changed in the post-2011 subsidy period.

As is usually the case when we use monthly data, serial correlation is always a possibility. Therefore, before regressing prices on a linear time trend, we test for the presence of autocorrelation and we corrected for this by applying a first-order residual model (Chapoto and Jayne 2009). We chose the four urban markets of Lusaka, Chipata, Ndola, and Kasama for analysis, which together account for roughly 58% (table 1) of Zambia's urban population.

[1] This is based on information provided by the Grain Traders Association of Zambia, March 2012.

However, spatial variations in maize and maize meal prices are generally minimal, therefore, inferences from these four urban markets can be associated with the other urban markets in the country. To examine whether the mill-to-retail marketing margin between wholesale maize grain and retail breakfast meal was the same before and after September 2011 when FRA started selling maize grain to millers at below-market prices (400 kwacha per kilogram), we use Chow's Breakpoint Test. To do this test, we divide the sample data into two sub-samples according to our different market phases using a dummy variable. For each subsample, Chow's test fits the regression separately to show if there is any significant difference in the estimated equations. The Chow test was chosen because any possible structural changes between the two study periods could be caused by differences in the intercept or the slope coefficient or even both (Chow 1960).

Table 1. Share of Lusaka, Chipata, Ndola, and Kasama Urban Markets of Zambia's Total Urban Population

Urban market	Percentage (%)
Lusaka	32.6
Chipata	10.4
Ndola	10.4
Kasama	4.7
Sub-total	58.1
Other urban markets	41.9
Total	100

Source: CSO/Living Conditions Monitoring Survey 2010.

4. RESULTS AND DISCUSSION

According to the *F*-test of the joint significance of the two dummy variable terms, we failed to reject the null-hypothesis that these two variables were not significant, i.e.,

$H_0: \alpha_2 = \beta_2 = 0$

This means that we do not find evidence that both the level *and* the trend in marketing margins have changed after September 2011. However, testing for changes in the level of marketing margin alone through model (2)

$$Mktmargin_{it} = \alpha_1 + \alpha_2 * d2011_t + \beta_1 month_t + \varepsilon_t \quad (2)$$

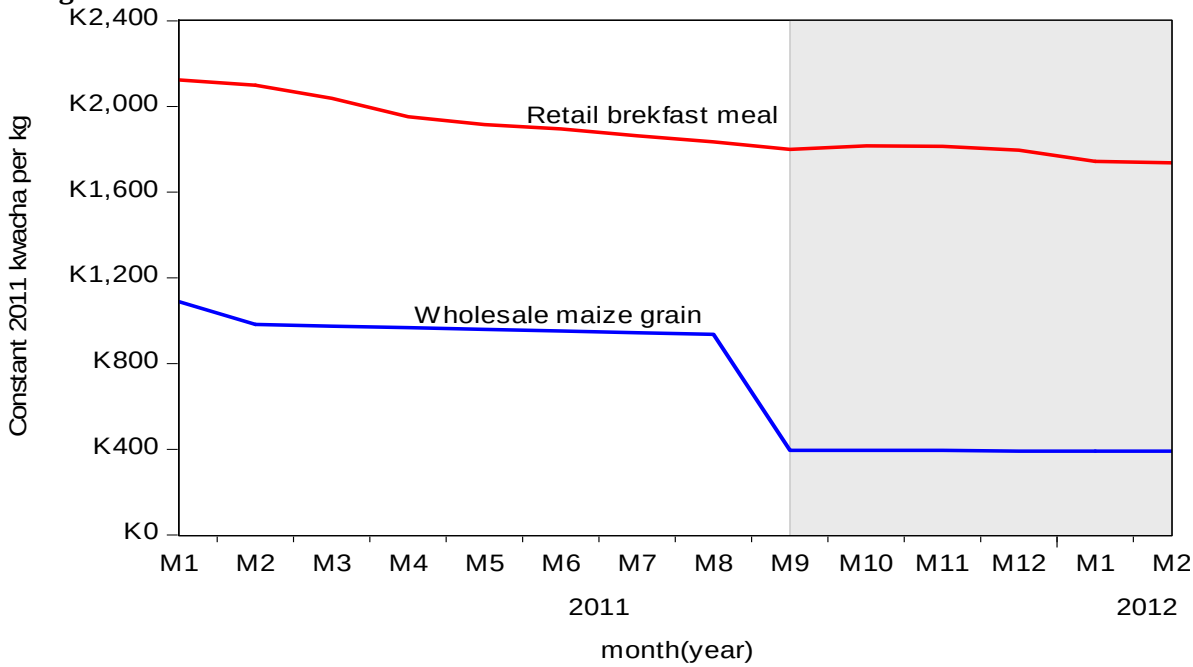
did consistently reject the null hypothesis of $\alpha_2 = 0$ and hence provide evidence of significant differences in the marketing margin after the subsidies were conferred to millers. The Chow test results for Lusaka's urban market reveal important differences at 5% level of significance in the estimated equations for the two study periods.

