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IFPRI Discussion Paper 00836

December 2008

Higher Fuel and Food Prices

Economic Impacts and Responses for Mozambique

Channing Arndt

Rui Benfica

Nelson Maximiano

Antonio M.D. Nucifora

James T. Thurlow

Development Strategy and Governance Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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IFPRI's research, capacity strengthening, and communications work is made possible by its financial contributors and partners. IFPRI receives its principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR). IFPRI gratefully acknowledges the generous unrestricted funding from Australia, Canada, China, Finland, France, Germany, India, Ireland, Italy, Japan, Netherlands, Norway, South Africa, Sweden, Switzerland, United Kingdom, United States, and World Bank.

AUTHORS

Channing Arndt, University of Copenhagen

Rui Benfica, The World Bank

Nelson Maximiano, Mozambique Ministry and Development

Antonio M.D. Nucifora, The World Bank

James T. Thurlow, International Food Policy Research Institute
Research Fellow, Development Strategy and Governance Division

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ACKNOWLEDGEMENTS

The authors would like to thank participants from a workshop held in May 2008 in Maputo, Mozambique, where the food and fuel crisis was discussed. In addition, we thank an anonymous referee for valuable comments. All remaining errors and omissions are the sole responsibility of the authors. Finally, the views expressed in this paper are the views of the authors and do not necessarily reflect the views of the institutions to which the authors are affiliated.

ABSTRACT

Rising world prices for fuel and food represent a negative terms-of-trade shock for Mozambique. The impacts of these price increases are analyzed using various approaches. Detailed price data show that the world price increases are being transmitted to domestic prices. Short-run net benefit ratio analysis indicates that urban households and households in the southern region of the country are more vulnerable to food price increases. Rural households, particularly in the northern and central parts of Mozambique, often benefit because they sell more food goods than they consume (i.e., net seller). Long-term analysis using a computable general equilibrium model of Mozambique indicates that the fuel price shock dominates rising food prices from both macroeconomic and poverty perspectives. Here again, negative impacts are greater in urban areas than in rural areas. The importance of agricultural production response in general, and export response in particular, are highlighted in this discussion. Policy analysis reveals difficult trade-offs between short-run mitigation and long-run growth. Improved agricultural productivity has powerful positive impacts, but remains difficult to achieve and may not address the immediate impacts of higher prices.

Keywords: price transmission, terms-of-trade shocks, food security, Mozambique

JEL codes: O13 and Q18

1. INTRODUCTION

Mozambique has made tremendous strides in reducing poverty over the past 14 years, following the conclusion of the civil war in 1994. Household survey data indicate that the national poverty headcount fell from 69 to 54 percent during 1997–2003. Reduction in rural poverty has been even more pronounced, although the proportion of people who are poor in these areas remains higher than in urban centers. Given these trends, and with the country still growing rapidly, it is expected that the next household survey due in 2009 will confirm that poverty has continued falling. However, the recent dramatic increases in world agricultural and fuel prices may undermine at least some of the expected gains.

Rising world prices certainly represent a negative terms-of-trade shock for Mozambique, since the country imports almost all of its fuel and is a net importer of food. However, the poverty impact of higher prices depends on a range of factors, including (i) the structure of production and consumption at the household level; (ii) the extent of the agricultural supply response; (iii) the extent of export response; and (iv) the fuel intensity of the economy. On the one hand, higher agricultural prices may represent an opportunity to raise rural incomes, since about 80 percent of the labor force derives their livelihoods from agriculture and related activities. Conversely, many households rely on purchased food, particularly in urban areas, and so may be adversely affected by rising food prices. Moreover, higher fuel prices will also affect poverty due to fuel's economywide linkages, especially to Mozambique's burgeoning agro-processing sectors. Finally, macroeconomic adjustments and public policy responses to accommodate the terms-of-trade shock will also affect household incomes. Accordingly, the impact of higher prices will vary over the short and long term, and across rural and urban areas within the country.

This paper assesses the impact of higher fuel and food prices at both household and macroeconomic levels. It also considers policy options to mitigate some of the negative impacts of higher prices. Section 2 presents information on the extent of international food and fuel price increases and their transmission to local markets in Mozambique. Section 3 presents household-level analysis focused on the first-order impact of the food price increases. Section 4 complements previous sections by examining the impact of higher food and fuel prices within a general equilibrium framework. Section 5 discusses the likely impact of alternative policy options. A final section summarizes and concludes this discussion paper.

