Who Wins and Who Loses from Staple Food Price Spikes?

Welfare Implications for Mozambique

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WORLD BANK GROUP
Poverty and Equity Global Practice
October 2018
Abstract

With a large share of the population dependent on agriculture and high exposure to natural disasters and other food price shocks, the welfare impacts of food price inflation in Mozambique cannot be ignored. This paper performs incidence analysis exploiting the spatial location of households to match data on consumption with production from agricultural activities to simulate the welfare effects of food price changes. The analysis focuses on maize, rice, and cassava, which form a substantial part of the Mozambican diet, as a source of calories and budgetary allocation. The results show large net negative welfare effects of food price rises in rural areas and small, negative effects in urban areas. A 10 percent increase in maize prices is associated with a reduction of 1.2 percent in consumption per capita in rural areas and 0.2 percent in urban areas. The effects from changes in the prices of rice and cassava are lower but qualitatively equal. Overall, the negative effects are larger for the bottom half of the distribution and imply that the price spike in 2016–17 may have translated into a poverty increase of 4–6 percentage points, with some of the poorest provinces bearing much of the brunt. The results hold to changes in some of the underlying assumptions of the simulations.

This paper is a product of the Poverty and Equity Global Practice. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/research. The authors may be contacted at jbaez@worldbank.org.
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JEL Classification: O13, Q12, Q18
Keywords: food prices; incidence analysis, poverty; Africa.

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1. Introduction

The global food and fuel price spike in 2007-08 motivated many researchers to examine the welfare effects of these aggregate shocks on households in various developing countries. These price spikes were found to have a significant net negative impact on food security and poverty, with studies estimating that between 141.2 million and 155.6 million people could have fallen under the $1.25 per day poverty line due to the price increase (de Hoyos & Medvedev, 2011; Ivanic & Martin, 2014). However, there is widespread heterogeneity in the results of food price welfare incidence analysis, with the effects varying with location (both across and within countries), the temporal scale of the analysis, price levels as well as their volatility, and the degree of price transmission to local markets (Headey & Martin, 2016). Given this heterogeneity, the appropriate policy responses to these price rises are not always clear.

While global agricultural prices have been relatively low, especially after 2011, many individual countries have continued to experience sudden rises in prices. A case in point is Mozambique, which saw steep food price inflation during 2016-17, going up as high as 40%. With a higher risk of natural disasters, a large share of the population dependent on agriculture and unequal progress in development across regions, the likelihood of negative welfare impacts of food price inflation in Mozambique cannot be ignored. The context specific nature of the impacts of price hikes and their policy responses necessitates a deeper understanding of the welfare incidence of the price spikes in Mozambique to better target the segments of the population who are likely to require support.

This paper performs food price incidence analysis in Mozambique, combining data from household and farmer surveys on consumption and agricultural activities collected from Mozambique in 2014 and 2015. We exploit the spatial location information of households across two different data sets to match household consumption data with production data from the set of nearest neighbors. In addition, we also incorporate disaggregated, market-level price data on major staples to simulate the welfare and poverty effects using observed price changes. As a result, in contrast to many previous studies, this allows us to analyze the spatial variation in the impact of food costs using actual prices faced by the households.
The analysis focuses on the price effects of maize, rice and cassava, which form the main staple and constitute on average more than 30% of the food budget share. We find evidence for a large net negative welfare effect of price rise in rural areas, and a small, negative effect in the urban areas. Overall, the simulations show that a 10% increase in maize prices would result in an average household welfare (as measured by consumption per capita) reduction of 1.2% in the rural areas and 0.2% in urban areas. The welfare reductions due to a similar increase in the price of rice and cassava are much smaller – 0.2% and 0.4% respectively in rural areas, and 0.2% and 0.1% respectively in the urban areas. The largest negative welfare impacts are seen in poorer provinces where the dependence on maize for food consumption is higher. These include Manica, Niassa and Tete where a 10% price increase would result in a negative welfare impact of more than 2.5% on average in the rural areas.

These effects are higher when we take into consideration the observed price rise during 2016, which was larger than 10%. The price of maize (relative to the consumer price index for food items) increased by as much as 89% between 2014 (at the start of the household survey sample period) and 2016. Prices of rice and cassava also increased, albeit at a relatively lower level of 22% and 37%, respectively. The net welfare impact of these price increases ranges from a loss of 11.7% in rural areas to 2.7% in urban areas with respect to initial household expenditure. The negative effect is much higher (greater than 20%) in the rural areas of Niassa, Tete, Manica and Sofala.

The negative welfare effect translates into an increase in poverty. Overall, the 2016 food price spike led to an increase in the poverty headcount ratio of 5.9 percentage points. The bulk of the poverty increase occurred in the rural areas, with the provinces of Tete and Manica bearing much of the brunt. We also examine the sensitivity of these estimates to model assumptions – in particular, assumptions about how much of the increase in consumer prices is transmitted to producer prices. We simulate the poverty estimates under various scenarios and find that under the assumption of no change in producer prices, the poverty headcount ratio increased by close to 8 percentage points. This corresponds to an upper-bound on the potential poverty impact of the price rise – this is also because the simulation does not account for behavioral responses such as substitution of crops produced and food consumed. At 3.5 percentage points, the negative effects
still hold under an optimistic scenario in which the percent increase in producer prices is twice that of the consumer price increase.

This report is structured as follows. Section 2 presents the theoretical framework and a review of related literature. Following this Section 3 describes the data used, and an overview of the food consumption patterns and food price rises in Mozambique in the recent period. Section 4 discusses the estimates of welfare incidence based on aggregating consumption and production values at the province level as well as using spatial matching methods to construct values at the household level. Section 4 also discusses the interpretation of the findings and results of some robustness checks. Finally, Section 5 presents the conclusions.

2. Background

2.1 Theoretical framework

The rise in food prices, particularly staples, is likely to reduce the purchasing power of net food-buying households. As a result, these consumers may be forced to shift their expenditure behavior – either lowering non-food expenditure or substituting towards cheaper food items. Such coping behavior may not provide sufficient safeguards against food insecurity and poverty, particularly in developing country contexts where access to credit, savings, public safety nets or other institutions may limit ability of these households to smooth consumption effectively. On the other hand, households that are net-sellers of commodities undergoing the price spike may see an increase in profits (income). These positive effects are mediated by the spatial variation in the degree of price transmission to primary agricultural markets, marketable surplus available for the net-sellers, as well as numerous other factors.

Therefore, the aggregate welfare effect needs to be estimated considering these different segments of households. The standard approach has been to use measures of compensating variation (CV) or equivalent variation (EV) to estimate changes in household welfare due to price changes. A brief overview of the theory underlying these welfare calculations is provided below, using the CV measure, drawing upon Deaton (1989) and Minot & Dewina (2015).
We start with considering the definition of CV for a change in the price vector from \( p_0 \) to \( p_1 \) for consumer prices and \( P_0 \) to \( P_1 \) for producer prices. Let \( e(. ) \) be the expenditure function and \( \pi( . ) \) be the profit function for a household (this could include various kinds of production activities including farming or the sale of household labor through wage labor). The negative of the compensation required to keep utility constant is the CV, and this can be written as the change in welfare due to a higher consumption price and the increase in profits due to a higher selling price of the goods produced by the household:

\[
CV = [e(p_0, u_0) - e(p_1, u_0)] + [\pi(P_1, w_1) - \pi(P_0, w_0)]
\]  

(1)

where \( w \) is the vector of input prices. Using a second order Taylor expansion around the initial points, we can approximate (1) as follows:

\[
CV = \sum_{i=1}^{n} \frac{1}{1!} \frac{\partial e(p_{i0}, u_0)}{\partial p_i} (p_{i0} - p_{i1}) + \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{1}{2!} \frac{\partial^2 e(p_{i0}, u_0)}{\partial p_i \partial p_j} (p_{i0} - p_{i1})(p_{j0} - p_{j1})
\]

\[
+ \left\{ \frac{1}{1!} \sum_{i=1}^{m} \frac{\partial \pi(P_0, w_0)}{\partial P_i} (P_{i1} - P_{i0}) \right\}
\]

\[
+ \left\{ \frac{1}{2!} \sum_{i=1}^{m} \sum_{j=1}^{m} \frac{\partial^2 \pi(P_0, w_0)}{\partial P_i \partial P_j} (P_{i1} - P_{i0})(P_{j1} - P_{j1}) \right\}
\]

\[
+ \left\{ \frac{1}{1!} \sum_{i=1}^{s} \frac{\partial \pi(P_0, w_0)}{\partial w_i} (w_{i1} - w_{i0}) \right\}
\]

\[
+ \left\{ \frac{1}{2!} \sum_{i=1}^{s} \sum_{j=1}^{s} \frac{\partial^2 \pi(P_0, w_0)}{\partial w_i \partial w_j} (w_{i1} - w_{i0})(w_{j1} - w_{j1}) \right\}
\]

The first term (row one) above approximates the welfare effect of the change in consumer prices, the second term describes the effect of change in producer prices, while the last term indicates the change in input prices. The second-order approximation for CV can be rewritten using Shephard’s and Hotelling’s lemmas. Following the notation in Minot & Dewina (2015), we define \( Q_i \) as household demand for good \( i \), \( S_i \) as output supply produced for \( i \) and \( X_i \) as demand for input \( i \), and rewrite the CV as:
Finally, we can write the CV expression in terms of elasticities and shares. Letting $Y_0$ be the initial income, $q_i$ the budget share of consumption good $i = \frac{Q_{i0}p_{i0}}{Y_0}$, $s_i = \frac{S_{i0}p_{i0}}{Y_0}$ is the value of output $i$ as share of income, $x_{i0}$ the value of input $i$ as a share of income, and defining the demand elasticities as $\varepsilon_{ij}$, elasticity of output supply as $\theta_{ij}$ and elasticity of input demand as $\gamma_{ij}$, and $\hat{p}$ as proportional change in price:

$$CV = \sum_{i=1}^{n} Q_{i0} (p_{i0} - p_{i1}) + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{\partial Q_i}{\partial p_j} (p_{i0} - p_{i1})(p_{j0} - p_{j1})$$

$$+ \left\{ \sum_{i=1}^{m} S_{i0} (P_{i1} - P_{i0}) + \frac{1}{2} \sum_{i=1}^{m} \sum_{j=1}^{m} \frac{\partial S_i}{\partial P_j} (P_{i1} - P_{i0})(P_{j1} - P_{j0}) \right\}$$

$$+ \left\{ \sum_{i=1}^{s} X_{i0} (w_{i1} - w_{i0}) + \frac{1}{2} \sum_{i=1}^{s} \sum_{j=1}^{s} \frac{\partial X_i}{\partial w_j} (w_{i1} - w_{i0})(w_{j1} - w_{j0}) \right\}$$

