Welfare impacts of seasonal maize price fluctuations in Malawi

Levison Chiwaula, Joachim De Weerdt, Jan Duchoslav, Joseph Goeb, Anderson Gondwe, & Aubrey Jolex

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P.O. Box 30883, Capital City, Lilongwe Malawi

Chiwaula (l.chiwaula@mwapata.mw) is the Research Director at MwAPATA Institute. De Weerdt is a senior Research Fellow with the Development Strategy and Governance Unit of the International Food Policy Research Institute (IFPRI). He is based in Lilongwe where he heads IFPRI's Malawi Country Office. Duchoslav is a Research Fellow with the Development Strategy and Governance Unit of the International Food Policy Research Institute (IFPRI), based in Lilongwe. Goeb is an Assistant Professor in the Department of Agricultural, Food, and Resource Economics at Michigan State University (MSU/AFRE and a Principal Investigator for MwAPATA Institute. Gondwe is a Research Fellow at MwAPATA Institute. Jolex is a Research Associate at the Innovation for Poverty Action, Manila, Philippines.

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Abstract

Maize prices fluctuate significantly throughout the year in Malawi, creating winners and losers depending on who is selling and who is buying the staple at different times. We link maize market price data to nationally and temporally representative household survey data on maize sales and purchases to quantify welfare gains and losses throughout the year. A stable maize price would lead to only a modest increase in Malawi's total social surplus when summed across a whole year, but a dramatic reduction in hunger during the lean season. We discuss policy options to smooth maize prices throughout the year.

JEL: Q18, Q13, I30

1. Introduction

The recent spike in global food prices has renewed academic attention to the effects of food price inflation on consumer and producer welfare. This new literature builds on earlier research inspired by periods of high food prices in the mid-1970s and late 2000s. This body of literature focuses on headline-grabbing but rare events. In this paper, we instead turn our attention to the welfare effects of a more ordinary but, due to its regularity, equally impactful source of food price instability: seasonality caused by reliance on the natural yearly cycle of rainfed agricultural production. We estimate that in a typical year in Malawi, seasonal maize price fluctuations lead to 198 million person-days of hunger. Completely stabilizing maize prices throughout the season would lead to only a modest increase Malawi's total social surplus when summed across a whole year, but a dramatic reduction in the incidence of hunger.

The first efforts to understand the relationship between food prices and welfare are theoretical in nature and focus on the welfare implications of food price stabilization through trade or the use of grain reserves. In a series of papers published after the food crisis of the mid-1970s, Just et al. (1978), Bigman and Reutlinger (1979) and Turnovsky et al. (1980) demonstrate that in most cases, food price stabilization benefits consumers but not necessarily producers.

In non-industrialized settings where a large share of consumers also produce food, the opposite effects that price fluctuation has on consumer and producer welfare complicate the assessment of the impact of food price changes on net welfare. Unsurprisingly, empirical studies do not form a consensus in this respect, and their results often depend on context-specific factors (see, for example, Sah and Stiglitz 1987, Ravallion 1990, Ivanic and Martin 2008, Swinnen and Squicciarini 2012). After correcting for recall errors in an analysis of the impact of food price changes on poverty and food security in multiple countries, Headey and Marin (2016) find that continued increases in food prices have often benefited the poor and likely contributed to a faster reduction in global poverty. In Mozambique, Arndt et al. (2008) show that food price increases hurt urban households but benefit rural households who are net sellers. Benfica (2014) finds a similar pattern in Malawi. In Kenya (Levin and Vimefall 2015), and Cameroon (Quentin 2015), higher maize prices are shown to negatively affect welfare of poor households. Similar findings are reported in a multi-country study covering Ethiopia, Malawi, Niger, and Tanzania (Magrini et al. 2017). Based on data from Thailand, Deaton (1989) shows that the bulk of the households benefiting from higher rice prices lie in the middle of the income distribution. This is due to the fact that poor households generally tend to be subsistence farmers while rich households tend not to grow rice at all and thus do not receive greater returns from sales. Barrett and Dorosh (1996) find that gains from price increases are highly concentrated among the largest rice farmers in Madagascar who are able to produce the largest surpluses to sell. In Nigeria, Adekunle et al. (2020) conduct separate analyses for net buying and net selling households and find that net food buyers suffer negative welfare outcomes of price increases while net sellers have positive welfare outcomes. Araar and Verme (2019) compare different welfare estimation methods and demonstrate that for price changes larger than 10% different welfare measures show divergent effects.

The complicated and often negative impacts of food price fluctuations have moved many governments to hedge poor farmers and consumers with price stabilization policies for staple foods. However, the identification of who benefits or loses from price stabilization policies depends on the ability to unambiguously identify who is a net buyer or a net seller which is currently difficult to establish due to data measurement issues (Carletto 2012). In rural Ethiopian households, eliminating price volatility was found to yield gains in welfare but in a distributionally regressive fashion (Bellemare et al. 2013). In another study, the price stabilization interventions of the Food Reserve Agency in Zambia were found to increase food prices, which benefited surplus maize producers but adversely affected net buyers of maize and the majority of the rural poor (Mason et al. 2013). Both these studies use panel data to estimate household welfare effects of price changes over several years. However, seasonality in food prices within a single year also has important welfare implications due to timing of purchases and sales (Sahn 1989), and these seasonal welfare impacts due to within-year price variation have received relatively little attention. Our paper seeks to fill this literature gap.

We link maize market price data from Malawi – a country whose staple price volatility is among the highest in the world due to predominantly rainfed production and a single annual harvest – to nationally and temporally representative household survey data on maize sales and purchases to quantify welfare gains and losses from seasonal price fluctuation measured as the net benefit ratio introduced by Deaton (1989). We then convert monetized welfare changes due to a theoretical price stabilization intervention to plausible changes in energy intake to estimate the impact of price seasonality on food security.

The rest of the paper is organized as follows. Section 2 outlines the contextual background of the study. Section 3 describes the data, section 4 discusses the methodologies used in the study, and section 5 presents the results and findings. The final section summarizes our results and discusses their policy implications.