F-statistic	3.438	Probability	0.019
Log likelihood ratio	10.378	Probability	0.016

Both test statistics reject the null hypothesis of no significant difference in the level of the mill-to-retail marketing margin between wholesale maize grain and retail breakfast meal before and after the September 2011. The calculated F-statistic of 3.438 is greater than the critical F-value of 3.06 for the 5% level of significance hence the null hypothesis of no structural change is rejected. This finding can further be supported by the log likelihood ratio statistic of 10.378, which is also greater than 9.49 at the 5% significance level. In short, these statistical results indicate that maize milling/retailing margins widened significantly after the maize subsidy was conferred to millers starting in September 2011.

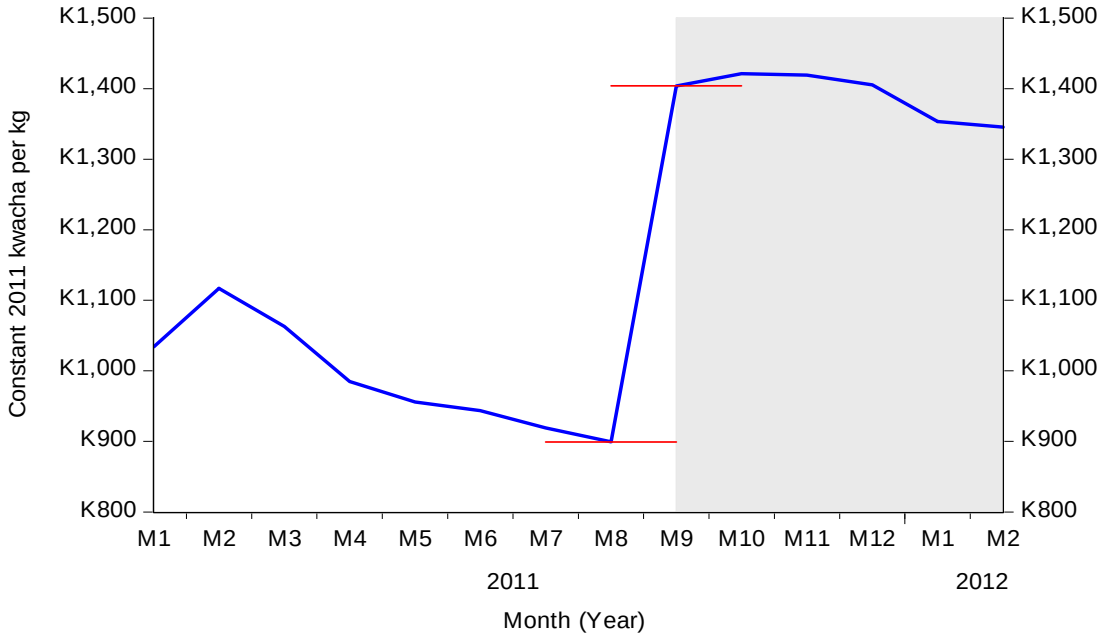
These findings are consistent with a cursory examination of maize grain and maize meal price trends, which show a large apparent increase in the margins accruing to millers and/or retailers after the introduction of the FRA subsidy to millers in September 2011. Retail prices for breakfast meal hardly decreased at all while the wholesale maize grain price fell by over 600 kwacha per kg in 2011 kwacha. Very little of the treasury costs involved in selling grain to millers at abnormally low prices since September 2011 have benefited Zambian consumers.

