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Abstract: A propitiously timed household survey carried out in Mozambique over the period 2008/09 permits us to study the relationship between pronounced shifts in food prices and child nutrition status. We focus on child malnutrition status in different survey quarters characterized by very different food price inflation rates. We find that the prevalence of wasting and underweight amongst under-five children is significantly lower in the fourth quarter, when the inflation rate for basic food products is low. Consistent with a short run shock such as a price shock, stunting rates and height-for-age Z-scores, which reflect longer run factors, are insignificantly different across quarters. We conclude that the best available evidence points to the food and fuel price crisis as substantially increasing malnutrition amongst under-five children in Mozambique during the period of the shock.

Keywords: food prices, inflation, child malnutrition, Mozambique.

JEL classification: C51, D12, I32, O12.

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1 Introduction

In 2008, countries around the globe experienced a dramatic food and oil price shock. From January 2007 to June 2008 real world food prices increased by more than 60 per cent (cf. FAO 2012) while the world price of oil increased by about 125 per cent over the same period. The full implications of the 2008 food and fuel price crisis are yet to be understood and remain an important topic of research (e.g., Ortiz et al. 2011; Abbott and de Battisti 2011; Headey 2011; Headey et al. 2012; Verpoorten et al. 2012). The nutritional consequences, in particular amongst children, are a primary concern (e.g. Lock et al. 2009; Keats and Wiggins 2010; Tiwari and Zaman 2010; Ruel et al. 2010; Christian 2010; Brinkman et al. 2010).

The unfolding nutritional consequences of price shocks, in particular in the short to medium run, remain largely under-investigated due, in significant measure, to lack of data (Torlesse et al. 2003). A number of papers have examined the impact of regional or national food price crises on child nutritional status in affected areas, for example, due to drought or general economic turndown (see the next section for further references). However, most of this work has relied on yearly observations of child nutritional status and other low-frequency data or has compared nutritional outcomes before and during (or after) some crisis.

This paper studies the nutritional status of children in Mozambique by quarter over a full year beginning in September 2008. These periods of the year (quarters) are characterized by very different inflation levels for basic food products. We are able to conduct this analysis due to a large scale household budget survey that: (a) is representative quarterly, (b) contains an anthropometrics module, and (c) took place over the period September 2008 to August 2009. This period follows directly on the peak of the world price spike for food and fuel which occurred in June 2008.

It is important to point out that the prices of basic food products in Mozambique actually peaked between September 2008 and February 2009 (a few months after the world food price index peak) before declining sharply between June and August 2009. Using individual-level matching analysis applied to children surveyed in different survey quarters, we find that the prevalence of contemporary malnutrition among children aged 0-59 months was significantly lower in the last months of the survey, when inflation rates for basic food products were lower. At the same time, chronic malnutrition measures seem not to differ significantly among groups interviewed in different survey quarters over the investigated twelve month period.

The remainder of this paper is structured as follows. Section 2 reviews literature. Section 3 describes the data employed for the analysis. Section 4 provides descriptive statistics. Section 5 presents the approach employed and the results. Section 6 concludes that strong price movements appear to have significantly impacted the nutritional status of children in Mozambique.

2 Literature

Studies examining the impact of a crisis on child nutritional outcomes are plentiful, although somewhat dispersed, in the literature. With respect to prices, Torlesse et al. (2003) use yearly data collected from 1992-2002 to examine how changes in rice prices affect child underweight in Bangladesh. Using aggregate data, they find that rice prices are strongly correlated with underweight (corr. coef. = 0.91, $p = 0.001$). A number of other contributions study the impact of a crisis using micro data. For example, Block et al. (2004) assesses the nutritional impact of Indonesia's drought and financial crisis of 1997/98, Yamano et al. (2005) examines the effect of a shock (drought) and food aid on child growth in Ethiopia for the period 1995-96, and Hoddinott and Kinsey (2001) investigate the impact of drought on child growth in Zimbabwe, using panel data for the period 1993-1997.

More recently, Stillman and Thomas (2008) examine the impact of the decline in economic activity in Russia between 1996 and 1998 on six dimensions of nutritional status using annual data. Miller and Urdinola (2010) investigate how child mortality in Colombia responds to fluctuations in world Arabica coffee prices (where a counter-cyclical relationship might be expected) and document starkly pro-cyclical child deaths. Their analysis is also based on yearly data, hence focusing on medium to long run effects. Finally, Hartwig and Grimm (2012) analyze the food crisis in 2002 in Malawi relying on representative data collected before and after the crisis.