2. Background

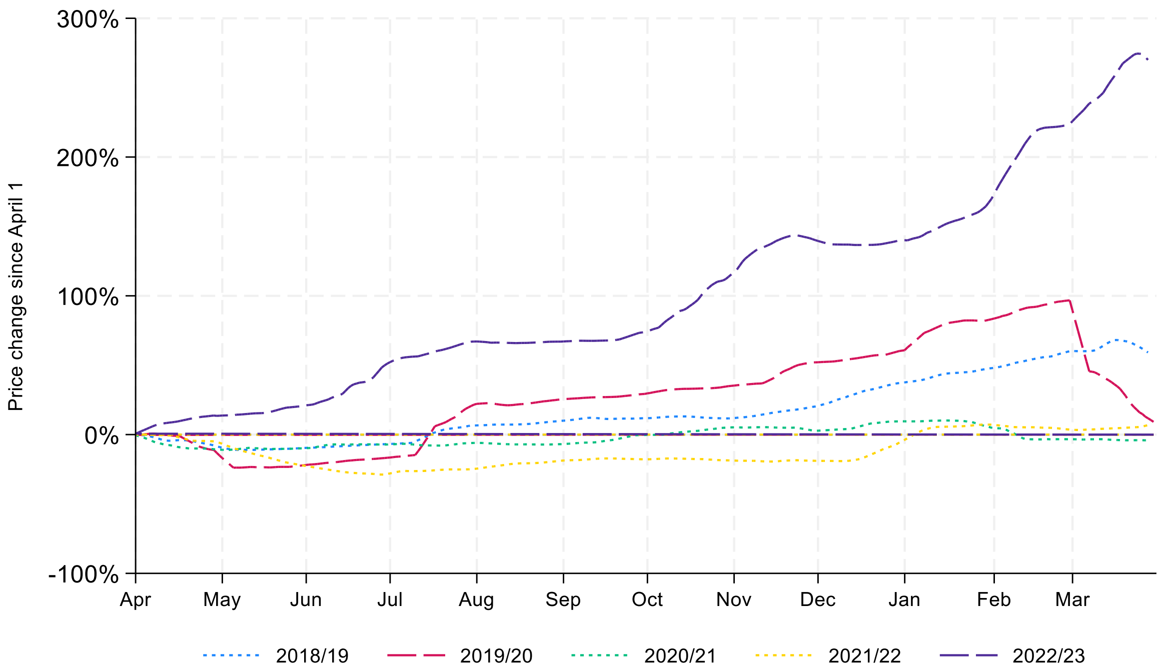
Maize is Malawi's main food crop grown by 88% of farming households (74% of all households). It takes up nearly half of the country's cultivated land, most of which is unirrigated. Many maize producers sell a portion of their output, but most households, who on average derive about half of their energy intake from the grain, are dependent on markets to buy maize for consumption at some point in the year (De Weerdt and Duchoslav 2022).

Its centrality to Malawian agriculture and diets makes maize a very political crop and subject to many policies and regulations. Its production is heavily subsidized. Each year, vast amounts are purchased and deposited into the country's Strategic Grain Reserve (SGR) and released back onto the market later in the season. The government regulates minimum farmgate prices of maize and regularly restricts exports of the commodity.

Many of these policies are intended to dampen the seasonal maize price fluctuations associated with producing the crop in an agricultural system that is almost exclusively rain-fed and relies on a single annual rainy season. Unfortunately, they often do the opposite due to mistiming and poor implementation (Duchoslav et al. 2022). Poor temporal arbitrage in maize markets, market power along the marketing chain, and sell-low, buy-back-high behavior among liquidity and credit constrained households likely further deepen the price cycle (Stephens and Barrett 2011). As a result, Malawi regularly experiences some of the most acute seasonal differences in maize prices in sub-Saharan Africa (Gilbert et al. 2017), despite reasonably good spatial maize market integration (Myers 2013, Burke and Myers 2014).

Figure 1 shows seasonal price fluctuations in nominal maize prices since April for four successive past cropping seasons from 2018/19 to 2022/23. Except for the 2022/23 agricultural marketing season, maize prices in Malawi normally experiences a slump just after April which is the harvesting period, and they start increasing after June. Peak maize prices are normally observed around February and March of every m year. Considering the magnitude of these seasonal fluctuations, welfare gain from smoothing them could be substantial.

Figure 1. Maize price seasonality (2018/19-2022/23)



3. **Data**

We use two sources of data. The first is the fifth Malawi Integrated Household Survey (IHS5) collected by the National Statistical Office (NSO) from April 2019 to April 2020 as part of the Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA). Covering 11,434 households, the survey is representative at the national level, including the country's regions, urban-rural areas, and district levels. The survey is also temporarily representative at the monthly level (see Table A1 and Figure A1 in the appendix for balance tests and interview locations by month respectively) which allows us to describe seasonal consumption patterns of Malawian households[1]. NSO gathered consumption data through the standard LSMS-ISA food consumption module detailing the food items consumed by the household in the past 7 days. For each food item consumed by the household, we know the

[1] To maintain temporal representativeness of the consumption data, we pool observations from April 2019 and April 2020. We match them to their respective price points, but present them as part of the same month in charts for ease of interpretation.

total quantity consumed from three sources: from purchases, from own production, and from gifts or other sources.

Table 1. Descriptive statistics

	All households	Income		Location		Maize area		
		Poor	Non-poor	Rural	Urban	No maize	Smaller	Larger
Number of households								
Unweighted	11,434	4,468	6,966	9,342	2,092	3,299	3,970	4,165
Weighted	4,122,702	1,751,742	2,370,960	3,452,625	670,078	1,073,540	1,498,637	1,550,525
Household size	4.4	5.3	3.8	4.5	4.2	4.0	5.5	3.8
Annual income per capita (MWK '000)	282	114	391	230	517	411	188	271
Cultivated land areas								
All crops (ha)	0.49	0.53	0.47	0.56	0.18	0.10	0.46	0.84
Maize (ha)	0.33	0.36	0.31	0.38	0.13	0.00	0.29	0.64

Notes: Income is a real expenditure-based calculation deflated to the price level in April 2019. We use the national poverty line of MWK 165,879 per capita per annum, which is equivalent to $0.63 per capita per day at nominal exchange rates and $1.70 per capita per day at PPP, i.e., below the international poverty line. The threshold for smaller/larger maize-growing households is 0.1 ha of maize cultivated per capita.

The second data source are daily maize prices collected by the International Food Policy Research Institute (IFPRI) from 26 major markets in Malawi.

4. Methodology and results

a. *Estimating maize consumption*

Due to the importance of maize in Malawian diets, the LSMS-ISA questionnaire asks about its consumption in four different forms: maize grain (or kernels), whole grain maize meal, refined maize meal and maize 'bran meal'. To compare kg of maize consumption like-for-like across these four products, we scale maize meal and bran back to a kernel equivalent (in which maize prices are also typically expressed). The whole grain meal, locally known as *mgaiwa*, keeps 96% of the whole kernel, while refined meal will remove the germ and bran, keeping only 85% of the kernel (Jayne et al. 1995). We use these ratios to convert the whole grain and refined meal into the equivalent amount of maize kernel needed to produce them.

Maize bran is a by-product of the milling process and consists of 15% of the kernel removed when milling refined meal. The bran is often mixed together with *mgaiwa* and consumed as a product locally known as *madeya*. *Madeya* is considered an inferior product, which is reflected in its lower price. To convert *madeya* back into kernel maize equivalent, we scale using the median price of *madeya* relative to the median price of *mgaiwa*. That makes the consumption of 1.27 kg of *madeya* equivalent to the consumption of 0.96 kg of *mgaiwa*, which in turn is 1 kg of maize kernel.[2]

b. *Defining seasonality*

The household survey data do not allow us to measure consumption seasonality at the household level because of a short (7-day) recall period for food consumption. However, we are able to assess seasonality for typical households because the interviews were randomly spread over the course of an entire year. From the date a household was interviewed, we know over which 7-day period it was reporting consumption and use that information to calculate the average amount of maize consumed by households in each calendar month, disaggregated by three different sources: own production, purchases, and gifts and other sources.

In establishing sales seasonality (how much maize was sold when), we face two complications. The first is that the survey was rolled out in April 2019, at which point households were reporting on harvests and sales of the previous 2017/18 harvest. As the survey progressed, households started reporting on the 2018/19 harvest. About 70% of maize farmers reported on the 2018/19 harvest, and we restrict our sample for sales related calculations to this season.