Fig 1a. Constant Prices of Wholesale Maize Grain and Retail Breakfast Meal per Kilogram in Lusaka



Source: Agricultural Marketing Information Centre 2011 – 2012.

Fig 1b. Market Margins of Wholesale Maize Grain to Retail Breakfast Meal in Lusaka in Constant Prices per Kg



Source: Agricultural Marketing Information Centre 2011 – 2012.

Zeroing in on the period January 2011 – February 2012, figure 1b (Lusaka urban market) shows how market margins of wholesale maize grain to retail breakfast meal jumped from the level of roughly 900 kwacha per kg by August to 1,400 kwacha per kg after September 2011. Of course we do not expect the same decline in retail breakfast meal prices within the same month or so because millers still had to mill the previous maize stock which was bought at a higher price before government subsidized FRA wholesale maize grain to millers. However, retail prices of breakfast meal continued declining at the same rate of 4 kwacha per kilogram each month implying benefits enjoyed by the commercial millers were not passed onto consumers.

Results for the other urban markets are shown in Table 2. From equation 1, results reveal that the differential intercept coefficient is positive in each four urban areas, but only statistically significantly so in the Ndola area. According to Figure 1a above, we see the trend of retail breakfast meal prices remained unaffected even after a reduction in wholesale price of maize grain to millers. These findings indicate that government's sale of maize through the Food Reserve Agency to millers at roughly 400 kwacha per kilogram in late 2011 and most of 2012 has not benefited consumers, but has greatly benefited either millers, retailers, or both. There was statistical significant change in the mill-to-market margins after the intervention. Although millers did not pass these benefits onto consumers, these subsidies drained the government treasury greatly.

It should be noted that the differential intercept for Chipata and Kasama urban markets are nearly significant e.g. p=0.0849 for Kasama market. The shaded area in all the figures show the second phase of our study period. Figures 2b, 3b, and 4b show the trend of market margins between wholesale maize grain and retail breakfast meal in Chipata, Ndola, and Kasama respectively. In Chipata the mill-to-retail market margins went up from 1200 kwacha in August 2011 to 1600 kwacha per kg the following month. In Ndola the market margins increased from roughly K900 in August to K1,500 per kilogram the following month of 2011 while for Kasama the margins rose by K600 kilogram^{-1} over the same period. When we compare the margins between January 2011 and February 2012 we find the margins in Lusaka rose by K300, in Ndola by K700 while in Kasama by K200 per kilogram. The increase in mill-to-retail market margins are partly explained by the relatively flat trend of breakfast meal prices (figures 2a, 3a, and 4a) while wholesale maize prices sharply went down after government through the Food Reserve Agency subsidized wholesale maize grain to millers in September 2011. These subsidies appear to have been highly beneficial to millers but appear not to have been passed along to consumers of maize meal.

Table 2. Market Margins of Wholesale Maize Grain to Retail Breakfast Meal and Differential Intercept Coefficient in Lusaka, Chipata, Ndola and Kasama

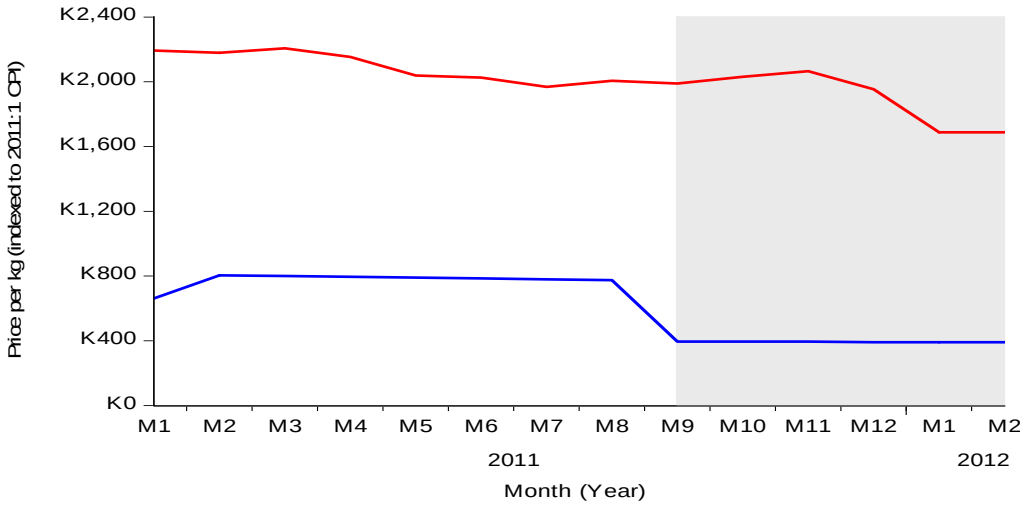
	Lusaka	Chipata	Ndola	Kasama
Constant	1674**	2732**	2174**	2277**
	(124)	(212)	(193)	(221)
Month	-3.77**	-10.05**	-8.40**	-8.28**
	(1.47)	(2.44)	(2.27)	(2.58)
Dummy	508**	325	553**	481
	(204)	(229)	(258)	(277)
R^2	0.51	0.80	0.69	0.71
F-stat	49.77**	195.15**	104.27**	114.97**