2. PRICE TRANSMISSION

The government has allowed the recent increase in world agricultural and fuel prices to pass through to domestic markets by avoiding the introduction of trade distortions or subsidies while providing support to economic sectors most vulnerable to rising energy prices.¹ Table 1 compares nominal fuel and staple food prices in international and Maputo retail markets. The increase in domestic fuel prices is consistent with the increase in international prices. While the “pass-through” effect of fuel prices has been lower for rice and maize, some additional transmission of impacts (i.e., ‘pass-through’) is expected over the coming months as the local harvest no longer cushions local retail prices. By contrast, wheat prices have increased much faster than international prices.

Table 1. Changes in international and domestic retail prices

	July 2005	July 2006	July 2007	July 2008	Change, 2006-08 (%)
Average international price					
Rice, Thailand, 5% (US\$/ton)	277.0	315.0	329.0	732.0	132.4
Maize (US\$/ton)	108.0	114.0	147.0	265.0	132.5
Wheat, U.S. Hard red winter (US\$/ton)	144.0	202.0	238.0	328.0	62.4
Crude oil, spot (US\$/barrel)	56.0	72.0	74.0	133.0	84.7
Average retail price in Maputo					
Rice (Meticais/kg)	9.3	11.4	14.5	19.3	68.8
Maize (Meticais/kg)	5.9	6.5	6.4	10.2	57.0
Wheat flour (Meticais/kg)	11.0	11.8	15.5	24.5	107.6
Gasoline (Meticais/liter)	-	27.2	33.7	41.6	52.9
Diesel (Meticais/liter)	-	27.2	27.5	35.4	29.9
Kerosene (Meticais/liter)	-	16.5	20.3	28.7	74.1
Average retail prices of rice (US\$/ton)					
Beira	391.9	307.9	503.9	1,141.1	191.1
Chimoio	419.9	488.1	596.9	1,190.9	183.6
Cuamba	296.4	711.5	372.1	755.2	154.8
Maputo	381.1	452.4	562.0	800.8	110.1
Nampula	373.2	460.7	418.6	1,020.7	173.5
Pemba	512.3	555.6	542.6	1,120.3	118.7
Tete	532.8	634.9	515.5	1,161.8	118.1
Exchange rate (Meticais/US\$)	24.4	25.2	25.8	24.1	-

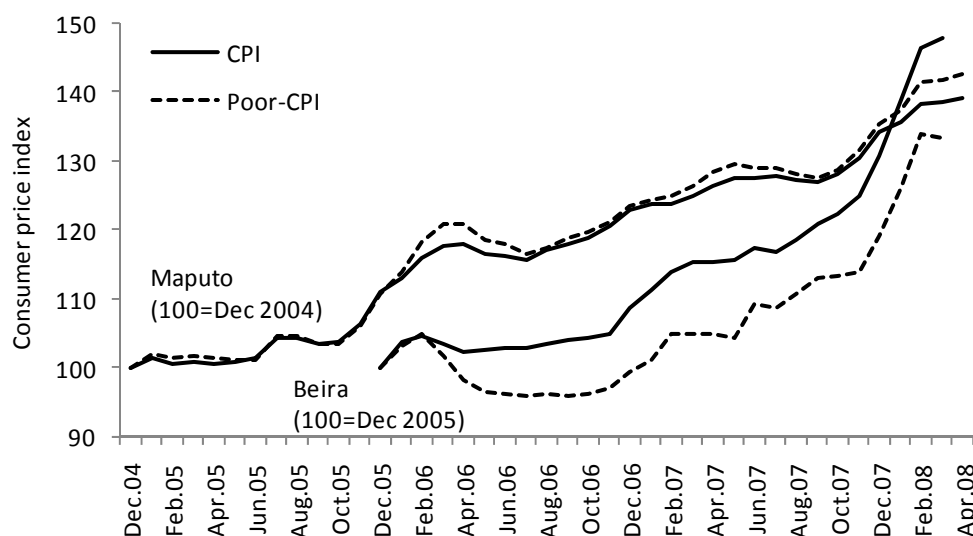
Source: This data is derived from the World Bank, Development Economics Prospects Group (<http://decpg.worldbank.org>); the Ministry of Agriculture, Mozambique, Weekly Agriculture Market Bulletin (<http://www.sima.minag.org.mz/index.htm>); and the Ministry of Energy, Mozambique.