The second complication is that households sell maize at different points in time, but are, obviously, only able to report on sales that made prior to the interview. Following Dillon (2020), we draw a cumulative distribution function of the share of households who sold any maize by month *m*, by restricting the estimate at each *m* to households interviewed in month *m*+1 or after. This means that each point on the cumulative distribution function is estimated using a

[2] In other words the conversion of kernel into *madeya* is done at a ratio of 1/(1.27*(1/.96)) = 0.76. Using this same price method to convert refined flour to *mgaiwa* equivalent and then to kernel equivalent produces a conversion ratio of 85% – matching the conversion rate cited in the literature based on weight.

different sample of households, namely those interviewed after the month in question. Thus, we rely on the temporal representativeness of the sampling during the year to estimate the share of farmers selling maize by each month.

c. *Measuring monetary welfare effects*

The monetary value of the welfare effects of maize price volatility depends on the timing of maize purchases and sales. We conducted the following thought experiment for each average household to assess this: suppose this household maintained the same quantities of maize bought (b_m) and sold (s_m) in each month of the year, but instead of facing the actual price for month *m*, denoted by p_m, it faced a hypothetical flat price that does not vary by month, denoted by $\tilde{p}$.[3] We therefore measure the net income effect of maize purchases and sales as follows:

$$w = \sum_{m=1}^{12}(s_m p_m - b_m p_m) \quad (1)$$

The sign of w in equation (1) indicates whether a household earns more (positive values of w) or less (negative values) income from maize sales than it uses for maize purchases.

In our thought experiment we hold the quantities and timing of maize sales s_m and purchases b_m constant and change the price at which these transactions happen. Rather than the prevailing market price for that month, p_m, we assume that the household now faces a stable price $\tilde{p}$, so that the net income effect now becomes:

$$\widetilde{w} = \sum_{m=1}^{12}(s_m \tilde{p} - b_m \tilde{p}) \quad (2)$$

We define the net income effect of the new set of prices by subtracting equation (1) from equation (2):

$$\Delta w = \sum_{m=1}^{12}(s_m \tilde{p} - b_m \tilde{p}) - \sum_{m=1}^{12}(s_m p_m - b_m p_m) = \sum_{m=1}^{12}\big((s_m - b_m)(\tilde{p} - p_m)\big) \quad (3)$$

[3] We will discuss below the likely implications of allowing quantities b_m and s_m to respond to prices. For the purpose of this exercise, we fix $\tilde{p}$ at the median price for maize grain for the period April 2019 to March 2020 (MWK 224 per kg). The shading in Figure 3 indicates that for April through September 2019, $p_m < \tilde{p}$, while from October 2019 to March 2020, $p_m > \tilde{p}$.

Dividing equation (3) by the mean monthly household consumption expenditure y, we obtain the Net Benefit Ratio (NBR or σ) introduced by Deaton (1989):

$$\sigma = \sum_{m=1}^{12} \left(\frac{(s_m - b_m)(\tilde{p} - p_m)}{y} \right) \quad (4)$$

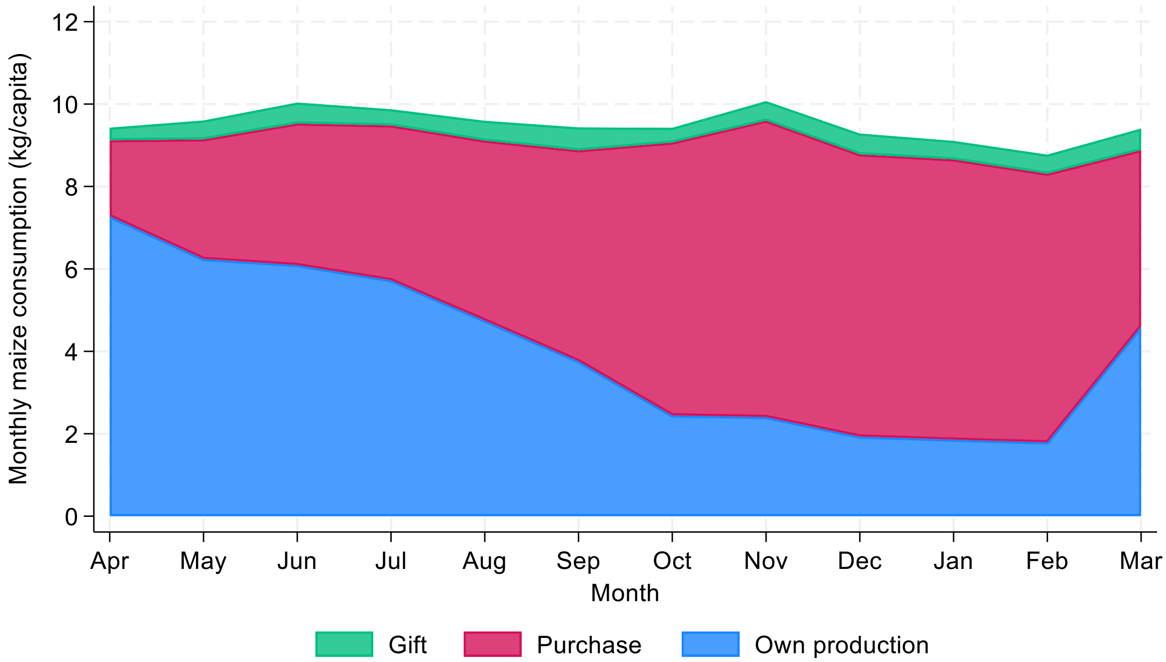
It expresses the monetary value of welfare gain or loss resulting from the fluctuation in price as a percentage of total consumption.

5. **Results**

a. Consumption seasonality

Figure 2 charts seasonal changes in maize consumption of the average Malawian household calculated following the methodology presented in section 4.a. above and illustrates three stylized facts.

Figure 2. Seasonality in maize consumption by source



First, consumption of maize is very large. Depending on the month, households consume between 9 and 10 kg of maize grain per capita per month. This implies an average daily per capita caloric intake of 1,100 kcal from maize alone. Clearly maize is central to energy intake for Malawian households.

Second, total maize consumption has a moderate level of seasonality. It is lowest in the lean season, starting to decline around December and arriving at its lowest point in February. By then it has dropped by about 10% compared to what it was between June and November.