Source: Agricultural Marketing Information Centre 2011 – 2012.

Standard errors are reported in parentheses. **indicates significance at the 95% level.

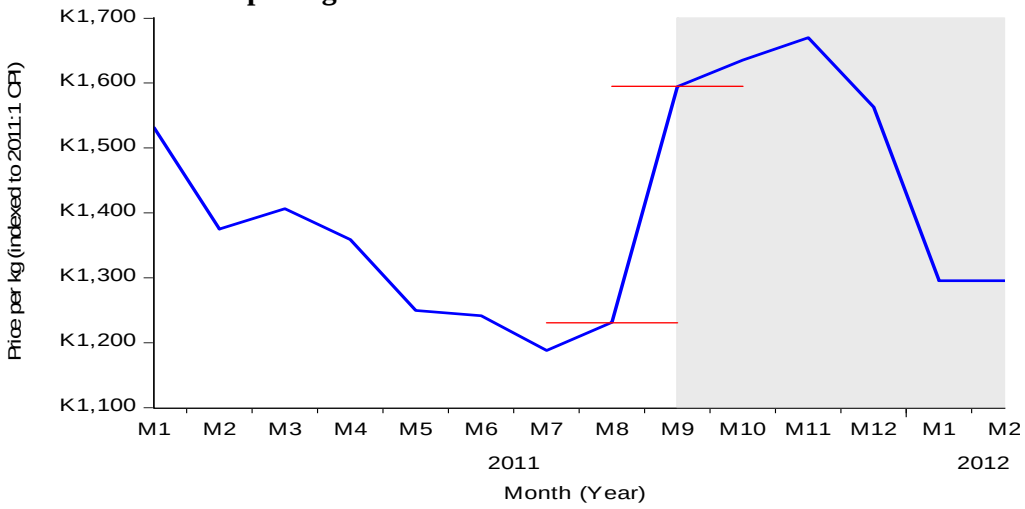
A potentially damaging consequence of subsidizing grain for selected millers is the impact on future competitiveness and market structure in the milling industry. Not all millers received access to the FRA subsidy. Those that did not, including the hundreds of informal small-scale production millers in the country, were disadvantaged by the FRA action. Essentially the FRA subsidy to selected millers provided greater profits for these firms which could be used in various ways to carve out greater market share at the expense of non-subsidized milling and retailing firms.

Fig 2a. Inflation-adjusted Prices of Wholesale Maize Grain and Retail Breakfast Meal per Kilogram in Chipata