At the time of the global food and fuel price crisis, various efforts were made to simulate the implications of the crisis for the welfare of countries, regions, and households. For example, Ivanic and Martin (2008) examined the implications of the food price crisis for ten countries. They found highly heterogeneous effects driven principally by the net buyer or net seller position of the household. Overall, they found that, across the ten countries considered, "the adverse welfare impact on net buyers outweighs the benefits to net sellers resulting in an increase in the number of poor and in the depth of poverty" (p. 1). Similarly, Arndt et al. (2008) focused on Mozambique and found negative implications for poverty using an economy-wide simulation model linked to a poverty module. This result was driven principally by fuel price increases although higher food prices also contributed to increases in poverty, particularly in urban areas.

With the passage of time, attention has shifted from simulating the impacts of the food and fuel price crisis on living standards in poor countries, to analyzing the implications of the crisis in retrospective. Unfortunately, relatively few data sets are well suited to the task. For El Salvador, de Brauw (2011) finds a decrease in height for age of children under three, which he attributes to the rise in food prices of 2008. He also finds that children in families with access to remittances or international migrants experienced lower declines in height for age. Arndt et al. (2012) use a dynamic economy-wide model, linked to a poverty module, to track macroeconomic aggregates and world prices over the period 2003 to 2009. With this approach, they are able to reproduce trends measured poverty rates from 2002/03 to 2008/09. They find that stagnation in consumption poverty rates in Mozambique were principally due to the near continuous increases in fuel prices over 2003 to 2009 and to the combination of slow agricultural productivity growth, particularly for food crops, negative weather shocks affecting the harvest in May/June 2008, and high world prices for food.

As noted by Ivanic and Martin (2008), the net buyer/seller position of the household determines the first order impact of food price changes on household welfare. In macroeconomic terms, Mozambique is a net food importer. In their simulation analysis, Arndt et al. (2008) investigated the net buyer/seller position of households using detailed data available for 2003. This analysis showed that about 26 percent of rural households and 76 percent of urban households are net food buyers even after a good harvest. In addition, for most rural households, the net sale is very small; and rural households typically rely on own production for the large majority of their food consumption. As mentioned, 2008 was not a good harvest with calorie availability from food production dropping by more than 6 per cent per rural inhabitant nationwide (MPD/DNEAP 2010) compared with 2002. Further, while prices for food generally rose alongside international prices, Arndt et al. (2012) show that prices at the local level also reflect local supply and demand conditions with relatively high prices reflecting particularly tight supply conditions. The present paper considers whether the combination of a negative supply shock and world/domestic price shocks affected malnutrition rates.

3 Data for Mozambique

The IOF 2008/09 (INE, 2012) survey contains detailed information on expenditure and consumption of food items for a stratified random sample of 10,832 households. It also contains anthropometric information for over 8,000 children under five years old from the same households. However, complete and valid anthropometric information was only available for about 7,000 children.

The IOF sample is representative for the whole of Mozambique as well as for the rural and urban zones and each of the ten provinces plus Maputo City. As noted, it is also representative through time. The survey began in September 2008 and ended in August 2009. The sample is representative for each of the four quarters of the IOF survey. Summary statistics for key variables are found in Table 1.

[table 1 about here]

We assess the nutritional status of children by combining their age, weight and height to calculate the following standard ratios: weight/age, height/age, and weight/height. This way of measuring malnutrition has the advantage that it only needs information on age, height and weight of children. These ratios are compared to the WHO's reference population that represents the expected distribution of the growth of under-five children (WHO 2006a, 2006b; WHO and UNICEF 2009). The degree of malnutrition is then generally measured by the so-called Z-score, defined as the ratio minus the reference ratio divided by the standard deviation of the reference ratio.

Three different forms of (moderate) malnutrition are usually identified, depending on the indicator that is used: i) stunting: when height-for-age Z-score values are below the international reference value by more than two standard deviations; ii) wasting: when weight-for-height Z-score values are below the international reference value by more than two standard deviations; iii) underweight: when weight-for-age Z-score values are below the international reference value by more than two standard deviations.