Broader measures also indicate considerable price transmission. Figure 1 presents the consumer price index (CPI) for the major cities of Maputo and Beira.² Fuel and food represent more than half of the consumption bundle in each city. Both graphs indicate rapid price increases beginning in October 2007. The rate of growth in prices is considerably more rapid in Beira, reflecting both the large share of fuel and food in the consumption basket” and a more rapid increase in the price of the “food basket.”

¹ In June, 2008, the government temporarily removed import duties and VAT (value-added tax) on diesel, and import duties on kerosene, thus partially offsetting the increase in world prices occurring since January 2008.

² Similar results were obtained for the northern city of Nampula.

Figure 1. Changes in consumer price index (CPI) and Poor-CPI in Maputo and Beira



Source: Data are based on Mozambique National Institute of Statistics (INE 2008) and the authors' calculations.

It is also interesting to explore whether the changes in the cost of living have been higher or lower for the poor. Hence, we compare the evolution of prices in the consumer price index with a specific poor-consumer price index (PCPI), which focuses on the goods consumed by the poor. With respect to food, the weights in the CPI calculation were adjusted to reflect both the composition of the “food basket” of the poor and the weight of food in total consumption of the poor. With respect to non-food items, quality and unit issues make adjustment more difficult. To obtain the poor consumers’ non-food basket, non-food items manifestly not consumed by the poor, such as airline tickets and automobiles, were eliminated from the CPI non-food basket. The weights on the remaining non-food items were then scaled such that the sum of weights for non-food items equals the observed non-food consumption share of poor households. The adjustments to develop the PCPI in Maputo and Beira reflect observed consumption patterns of the poor in each city. In both cities, the PCPI, like the CPI, has exhibited rapid growth since October 2007. In Maputo, recent prices have increased slightly faster for poor consumers, while the reverse is true in Beira. In both cities, the difference between PCPI and CPI is not very large, at least since the period tracked from October 2007 to April 2008.

Recent data published by the Mozambican Ministry of Agriculture suggest that prices have been transmitted to internal markets as well. Table 1 shows retail rice prices in selected local markets from July 2005 to July 2008. Retail prices rose substantially during this period throughout the country, both in port cities, such as Beira, and in inland markets, such as Tete and Chimoio. While recent percentage price increases were sometimes larger in inland markets, these were often due to lower initial price levels. Absolute price changes were more consistent across markets, reflecting the transaction cost wedge between local and border prices. Overall, domestic market price trends suggest that the recent food price increase has been widespread and will affect households throughout the country.³

³ The main harvest months are in May and June. The high prices registered in July 2008 could also reflect a poor 2008 harvest. Reliable information on the quality of the harvest will not be available until the end of 2008.

3. HOUSEHOLD-LEVEL ANALYSIS

International Experience

The first-order welfare impact of rising food prices depends on whether a household is a net consumer (buyer) or net producer (seller) of these food items. Typically, the urban poor are net consumers and are thus adversely affected by higher food prices. Effects on the rural poor are more varied, since they depend on the structure of consumption and household crop production and marketing. In any given country, regional differences can be expected and the average household net position may vary by crop. The *2007 World Development Report* (World Bank 2007) reported that, in four out of seven surveyed countries (Bolivia, Ethiopia, Bangladesh, and Zambia), the rural poor are on average net consumers, while in the three other countries (Cambodia, Madagascar, and Vietnam) the rural poor are on average net producers (see Table 2). However, most empirical analyses suggest that the rural poor are net consumers (Weber et al. 1988; Christiansen and Demery, 2007) and therefore suffer from higher food prices. As discussed in Zaman (2008), this is because the rural poor are often constrained by small landholdings, low productivity, input costs and distance to markets. As a result, they are generally unable to produce the marketable surplus required to exceed their food expenditures. These expenditures are typically financed via the sale of household labor and engagement in other nonfarm activities.