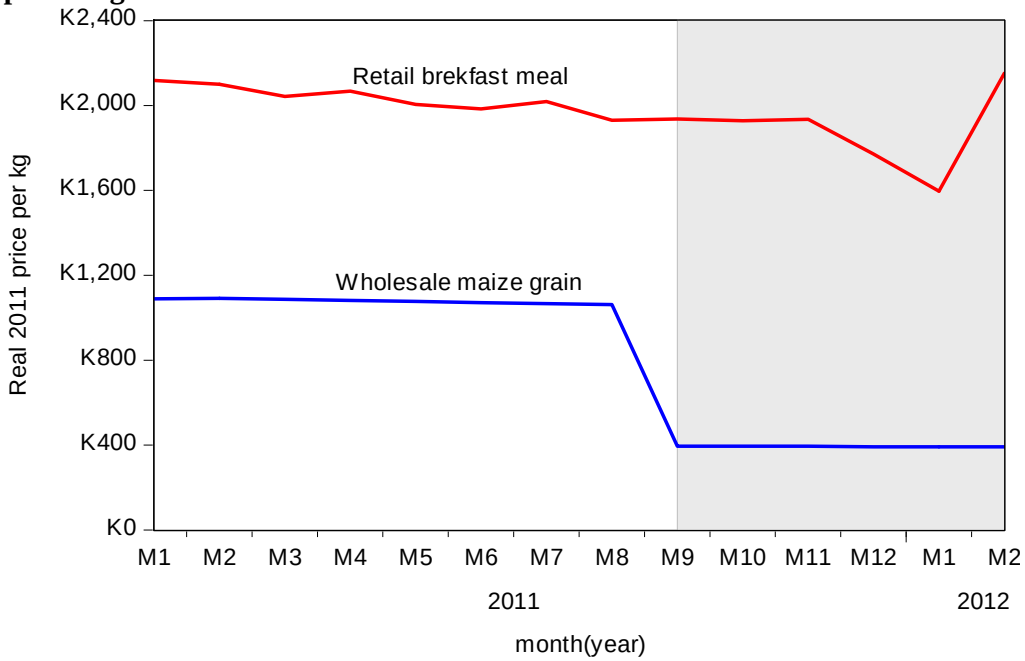
Source: Agricultural Marketing Information Centre 2011 – 2012.

Fig 2b. Market Margins of Wholesale Maize Grain to Retail Breakfast Meal in Chipata in Constant Prices per Kg



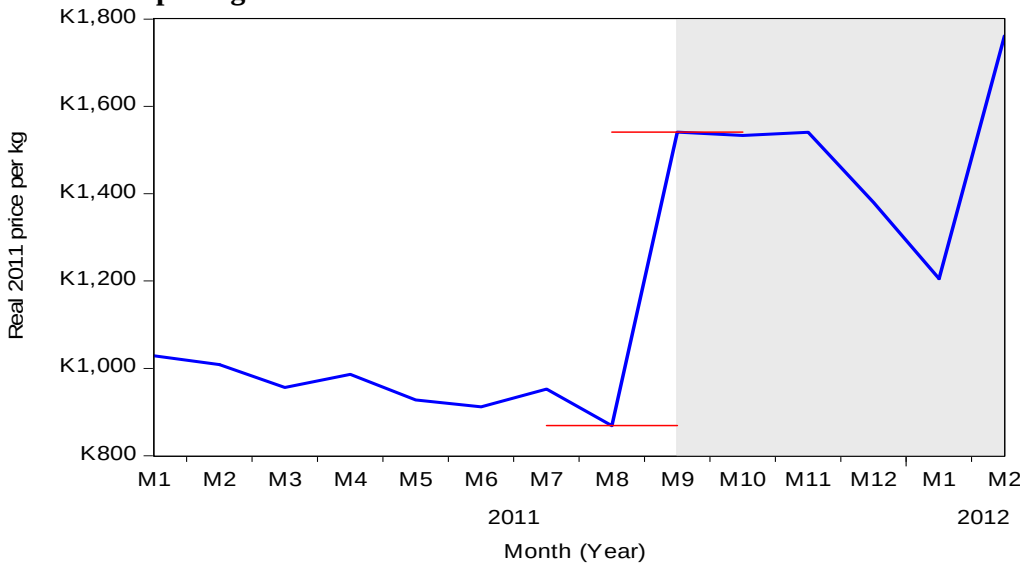
Source: Agricultural Marketing Information Centre 2011 – 2012.