Similarly, severe stunting, wasting, or underweight exist when the Z-scores are below minus three standard deviations. In general, while underweight or wasting may be driven by short-term factors like illnesses or food intake fluctuations throughout the year, stunting is considered an indicator of long-term malnutrition. Hence, for the purposes of this study, we expect weight-for-age and weight-for-height Z-scores to be relatively more sensitive to food price shocks compared with those for height-for-age.

4 Descriptive Information

4.1 Malnutrition

Based on IOF 2008/09, 18.7 per cent, 46.4 per cent and 6.6 per cent of 0-59 months old children are respectively suffering from moderate underweight, stunting and wasting (MPD/DNEAP, 2010). In Table 2 malnutrition prevalence is presented for all provinces and survey quarters. No province is in the top or in the bottom regarding malnutrition when considering all three measures. But Cabo Delgado (underweight), Manica (stunting) and Sofala (wasting) are among the provinces with the most malnourished children. Maputo Province and Maputo City perform best regarding both underweight and stunting. There is some variation in malnutrition during the IOF year. Based on quarterly measurements we see that the three types of malnutrition show peaks in the second or third quarter, before falling in the fourth quarter.

[table 2 about here]

This pattern may correspond with normal seasonal price variation whereby food from the main production year begins to become available around March with the post-harvest price trough normally occurring around June. The 'hungry season' generally runs from about December through February. There is some evidence of seasonality in calorie consumption at the household level driven by this seasonal pattern of price fluctuation, particularly for rural households in the center and the north (Arndt, Barslund and Sulemane, 2005). In terms of child nutrition, data from an earlier survey covering a whole year in the period 1996/97 does not point to a systematic seasonal variation in malnutrition. Nevertheless, it is possible that some seasonality exists.

Given the lack of data to estimate normal seasonal variation in malnutrition rates, we are not able to identify the additional malnutrition associated directly with the food and fuel price crisis. However, both due to world price movements and a short production year nationally, the period in question does generate a spike in basic food prices that rises substantially beyond the levels that Mozambican households might reasonably have expected with associated implications for child malnutrition (see Figure 1).

[figure 1 about here]

4.2 Inflation and malnutrition

As shown in Figure 1, basic food world prices soared in 2007-08 and peaked around June 2008, declining to pre-crisis levels at the end of 2008. This shock took a few months to transmit to local markets in Mozambique, where the prices of basic food products actually peaked between September 2008 and February 2009, declining sharply between June and

August 2009. The data in Figure 1 are monthly. As the household survey data is representative on a quarterly basis, we present indices of basic food inflation rates, as well as malnutrition rates, by quarter and region in Figure 2. The indices are derived on the basis of consumption patterns derived from the households surveys combined with price data for basic foods derived from Mozambique's Agricultural Markets Information System (MINAG, 2014).

[figure 2 about here]

From Figure 2, one notes that food price inflation rates decline immediately after the first quarter in the southern region, and in urban areas, while remaining high until the third quarter in the central and northern regions, and in rural areas. With respect to malnutrition, wasting rates are low and only a small share of the total population of children move across the two standard deviation threshold between any two quarters. Stunting and especially underweight rates exhibit considerable intra-annual variation, with important regional differences. It is perhaps surprising that fewer children move back and forth across the wasting threshold compared with underweight, but this is consistent with recent findings from other crises, cf. e.g. de Brauw (2011), and Hartwig and Grimm (2012).

5 Approach and results

5.1 Propensity score matching

As noted in section 3, households were interviewed only once in the IOF budget survey. However, each quarter of the survey was designed to be representative of the whole sample. This implies that households interviewed in the first quarter should not be very different compared with households interviewed in quarters two, three, or four.

We use this feature of the survey design to compare nutritional status among under-five children in the first quarters – when inflation was high – with nutritional status among under-five children in the last quarter – when inflation was generally low. We expect contemporary child malnutrition – particularly wasting and underweight – to be lower in the fourth quarter when food price inflation is lower.

While we are able to control reasonably comprehensively across households based on a series of short-term time invariant factors, our ability to control for factors external to the household is more limited. The observed differences across households represent the combined effect of differences in harvest quality, local prices, international prices, and potentially other factors.