Table 2. Net buyer/seller positions of eight low-income countries

	Bolivia	Ethiopia	Bang- ladesh	Zambia	Cam- bodia	Mada- gascar	Vietnam
	2002	2000	2001	1998	1999	2001	1998
Share of internationally traded staples in food consumption of the poor (%)	25.5	24.1	41.2	40.4	56.3	62.7	64.4
Distribution of poor (%)							
Urban (buyers)	50.9	22.3	14.9	30.0	8.4	17.9	6.1
Rural landless (buyers)	7.2	n/a	53.3	7.4	11.5	14.8	5.8
Smallholders (net buyers)	29.1	30.1	18.8	28.8	25.8	18.9	35.1
Smallholders (self-sufficient)	7.1	39.5	4.6	20.8	18.0	27.3	19.4
Smallholders (net sellers)	5.6	8.0	8.4	13.0	36.3	21.1	33.6

Source: Data derived from the World Bank's *World Development Report 2007* (www.worldbank.org).

The Net Benefit Ratio of a Food Price Shock

In a seminal piece related to the estimation of the short-run welfare impact of price changes on household welfare, Deaton (1989) postulated that the first-order welfare effect of relative food price changes is proportional to the net benefit ratio (NBR). This ratio is the difference between the consumption and production ratios. The consumption ratio is defined as the elasticity of the cost of living with respect to changes in price, which is driven by consumption shares. The production ratio is the elasticity of food sales to total household monetary income. The NBR acts as a proxy for a measure of the short-run impact of food price changes on household welfare, and can be interpreted as the elasticity of real income with respect to a food price change. For net producers this elasticity is positive, while for net consumers it is negative. The basic model used by Deaton can be represented as follows for a single household:

$$\Delta W = \Delta p_i \cdot (PR - CR)$$

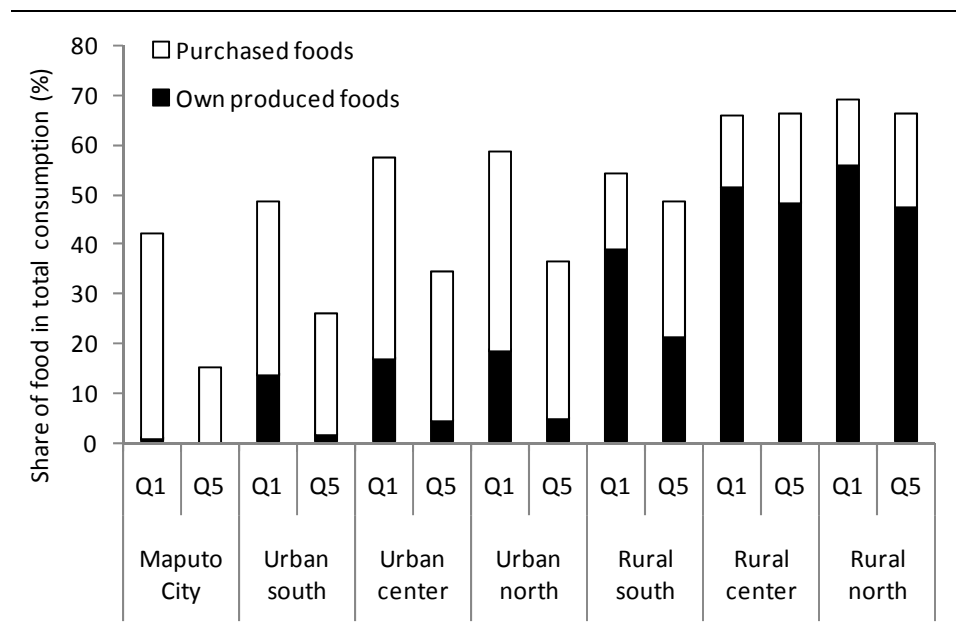
where Δw is the change in welfare, Δp is the food price change, and PR and CR are the food production and consumption ratios, respectively. The proxy used for the production ratio (PR) is the share of the value of agricultural sales and own production in total household income, while the proxy used for consumption (CR) is the share of the value of food purchases and own consumption in total household expenditures.