The classical welfare change measure proposed by Deaton (1989) is an approximation of the expression in (2) defined as the following:

$$\frac{CV}{Y_0} = \sum_{i=1}^{n} -q_{i0}\hat{p}_i + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \varepsilon_{ij}\hat{p}_i\hat{p}_j + \sum_{i=1}^{m} s_{i0}\hat{p}_i + \frac{1}{2} \sum_{i=1}^{m} \sum_{j=1}^{m} \theta_{ij}\hat{p}_i\hat{p}_j + \sum_{i=1}^{s} x_{i0}\hat{w}_i$$

$$+ \frac{1}{2} \sum_{i=1}^{s} \sum_{j=1}^{s} \gamma_{ij}\hat{w}_i\hat{w}_j$$

The term in (3) $(s_{i0} - q_{i0})$, is often referred to as the net benefit ratio (NBR). This is also known as the net consumption ratio, which is the ratio of the net sales of commodity $i$ to the household income (Minot & Dewina, 2013). This measure provides a relatively straightforward way to capture the welfare incidence of food price changes using household survey data on net sales of food products. The effect on individual households is calculated as a function of its own income and consumption variables. This can then be used to simulate the distributional impacts by different household types (rural/urban, across quantiles of income, across regions etc.) in a regression framework (De Janvry & Sadoulet, 2008).
Comparing (2) and (3) provides a clear picture of the simplifying assumptions that are required for the NBR based measure to be robust. First, it assumes that there is no demand response to consumption price changes through substitution eliminating the cross-elasticity term (the second term) in equation (2). Second, the proportional price changes are assumed the same for both consumer prices and producer prices, and therefore the first and the third terms in equation (2) are combined. Third, it is also assumed that producers do not exhibit any supply responses allowing the fourth term to be ignored. Finally, there are no significant changes in input prices including wage rates thereby ignoring the last two terms of the second-order approximation in (2).

In practice, household survey data limitations often constrain the extent to which these assumptions can be relaxed in the welfare analysis. Even though the micro-econometric approach described above provide many insights, the partial equilibrium nature of this analysis fails to account for various macroeconomic factors that could change the welfare incidence of food price spikes. For instance, economy-wide changes in relative prices, factors affecting structure of production and wage rates in the economy can alter households’ real income. Past work has found that while certain sections of the population are affected negatively in the short-run due to rising food prices, the long-run effect could be zero or positive after accounting for changes in wage rates (Rashid, 2002; Ravallion, 2000).

Understanding the macroeconomic processes is particularly relevant to the 2016 Mozambique case given the underlying currency market shocks. Studies employing general equilibrium methods range from simple simulations to full scale CGE models (Wodon & Zaman (2008) provide a literature overview). In particular, micro-simulation approaches, in which survey households are embedded in the CGE model, can provide a more comprehensive picture of the welfare and poverty impacts of food price spikes (De Janvry & Sadoulet, 2008). In this approach, a CGE model is used to estimate changes in the average income for representative household groups. These changes are then passed down to individual households within each group and consumption expenditures are recalculated to estimate the welfare incidence. Nouve & Wodon (2008) carry out such an analysis for the case of Mali. Particularly relevant for this study is the work by Arndt et al., (2008) discussed later in this section.
2.2 Literature on welfare impacts of food price changes

As mentioned before, the impacts of food price changes have received much attention in the aftermath of the 2007-08 global price spike. While a complete review of these studies is beyond the scope of this paper, we focus here on studies that have examined this subject in Mozambique or other countries in Africa that offer a similar context. Overall, the short-term impact of earlier food price spikes in Africa has mostly been found to result in a net increase in poverty in most countries. However, there is a large variation in impacts across countries and within a country – across rural/urban areas, as well as across spatial regions. A second observation stemming from the literature is that relaxing the household supply and demand response assumption appears to have less of an effect on the results relative to the importance of dealing with differences in consumer and producer price rises.

The common approach has been to use CV calculations based on equation (2), with varying degrees of simplifying assumptions. Some studies have used the first-order approximation in Equation (3), identical to Deaton’s approach. For instance, Wodon et al., (2008) use household survey data for twelve West and Central African countries to examine the impact of the 2007-08 price rise. They present estimates of the impact on poverty based on the Deaton methodology under two different scenarios – first, when both consumers and producers face the same price rise, and second, when only consumers face the price hike. The upper-bound (results from the second scenario, considering only consumer price rises) of their poverty impact estimates, with a 50 percent increase in food price of staples, range from 1.8 percentage points in Ghana to 9.6 percentage points in Senegal. Their analysis indicates that the impact is mediated by the share of the food commodities undergoing price changes in the consumption expenditure of households as well as the degree of dietary diversity in food consumption. As expected, they also find significant differences in urban and rural areas, with poverty impacts being higher in urban areas in general. Perhaps surprisingly, in three of the countries in their sample – Ghana, Senegal and Liberia – they find that the impact on poverty is higher in rural areas (Wodon & Zaman, 2008).

Another study utilizing data from multiple developing countries is by Ivanic & Martin (2014) who examine the impact of the 2010-11 food price surge. Their sample includes 28 low and middle-income countries, but the sample is not limited to African countries and considers price changes...
for 38 agricultural commodities. Their approach builds on the Deaton formulation through the additional inclusion of demand substitution, i.e., the second term in equation (2), while the other terms in the CV expression are ignored. They use country-level actual changes in domestic prices wherever available in their simulations. Except for Vietnam, they find an increase in poverty in all countries in their sample. Overall, they estimate a net increase in poverty of 44 million people.

Other researchers have attempted a more complete welfare estimation by including the higher order effects of equation (2). Minot & Dewina (2015) use household survey data from Ghana to examine the sensitivity to various assumptions. Specifically, they consider the following four scenarios: (i) no demand or supply response and identical price rise for consumer and produce prices (the Deaton first-order approximation); (ii) similar to (i) but with producer prices rising twice as much as consumer prices; (iii) assuming household supply and demand response (with demand and supply elasticity of 0.3 assumed) and identical consumer and producer price rise; (iv) combination of (ii) and (iii). In the base scenario, they find that households are negatively affected in the short-term. When testing the sensitivity of their results to different assumptions the authors find that the results do not change significantly when supply and demand responses are included (i.e., scenario (iii)). This suggests that short-term estimates resulting from the first-order approximations are likely to be reasonably close to the impact in the medium and long term, particularly for price changes in staple commodities, which are often relatively inelastic in supply and demand. However, the change in results is more substantial in scenarios (ii) and (iv) when the assumption of identical price rises for producer and consumers is dropped. They find that the standard assumption predicts a 1 percent increase in poverty, while the alternative assumption in scenario (ii) predicts a 2 percent reduction in poverty. A similar finding is presented in Dawe & Maltsoyelou (2009) who observe, “assuming equal percentage changes for both farm and consumer prices leads to a bias towards finding negative impacts of higher food prices”.

A number of other studies have focused on including the supply and demand responses into the CV calculations, but not many studies have accounted for the assumptions about marketing margins. For instance, Attanasio et al. (2013) estimate a Quadratic Almost Ideal Demand System (QUAIDS) for Mexico and use these estimates in analyzing the welfare effects of food price rises. Similar work has been done for Mali and Cameroon (Kane et al., 2015; Me-Nsopc & Staatz, 2016).
In most of these other studies, as well the authors generally find that the inclusion of second order effects has only a marginal impact on the results that are found from considering only the first-order terms.

Other studies have sought to identify the impact of food price spike on consumption measures. For example, in a study focused on Ethiopia (Alem & Söderbom, 2012), the authors focus on estimating the effect of food prices on household consumption of food, and self-reported measures of the effect of the shock on the quantity of food consumed and overall effect as perceived by the household head using three rounds of panel data. Their results indicate that those households with low levels of assets are likely to be more vulnerable to food price shocks.

In other related work Verpoorten, Arora, Stoop, & Swinnen (2013) examine the impact of the price rise using self-reported food insecurity measures from the Afrobarometer data set for two periods – 2005 and 2008. Their data set covers numerous countries including Mozambique. The authors argue that these self-reported measures provide a better picture of the impact of food price changes on food security rather than consumption data from household surveys, which might be prone to measurement error. Other studies have pointed towards this issue, among other potential problems that arise when using survey reported measures of consumption to measure welfare impact (Headey & Martin, 2016). Using the self-reported measures for Africa Verpoorten et al. find that there was only a small increase in the incidence of food insecurity and decreases in the depth of food insecurity, contrary to the conclusions widely drawn in other studies.

2.3 Food price impacts in Mozambique

There is a previous study focusing on the effect of the 2007-08 food and fuel price spike on household welfare in Mozambique (Arndt et al., 2008). The authors use data from the 2002/03 National Household Consumption Survey (Inquérito aos Orçamentos Familiare (IOF) 2002-03) which provides information on income from the sale of agricultural output and on own consumption levels but has no information on production of specific agricultural commodities. Therefore, in their analysis, they calculate NBR using share of the value of agricultural sales and own production (‘auto-consumption’) in total household income as proxy for production share and the ratio of total expenditure on all food items, including the value of own consumption, relative
to total household expenditure as proxy for consumption share. This methodology differs from the one used in this study. We use agricultural production information for individual commodities by drawing data from the Integrated Agricultural Survey (2015) rather than using information on net agricultural sales alone from the Household Income and Expenditure Survey (2014-15). As a result, this report is able to examine the welfare effect of price increases in three main staple food items.

Based on these proxy measures Arndt et al find that the NBR was 10 % for rural areas and -22 % for urban areas for a hypothetical, overall food price increase of 100%. Accordingly, based on the Deaton approximation, they find that a price increase negatively hurts urban consumers while benefitting rural households. In contrast, the findings from our analysis indicate a negative impact on both urban and rural households. Our results are consistent with evidence from other studies in Africa which have found that a larger than expected share of rural households also tend to be net buyers and are likely to lose from food price increases (Minot & Dewina (2015) in the case of rice and maize in Ghana; Wodon & Zaman (2008) in Ghana, Senegal and Liberia). Arndt et al also find regional differences, with urban households in south and central regions of Mozambique being the most negatively affected. Across region and expenditure quintiles, they find that the poorest households in Maputo are the worst affected, while middle income households in rural north and center are likely to benefit the most.¹

In order to overcome the limitations posed by their NBR analysis Arndt et al. extend their analysis by undertaking a general equilibrium analysis for Mozambique, shocking their model with prices that are reflective of the 2007-08 period. They use a CGE model calibrated to a 2003 Social Accounting Matrix (SAM) (see Arndt et al., and Thurlow(2008) for details of their model), along with the household survey data from 2002/03. The simulated price rises for food and fuel commodities range from 25-75%, under four different scenarios (varying the commodities experiencing the price rise and under differing assumptions for changes in land allocation for crops). Under their preferred scenario, they estimate a four percentage-point increase in national poverty rate, with the effect being larger in urban areas. The impact appears to be largely driven

¹ Note that these observations by the authors are drawn based on the NBR values alone for each group of households (calculated based on the proxies for aggregate consumption and production ratios for households).
by increases in the price of fuels. They also note that the NBR results are consistent with their general equilibrium results under the assumption where land is fixed, namely that it is not easy to change allocation of land between crops, which is likely to be the case in the short term.