In order to compare malnutrition rates between children interviewed in different quarters, we compute the average treatment effect on the treated (ATT) employing the propensity score matching technique (Rosenbaun and Rubin, 1983). In this case, the 'treatment' is given by the different level of inflation. We designate the treatment group as the group of under-five children surveyed in the fourth quarter. The control group is thus the group of under-five children interviewed in the first three survey quarters.[1]

[1] In the Appendix, we also present an alternative specification in which the control group is formed by children surveyed in the first two quarters only. Results are shown in Table A1.

To compute the ATT, we assume that all relevant differences between under-five children in the first survey quarters and in the last quarter are captured by their observables and seek to select a control group from the non-treated pool of observations for which the distribution of the observables is as similar as possible to the distribution of the observables in the treated group. Various matching methods exist. Here, we implement full Mahalanobis matching (Leuven and Sianesi, 2003). Robustness checks (not shown) are also performed using kernel, nearest neighbor, and radius matching, without obtaining noticeable differences in the results.

The observable characteristics selected as controls are child's gender and age (in months), child's age squared, household size, gender of the household head, water and sanitation characteristics of the dwelling, roof quality, years of education of the mother, and dummies for provinces and urban/rural areas (see Table 1).

Table 3 shows that matching greatly reduces differences in sample means between the control and treated group with respect to the observable characteristics. After matching, none of the variable means are statistically different between the two groups. Moreover, the standardized difference or bias after matching is less than 5% for all covariates, which suggests that a good balance was obtained (Rosenbaum and Rubin, 1985).

5.2 Results

Having defined the treatment and control group, and the observable characteristics, we compute the ATT using various outcome variables: weight-for-age Z-scores, weight-for-height Z-scores, height-for-age Z-scores as well as wasting, underweight, and stunting dummy variables. Checks are then performed using the consumption poverty headcount ratio and total consumption as outcome variables.

If our hypothesis – that contemporary malnutrition was affected by different inflation levels experienced in different quarters – is correct, we expect wasting and underweight to be lower among children surveyed in the fourth quarter (i.e., the treatment group). We also expect average weight-for-age Z-scores and weight-for-height Z-scores to be higher for this group, as this would indicate lower malnutrition levels.

We also expect height-for-age Z-scores and corresponding stunting rates to be relatively unresponsive to changes in basic food inflation rates due to the relative stability of this indicator. In Table 4, we present the ATT results for each of the outcome variables. As expected, weight-for-age Z-scores, weight-for-height Z-scores, wasting, and underweight are different among the two groups of children with the sign of the difference going in the expected direction. These results indicate that malnutrition was significantly lower among children in the fourth survey quarter, when inflation rates were substantially lower in all regions of the country. Also as anticipated, height-for-age Z-scores and stunting levels are not statistically different among the two groups, indicating that chronic malnutrition was not strongly affected.

[table 4 about here]

In terms of other observable welfare indicators, the treatment group exhibits a significantly lower poverty rate, pointing to improved living conditions overall. In terms of real value of consumption, the treatment group also exhibits higher total consumption though this difference is not statistically significant. These temporal welfare patterns are consistent qualitatively with those observed by Arndt et al. (2012).

6 Summary and conclusions

We employ household survey data from Mozambique to consider the implications of food price inflation for the nutritional status of children aged 0-59 months. The anthropometric data was collected from September 2008 to August 2009, which provides the possibility to shed light on the nutritional consequences of the 2007-09 food and fuel price crisis.

We find that contemporary malnutrition prevalence and levels, as measured by weight for height and weight for age, are significantly different between treatment and control quarters after controlling for time-invariant observables at the household level, such as education of the mother. The salient difference between the treatment and control groups is the rate of food price inflation experienced during their respective survey quarters. Findings for stunting also point to a strong role for price inflation as a driver. Short run factors, such as a temporary food price spike, should not strongly impact height for age measures; and these measures are insignificantly different between the two groups.

We conclude that the strong food price inflation experienced during the first three quarters of the IOF survey is by far the most likely factor to have aggravated child malnutrition compared with the fourth quarter, where food prices inflation was subdued. The effect of price inflation was particularly strong with respect to the weight for age indicator with the share of children classified as underweight nearly halving.