A brief literature review of the empirical application of this approach is provided by Zaman (2008). Deaton, in his work in Thailand, showed that, relative to either the poorer or wealthier rural households, it was middle-income farmers that benefited the most from an increase in food prices. This method was subsequently applied by Barret and Dorosh (1996) using data from Madagascar; Budd (1993) in Côte d'Ivoire and Klytchnikova and Diop (2006) in Bangladesh. These techniques do not allow for any behavioral change on the part of producers or consumers (that is, production and consumption patterns remain unchanged). The analysis thus illustrates the first-order impact of the food price shock. Second-order adjustments, such as shifts in consumption away from commodities with relatively large price increases, should dampen any negative first-order impacts. These will be considered in Section 4.

Estimating the NBR for Mozambique

Consumption ratios are calculated using data from Mozambique's 2003 nationally representative household survey, which contains the recent information on household incomes and expenditures (INE 2003).⁴ As indicated above, a household's consumption ratio is determined by its expenditure shares. At the national level, the share of food in total household consumption is 60 percent. It is highest for rural households in the northern and central regions of the country (about 70 percent), and lowest for the richest quintile in Maputo city (11 percent) (see Figure 2).

Figure 2. Own and purchased food expenditure shares



Source: Derived from authors' calculations using the 2003 national household survey (INE, 2003).

⁴ The survey was carried out from July 2002 to June 2003: 8700 households were interviewed with the reference period for consumption being one week. Households were visited at least three times during the reference period. More recent data on rural farm household net buyer status is shown in Boughton et al. (2007) and Tschirley and Abdula (2007).

Small-scale farming whereby households produce mainly for their own consumption (sometimes referred to as “own production”) is important in Mozambique. It accounts for three quarters of rural household food consumption. This suggests that rural households may be fairly insulated from variations in market prices. Indeed, even though food accounts for a larger share of total consumption in rural households, the share of *purchased* food in total food consumption is lower for rural households (25 percent) compared to urban households (81 percent). Higher dependence on marketed foods is also observed at higher income levels and in the southern region. Home consumption is less prevalent for urban households in general, and in the capital city, Maputo, consumption of own-produced foods is virtually nonexistent.

Production ratios were derived using the 2003 household survey. Although the survey does not contain specific information on agricultural production, it has information on income from the sale of agricultural output and on own household consumption levels. In the analyses that follow, agricultural production is proxied by sale of agricultural items combined with own consumption and production. Thus, the production ratio is the share of agricultural sales and own production in total household income (including own consumption). Similarly, the consumption ratio was calculated as total expenditure on all food items, including the value of own consumption relative to total household expenditure. The net benefit ratio was calculated by subtracting the consumption ratio from the production ratio, and is shown in Table 3.

Table 3. Calculation of net benefit ratios for Mozambique

	Net position (% of households)		Effect of 100 percent food price increase (%)		
	Net food sellers (NBR>0)	Net food buyers (NBR<0)	Food/total income (PR)	Food/total expenditure (CR)	Net benefit ratio (NBR)
Mozambique	58.5	41.5	65.0	64.5	0.5
Urban areas	23.7	76.3	28.3	49.7	-21.5
Rural areas	73.7	26.3	80.9	70.9	10.0
Southern region	38.4	61.6	45.4	55.2	-9.8
Urban areas	14.6	85.4	16.4	42.2	-25.8
Rural areas	51.2	48.8	60.8	62.1	-1.3
Maputo City	4.1	95.9	3.4	30.8	-27.4
Central region	65.0	35.0	72.8	69.2	3.5
Urban areas	23.5	76.5	31.5	54.2	-22.6
Rural areas	75.5	24.5	83.2	73.0	10.1
Northern region	67.8	32.2	73.3	67.7	5.6
Urban areas	36.9	63.1	42.4	58.2	-15.8
Rural areas	82.1	17.9	87.5	72.1	15.4

Source: Based on authors' calculations, using the 2003 national household survey (INE, 2003).

Note: NBR is net benefit ratio; PR is producer ratio; and CR is consumption ratio.