In addition to the Arndt et al (2008) study a few other researchers have examined related aspects of the food price spike in the Mozambique context. Nhate, Massingarela and Salvucci (2013) examine the price transmission from international markets to Mozambique, the degree of integration across various markets in the country, and the political economy of the government policy responses to the 2007-08 price rise. They find that domestic prices for rice and wheat are only partially integrated with the international prices, and that the domestic prices remain high even after international prices had declined. Within the country, they find that the prices in the largest market in Maputo, the capital, transmit partially to some markets (Nampula), but not others (Beira).

Minot (2014) also undertakes a price analysis of agricultural commodities in 11 countries, including Mozambique. The analysis covers the period from January 2003 to December 2010, and includes beans, cooking oil, maize, millet, rice, and sorghum. The author notes that the retail prices in some of the markets experienced high volatility in the lead-up and during the food-price spike, particularly maize, though it is lower than in countries where the governments actively attempted to intervene in the markets in an attempt to stabilize prices.

3. Data and descriptive statistics

3.1 Overview of the data

This paper uses data from two main sources: (i) the 2014/15 round of the national household income and consumption expenditure survey, the Inquérito sobre Orcamento Familiar (IOF), conducted by Mozambique's National Institute of Statistics and (ii) farm level data from the 2015 Integrated Agriculture Survey (IAS) done by the Ministry of Agriculture and Food Security. A brief description of each data set and how they are used in the analysis is provided below. Later in this section we also discuss the data on market-level food prices, including trends across space and time.
The IOF-2014/15 surveyed a sample of households that is representative at (i) national, (ii) national urban and national rural, (iii) regional (South, Center and North) and (iv) provincial levels (ten provinces plus Maputo City). The IOF-2014/15 survey is a panel, with each household interviewed thrice during the period Aug 2014 - July 2015. The sample size ranges from 10,373 to 11,506 with some variation across the three rounds owing to attrition, with attrition being higher in some provinces. The IOF-2014/15 recorded food consumed by the household in the past week from both purchases and auto-consumption through a 7-day diary. It also provides details of household income, including net income from sales of agricultural products, but it is recorded only at the aggregate level and not by commodity. Therefore, the IOF data is insufficient to calculate NBR based welfare estimates. At best, it can be used to calculate NBR values for representative groups of households, similar to the values presented in Arndt et al (2008). Therefore, additional information on household production is necessary to calculate more accurate values of the NBR.

The IAS 2015 (IAS-2015) collects detailed farm level data, including information on crop quantity produced, share and volume of output sold in the market by crop from a sample of 7,485 agricultural households. Using sales data from IAS, we impute values of the crop sales to households in the IOF, and then use these imputed values for calculating the NBR. To start with, we will impute values at an aggregate regional level. However, a caveat to be borne in mind is that the AIS samples agricultural households with an over-representation of rural households. Additionally, even within urban households the AIS samples those who have agricultural operations. This may result in a bias towards a positive NBR when using aggregate regional values from the IOF and AIS. In later steps, we will use a more refined approach level exploiting the geocoded locations of the sample households in the IAS and the IOF to impute values of sales at a finer spatial level to limit this potential bias.

### 3.2 Household expenditures and food consumption shares

Food expenditure forms a disproportionately large share of consumption for households in Mozambique. Based on the consumption data from the IOF-2014/15, 56% of the total consumption at the national level goes towards food on average (Column (3), Table 1). We find a large regional variation in the households’ food budgetary share corresponding to the variation in expenditure levels. The three poorest provinces of Niassa, Nampula and Zambezia have a median daily per
capita consumption of only 23.6 – 26.5% of the median per capita consumption in the capital Maputo city (Column (2), Table 1). As expected, these provinces also devote a higher share of their consumption to food expenditure, with the highest value being 72.1% in the Niassa province. At 31%, the lowest share is found in Maputo city.

We also find significant variation in the consumption patterns across urban and rural areas. Figure 1 shows in square brackets the mean share of food expenditure for rural and urban areas in each province. Additionally, the provinces are shaded to reflect the average share of auto-consumption within the food budget. The food budget share is higher in rural areas, particularly in the provinces in the poorer Northern region (Cabo Delgado, Niassa, Nampula and Zambezia), and tend to be lower in the Southern provinces (Inhambane, Gaza and Maputo). While lower than in the rural areas, the food expenditure shares are still higher than 50% in the urban centers from the northern provinces of the country. Given these consumption patterns, households in rural areas and in the poorest provinces are likely to be particularly sensitive to changes in food prices.

In addition to the budgetary share of food consumption, the degree to which a household depends on its own production also has have implications for the welfare impacts of food price changes. Wide geographical variability is also visible in the extent to which households depend on their own production (auto-consumption) for their food in Mozambique Table 1. Overall, the share of auto-consumption as a percentage of the food budget is higher in the poorer northern regions of the country, where it is over 70%, and tends to decrease towards the south. This share tends to be lower in urban areas where agricultural households growing food crops is less prevalent. However, it is interesting to note that households in urban areas in the North as well as in some of the Central provinces also feature a substantial share of auto-consumption. For instance, even urban areas of Zambezia have a 36% share of auto-consumption on average. Given this high dependence on own production of food in rural areas, an increase in food prices could potentially be net welfare positive for some of the households.

3.3 Main components of food expenditures

Household food consumption patterns in Mozambique are similar to other low-income contexts with staples representing the largest share of the food budget. In particular, maize (in the form of
corn flour) is the largest item (by value) in the food consumption basket, constituting nearly 20% of total food expenditures (Table 2). The next prominent staple consumed is cassava, followed by rice. The share of these three main food items varies across regions and between urban and rural areas as well.

Maize is a central part of the diet among rural households in the poorest provinces accounting for more than half of the food budget in Niassa, Tete and Manica (Figure 2). The share of maize items tends to be much lower in the southern provinces of Gaza, Inhambane and Maputo, ranging between 6.7% to 16% on average, among rural households. Similarly, the share of maize tends to be much lower in the urban areas, with the highest being around 18% in Niassa. Rice and cassava budget shares also show large variation across the country (Figure 3). The highest shares are found in the north-central regions of Nampula and Zambezia, with rice and cassava items comprising over 25% of the food budget in the rural areas. Households’ consumption of rice and cassava is much lower in the other provinces and is also small in the urban areas across most provinces.

Figures 2 and 3 also show the variation in the auto-consumption share of these main staples in the household food consumption. The share of auto-consumption in the households’ consumption of maize is over 80% across the rural areas in all provinces. The share of auto-consumption is the highest in the provinces which are among the poorest and have the largest share of maize in their food budget – Niassa and Tete – with auto-consumption being the source of nearly all of the household maize consumption on average (more than 98%). It is also over 90% in the provinces of Manica, Sofala, Cabo Delgado and Zambezia as well. The maize auto-consumption share is surprisingly high even in the urban areas for some of these provinces, with the share being over 90% in the provinces of Niassa and Manica. The lowest dependence on auto-consumption for maize is seen among the urban households in Inhambane and Maputo.

The share of auto-consumption in rice and cassava is generally lower compared to maize items. It comprises more than 90% of the rice and cassava consumption only for rural households in the provinces of Nampula and Zambezia. Similar to maize, a substantial portion of the consumption in urban households in these provinces which have relatively higher dietary share of rice and cassava, comes from auto-consumption as well. These relatively high levels of auto-consumption
for staples may offer some buffer for households in Mozambique against the negative welfare effects of price shocks for these commodities.

### 3.4 Recent trends in food production, imports and prices in Mozambique

Maize and cassava are two of the most important crops grown by farmers in Mozambique while cultivation and production of rice is relatively lower. Production of these staples has traditionally been fairly volatile, and this appears to be the case in recent years as well (Figure 4). In most years Mozambique is a net importer of maize and rice, while most of the cassava production and consumption is done domestically. The predominant source of maize is South Africa (Figure 5), while rice is imported from Thailand as well as some other major countries (Figure 6).

Our analysis focuses on the price spike that occurred in 2016 (Figure 7). The underlying reasons attributed to the food price spike range from unanticipated weather shocks to macroeconomic factors owing to pressure in the currency markets. The overall price of food as measured by the FAOSTAT food and non-alcoholic beverages CPI shows a slight increase at the start of 2015, but climbs down by the mid-2015 (Figure 7, Panel A). The prices start to climb rapidly once again towards the end of 2016 and then continue to rise through most of the year. This overall pattern is reflected in the prices of maize, rice and cassava as well.

Panels B through D of Figure 7 portray the mean of the retail prices for maize, rice and cassava respectively, across provinces. The market-level price data are from Mozambique’s Agricultural Market Information System (Sistema de Informação de Mercados Agrícolas, SIMA). SIMA collects price data on a weekly basis at producer, wholesale and retail levels from main markets across the country. However, consistent reporting is available mostly for retail prices only. There is an upward trend in prices across all the three commodities starting around July 2015, with a higher level of prices all through 2016. Table 3 shows the average increase in the retail price (relative to the increase in CPI Food) for each province between 2014 and 2016. Maize, the key staple of the Mozambican diet, experienced the highest increase in prices, rising by more than 88% in 2016 compared to the average price in 2014. There is substantial spatial variation in price rise

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2 The main factor for the production shock observed in 2013 is the widespread agricultural damage from flooding during Jan-Feb 2013.
3 Cassava prices are reported consistently only for the provinces of Zambezia, Nampula, Niassa and Cabo Delgado.
4 The data used in this study correspond to the monthly reports of prices from SIMA.
levels as well ranging from maize price increases of nearly 180% in Gaza to a low of about 50% in Cabo Delgado. In comparison to maize, the increase in the relative price of rice is lower at about 22% for the overall country, with a high of nearly 39% in Maputo. The price increase in cassava was higher than rice, rising by nearly 37%.