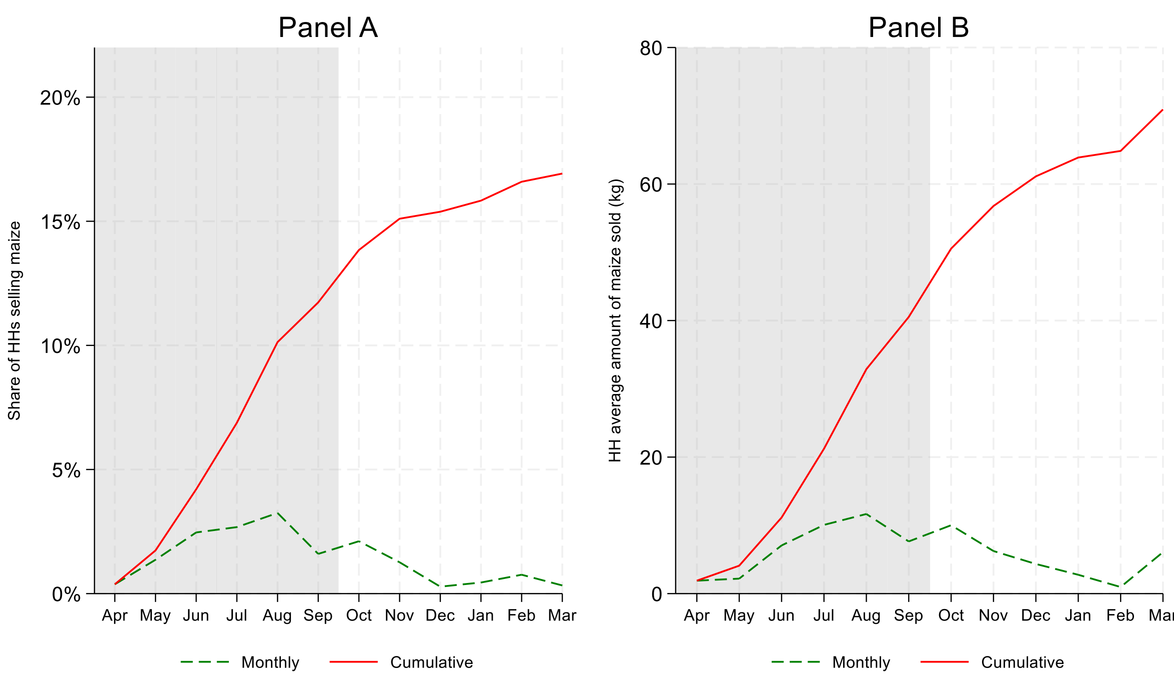
Third, seasonal fluctuations are much more pronounced in the shares of maize consumption coming from purchases and from own fields. Whereas right after the harvest, in April, people consume 7.2 kg of self-produced maize per capita per month, this drops to just 1.9 kg per capita per month during the lean season, December through February. The amount of purchased maize that the household consumes in a month follows an inverse trend from 6.8 kg per capita at its peak in the lean season to only 1.8 kg per capita in April. The share coming from gifts and other sources is small and seasonally stable.

b. Sales seasonality

While practically all Malawian households consume maize, 74% of households also produce it. For our welfare calculations it is important to understand how much of this maize production is sold, as well as the timing of these sales.

The solid red line in Panel A of Figure 3 shows the cumulative share of households who sold any maize from the latest harvest by a given month. It starts at 0 in April, rises quite steeply up to November, after which it flattens out. Important to note is the very low level at which the line plateaus: while 74% of Malawian households grow maize, only 16% of households sell any maize they have produced. As such welfare impacts of maize sales only apply to 16% of households which, dampens the impacts of maize price fluctuations on selling households as noted by Benson (2020). The impacts of maize price fluctuations could be substantial because of the large proportion of households who are net buyers as evidenced by the large share of maize purchases in total consumption and the small shares of households selling maize.

Figure 3. Seasonality in maize sales, share of households who sold any maize by month.



From the cumulative distribution we can derive a distribution function of the share of households making their first sale in each month (dashed green line in Panel A of Figure 3). We see that peak time for households entering the maize sales market is June, July and

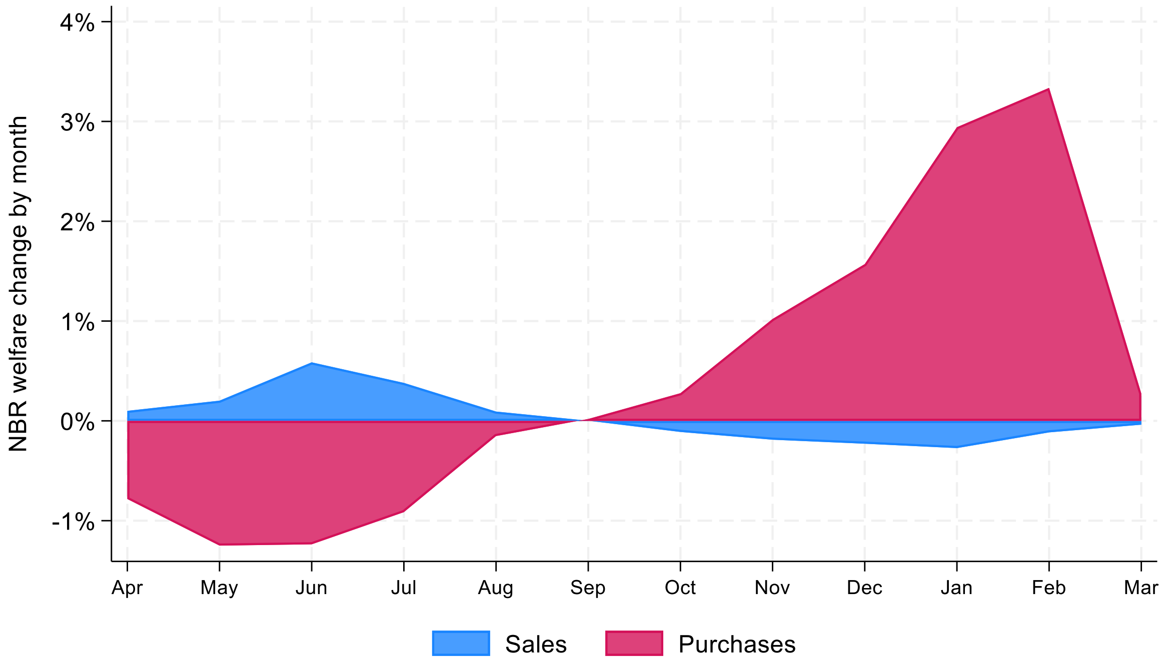
August, but never exceeds 3% per month, a very low number consistent with very few households selling.

The solid red line in Panel B of Figure 3 shows a similar cumulative distribution function for the average household quantity of maize sold by a given month. We see that 57% of the quantity of maize is sold between April and September, when prices are below the median for the year (shaded portions of both panels in Figure 3). Less than 14% of the maize is sold between November and March when prices are highest. Note that the curve in Panel B does not plateau off as markedly as the curve in Panel A, implying that the average volume of monthly sales per household increases from November to March. It is primarily the larger and better-off producers who make these high-volume sales towards the end of the season. Between December and March maize sales are effectively zero for poor households and for small maize growers, while over the same period a small share of non-poor and larger maize farmers are able to sell a conditional average of more than 500 kg per household. This is more than the conditional average amount sold by poor households at harvest time. More details on this can be found in Figure A2 in the appendix, which splits Figure 3 by poverty, rural/urban, and maize farm size.

c. *Monetary welfare*

Figure 4 plots the NBR for each month. We see that at the peak of the lean season, a lower price of maize would result in just over 3% monetary welfare gain, on average. For the poor, who start from a lower consumption base, the welfare gain from stable prices reaches a peak of 6% in February (Appendix Figure A3). Monetized welfare calculations (the numerator in NBR) show similar overall patterns to NBR and peak welfare gain of about MWK 750 per capita per month in February (Appendix Figure A4).

Figure 4. NBR welfare changes from price stability by month, maize sales and purchases



It is not clear whether prices can ever be completely stabilized and, if they could, how the costs of doing so would weigh against our estimated benefits. It is therefore instructive to think through a scenario where prices still follow a seasonal pattern, but variation is reduced by, say, 50%. There are still considerable welfare gains from such a scenario, with the peak lean season benefits of just below 2% monetary welfare gains on average (Appendix Figure A5).

d. What if quantities adjust?