Household NBRs vary substantially across households. Thus, for each geographical location and income group, it is important to distinguish between net sellers (positive NBR) and net buyers (negative NBR). As shown in Table 3, 74 percent of rural households are net food sellers, whereas 76 percent of urban households are net buyers. Accordingly, the net benefit ratio is 10 percent for the rural households, and -22 percent for the urban households. This means that, on average, a 10 percent food price increase would, in the short run, raise rural real incomes by 1.0 percent and reduce urban real incomes by 2.2 percent. Table 3 also highlights sharp differences across rural and urban areas and across regions within

the country. The population in the urban south and center are most severely hurt by food price increases, followed by the urban north. Moreover, the population in the rural south is also negatively affected. Based on the NBR, rural households in the north and the center benefit as a group from rising world prices. Table 4 shows the NBR across national expenditure quintiles. The poorest households in Maputo tend, in the short run, to lose the most from food price increases, while middle-income groups in the rural north and center gain the most. This is consistent with Deaton's findings (1989).

Table 4. Net benefit ratios by expenditure quintile for Mozambique

	All households	Household expenditure quintiles				
		Q1	Q2	Q3	Q4	Q5
Mozambique	0.5	-1.6	0.9	2.9	0.9	-0.8
Urban areas	-21.5	-22.8	-20.6	-22.9	-22.4	-18.7
Maputo City	-27.4	-39.9	-32.2	-28.4	-22.9	-12.0
Southern region	-25.8	-21.6	-29.6	-32.0	-26.0	-18.6
Central region	-22.6	-27.7	-17.2	-22.0	-26.6	-20.1
Northern region	-15.8	-14.7	-15.5	-13.3	-15.4	-20.4
Rural areas	10.0	7.6	11.5	12.5	11.0	7.2
Southern region	-1.3	3.6	-1.9	-0.9	-4.1	-5.2
Central region	10.1	5.1	11.5	14.0	11.5	8.6
Northern region	15.4	14.0	18.3	16.5	16.1	11.5

Source: Based on authors' calculations, using the 2003 national household survey (INE, 2003).

4. GENERAL EQUILIBRIUM ANALYSIS

Macroeconomic Dimensions of the Price Shock

The previous section examined rising food prices from a microeconomic perspective. However, changes in terms of trade brought about by rising world prices are fundamentally macroeconomic phenomena. It is thus indispensable to consider macroeconomic dimensions, including the balance of payments, the distribution of shocks across macroeconomic aggregates, and the implications for wages. We consider each of these factors in turn.

Balance of Payments

Mozambique is a food-deficit country, importing all of the wheat and three quarters of the rice demanded internally (an amount of 470,000 and 320,000 tons, respectively, each year). Maize is both imported by the South and exported from the North, however; overall, the country is a net importer of maize. Major agricultural exports include tobacco, cashew, cotton, sugar, and fish. Overall, national accounts for 2006 indicate that the ‘free-on-board’ (FOB) value of agriculture and food exports amounted to about 90 percent of the ‘cost-insurance-freight’ (CIF) value of agriculture and food imports. Food price increases are therefore a negative terms-of-trade shock, despite being partially offset by rising prices for some agricultural exports. Table 5 provides basic information on trade for the year 2006.

Table 5. Trade in agriculture, food, and petroleum products in 2006

	Value (US\$ million)	Share of total exports/imports (%)	Share of total GDP (%)
Value of imports	2,966	100.0	43.0
Agriculture and food	351	11.8	5.1
Staple grains and derived products	153	5.2	2.2
Petroleum and petrochemicals	537	18.1	7.8
Petroleum products	361	12.2	5.2
Value of exports	1,971	100.0	28.5
Agriculture and food	318	16.1	4.6
Staple grains and derived products	4	0.2	0.1

Source: Derived from national accounts data with local currency converted to U.S. dollars (US\$) using the average exchange rate for 2006.