4. Welfare effects of food price increases

4.1 Net-benefit ratios using province level estimates

Given the centrality of maize, rice and cassava consumption to the Mozambican diet, we focus on these staples to examine the welfare implications of rise in food prices. We draw from the IOF-2014/15 to construct province-level estimates for value of maize, rice and cassava consumed and total household consumption. Next, we use data on harvested quantities and sale value and quantities from the AIS-2015 to estimate province-level production values for these crops. In the data, sales values are observed only for households engaged in market transactions. Therefore, we construct unit values for these households and impute the mean value to the remaining households in the province that grew but did not sell in the market. These unit sales values are used to estimate the total value of maize, rice and cassava production.

The province-level figures are used to calculate consumption and production ratios (CR and PR) and estimate the Deaton welfare measure (equation 3) as follows:

\[
\text{Consumption Ratio (CR)} = \frac{\text{Value of maize consumption (including autoconsumption)}}{\text{Total consumption expenditure}} \tag{4}
\]

\[
\text{Production Ratio (PR)} = \frac{\text{Value of maize production}}{\text{Total consumption expenditure}} \tag{5}
\]

\[
\text{Net benefit ratio (NBR)} = \text{PR} - \text{CR} \tag{6}
\]

One advantage of these estimates is that the implicit prices used to calculate consumption and production values reflect the differences in producer and consumer market prices since they are

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5 This analysis combines the prices for Maputo City and Maputo Province and use the same values for both regions in the welfare analysis later. Also, we use the overall national value for the provinces for which cassava price data are not available.

6 We also run the analysis with addition of other food items (sorghum and millet). However, the effects are largely driven by the impact of maize and the net welfare impact remains almost unchanged with addition of other food items.

7 We first calculate per capita daily values, and then use these to estimate annual values at the household level.

8 The overall production ratio changes by less than 0.1 percent when we use the median value to impute unit sale prices.
based on unit values from consumption purchases in the IOF data and the unit sales value from maize sales in the AIS data, respectively. A caveat to be noted is that the sample of households in the AIS data is skewed towards rural regions (about 16% of the sample is urban). As a result, estimates of production ratios for urban households may be prone to larger sampling error.

We first start with examining the NBR for each of the individual food items within each province. The results are summarized in Table 4. Panel A presents the results for maize, Panel B for rice and Panel C for cassava, respectively. In general, the average NBR is negative for maize, and the magnitude of the welfare impacts is also larger for maize. The last row of Panel A shows that on average, for the whole country, maize forms about 10.7% of the total expenditure and maize production value accounts for 4.6% of the total. This is consistent with the fact that Mozambique is a net-importer of maize and that consumer prices are higher than producer prices. The negative NBR implies a negative effect of maize price increases. A 10% increase in the price of maize would reduce the average welfare of households by 0.61%. The negative effect holds for all provinces except for Zambezia and Maputo City and is higher in the poorest provinces with the highest dependence on maize – Niassa, Manica and Tete. In each of these a 10% increase in prices results in a negative welfare impact of more than 1%.

The PR for rice is nearly the same as it is for maize, on average, while the CR is much smaller (Panel B, last row). The NBR for the whole country, on average, is 0.031 indicating that a 10% increase in rice prices would result in a positive welfare effect of about 0.3%.9 The welfare implications for rice price increases are generally positive across all provinces with the exception of Cabo Delgado and Inhambane. The magnitude of the positive effect ranges from a high of 0.9% for Sofala to a low of 0.1% in Nampula. An increase in cassava prices, on the other hand, has moderate negative welfare implications on average. Overall, the NBR indicates that a 10% increase in cassava prices implies a negative effect of close to 0.2%. The welfare effect is negative for most provinces, with the highest effect seen in Nampula – a 0.8% reduction in welfare.

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9 It is worth interpreting this result with caution since the overall net positive NBR for rice may be driven by potential bias in the urban areas. For instance, in the AIS-2015 sample in Maputo City, 96 percent are rice producers. Similarly, a high share of urban households are rice producers in urban areas in other provinces as well. In contrast, in the IOF-2014/15 data less than 1 percent of the households in Maputo city report any income from agricultural sales; and less than 1 percent report any auto-consumption of rice.
Table 5 shows the estimates disaggregated by urban and rural areas in each province. Overall, we find that the sign of the NBR implies a negative welfare impact for rural households due to increase in maize and cassava prices, and a positive impact of rice. In urban areas a positive effect is seen in the case of maize and rice, whereas an increase in cassava price has negative welfare implications. Maize consumption accounts for about 15% of the total consumption in rural areas while the share of the production value is around 5.5% for rural households. The negative NBR value suggests that a 10% increase in prices would reduce the welfare of rural households by nearly 1% (Table 4, Panel A, last row). Maize forms a smaller component of consumption as well as production in the urban areas. As a result, the effect on urban areas is much more muted. Additionally, as noted earlier, the fact that the AIS sample density is much lower for urban areas may also introduce larger sampling errors for the calculation of the PRs for the urban areas.

As expected, the strongest negative effects are visible in the rural parts of the country where food budgets shares and the share of maize in food consumption are high. The worst-affected are the rural households in Niassa where a 10% increase in price of maize translates into a 2.8% drop in welfare. A high negative effect is also seen in Manica, Tete and Sofala provinces where a 10% increase in maize price would lower welfare of rural households by 2.4, 1.8 and 1.7%, respectively. Rice consumption ratios are smaller across the board, while production ratios are high, particularly in rice producing provinces. The NBR for rice is positive in most of the rural areas. The magnitudes of the welfare effects for price increases in cassava are generally much smaller. The largest effects are seen in the provinces of Nampula and Zambezia, which also have the largest share of food expenditure on cassava and rice.

4.2 Net welfare effects based on province-level estimates

We now focus on quantifying the net welfare effect of the increase in prices across all three food items. We aggregate across the commodities following Equation (3) and using the observed change in price for each good for each province (seen in Table 3). The resulting estimates are presented in Table 6. Overall, the results imply a welfare loss for rural households, while urban households stand to gain. On net, rural households lose nearly 9% (measured as a share of households’ total expenditure), while urban households show a modest gain of 0.6%. For comparison, a study of food price changes in India during 2006-08 found on average a net welfare loss of -6.2% for rural
households, for price increases ranging from of 28.6 to 51.8% across four commodities (De Janvry & Sadoulet, 2009). Given that the households in Mozambique are poorer on average, and the price spike is much higher in this case, the effect of -9% appears to be reasonable.

Negative effects in the rural areas are driven mostly by the impact through maize. This is consistent with the fact that maize forms the highest share of food expenditure and experienced the largest increase in prices relative to other food items. Maize price increases result in a large welfare loss of about 20% in Niassa, Tete, Manica and Inhambane. The effect from cassava tends to dominate in Nampula and Zambezia where it forms a relatively larger share of the food basket. Some positive general welfare gains are seen in the case of rice in many of the rural areas.

Urban areas in many provinces show positive gains from maize price increases, which is rather unexpected. As noted earlier, one of the reasons may be due to possible sampling bias in the AIS data. Since the survey focuses on agricultural households, the sample of urban households may overrepresent those who have agricultural operations. As a result, province-level aggregates maybe discounting urban households which do not farm, and therefore, do not appear in the survey. In the next section we present our preferred set of results, in which IOF-2014/15 households are matched to spatially proximate AIS-2015 households to mitigate the potential sampling problem. This approach also allows us to estimate the welfare incidence at the household rather than at the province level, thereby allowing to examine the movement of households into or out of poverty.

4.3 Net-benefit ratios using household level estimates

To improve the measurement of production ratios, we impute production values to IOF-2014/15 households using data from spatially matched AIS-2015 households. We find for each household in the IOF-2014/15 the nearest neighbors within a radius of 10 km in the AIS-2015. We check the sensitivity of the estimates by varying the radius to 5 km and to 15 km and find that the results remain robust to these changes. Averages of the maize, rice and cassava production quantities for the neighboring households are used to impute production values to households in the IOF-2014/15. In the urban areas the production values are imputed only for those households in the IOF-2014/15 that report non-zero auto-consumption values. Households that have zero own-

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10 The Stata package `geonear` is used for the spatial matching (Picard, 2012).
consumption of maize, rice or cassava in urban areas are more likely to be doing so because they have no production of their own and depend on market purchases. It is harder to make this assumption for the rural areas since most rural households are engaged in farm activities to varying degrees. Zero auto-consumption here is likely to be a result of the household running out of their own stocks during the period when the consumption data were collected.

The sample of matched IOF-2014/15 and AIS-2015 households is used to calculate consumption, production and net-benefit ratios. Table 7 presents the results of this analysis. The main differences are observed in the mean production ratios, which are in general lower compared to earlier as a result of setting production value to zeros for those households showing no auto-consumption in the urban areas and those with no neighbors producing maize, rice or cassava. Overall, we find that the welfare results for maize and cassava in the rural areas are qualitatively similar to the province level estimates. Yet, there are some differences in direction of the effects of a rise in the price of rice and the net effects in urban areas. An increase in the price of rice is associated with a reduction in household welfare whereas increases in the prices of the three staples lead to net welfare losses in urban areas.

The largest negative impacts continue to be driven by maize in the rural areas, where a 10% price increase results in a 1.1% reduction in welfare. The largest welfare reductions (over 2%) are experienced in the provinces of Niassa, Tete, Manica and Sofala. The direction of the maize effects in rural areas is consistent with the finding using province-level values, but the magnitude of the effects is higher. Compared to the results in the earlier section, the effects for maize diverge a lot more in the urban areas. This is likely the result of correcting for the oversampling of farm-operating households in the urban AIS-2015 sample. The household-level analysis consistently shows negative welfare impacts across urban areas over the country owing to lower PR values. There is a net welfare reduction of about 0.2% for a 10% increase in the price of maize, much smaller than the estimated effect for rural areas.

The welfare implications for cassava are in line with the patterns observed in the estimates in Table 5. We continue to see a negative welfare incidence of cassava price increase in the provinces of

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11 The consumption ratios differ slightly from those in Table 5 because of differences in about 1.4% IOF sample due to missing or incorrect geographic coordinate variables.
Nampula and Zambezia, with the magnitude of the welfare reduction being higher compared to that observed in the previous section. Small, negative welfare incidence is seen across the urban areas in all provinces, with a net welfare reduction of 0.1% for a 10% price increase. The results vary the most for rice price rises. The large positive welfare gains seen in the province of Sofala disappear. Instead, we see moderate negative welfare reductions in both rural and urban areas across all provinces.