So far, we have assumed no quantity reaction from producers and consumers. That most people sell after harvest when prices are low and buy when prices are high suggests that prices exert only a weak influence over s_m and b_m. This is consistent with the centrality of maize in Malawian diets. In the IHS consumption module, 98% of all households report consuming maize in the past week, and quantities reported suggest it is eaten every day. With maize being the main source of calories, there is a very large marginal utility of consumption up to a certain number of calories per day, after which that marginal utility quickly drops to zero. In other words, demand for maize by households who consume below the threshold is highly price elastic, but once the threshold is reached, demand becomes highly inelastic with respect to price. Put yet another way, anyone under the threshold would revise the quantity consumed upwards in response to lower prices in the lean season. That is not consistent with NBR assumptions but creates an additional positive effect that we are not capturing, leading our measure to underestimate the positive impact. On the other hand, in the post-harvest season, when prices are low and the stable price would be higher, anyone revising b_m downwards because of the higher prices might be pushed below the calorie threshold. That would be a negative effect that we do not capture. However, this is exactly the period when most people are primarily consuming from own production (Figure 2) and are shielded from such an effect.

Finally, in the longer run, one could expect stable and predictable prices to make growing maize more attractive, being subject to less price risk. Beyond producers and consumers, stable prices have been argued to benefit all value chain actors - including input suppliers, traders and processors – and contribute to macroeconomic stability (Timmer 1989).

e. Impacts on hunger

Hunger is a recurrent phenomenon in Malawi. During the 2023 lean season, after a harvest that was neither particularly good nor bad, IPC (2022) predicted that 20% of the Malawian population would require assistance to avert hunger. Ensuring sufficient calorie intake during the lean season is therefore a primary concern. The blue dashed line in Figure 5 represents the status quo or baseline situation for the average Malawian. This line lies 97 to 282 kcal per person per day above average caloric requirements (indicated by the red line) between April and October. It dips under the red line in November and stays about 98 to 290 kcal per person under requirements until March.[4]

[4] The energy requirement depends not only on the characteristics of each individual (the average adult man needs more energy than the average adult woman, who needs more energy than the average child), but also on how much hard physical work the individual does. For many people, the amount of hard labor is not constant, and typically peaks at the beginning of the growing season in December.
To obtain the average per capita energy requirement for each month, we first calculate the total energy requirement per individual based on their age and sex, using values recommended by FAO, WHO and UNU (2001). For individuals between 15 and 64 years old, we then make further adjustments for hours of hard physical work as follows. We first calculate how many hours the individual worked on the

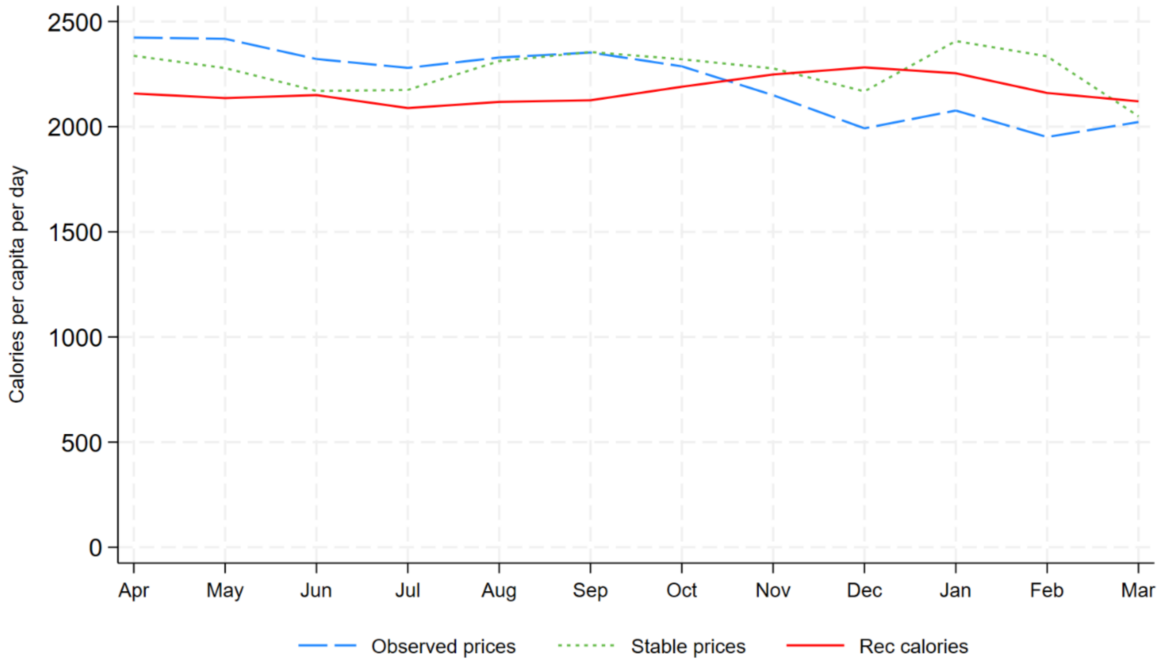
The green dotted line in Figure 5 represents the following counterfactual scenario: Adding to the notation already introduced, if the household purchases an amount of maize b_m in month m, with a caloric value of $kcal(b_m)$, then for the same total outlay $b_m p_m$ at the prevailing monthly price p_m, it could buy a total quantity of $b_m p_m / \tilde{p}$ at stable price $\tilde{p}$, giving a counterfactual caloric intake of $kcal(b_m p_m / \tilde{p})$. Under this counterfactual scenario, we see a smoothing of consumption over the season, resulting in more optimal spread of calorie intake across the year. We estimate that, in total, this would avoid 185 million person-days of consumption under the calorie threshold in the lean season. In the same season, an estimated 1.9 million people were food insecure in Malawi between November and March (IPC, 2020), which is equivalent to 289 million person-days of consumption under the calorie threshold assuming that all food insecure people consumed below the optimal energy intake for the full duration of the 5 months, and fewer if at least some people consumed at or above the optimum at least some of the time during the 5 months.[5] Full price stabilization would therefore have helped reduce the incidence of hunger by at least 64 percent.

As observed in the welfare estimates, there are still large benefits in calorie consumption under a scenario where price volatility is reduced by 50% rather than being fully stabilized. In that scenario, 73 million person-days of hunger would be avoided during lean season, or 25 percent of estimated hunger incidence.

household's own farm and as a casual laborer in the week preceding the interview. Next, we determine, per individual, how much that estimate deviates from the yearly sex-specific averages across the whole sample. We then use the results of Srinivasan et al. (2020) to adjust the calorie requirements for each hour of hard labor above or below the average (14% for women and 13.5% for men). Finally, we add all the adjusted individual requirements up within each household and divide by household size to obtain a household level daily per capita requirement, allowing us to draw the red line in Figure 5.

[5] 99% of the food insecure people were projected to be in IPC Phase 3. This means that they either had food consumption gaps that were reflected by high or above-usual acute malnutrition, or that they were marginally able to meet minimum food needs but only by depleting essential livelihood assets or through crisis-coping strategies.