Table 5 also indicates that, in macroeconomic terms, the fuel price shock is likely to dominate. Fuel and petrochemical imports amounted to 18 percent of imports in 2006 compared to 12 percent for agriculture and food. Moreover, the recent price shock has centered on fuel and cereals, which represented 12 and 5 percent of imports, respectively. Since Mozambique does not export fuel or petrochemical products, there is no compensating rise in export prices to mitigate the negative terms-of-trade shock.⁵

The impacts of rising fuel prices on the balance of payments can be considered through the following equation:

$$B + P_E E - (P_N M_N + P_O M_O) = \Delta R$$

⁵ Mozambique has recently started exporting natural gas. However, these exports are relatively small, and most of the revenues accrue to foreign exploration companies. Pricing contracts are also fixed so that the natural gas price that Mozambique receives varies little with world prices for hydrocarbons.

where B represents net financial flows, E represents exports, M_o and M_n are fuel and nonfuel imports, P is world prices, and ΔR symbolizes changes in international reserves. The equation indicates that increases in world oil prices (P_o) must be accompanied by some combination of reduced fuel imports (M_o), reduced nonfuel imports (M_n), increased exports (E), increased foreign borrowing (B), or falling foreign reserves (ΔR). Since fuel prices are expected to remain high, at least over the medium term, foreign borrowing (B) and the use of foreign reserves (ΔR) can only act as transition measures.⁶ Thus, the long-run solution involves exporting more and/or importing less.

Macroeconomic Aggregates

Exporting more and importing less involves a (sometimes painful) shift in the structure of the economy away from the production of non-tradeables (for example, services) towards the production of tradeable goods, which are either exported or displace imports. Exporting more and importing less also involves a reduction in absorption, which is the measure of the total volume of goods and services available in the economy. Absorption is a measure of total welfare and can be depicted by rearranging the national income identity:

$$GDP + M - E = Absorption = C + I + G$$

where GDP is gross domestic product, M is imports, E is exports, C is household consumption, I is public and private investment, and G is recurrent government spending. With GDP staying constant, a decrease in imports and an increase in exports imply a reduction in absorption. In this case, it means that Mozambique—already one of the poorest countries in the world—becomes even poorer. If the adjustments needed to reduce imports and increase exports cause GDP (or the rate of GDP growth) to decline, then absorption is further reduced (relative to its trend rate).

Reduced absorption must be borne by consumption (C), investment (I), and/or government spending (G). The household-level analysis in Section 3 focused on changes in consumption. However, in the case of Mozambique, where foreign assistance represents half of government spending and almost all public investment, it would be possible to redirect foreign aid to subsidize food and fuel consumption. In this case, household consumption (C) would be preserved at the cost of reduced public investment (I) in education, health and other sectors. In other words, while absorption is likely to decline after a negative terms-of-trade shock, the distribution of reduced absorption across the macroeconomic aggregates of GDP is strongly influenced by policy. As shown in Section 2, policymakers in Mozambique have allowed higher world prices to be transmitted to domestic markets, without any large-scale efforts to insulate household consumption. Nevertheless, in the following section, we will consider the implications of policies to insulate domestic markets.

Wages

Rising world prices will alter Mozambique's structure of production. In general, a negative terms-of-trade shock favors the production of tradeables over non-tradeables. More specifically, production of commodities whose prices have risen, such as cereals, should increase due to enhanced profitability, while fuel-intensive producers' profitability should decline. In addition, structural changes may be driven by the shifting composition of absorption. The changing production structure will affect factor returns. For example, if rising world prices favor cereals, and if cereals production uses land and unskilled labor intensively, then land rental rates and unskilled wages should rise relative to the market returns for capital and skilled labor. In this case, a rise in rural wages following a food price increase could mitigate and even reverse the negative first-order impacts for food-deficit households.

⁶ There is no evidence that Mozambique will benefit from a significant special dispensation of donor funding to cope with the current crisis.

The impact of higher food prices on wages has been examined empirically in other countries (Zaman 2008). Ravallion (1990) uses data from Bangladesh and India to argue that, while the rural poor are adversely affected in the short run by rising food prices, the impact over the long run can be neutral after adjusting for changes in wage rates. This result is due to the response of rural wages to the price of food grains (a second-order or medium-term impact). However, the extent to which wages respond to changing food prices has been questioned by Rashid (2002). Using time series data from Bangladesh, Rashid argues that changes in rice prices since the 1980s have had a negligible effect on agricultural wages. Using data from a number of African countries, Christiansen and Demery (2006) extend this analysis by including the additional second-round effect of increased farm productivity. They conclude that policies leading to higher food prices are likely to increase poverty, even after accounting for wage and productivity effects.