These results remain robust to varying the distance within the neighbors that are matched. In Table 8 we show the overall rural-urban CR, PR and NBR estimates using 5 km radius and a 15 km radius cut-off, along with the 10 km radius results from above. We find a very small change in going from 5 to 10 km radius, but the effects remain qualitatively the same. As we increase the radius beyond a certain threshold the sample of neighbors start to remain unchanged as we exhaust all neighbors within a sample cluster. As a result, the estimates remain virtually unchanged between 10 km to 15 km radius. Increasing the cut-off to higher numbers is likely to introduce as neighbors’ households that may be exposed to different microclimatic and soil conditions. In the absence of other common characteristics to match IOF-2014/15 and AIS-2015 households on, this simple spatial imputation appears to provide a robust compromise.

4.4 Net welfare effects based on spatially imputed values

Table 9 presents the welfare effects of the observed 2016 price rises using the NBR elasticities obtained from spatially matching households in the IOF-2014/15 and the AIS-2105. The results for rural areas indicate a slightly higher negative incidence of the price rise, with an overall average reduction in household consumption of 13%. Once again, we find that the effect is by and large driven by the impact of maize price increases, except for the substantial role of cassava in Nampula and Zambezia. The evidence also suggests that there is a negative welfare incidence on urban households of nearly 2.6% of household consumption on average.

Table 10 shows the estimated net welfare incidence of the price increases across quintiles (based on per capita expenditure levels) for maize, rice, cassava and the overall effect. Negative welfare effects tend to decline with an increase in the income quintile. However, the largest negative welfare reduction is seen amongst the 2nd and 3rd quintiles in the rural areas. This net effect is
driven by the divergence in the impact of maize among the poorest quintiles in both rural and urban areas. In both cases households in the 1st quintile have smaller negative effects of maize price increase on average, but consistently have a higher negative effect owing to cassava price increase relative to the two quintiles above them. This is likely due to cassava being a cheaper source of calories. Based on the average daily quantity consumed and the value of consumption from the IOF-2014/15, we estimate the calories per MZN from cassava (322.0), maize (199.4) and rice (173.7). As a result, cassava is likely to form a more dominant part of the diet for the poorest households. At the same time, cassava witnessed a relatively lower price rise compared to maize. Panel C shows that the poorest quintile has a larger portion of their food budget devoted to cassava and a relatively smaller share towards maize in comparison to the 2nd and 3rd quintiles.

We also use the spatial imputation-based values to estimate the effect of the price change on short-run poverty. We use a reference poverty line of 25.85 Metical per capita consumption expenditure. For each household, we estimate the implicit effect on consumption expenditure based on the net welfare effects calculated above and measure the movement of individual households across the poverty threshold based on the updated expenditure. Table 11 shows that there is a net increase in the poverty headcount ratio (HCR) of about 5.9 percentage points from 46.7% to 52.6%. Much of the increase is in rural areas where the HCR rose by nearly 8.5 percentage points. At about 1.34 percentage points, the effect in urban areas is much smaller. The worst affected households are those in the poor, rural areas of Manica, Niassa and Sofala.

4.5 Discussion and sensitivity checks

The changes in poverty presented above are best seen as short-run estimates. Given the relatively short time span within which the price increase occurred it is plausible that the households have limited potential for adjusting their consumption. The short window also limits changes in the households’ production decisions in response to the agricultural market price changes. These assumptions ignore any second order response (the higher order terms in Equation (2)). Much of the previous work on the welfare impacts of food price rises in the past has made similar assumptions as well. These assumptions have been found to be reasonably robust across studies.

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12 This is based on the World Bank poverty line estimates presented in “Strong but Not Broadly Shared Growth – Mozambique Poverty Assessment”.
that included second order effects in their analysis. As mentioned in the review of literature section, the inclusion of second order terms generally resulted in only a marginal impact on welfare across a number of African countries (Minot & Dewina (2015) for Ghana; Kane et al (2015) in Mali; and Me-Nsope & Staatz (2016) in Cameroon). In this paper we also assume that the consumption and producer behavioral responses are likely to have a relatively small effect on net welfare in the short term. However, the effects on welfare are likely more sensitive to relaxing the assumption that proportional changes in prices are the same for both producers and consumers.

As is the case in most previous studies, producer price data are not consistently available for Mozambique and we cannot directly estimate the change in the marketing margins (difference between consumer and producer prices) during the period of the price rise. Therefore, following Minot & Dewina (2015) and Wodon et al. (2008), we examine the sensitivity of our base case estimates (Table 10 and Table 11), where we assumed proportional producer and consumer prices increases, by simulating the welfare changes under a range of marketing margins. More specifically, we simulate the four following scenarios: (i) zero percent increase in producer prices – an upper-bound on the negative welfare impacts of the food price increase; (ii) an increase in producer prices equal to 50% of the percent increase in consumer prices; (iii) 1.5 times the percent increase in consumer prices and (iv) twice the percent increase in consumer prices, the most optimistic scenario, proxying a lower bound.

Table 12 presents the net welfare impacts under each of the four scenarios. As one would expect, the highest negative effect is observed under the assumption of no producer price increase – 12.65% compared to 8.94% in the base scenario. The size of welfare reduction drops as the assumed percentage increase in producer prices becomes larger. However, we find that the welfare effects remain negative even if the percent increase in producer prices is twice that of the increase in consumer prices. Under this scenario the household welfare loss for the whole country is still around 5%. Only in the provinces of Nampula and Zambezia, which have high PR of maize, we see a positive impact under the optimistic scenario.

A similar pattern is seen in Table 13, which presents the corresponding impact on poverty prevalence under each of these scenarios. The overall poverty headcount ratio increases to 54.6 %
under the assumption of no change in producer prices (a 4 percentage point increase over the base scenario). This presents an upper-bound on the poverty impact of the food price spike. On the lower-end, with the percent increase in producer prices being double the consumer prices, the resulting poverty headcount of 50.1% is lower than the base scenario but still nearly 3.5 percentage points over the initial poverty rate prior to the price change.

5. Conclusions

We examined the potential welfare implications of food price increases for the main staples in Mozambique. The analysis focuses on maize, rice and cassava, which form a substantial part of the Mozambican diet, both as a source of calories and household budget shares. We estimate net-benefit ratios for each of these food items, and examined the variation across regions, location and income-groups in Mozambique. Overall, our results indicate that an increase in price of any of these crops is associated with a reduction in welfare. Perhaps surprisingly, we find a negative effect even in rural areas, with the magnitude being higher compared to urban areas. This is driven by the fact that rural households in Mozambique have a large share of consumption devoted to food, and a substantial part of that budget comprises staples, above all maize. Food budget shares in rural areas are as high as 70% in the poorest provinces, and maize comprises more than 25% of the food budget. Given the high proportion of maize and other staples in the food basket, agricultural households are on average net consumers of these items even in rural areas. The share of maize, rice and cassava in the food expenditure of urban households is in general much lower.

The largest negative effect is seen in the case of maize, with a reduction in household consumption of 8.7–10.8%. The largest losses in welfare are experienced by households in rural areas of the provinces of Niassa, Tete, Manica and Sofala, which are among the poorest regions of the country. We also find large, negative impacts on welfare due to increase in the price of cassava in the provinces of Nampula and Zambezia. The magnitude of the welfare reductions due to an increase in price of rice are much smaller on average. We also examine the sensitivity of the results to changes in the assumptions about producer-consumer price differences. Even under an optimistic
scenario that assume a percent increase in producer prices twice as large as the percent increase in consumer prices, the welfare incidence remains negative (-5%) for the country as a whole.

The welfare incidence analysis across the income distribution shows negative effects across all income groups. Yet, there is heterogeneity across quintiles. The largest losses are not experienced by the poorest, but mostly by rural households in the middle of the distribution (quintiles 2 and 3), which are below but closer to the poverty line. However, the poorest households (two lowest quintiles) tend to experience the largest welfare reductions in the urban areas. These welfare losses imply an overall increase in the poverty headcount ratio of nearly 6 percentage points (from 46.7% to 52.6%).

The results of this study indicate that the welfare effects of food price spikes in Mozambique are likely to be disproportionately felt by the households in specific regions and within certain bands of income. These households reside in relatively poorer regions of the country and may be vulnerable to other shocks as well. These findings underscore the importance of minimizing the welfare losses of increases in the prices of staples. Increasing productivity in agriculture and resilience to weather shocks and other risks (e.g. pests) will contribute to raising the supply of food to Mozambique’s own rapidly growing population and regional markets. The opposite, inhibiting trade within the country and across borders in periods of high prices, will undermine agricultural output and food availability. Similarly, improvements in the efficiency of local agricultural markets (better connectivity, information on prices, etc.), including the functioning of input markets, will reduce production and marketing costs, reducing the welfare impacts of food price volatility. Early warning systems such as food security, food price and rainfall monitoring systems can help identify hot spots and manage food surpluses and humanitarian assistance. Finally, there is a need for non-distortionary, rapid scalable safety nets to protect the well-being of those highly vulnerable to high food prices.
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Table 1: Daily consumption per capita, food budget share and share of auto-consumption (median and standard deviations)

|                | (1) N | (2) Daily consumption per capita (in MT) | (3) Food budget share (%) | (4) Share of auto-consumption in food exp. (%) |
|----------------|-------|------------------------------------------|---------------------------|-----------------------------------------------|
| Cabo Delgado   | 2644  | 25.84                                    | 55.95                     | 65.76                                         |
|                |       | (97.29)                                  | (18.19)                   | (34.29)                                       |
| Gaza           | 2409  | 29.34                                    | 39.45                     | 44.61                                         |
|                |       | (74.59)                                  | (19.05)                   | (35.24)                                       |
| Inhambane      | 2477  | 34.02                                    | 48.15                     | 55.58                                         |
|                |       | (90.71)                                  | (18.29)                   | (33.56)                                       |
| Manica         | 2572  | 31.71                                    | 60.14                     | 66.23                                         |
|                |       | (60.00)                                  | (19.34)                   | (34.86)                                       |
| Maputo Cidade  | 3052  | 80.43                                    | 31.13                     | 0.00                                          |
|                |       | (780.07)                                 | (16.38)                   | (6.67)                                        |
| Maputo Province| 3042  | 64.21                                    | 37.12                     | 2.45                                          |
|                |       | (174.03)                                 | (16.38)                   | (22.49)                                       |
| Nampula        | 4210  | 20.24                                    | 63.54                     | 68.12                                         |
|                |       | (146.12)                                 | (19.24)                   | (36.67)                                       |
| Niassa         | 2455  | 18.99                                    | 72.08                     | 80.02                                         |
|                |       | (47.54)                                  | (20.92)                   | (34.79)                                       |
| Sofala         | 2951  | 26.08                                    | 60.07                     | 39.86                                         |
|                |       | (89.61)                                  | (21.32)                   | (37.32)                                       |
| Tete           | 2804  | 29.21                                    | 60.99                     | 70.65                                         |
|                |       | (75.41)                                  | (19.23)                   | (33.19)                                       |
| Zambezia       | 3878  | 21.31                                    | 66.91                     | 72.87                                         |
|                |       | (72.73)                                  | (19.00)                   | (32.61)                                       |
| Total          | 32494 | 26.81                                    | 58.04                     | 60.14                                         |
|                |       | (203.43)                                 | (21.43)                   | (37.15)                                       |

Note: (i) Based on IOF 2014-15 data with sample combined across all quarters; (ii) Budget shares based on total expenditure; food expenditure includes value of food consumed from own production, purchases and food consumed outside home; (iii) Median values with standard deviation in parentheses, values weighted by sample weights.