Figure 5. Mean daily calorie consumption by month, observed and stable prices



6. Summary and discussion

We have shown that a stable maize price would lead to a relatively modest increase in Malawi's total social surplus when summed across a whole year, but a dramatic reduction in hunger during the lean season. Unfortunately, large seasonal maize price fluctuations persist in Malawi. This presents clear opportunities for arbitrage: one would expect traders to buy maize when and where it is cheap, store it until prices increase, and resell it when and where it is more expensive, until price differences equal marginal costs of storage and transport. Such arbitrage transactions should happen temporarily, that is buying when prices are low after the harvest and selling as they increase towards the lean season; spatially at the domestic level, that is buying in the north of the country, where maize is more abundant relative to population size and selling in the south; and spatially at the international level by trading with neighboring countries where maize price seasonality is less pronounced (Cardell and Michelson 2022, Gilbert et al. 2017). The fact that arbitrage does not smooth prices more suggests that maize markets are not functioning well in Malawi.

Many factors impede good functioning of Malawi's agricultural markets. Removing some hurdles, such as poor transportation, communication, and marketing infrastructure, would have long-run benefits to trade, but will require considerable capital investments. Other impediments can be overcome through relatively cheap policy adjustments. At present, the government tends to intervene in agricultural markets in often arbitrary and unpredictable ways. Current legislation grants individual ministers broad and virtually unchecked powers to intervene in agricultural markets by licensing the buying, selling, or marketing of crops, deciding who is permitted to obtain a license; setting the minimum and maximum prices for crops; enumerating export procedures; and generally doing whatever appears necessary or desirable for the purposes of regulation. At the same time, existing legislation provides no safeguards or compensation for individuals adversely affected by actions taken under the laws, nor does it describe the conditions under which specific ministerial powers should be exercised. This opens the door for policy decisions to be made in an arbitrary manner. Even if policy decisions are consistent, the mere legal possibility of arbitrariness undermines the confidence of farmers, traders, and processors in how predictably agricultural markets operate in Malawi, which in turn restricts production, trade, and investment. It also increases price risk for crop storage and reduces investments in new facilities. Establishing clear, binding rules and procedures for such interventions would greatly improve the predictability and thus functioning of Malawi's agricultural markets and increase investment in crop storage.

Some government interventions even directly contribute to maize price seasonality. They are often mistimed, being decided upon late and implemented even later. As a result, maize exports are often banned when prices are lowest following harvest, and export mandates are only issued once prices have increased. Similarly, Malawi's Strategic Grain Reserve (SGR) gets replenished once prices are on the rise, but drawdowns from it often find their way to consumers during harvest time – too late to help during the lean season and depressing prices which are already falling. Doing away with such interventions would reduce seasonal price fluctuations compared to current practice.

Timing market interventions correctly would reduce maize price seasonality even more. Correcting the timing of export bans and mandates should in principle be easy and practically costless to the treasury. Improving the timing of SGR drawdowns should also not cost the treasury anything, while buying maize for SGR replenishment earlier in the season when prices are lower would lead to significant savings for the public purse.

There is no guarantee, however, that maize prices will become perfectly stabilized even if all the changes described above are affected. To achieve stable prices, the government could intervene more forcefully. One obvious avenue for price stabilization is the SGR. In theory, the SGR could buy up enough maize after the harvest and release it into the market during the lean season to fully stabilize its price. However, even partial stabilization of prices would require frequent and expensive movement of maize in and out of the SGR, and the required volumes of maize would likely be prohibitively expensive to store (Baulch and Botha 2020).

An alternative to central storage would be the promotion of home storage of maize by smallholder farmers. Improving storage for own consumption to enable households to maintain a stable share of own-produced consumption throughout the year would have the same income effect as stabilizing prices. It is, however, not clear how widespread availability of maize storage at the household level could be achieved, let alone how much it would cost.

This leaves a final alternative of promoting medium-scale private storage owned and operated by larger traders. This is quite limited in Malawi, which leads to poor temporal arbitrage and the possibility of collusion and rent seeking by the few businesses with storage facilities. Traders are unlikely to invest into more storage capacity unless the government reduces market uncertainty by committing to less intervention in maize markets, or at least to clearly defined rules and objectives for when and how government will intervene, as discussed above.

Thanks to its ability to strengthen trade and investment, a predictable, rules-based market environment seems to be the best way of reducing maize price volatility and thus improving food security in Malawi.

The degree to which maize price stabilization is economically sensible, and the combination of reforms and interventions through which it can best be achieved, will ultimately depend on the cost of these interventions relative to the benefit of stabilized prices. In this paper, we describe a method to estimate the latter, and provide a short-run upperbound estimation of the social benefits of fully stabilizing maize prices over the course of an agricultural season in Malawi. Future work should focus on estimating the costs of the policies and interventions that can lead to price stabilization. Other limitations of this study could also be explored with future research including estimating welfare over a longer time period, allowing for substitutions in consumption as a result of relative price changes, and exploring more heterogeneity among households and across geographic regions.

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Appendices

Table A1. Balance tests

	Test of monthly differences	
Variable	F-stat	P-value
Household characteristics		
Size	1.53	(0.12)
Adult equivalents	1.57	(0.10)
Rural	1.35	(0.19)
Grew crops	0.88	(0.56)
Grew maize	0.76	(0.68)
Income per capita	0.73	(0.71)
Poor	1.34	(0.20)
Reported maize sales (kg) by month		
June	1.54	(0.14)
July	1.18	(0.31)
August	1.18	(0.31)

Notes: We regressed each variable listed in the first column on month dummies. The test statistic is an F-test of joint equality across the month indicators. Maize sales balance tests include only households selling maize with sample restricted to those households interviewed after the month of reported sales.