In terms of limitations, we stress that we are not able to explicitly untangle the effects of the food and fuel price shocks from normal seasonal fluctuations in child nutrition indicators. At the same time, ample evidence illustrates that the food price inflation experience by the control group was notably rapid (see Figures 1 and 2), and the available information from previous anthropometric surveys does not point to a strong seasonal effect on malnutrition indicators.

In terms of future research, the channels through which food prices can impact on child anthropometrics remain under-explored. The direct and most obvious channel of impact is through changes in the quality and quantity of food consumption. However, there are also other possible, more indirect, channels of impact resulting from changes in household behavior. For example, as discussed in Thomson and Metz (1999), time spent breastfeeding children may be reduced due to more time spent on farming (since output prices have increased and thus farming is more profitable) or more time spent working off farm. In addition, the long running research agenda on policies that result in more stable food supplies (and hence more stables prices) both nationally and internationally remains strongly relevant to poor people in poor countries such as Mozambique.

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8 Tables and Figures

Table 1. Summary statistics.

Variable	N	Mean	Std. Dev.	Min	Max
Weight-for-height Z-score	7118	0.10	1.44	-4.96	4.96
Weight-for-age Z-score	7010	-0.95	1.27	-5.32	4.38
Height-for-age Z-score	7009	-1.78	1.74	-6	5.9
Wasting	7118	6.55	24.74	0	100
Underweight	7010	18.74	39.03	0	100
Stunting	7008	46.41	49.87	0	100
Headcount ratio	7714	59.53	49.09	0	100
Daily pc consumption	7714	20.93	24.61	0.61	1044.55
Girl	8634	0.52	0.50	0	1
Age (in months)	8634	28.14	16.68	0.03	59.89
Age squared	8634	1070.04	994.62	0.00	3587.20
Safe water	8634	0.17	0.38	0	1
Sanitation	8633	0.50	0.50	0	1
Mother's education years	8634	1.96	2.68	0	12
Household size	8650	6.23	2.67	2	34
High quality roof	8634	0.28	0.45	0	1
Female household head	8634	0.23	0.42	0	1
Rural	8650	0.73	0.44	0	1
Niassa	8634	0.07	0.25	0	1
Cabo Delgado	8634	0.08	0.27	0	1
Nampula	8634	0.20	0.40	0	1
Zambezia	8634	0.20	0.40	0	1
Tete	8634	0.10	0.29	0	1
Manica	8634	0.07	0.26	0	1
Sofala	8634	0.08	0.28	0	1
Inhambane	8634	0.06	0.23	0	1
Gaza	8634	0.06	0.23	0	1
Maputo Prov	8634	0.06	0.23	0	1
Maputo City	8634	0.04	0.19	0	1

Source: Authors' calculations from the IOF database combined with WHO (2006a).

Table 2. Moderate malnutrition prevalence in provinces and over time. %

Province	Wasting	Underweight	Stunting
Niassa	5.4	17.1	50.0
Cabo Delgado	6.2	25.5	54.0
Nampula	8.3	21.8	55.5
Zambezia	5.2	19.1	48.6
Tete	9.3	24.5	52.2
Manica	5.1	20.6	58.4
Sofala	11.7	19.6	35.7
Inhambane	2.8	9.5	38.1
Gaza	4.3	14.3	32.8
Maputo Province	5.0	7.5	20.2
Maputo City	3.7	6.8	24.0
Sep-Nov 2008	5.8	16.3	42.9
Dec 2008-Feb 2009	7.8	22.8	47.0
Mar-May 2009	6.8	22.1	49.7
Jun-Aug 2009	5.6	12.9	45.5
Total	6.6	18.7	46.4

Source: Authors' calculations from the IOF database combined with WHO (2006a).

Table 3. Quality of the matching procedure.