Source: World Bank using IOF 2014/15

Table 2: Share of cereals and tubers in household food expenditures

| Name                                | Overall | Rural | Urban |
|-------------------------------------|---------|-------|-------|
| Corn flour                          | 19.13   | 25.55 | 5.27  |
| Cassava flour                       | 6.81    | 9.02  | 2.03  |
| Husked rice                         | 4.21    | 4.23  | 4.16  |
| Po                                  | 3.59    | 1.42  | 8.28  |
| Corn (gro)                          | 1.22    | 1.54  | 0.52  |
| Spaghetti pasta                     | 0.55    | 0.28  | 1.12  |
| Sorghum flour                       | 0.54    | 0.71  | 0.17  |
| Millet flour                        | 0.49    | 0.69  | 0.06  |
| Cakes, muffins and cream pastries  | 0.15    | 0.13  | 0.20  |
| Sorghum in gro                      | 0.14    | 0.20  | 0.03  |
| Husk in rice                        | 0.08    | 0.09  | 0.04  |
| Millet in gro                       | 0.07    | 0.10  | 0.01  |
| Wheat flour                         | 0.07    | 0.05  | 0.11  |
| Cookies                             | 0.06    | 0.06  | 0.08  |
| Badgias                             | 0.05    | 0.04  | 0.06  |
| Elbow pasta (noodles)               | 0.04    | 0.03  | 0.07  |
| Nestum                              | 0.02    | 0.00  | 0.06  |
| Chamussas                           | 0.01    | 0.00  | 0.03  |

Source: World Bank using IOF 2014/15
Table 3: Percentage change in retail prices relative to consumer food price index 2014 to 2016

|       | Maize | Rice | Cassava |
|-------|-------|------|---------|
| Niassa| 73.2  | 12.1 | 12.7    |
| Cabo Delgado | 50.3  | 14.6 | 30.1    |
| Nampula| 54.2  | 23.2 | 36.8    |
| Zambezia| 78.2  | 26.9 | 51.3    |
| Tete   | 100.3 | 20.3 | -       |
| Manica | 88.7  | 10.5 | -       |
| Sofala | 118.4 | 26.4 | -       |
| Inhambane| 75.6  | 20.1 | -       |
| Gaza   | 179.1 | 9.9  | -       |
| Maputo Province | 77.5  | 38.8 | -       |
| Total  | 88.5  | 22.0 | 39.1    |

Notes: prices are deflated using the Food CPI from FAOSTAT; percentage change is between the annual average prices of each commodity from 2014 to 2016.

Source: Retail price based on data from SIMA
Table 4: Consumption, production and net-benefit ratios by province

**Panel A: Maize**

| Province     | CR  | PR  | NBR (PR - CR) |
|--------------|-----|-----|---------------|
| Niassa       | 0.310 | 0.117 | -0.193         |
| Cabo Delgado | 0.102 | 0.024 | -0.077         |
| Nampula      | 0.049 | 0.023 | -0.026         |
| Zambezia     | 0.100 | 0.117 | 0.018          |
| Tete         | 0.238 | 0.113 | -0.125         |
| Manica       | 0.213 | 0.054 | -0.158         |
| Sofala       | 0.103 | 0.028 | -0.074         |
| Inhambane    | 0.018 | 0.005 | -0.013         |
| Gaza         | 0.032 | 0.017 | -0.015         |
| Maputo Province | 0.007 | 0.002 | -0.005         |
| Total        | 0.107 | 0.046 | -0.061         |

**Panel B: Rice**

| Province     | CR  | PR  | NBR (PR - CR) |
|--------------|-----|-----|---------------|
| Niassa       | 0.018 | 0.061 | 0.044         |
| Cabo Delgado | 0.032 | 0.022 | -0.010        |
| Nampula      | 0.022 | 0.033 | 0.010         |
| Zambezia     | 0.041 | 0.077 | 0.036         |
| Tete         | 0.004 | 0.009 | 0.005         |
| Manica       | 0.007 | 0.012 | 0.004         |
| Sofala       | 0.023 | 0.117 | 0.093         |
| Inhambane    | 0.020 | 0.010 | -0.009        |
| Gaza         | 0.017 | 0.097 | 0.079         |
| Maputo Province | 0.007 | 0.034 | 0.027         |
| Total        | 0.018 | 0.048 | 0.031         |

**Panel C: Cassava**

| Province     | CR  | PR  | NBR (PR - CR) |
|--------------|-----|-----|---------------|
| Niassa       | 0.010 | 0.006 | -0.004        |
| Cabo Delgado | 0.044 | 0.004 | -0.039        |
| Nampula      | 0.089 | 0.011 | -0.078        |
| Zambezia     | 0.083 | 0.012 | -0.071        |
| Tete         | 0.000 | 0.004 | 0.004         |
| Manica       | 0.003 | 0.004 | 0.001         |
| Sofala       | 0.003 | 0.001 | -0.002        |
| Inhambane    | 0.010 | 0.002 | -0.008        |
| Gaza         | 0.010 | 0.000 | -0.010        |
| Maputo Province | 0.002 | 0.000 | -0.001        |
| Total        | 0.023 | 0.004 | -0.019        |

Note: based on province-level aggregate values of consumption from IOF and production from AIS data

Source: World Bank based on IOF-2014/15 and IAS-2015
Table 5: Consumption and production ratios and net-benefit estimates for maize, rice and cassava by urban-rural in each province

Panel A: Maize

| Province        | Rural          | Urban          | NBR (PR - CR) |
|-----------------|----------------|----------------|---------------|
|                 | CR  | PR  |         | CR  | PR  |         |
| Niassa          | 0.416| 0.134| -0.281  | 0.064| 0.062| -0.002 |
| Cabo Delgado    | 0.137| 0.027| -0.110  | 0.026| 0.016| -0.011 |
| Nampula         | 0.079| 0.029| -0.050  | 0.016| 0.017| 0.002  |
| Zambezia        | 0.133| 0.142| 0.009   | 0.031| 0.057| 0.026  |
| Tete            | 0.321| 0.138| -0.182  | 0.010| 0.028| 0.017  |
| Manica          | 0.297| 0.061| -0.236  | 0.075| 0.046| -0.030 |
| Sofala          | 0.212| 0.041| -0.171  | 0.015| 0.017| 0.002  |
| Inhambane       | 0.028| 0.007| -0.021  | 0.003| 0.002| -0.001 |
| Gaza            | 0.045| 0.018| -0.028  | 0.010| 0.024| 0.014  |
| Maputo Province | 0.021| 0.005| -0.016  | 0.003| 0.001| -0.002 |
| Maputo Cidade   | -   | -   | -       | 0.001| 0.004| 0.003  |
| Total           | 0.153| 0.055| -0.099  | 0.023| 0.025| 0.002  |

Panel B: Rice

| Province        | Rural          | Urban          | NBR (PR - CR) |
|-----------------|----------------|----------------|---------------|
|                 | CR  | PR  |         | CR  | PR  |         |
| Niassa          | 0.019| 0.072| 0.053   | 0.015| 0.004| -0.012 |
| Cabo Delgado    | 0.034| 0.024| -0.010  | 0.027| 0.024| -0.003 |
| Nampula         | 0.026| 0.039| 0.013   | 0.018| 0.031| 0.012  |
| Zambezia        | 0.047| 0.091| 0.044   | 0.029| 0.046| 0.017  |
| Tete            | 0.004| 0.009| 0.005   | 0.003| 0.011| 0.009  |
| Manica          | 0.007| 0.016| 0.008   | 0.007| 0.005| -0.002 |
| Sofala          | 0.030| 0.232| 0.202   | 0.018| 0.049| 0.031  |
| Inhambane       | 0.025| 0.014| -0.011  | 0.012| 0.003| -0.009 |
| Gaza            | 0.021| 0.069| 0.048   | 0.012| 0.128| 0.116  |
| Maputo Province | 0.011| 0.049| 0.037   | 0.006| 0.000| 0.000  |
| Maputo Cidade   | -   | -   | -       | 0.005| 0.061| 0.056  |
| Total           | 0.020| 0.056| 0.036   | 0.014| 0.033| 0.020  |

Panel C: Cassava

| Province        | Rural          | Urban          | NBR (PR - CR) |
|-----------------|----------------|----------------|---------------|
|                 | CR  | PR  |         | CR  | PR  |         |
| Niassa          | 0.013| 0.007| -0.006  | 0.004| 0.003| -0.001 |
| Cabo Delgado    | 0.061| 0.005| -0.056  | 0.007| 0.004| -0.003 |
| Nampula         | 0.150| 0.014| -0.137  | 0.023| 0.010| -0.013 |
| Zambezia        | 0.112| 0.014| -0.097  | 0.023| 0.006| -0.017 |
| Tete            | 0.000| 0.005| 0.004   | 0.000| 0.002| 0.002  |
| Manica          | 0.004| 0.005| 0.001   | 0.001| 0.002| 0.001  |
| Sofala          | 0.005| 0.002| -0.004  | 0.001| 0.001| -0.000 |
| Inhambane       | 0.016| 0.003| -0.012  | 0.002| 0.001| -0.001 |
| Gaza            | 0.015| 0.000| -0.014  | 0.002| 0.000| -0.002 |
| Maputo Province | 0.004| 0.001| -0.002  | 0.001| 0.000| -0.001 |
| Maputo Cidade   | -   | -   | -       | 0.000| 0.001| 0.000  |
| Total           | 0.035| 0.005| -0.029  | 0.006| 0.003| -0.003 |

Note: based on province-level aggregate values of consumption from IOF and production from AIS data