Fig 3a. Inflation-adjusted Prices of Wholesale Maize Grain and Retail Breakfast Meal per Kilogram in Ndola



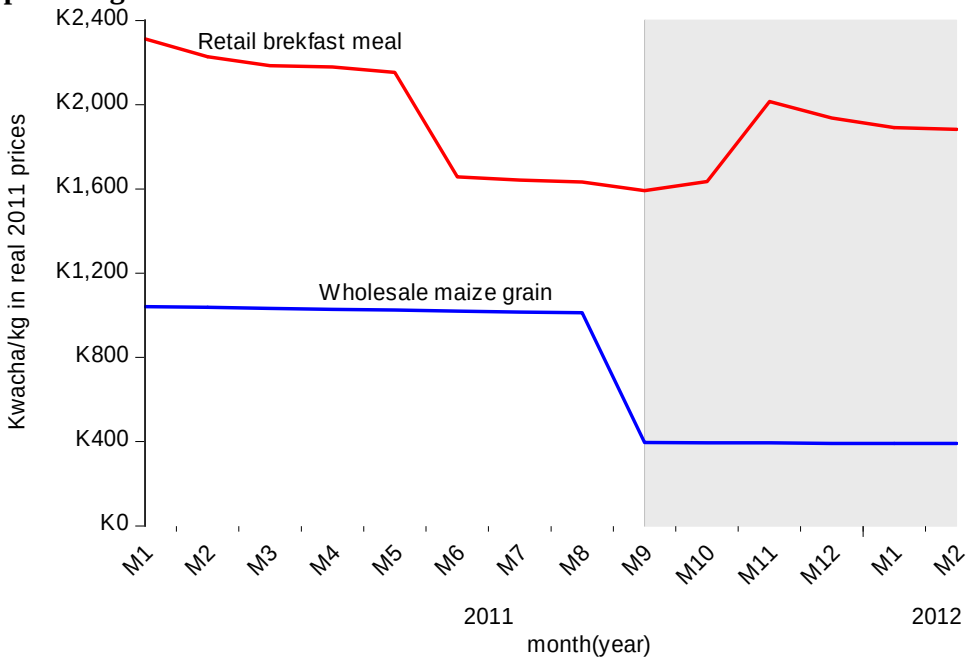
Source: Agricultural Marketing Information Centre 2011 – 2012.

Fig 3b. Market Margins of Wholesale Maize Grain to Retail Breakfast Meal in Ndola in Real Prices per Kg



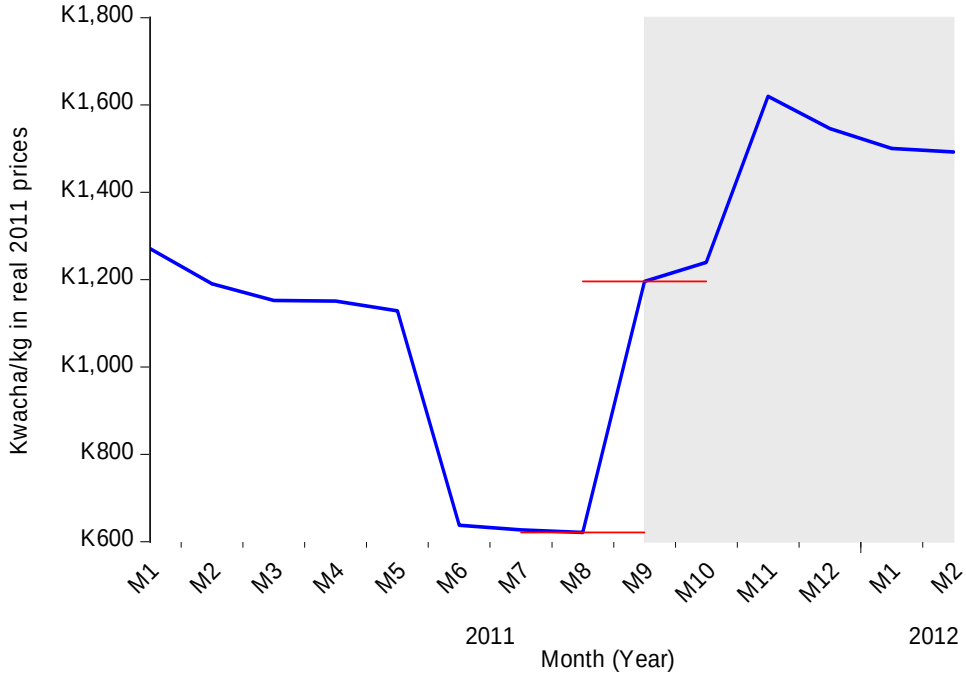
Source: Agricultural Marketing Information Centre 2011 – 2012.