Figure A1. Interview locations by month

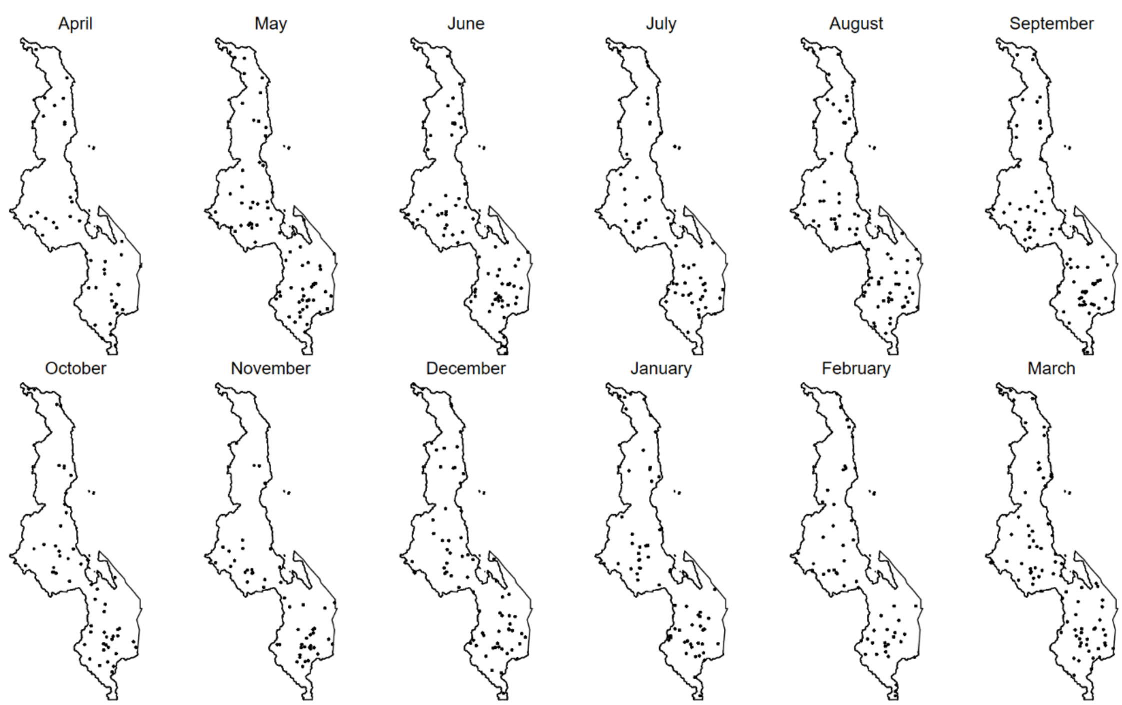
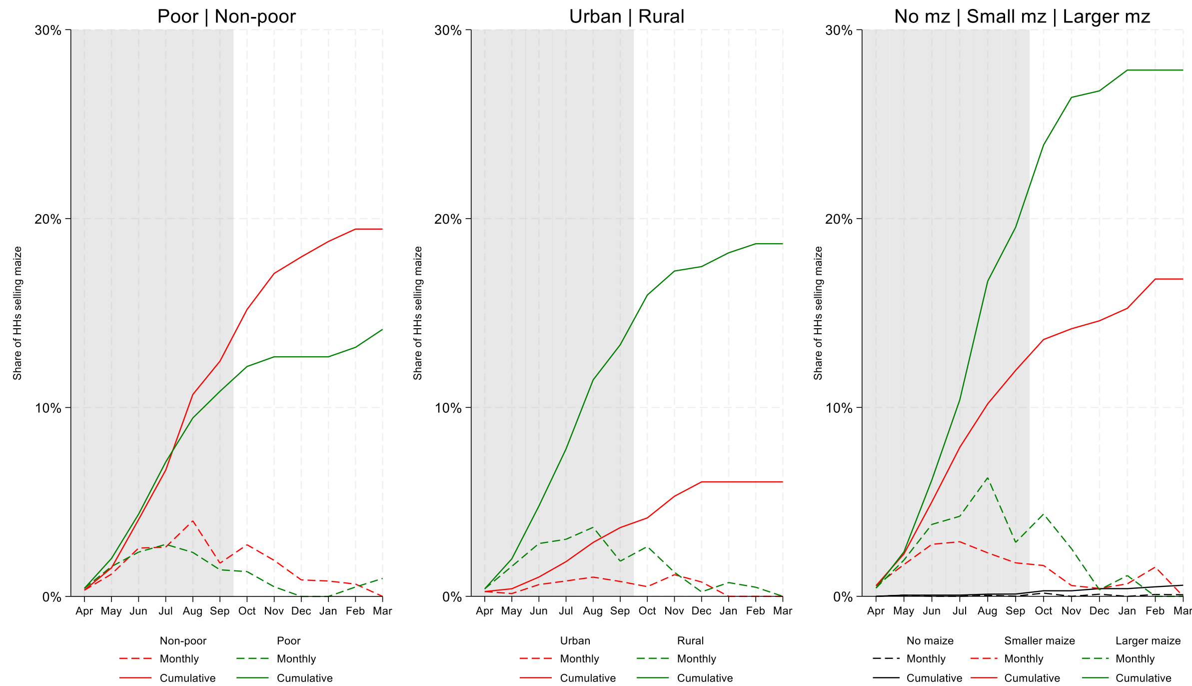


Figure A2. Seasonality in maize sales, share of households who sold any maize by month, by group

PANEL A: Share of households that sold maize by month



PANEL B: Household maize kgs sold by month

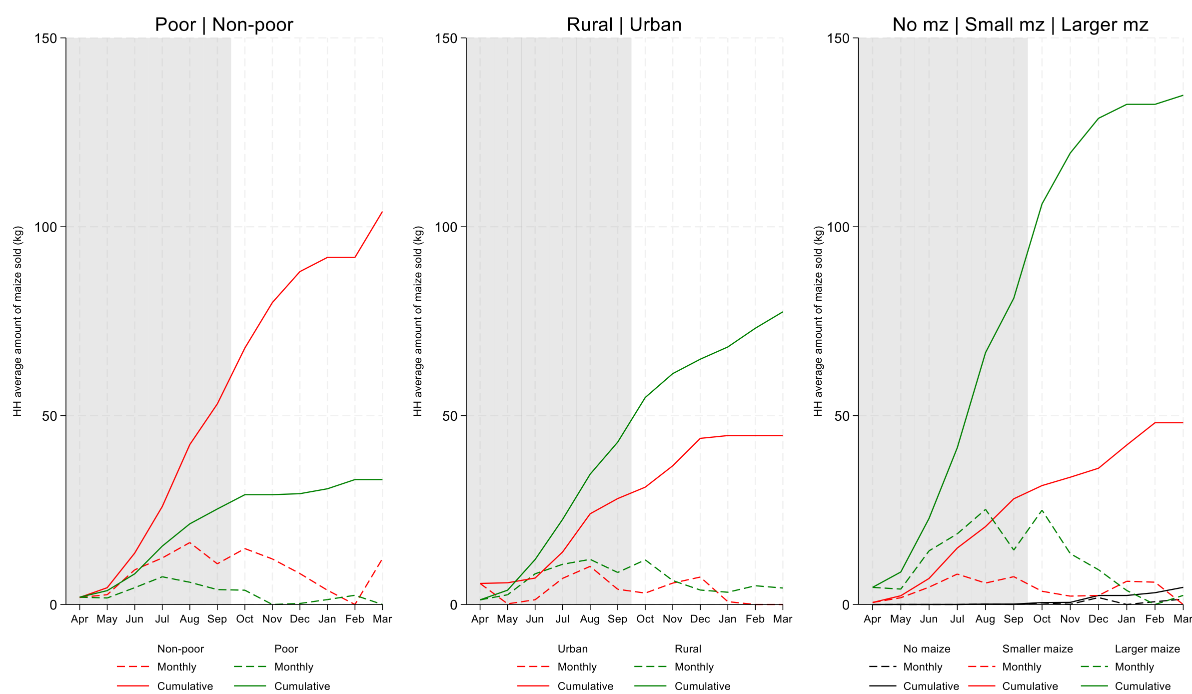
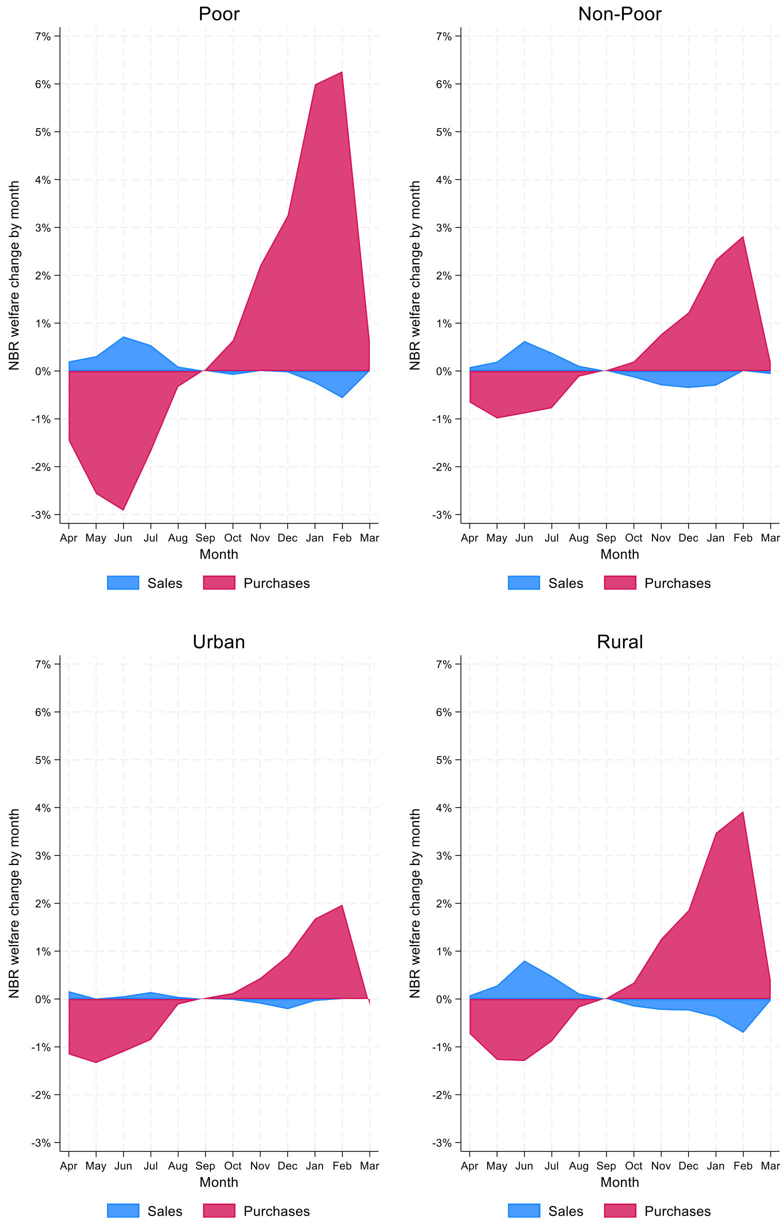