Source: World Bank based on IOF-2014/15 and IAS-2015
Table 6: Net welfare impact (as percentage of initial total household consumption)

|                  | Panel A: Rural          |                  | Panel B: Urban          |
|------------------|-------------------------|------------------|-------------------------|
|                  | From maize   | From rice      | From cassava  | Net effect  | From maize   | From rice      | From cassava  | Net effect  |
| Niassa           | -20.608      | 0.641          | -0.076        | -20.044      | -0.135       | -0.140         | -0.010        | -0.285      |
| Cabo Delgado     | -5.520       | -0.149         | -1.686        | -7.355       | -0.546       | 0.287          | -0.049        | -0.088      |
| Nampula          | -2.723       | 0.309          | -5.035        | -7.448       | 0.097        | 0.287          | 0.049         | 0.086       |
| Zambezia         | 0.743        | 1.196          | -5.000        | -3.061       | 2.020        | 0.450          | -0.049        | 1.595       |
| Tete             | -18.296      | 0.104          | 0.173         | -18.019      | 1.746        | 0.174          | 0.069         | 1.989       |
| Manica           | -20.906      | 0.088          | 0.045         | -20.773      | -2.642       | -0.019         | 0.041         | -2.620      |
| Sofala           | -20.236      | 5.344          | -0.146        | -15.038      | 0.242        | 0.813          | -0.001        | 1.054       |
| Inhambane        | -1.616       | -0.222         | -0.488        | -2.326       | -0.101       | -0.180         | -0.035        | -0.316      |
| Gaza             | -4.986       | 0.479          | -0.556        | -5.063       | 2.583        | 1.145          | -0.084        | 3.644       |
| Maputo Province  | -1.208       | 1.455          | -0.096        | 0.151        | -0.152       | 0.000          | -0.032        | 0.184       |
| Maputo Cidade    | -          | -              | -             | -            | 0.249        | 2.184          | 0.003         | 2.437       |
| Total            | -8.669       | 0.840          | -1.170        | -8.998       | 0.306        | 0.424          | -0.135        | 0.595       |

Note: Estimates based on aggregating IOF and AIS variables to province level to compute NBRs; welfare estimate based on price changes in Table 3; net effect is based on Equation (3).

Source: World Bank based on IOF-2014/15 and IAS-2015
Table 7: Consumption and production ratios and net-benefit estimates

Panel A: Maize

|                | Rural | Urban | NBR (PR - CR) | Rural | Urban | NBR (PR - CR) |
|----------------|-------|-------|---------------|-------|-------|---------------|
| Niassa         | 0.435 | 0.181 | -0.271        | 0.083 | 0.189 | -0.037        |
| Cabo Delgado   | 0.164 | 0.034 | -0.130        | 0.039 | 0.036 | -0.031        |
| Nampula        | 0.082 | 0.119 | -0.004        | 0.028 | 0.08  | -0.02         |
| Zambezia       | 0.126 | 0.126 | -0.046        | 0.064 | 0.079 | -0.032        |
| Tete           | 0.356 | 0.116 | -0.250        | 0.037 | 0.086 | -0.013        |
| Manica         | 0.285 | 0.06  | -0.225        | 0.085 | 0.101 | -0.053        |
| Sofala         | 0.245 | 0.031 | -0.210        | 0.021 | 0.034 | -0.015        |
| Inhambane      | 0.027 | 0.003 | -0.025        | 0.005 | 0.022 | -0.004        |
| Gaza           | 0.055 | 0.013 | -0.042        | 0.019 | 0.036 | -0.014        |
| Maputo Province| 0.037 | 0.006 | -0.031        | 0.005 | 0.008 | -0.005        |
| Maputo Cidade  | -     | -     | -             | 0.003 | 0.011 | -0.003        |
| Total          | 0.169 | 0.075 | -0.109        | 0.029 | 0.052 | -0.017        |

Panel B: Rice

|                | Rural | Urban | NBR (PR - CR) | Rural | Urban | NBR (PR - CR) |
|----------------|-------|-------|---------------|-------|-------|---------------|
| Niassa         | 0.015 | 0.003 | -0.004        | 0.026 | 0.102 | -0.023        |
| Cabo Delgado   | 0.03  | 0.006 | -0.024        | 0.038 | 0.067 | -0.036        |
| Nampula        | 0.023 | 0.011 | -0.010        | 0.028 | 0.082 | -0.022        |
| Zambezia       | 0.066 | 0.056 | -0.012        | 0.046 | 0.080 | -0.026        |
| Tete           | 0.003 | 0.000 | -0.003        | 0.004 | 0.030 | -0.004        |
| Manica         | 0.007 | 0.000 | -0.007        | 0.010 | 0.019 | -0.010        |
| Sofala         | 0.025 | 0.033 | -0.001        | 0.024 | 0.123 | -0.004        |
| Inhambane      | 0.017 | 0.001 | -0.016        | 0.017 | 0.010 | -0.017        |
| Gaza           | 0.022 | 0.003 | -0.019        | 0.014 | 0.206 | -0.013        |
| Maputo Province| 0.013 | 0.000 | -0.013        | 0.009 | 0.254 | -0.009        |
| Maputo Cidade  | -     | -     | -             | 0.008 | 0.253 | -0.008        |
| Total          | 0.024 | 0.013 | -0.011        | 0.019 | 0.137 | -0.014        |

Panel C: Cassava

|                | Rural | Urban | NBR (PR - CR) | Rural | Urban | NBR (PR - CR) |
|----------------|-------|-------|---------------|-------|-------|---------------|
| Niassa         | 0.017 | 0.002 | -0.015        | 0.006 | 0.009 | -0.006        |
| Cabo Delgado   | 0.060 | 0.004 | -0.056        | 0.012 | 0.010 | -0.010        |
| Nampula        | 0.181 | 0.016 | -0.164        | 0.048 | 0.020 | -0.042        |
| Zambezia       | 0.129 | 0.011 | -0.118        | 0.035 | 0.018 | -0.031        |
| Tete           | 0.001 | 0.000 | 0.000         | 0.000 | 0.006 | 0.006         |
| Manica         | 0.005 | 0.001 | -0.004        | 0.002 | 0.005 | -0.002        |
| Sofala         | 0.007 | 0.001 | -0.006        | 0.002 | 0.003 | -0.002        |
| Inhambane      | 0.027 | 0.003 | -0.024        | 0.004 | 0.002 | -0.003        |
| Gaza           | 0.026 | 0.000 | -0.026        | 0.007 | 0.001 | -0.006        |
| Maputo Province| 0.007 | 0.001 | -0.007        | 0.002 | 0.001 | -0.002        |
| Maputo Cidade  | -     | -     | -             | 0.001 | 0.001 | -0.001        |
| Total          | 0.059 | 0.005 | -0.052        | 0.01  | 0.006 | -0.009        |

Notes: using imputed production values from AIS to IOF households. *Source: World Bank based on IOF-2014/15 and IAS-2015*

Table 8: Sensitivity of estimates to changes in spatial matching radius

|                | Rural | Urban | NBR (PR - CR) | Rural | Urban | NBR (PR - CR) |
|----------------|-------|-------|---------------|-------|-------|---------------|
| Niassa         | 0.166 | 0.070 | -0.116        | 0.039 | 0.014 | -0.022        |
| Cabo Delgado   | 0.169 | 0.075 | -0.109        | 0.029 | 0.052 | -0.017        |
| Nampula        | 0.169 | 0.075 | -0.109        | 0.029 | 0.052 | -0.017        |
| Zambezia       | 0.021 | 0.005 | -0.012        | 0.021 | 0.004 | -0.016        |
| Tete           | 0.024 | 0.013 | -0.011        | 0.019 | 0.137 | -0.014        |
| Manica         | 0.024 | 0.013 | -0.011        | 0.019 | 0.137 | -0.014        |
| Sofala         | 0.059 | 0.005 | -0.052        | 0.01  | 0.006 | -0.009        |
| Inhambane      | 0.059 | 0.005 | -0.052        | 0.01  | 0.006 | -0.009        |
| Gaza           | 0.007 | 0.001 | -0.007        | 0.002 | 0.001 | -0.002        |
| Maputo Province| 0.059 | 0.005 | -0.052        | 0.01  | 0.006 | -0.009        |
| Maputo Cidade  | -     | -     | -             | 0.001 | 0.001 | -0.001        |
| Total          | 0.059 | 0.005 | -0.052        | 0.01  | 0.006 | -0.009        |

*Source: World Bank based on IOF-2014/15 and IAS-2015*
Table 9: Net welfare impact (as % of total household expenditure)

### Panel A: Rural

|                | From maize | From rice | From cassava | Net effect |
|----------------|------------|-----------|--------------|------------|
| Niassa         | -20.805    | -0.056    | -0.197       | -20.872    |
| Cabo Delgado   | -6.72      | -0.375    | -1.716       | -8.805     |
| Nampula        | -0.444     | -0.225    | -6.099       | -6.19      |
| Zambezia       | -3.677     | -0.228    | -6.193       | -9.776     |
| Tete           | -25.815    | -0.067    | -0.009       | -25.239    |
| Manica         | -21.033    | -0.078    | -0.13        | -21.24     |
| Sofala         | -26.78     | -0.075    | -0.221       | -24.316    |
| Inhambane      | -1.835     | -0.389    | -0.887       | -3.07      |
| Gaza           | -8.041     | -0.207    | -0.972       | -9.219     |
| Maputo Province| -2.45      | -0.62     | -0.25        | -3.316     |
| Maputo Cidade  | 0.000      | 0.000     | 0.000        | 0.000      |
| **Total**      | -10.674    | -0.206    | -2.603       | -13.147    |

### Panel B: Urban

|                | From maize | From rice | From cassava | Net effect |
|----------------|------------|-----------|--------------|------------|
| Niassa         | -4.018     | -0.277    | -0.093       | -4.383     |
| Cabo Delgado   | -1.528     | -0.525    | -0.262       | -2.315     |
| Nampula        | -1.222     | -0.52     | -1.514       | -3.246     |
| Zambezia       | -2.826     | -0.771    | -1.658       | -5.247     |
| Tete           | -1.273     | -0.087    | -0.007       | -1.318     |
| Manica         | -6.663     | -0.093    | -0.087       | -6.843     |
| Sofala         | -2.426     | -0.149    | -0.103       | -2.677     |
| Inhambane      | -0.358     | -0.382    | -0.119       | -0.855     |
| Gaza           | -2.235     | -0.149    | -0.226       | -2.699     |
| Maputo Province| -0.366     | -0.391    | -0.071       | -0.826     |
| Maputo Cidade  | -0.19      | -0.341    | -0.03        | -0.561     |
| **Total**      | -1.678     | -0.382    | -0.525       | -2.579     |

Note: Welfare estimate based on price changes in Table 3; net effect is based on Equation (3).
Calculation based on imputing AIS production values to IOF households.