Variable	Sample	Mean Treated	Mean Control	%bias	% reduction |bias|	t-test t	t-test p
Girl	Unmatched	0.51	0.51	-0.7		-0.24	0.810
	Matched	0.51	0.51	-0.7	-9.2	-0.21	0.833
Age (in months)	Unmatched	28.45	30.15	-10.6		-3.73	0.000
	Matched	28.45	28.53	-0.5	95.4	-0.14	0.889
Age squared	Unmatched	1063.80	1165.90	-10.3		-3.62	0.000
	Matched	1063.80	1062.60	0.1	98.9	0.03	0.973
Safe water	Unmatched	0.22	0.27	-10.0		-3.47	0.001
	Matched	0.22	0.22	-0.1	98.6	-0.04	0.966
Sanitation	Unmatched	0.61	0.59	4.3		1.53	0.126
	Matched	0.61	0.62	-0.9	79.6	-0.25	0.800
Mother's education years	Unmatched	2.88	2.64	8.0		2.87	0.004
	Matched	2.88	2.77	3.6	55.5	1.01	0.311
Household size	Unmatched	5.99	6.39	-14.9		-5.07	0.000
	Matched	5.99	5.94	2.0	86.6	0.62	0.536
High quality roof	Unmatched	0.37	0.39	-4.2		-1.48	0.139
	Matched	0.37	0.37	-0.4	90.9	-0.11	0.913
Female household head	Unmatched	0.25	0.25	0.6		0.2	0.839
	Matched	0.25	0.26	-2.9	-399.8	-0.81	0.419
Rural	Unmatched	0.58	0.56	2.1		0.73	0.466
	Matched	0.58	0.57	1.4	33.3	0.39	0.696

Source: Authors' calculations from the IOF database.

Notes: The control group is formed by children surveyed in the first three quarters of the IOF survey. Children surveyed in the fourth quarter are considered treated. Province variables are not shown.

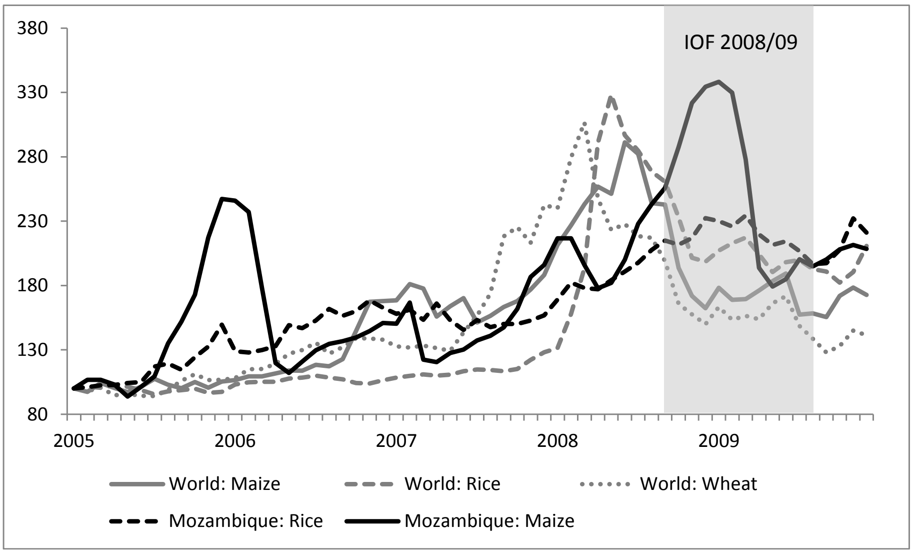
Table 4: Average treatment on the treated (ATT)

Outcome variable	Treated	Controls	Difference	S.E.	T-stat
Weight-for-age Z-scores	0.36	0.05	0.31	0.06	5.51*
Weight-for-height Z-scores	-0.71	-0.95	0.24	0.05	4.78*
Height-for-age Z-scores	-1.69	-1.65	-0.04	0.07	-0.64
Wasting	5.33	7.57	-2.23	0.97	-2.29*
Underweight	11.98	20.14	-8.16	1.46	-5.59*
Stunting	43.75	42.25	1.51	1.95	0.77
Headcount ratio	55.62	59.46	-3.84	1.85	-2.08*
Total consumption	23.01	22.24	0.78	1.22	0.63

Source: Authors' calculations from the IOF database.

Notes: The control group is under-five children surveyed between September 2008 and May 2009. The treatment group is under-five children surveyed between June and August 2009.