Fig 4a. Inflation-adjusted Prices of Wholesale Maize Grain and Retail Breakfast Meal per Kilogram in Kasama



Source: Agricultural Marketing Information Centre 2011 – 2012.

Fig 4b. Market Margins of Wholesale Maize Grain to Retail Breakfast Meal in Kasama in Real Prices per Kg



Source: Agricultural Marketing Information Centre 2011 – 2012.

5. CONCLUSIONS AND POLICY IMPLICATIONS

The mill-to-retail market margins were analyzed using a linear econometric model. In calculating the market margins we used monthly maize wholesale prices and retail breakfast meal prices collected by AMIC for each of the four urban markets studied. The period of consideration was from January 2000 to March 2012. This period was divided into two phases, that is before (phase 1) and after the September 2011 (phase 2) when FRA started selling maize grain to commercial millers cheaply at 400 kwacha per kilogram. Chow's test, which fits the regressions separately for each subsample showed a significant difference at a probability of 95% in the estimated equations. Given that premise, it is clear that structural changes between the two study periods took place. According to Ray (2010), structural change simply means the values of the parameters of the regression model do not remain the same throughout our entire study time period.

This study was motivated by the expected decline of mealie meal prices in the urban markets as a result of the government intervention to sell maize grain to large millers through FRA at below market prices. Our findings agree very well with Chapoto and Jayne (2006) as well as Kuteya and Jayne (2011) that maize meal prices in real terms have been declining over time. However, the rate at which these prices were decreasing after state intervention was less than that of maize grain. As such, the impact of this costly move was not felt by consumers. The mill-to-retail market margins increased tremendously immediately after FRA offloaded maize grain to commercial millers at 400 kwacha per kilogram. These maize grain subsidies which drained the state treasury appear to have benefited large millers alone since the move did not reduce mealie meal prices at the same rate as maize grain from FRA. If government's objective from these subsidies was also to reduce maize meal prices for the benefit of consumers, it does not appear to be supported by the econometric model results.

Maize subsidies are perceived as government's indirect support to commercial millers. But it is a well-documented fact that even small millers (hammer mills) play a major role in ensuring competition in the grain milling industry in the country. Therefore, if the playing field is not leveled, their activities are hampered by selective subsidies and as a result lessening competition in the grain milling industry. The end results are high marketing margins between wholesale maize grain and breakfast meal retail prices.

The foregone analysis indicates that selective subsidies conferred to certain players in the market do not necessarily have desired consequences when the market is not fully competitive. If the market were competitive, then subsidies conferred to millers would be passed along fully to consumers, which appear not to be the case in Zambia. Subsidies to maize millers have instead proved to be a drain on the government treasury without trickling down anticipated benefits to intended beneficiaries – urban consumers in this case. Our findings would support the Zambia National Farmers Union's call for increased scrutiny of the milling stage of the maize value chain:

> "*We also demand that Government instructs the Office of the Auditor General to conduct an Audit of all the Millers who benefited from the maize subsidy programmes immediately, to ascertain how the benefit of the subsidy was passed onto consumers. It is common knowledge that mealie meal prices did not come down hence justice demands that all those who may have abused the subsidy programme should be made accountable for profiteering at the expense of consumers and be banned from dealing with government in future*." (ZNFU 2009).

From our analysis, we draw the following key policy implications. First, using public funds to subsidize millers/retailers did not get transmitted to urban consumers; policy makers should be cautious about attempting to subsidize consumers by reducing the price of maize to millers.

Second, there is evidence of potential non-competitive behavior within either the milling industry or the retailing industry.

Third, not all millers benefited from the low FRA selling price. Selective subsidies to particular millers disadvantage millers not able to receive the subsidy, this creates unleveled playing field that can lead to future concentration in the market and adverse effects on competition within the maize value chain. Ultimately this affects both farmers and consumers.

Fourth, for government to realize her objectives of cutting down maize meal prices to help poor urban consumers, FRA's participation in the market needs to treat both large and small millers alike.

Fifth, because this subsidy program was not budgeted for in the first place, these subsidies may be crowd out public investments with proven impacts on agricultural growth.

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