Source: World Bank based on IOF-2014/15 and IAS-2015

Table 10: Net welfare impact (as % of total household expenditure) across income quintiles

### Panel A: Rural

| Quintile       | From maize | From rice | From cassava | Net effect |
|----------------|------------|-----------|--------------|------------|
| 1 - poorest    | -9.187     | -0.068    | -4.675       | -13.459    |
| 2              | -12.957    | -0.208    | -2.966       | -15.646    |
| 3              | -12.732    | -0.255    | -1.991       | -14.702    |
| 4              | -10.244    | -0.306    | -1.296       | -11.587    |
| 5 - richest    | -4.490     | -0.227    | -0.717       | -5.344     |
| **Total**      | -10.674    | -0.206    | -2.603       | -13.147    |

### Panel B: Urban

| Quintile       | From maize | From rice | From cassava | Net effect |
|----------------|------------|-----------|--------------|------------|
| 1 - poorest    | -2.603     | -0.534    | -2.068       | -5.18      |
| 2              | -3.648     | -0.585    | -0.89        | -5.102     |
| 3              | -2.284     | -0.508    | -0.366       | -3.150     |
| 4              | -1.633     | -0.374    | -0.159       | -2.162     |
| 5 - richest    | -0.373     | -0.199    | -0.071       | -0.643     |
| **Total**      | -1.678     | -0.382    | -0.525       | -2.579     |

### Panel C: Share of maize, cassava and rice in food budget across income quintiles

| Item     | Quintiles |
|----------|-----------|
|          | 1 | 2 | 3 | 4 | 5 |
| Maize    | 18.46 | 25.29 | 24.72 | 19.24 | 7.92 |
| Cassava  | 13.75 | 9.46 | 6.21 | 3.38 | 1.25 |
| Rice     | 4.19 | 4.90 | 4.60 | 4.33 | 3.02 |

Source: World Bank based on IOF-2014/15 and IAS-2015
| Province     | Initial | After | Initial | After | Initial | After |
|--------------|---------|-------|---------|-------|---------|-------|
| Niassa       | 67.2    | 75.38 | 71.09   | 81.5  | 57.75   | 60.5  |
|              | [1.04]  | [0.95]| [1.38]  | [1.18]| [1.58]  | [1.57]|
| Cabo Delgado | 49.64   | 53.36 | 49.4    | 54.12 | 50.25   | 51.43 |
|              | [1.06]  | [1.06]| [1.56]  | [1.55]| [1.45]  | [1.45]|
| Nampula      | 63.89   | 67.12 | 67.13   | 71.27 | 57.55   | 58.98 |
|              | [0.77]  | [0.76]| [1.03]  | [0.99]| [1.17]  | [1.17]|
| Zambezia     | 60.1    | 63.99 | 63.94   | 68.65 | 48.2    | 49.54 |
|              | [0.87]  | [0.86]| [1.13]  | [1.09]| [1.37]  | [1.37]|
| Tete         | 41.43   | 59.43 | 43.26   | 64.32 | 31.31   | 32.35 |
|              | [0.97]  | [0.97]| [1.37]  | [1.32]| [1.31]  | [1.32]|
| Manica       | 36.98   | 51.08 | 43.05   | 60.59 | 20.91   | 25.91 |
|              | [1.00]  | [1.04]| [1.52]  | [1.50]| [1.15]  | [1.23]|
| Sofala       | 48.19   | 55.65 | 60.75   | 71.58 | 29.12   | 31.47 |
|              | [0.96]  | [0.95]| [1.71]  | [1.58]| [1.04]  | [1.06]|
| Inhambane    | 31.08   | 32.63 | 36.64   | 38.6  | 14.55   | 14.86 |
|              | [0.97]  | [0.98]| [1.46]  | [1.47]| [1.01]  | [1.02]|
| Gaza         | 43.85   | 48.41 | 47.55   | 53.14 | 33.25   | 34.86 |
|              | [1.04]  | [1.04]| [1.53]  | [1.53]| [1.35]  | [1.36]|
| Maputo       | 10.43   | 11.4  | 22.01   | 25.25 | 5.95    | 6.03  |
| Province     |         |       |         |       | [0.57]  | [0.59]| [1.32]  | [1.38]| [0.55]  | [0.55]|
| Maputo Cidade| 3.74    | 4.09  | -       | -     | 3.74    | 4.09  |
|              | [0.35]  | [0.36]| -       | -     | [0.35]  | [0.36]|
| Total        | 46.68   | 52.6  | 55.01   | 63.42 | 31.27   | 32.61 |
|              | [0.29]  | [0.29]| [0.45]  | [0.43]| [0.36]  | [0.36]|

Note: Standard error in square brackets. Changes in poverty HCR relative to HCR prior to price change

Source: World Bank based on IOF-2014/15 and IAS-2015
### Table 12: Net welfare impact under different producer price change scenarios

| Province        | Base scenario | Percent increase in producer prices relative to the percent increase in consumer prices: |
|-----------------|---------------|-------------------------------------------------------------------------------------|
|                 | 0% (no change | 0.5 times | 1.5 times | Twice |
|                 | in producer   |           |           |       |
|                 | prices)       |           |           |       |
| Niassa          | -14.676       | -22.796   | -18.346   | -9.447 | -4.998 |
| Cabo Delgado    | -6.637        | -7.973    | -7.305    | -5.969 | 5.301  |
| Nampula         | -5.029        | -8.219    | -6.058    | -1.737 | 0.424  |
| Zambezia        | -8.592        | -15.824   | -10.851   | -0.904 | 4.069  |
| Tete            | -21.226       | -28.988   | -24.726   | -16.203| -11.942|
| Manica          | -16.686       | -20.853   | -18.77    | -14.603| -12.52 |
| Sofala          | -14.83        | -17.6     | -16.154   | -13.26 | -11.813|
| Inhambane       | -2.412        | -2.603    | -2.507    | -2.317 | -2.221 |
| Gaza            | -7.419        | -9.198    | -8.308    | -6.529 | -5.639 |
| Maputo Province | -1.481        | -1.628    | -1.555    | -1.407 | -1.334 |
| Maputo Cidade   | -0.561        | -0.582    | -0.572    | -0.551 | -0.541 |
| Total           | -8.943        | -12.647   | -10.416   | -5.952 | -3.72  |

Note: Changes in consumer prices for each province are those presented in Table 3. Source: World Bank based on IOF-2014/15 and IAS-2015

### Table 13: Impact on poverty under various producer price increase assumptions

| Province        | Initial HCR | HCR – Base scenario | Percent increase in producer prices relative to the percent increase in consumer prices: |
|-----------------|-------------|---------------------|-------------------------------------------------------------------------------------|
|                 |             |                     | 0% (no change in producer prices) | 0.5 times | 1.5 times | Twice |
|                 |             |                     |                                   |           |           |       |
| Niassa          | 67.2        | 79.28               | 77.87                              | 73.35     | 71.21     |
|                 | [1.04]      | [0.89]              | [0.92]                            | [0.98]    | [1.00]    |
| Cabo Delgado    | 49.64       | 54.17               | 53.69                              | 52.79     | 52.09     |
|                 | [1.06]      | [1.06]              | [1.06]                            | [1.06]    | [1.06]    |
| Nampula         | 63.89       | 68.4                | 67.58                              | 65.49     | 64.51     |
|                 | [0.77]      | [0.75]              | [0.75]                            | [0.77]    | [0.77]    |
| Zambezia        | 60.1        | 67.66               | 65.45                              | 61.47     | 59.54     |
|                 | [0.87]      | [0.83]              | [0.85]                            | [0.87]    | [0.87]    |
| Tete            | 41.43       | 63.87               | 61.9                               | 57.15     | 54.99     |
|                 | [0.97]      | [0.95]              | [0.96]                            | [0.98]    | [0.98]    |
| Manica          | 36.98       | 54.28               | 52.93                              | 49.86     | 48.5      |
|                 | [1.00]      | [1.03]              | [1.04]                            | [1.04]    | [1.04]    |
| Sofala          | 48.19       | 57.17               | 56.28                              | 54.31     | 53.84     |
|                 | [0.96]      | [0.95]              | [0.95]                            | [0.95]    | [0.95]    |
| Inhambane       | 31.08       | 32.77               | 32.75                              | 32.6      | 32.6      |
|                 | [0.97]      | [0.98]              | [0.98]                            | [0.98]    | [0.98]    |
| Gaza            | 43.85       | 49.25               | 49                                 | 48.05     | 47.79     |
|                 | [1.04]      | [1.05]              | [1.05]                            | [1.04]    | [1.04]    |
| Maputo Province | 10.43       | 11.56               | 11.56                              | 11.29     | 11.2      |
|                 | [0.57]      | [0.60]              | [0.60]                            | [0.59]    | [0.59]    |
| Maputo Cidade   | 3.74        | 4.09                | 4.09                               | 4.09      | 4.09      |
|                 | [0.35]      | [0.36]              | [0.36]                            | [0.36]    | [0.36]    |
| Total           | 46.68       | 54.63               | 53.6                               | 51.23     | 50.16     |
|                 | [0.29]      | [0.29]              | [0.29]                            | [0.29]    | [0.29]    |

Note: Standard errors of means in brackets. Source: World Bank based on IOF-2014/15 and IAS-2015
Figure 1: Food shares and auto-consumption shares in food budget

Source: World Bank using IOF 2014/15

Figure 2: Share of maize (corn) in household food expenditure and share of auto-consumption in corn budget

Note: Maize food items include corn flour and corn gro.

Source: World Bank using IOF 2014/15
Figure 3: Share of rice and cassava in household food expenditure and share of auto-consumption in rice and cassava budget

Note: Food items include husked and husk-in rice, cassava flour, fresh and dried cassava. 
Source: World Bank using IOF 2014/15

Figure 4: Production of maize, rice and cassava in recent years in Mozambique

Note: Trade statistics are from UN Comtrade Database (2018) and production is based on FAOSTAT data
Figure 5: Maize import quantity, imports as share of production and main sources of imports

Source: Trade statistics are from UN Comtrade Database (2018) and production is based on FAOSTAT data

Figure 6: Rice import quantity, imports as share of production and main sources of imports

Source: Trade statistics are from UN Comtrade Database (2018) and production is based on FAOSTAT data
Figure 7: Monthly food price index, and prices of maize, rice and cassava (2014-2016)

(Panel A) Consumer Prices - Food Indices

(Panel B) Maize (white) retail prices

(Panel C) Rice (general) retail prices

(Panel D) Cassava dried retail prices

Source: Consumer price index data is from FAOSTAT; commodity prices are based on data from SIMA