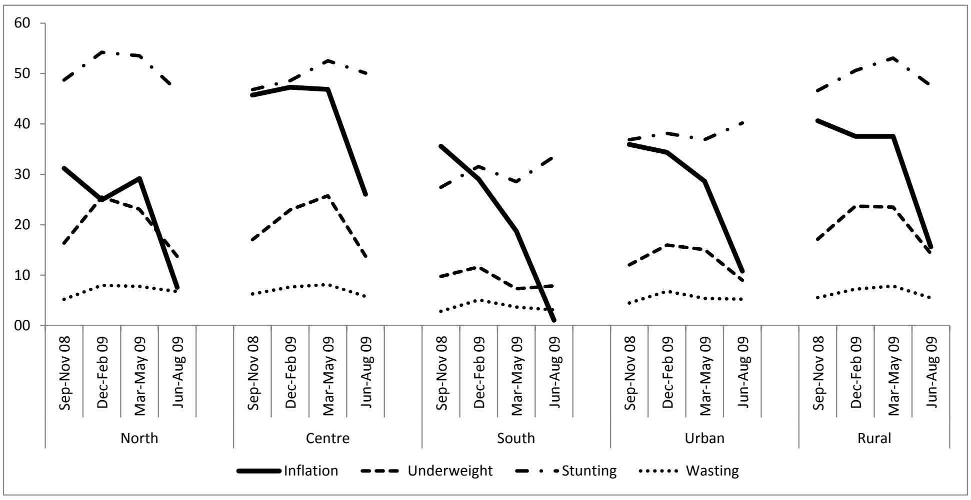
Figure 1. International and Mozambique prices for basic food commodities, Jan 2005-Dec 2009 (Jan 2005=100).



Source: FAO (2015a, 2015b).

Notes: Monthly data. International prices: Maize - US, No.2 Yellow, U.S. Gulf; Rice - Thailand, 100% B, 2nd grade, White rice broken, Bangkok; Wheat - US, No.2 Hard Red Winter (Ordinary Protein), US Gulf. Mozambique prices: maize and rice prices are obtained as simple averages of the prices recorded in the ten most important markets in Mozambique.

Figure 2. Inflation and malnutrition rate developments for regions and rural/urban areas.



Source: Authors' calculations using the IOF 2008/09 and MINAG (2014).

Notes: Numbers presented here are based on price information from the Agricultural Markets Information System (MINAG, 2014). Quarterly inflation is defined as the geometric mean, $\pi_{m,t}^{Q} = \sqrt[3]{\pi_{m,t}^{A} * \pi_{m,t-1}^{A} * \pi_{m,t-2}^{A}}$, of the annual inflation rate in the present month, $\pi_{m,t}^{A}$, and the two preceding months, $\pi_{m-1,t}^{A}$ and $\pi_{m-2,t}^{A}$. Annual inflation measures have the advantage of being relative to the prices that occurred during the preceding year, which was not strongly marked by special events and thus forms a reasonable anchor for price expectations of households.

9 Appendix

Here we present the results of an alternative matching specification in which the control group is formed by under five children surveyed in the first two quarters only – i.e. the third quarter is excluded from the analysis. The treatment group is still formed by children in the fourth quarter. This robustness check is performed because in some areas of the country – particularly in the south – the level of basic food inflation started to decrease already during the third quarter. Nonetheless, some of the main results remain unchanged: weight-for-height Z-scores and underweight are significantly different with the expected sign. Height-for-age Z-scores and stunting are not affected. Weight-for-age Z-scores are still significantly different for the two groups, while wasting prevalence is lower for the treatment group but the difference is not statistically significant in this case.

Table A1. Average treatment on the treated (ATT)

Outcome variable	Treated	Controls	Difference	S.E.	T-stat
Weight-for-age Z-scores	0.36	0.12	0.25	0.06	3.96*
Weight-for-height Z-scores	-0.71	-0.83	0.12	0.05	2.34*
Height-for-age Z-scores	-1.69	-1.65	-0.04	0.07	-0.59
Wasting	5.33	6.89	-1.55	1.00	-1.55
Underweight	11.98	17.19	-5.21	1.49	-3.48*
Stunting	43.75	41.62	2.13	2.05	1.04
Headcount ratio	55.62	61.72	-6.10	1.94	-3.14*
Total consumption	23.01	22.00	1.02	1.02	1.00

Source: Authors' calculations from the IOF database.

Note: The control group is under-five children surveyed between September 2008 and May 2009. The treatment group is under-five children surveyed between June and August 2009.