Figure A3. NBR welfare changes from price stability by month, maize sales and purchases, by group



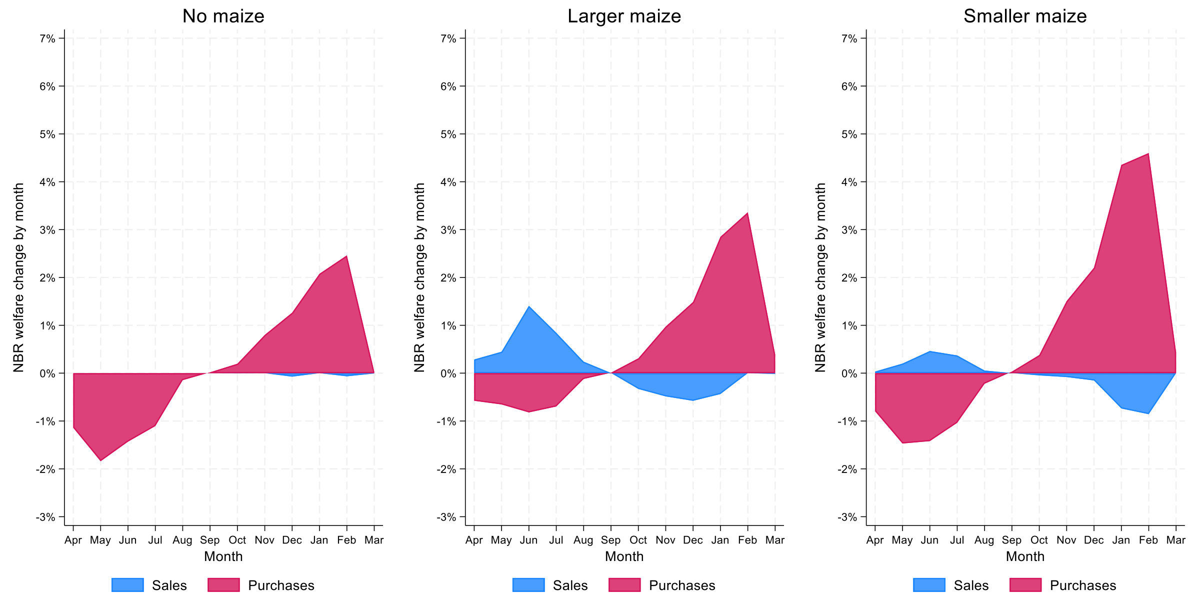


Figure A4. Monetized welfare changes from price stability by month, maize sales and purchases

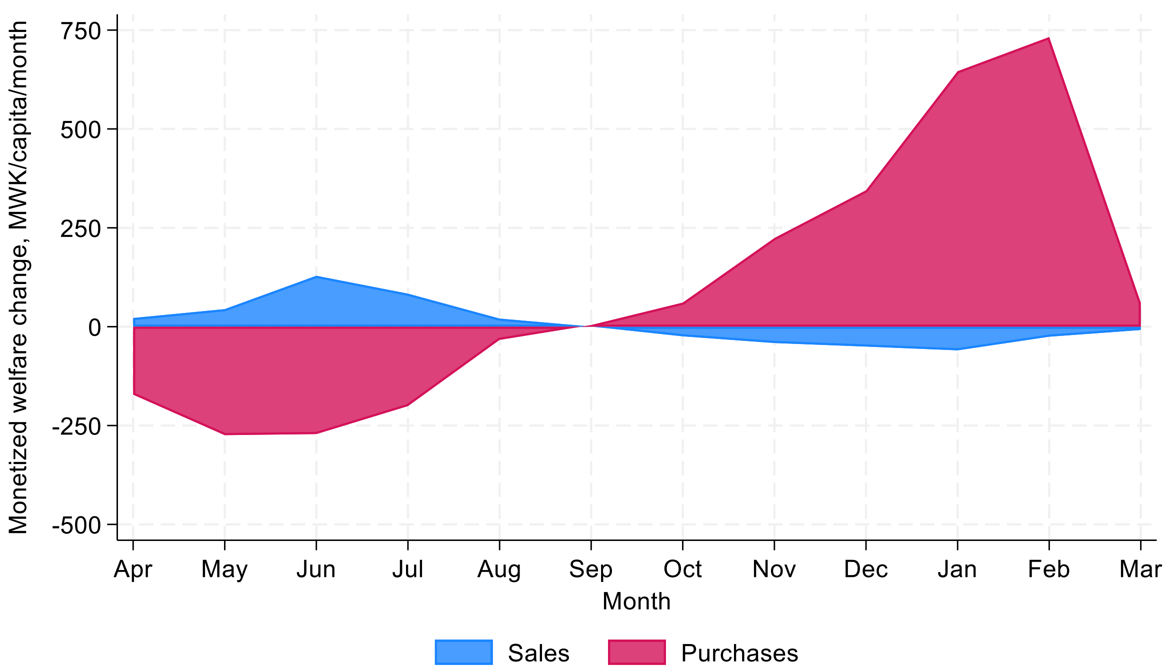


Figure A5. Scenario: 50% reduction in price seasonality. NBR welfare changes from price stability by month, maize sales and purchases