The inability of Rashid (2002) and Christiansen and Demery (2006) to isolate a wage effect could be due to a number of factors, including the magnitude of the food price shock, difficulties in measuring real rural wages, the technologies employed in response to the food price shock, the size of the agricultural sector relative to the rest of the economy, and/or the degree of labor mobility between agriculture and nonagriculture. The shocks currently being confronted by the world economy and Mozambique are the largest in a generation. Accordingly, second-order effects are more likely to be significant. In light of this and other macroeconomic dimensions, we now turn to a modeling framework that attempts to capture both first- and second-order impacts of the price shock.

A General Equilibrium Model of Mozambique

The impact of higher world prices is simulated using comparative, static, computable general equilibrium (CGE) models of Mozambique. These models have a number of characteristics that make them suitable for analyzing external shocks, trade and tax policies, income distribution, and structural change. First, CGE models simulate the functioning of a market economy, including markets for labor, capital and commodities, and model how changes in economic conditions are mediated through price and quantity adjustments. Second, the structural nature of these models permits a decomposition of multiple shocks, such as simultaneous increases in fuel and food prices. Third, CGE models respect economywide constraints, including the balance of payments and macroeconomic aggregates. Fourth, CGE models contain detailed sectoral disaggregation of data, allowing for differential price increases across commodities. Finally, these models provide a theoretically consistent framework for welfare and distributional analysis.

The structure and behavioral specification of a CGE model determines its results. As shown in Table 6, the Mozambique model contains 51 activities or shall we say commodities, including 23 agricultural sectors.⁷ Five factors of production are identified: three types of labor (unskilled, semi-skilled, and skilled); agricultural land; and capital. Segmented rural and urban labor markets distinguish between rural nonfarm and urban economies. Labor and agricultural land are assumed to be fully employed, while capital is immobile, earning only sector-specific returns. Within this structure, and subject to macroeconomic constraints, producers (according to the model) maximize profits under constant returns to scale, with the choice between factors governed by a constant elasticity of substitution (CES) function.⁸ Factors are then combined with fixed-share intermediates using a Leontief specification, which captures the varying fuel intensity of sectors. Under profit maximization, factors receive income where marginal revenue equals marginal cost based on endogenous relative prices. Thus, macroeconomic wage effects in the model are endogenously determined by sector-specific factor demands and economywide factor supply constraints.

⁷ Thurlow (2008) and McCool et al. (forthcoming) describe the CGE model and the 2003 social accounting matrix (SAM) to which it is calibrated.

⁸ Assuming that fixed rigid production technologies are relatively fixed over the medium term, we assume low and uniform factor substitution elasticities (0.5).

Table 6. Structure of the Mozambican economy in 2003

SAM* sectors	Sector or group name	GDP share (%)	Production share (%)	Export share (%)	Export intensity	Import share (%)	Import intensity
	Total GDP	100.0	100.0	100.0	11.5	100.0	23.5
1-21	Agriculture	25.9	15.4	20.3	14.9	3.3	5.2
1	Maize	3.5	1.9	0.2	1.0	0.3	4.1
2	Sorghum	1.1	0.6	0.0	0.0	0.0	0.0
3	Unshelled rice	0.7	0.4	0.0	0.0	0.0	0.0
4	Wheat	0.0	0.0	0.0	0.0	1.7	100.0
22	Mining	0.3	0.4	0.3	4.9	0.2	6.7
23-40	Manufacturing	13.7	20.5	54.5	35.4	70.1	56.9
32	Gasoline	0.0	0.0	0.0	0.0	0.8	100.0
33	Diesel	0.0	0.0	0.0	0.0	7.0	100.0
34	Other fuels	0.0	0.0	0.0	0.0	2.3	80.5
35	Other petrochemicals	0.4	0.6	0.3	6.1	10.0	74.5
37	Metals	5.2	5.8	48.0	94.8	5.3	71.2
41-43	Construction and energy	9.2	13.9	11.2	79.8	5.4	79.6
44-51	Services	50.9	49.7	13.7	3.2	21.0	9.2

Source: Based on data from Mozambique's 2003 social accounting matrix (SAM) (McCool et al., forthcoming).

Notes: The acronym SAM stands for "social accounting matrix," a system that is used in Mozambique to track the structure of the economy. "GDP" refers to value-added at factor cost, and "Production" refers to total sales by domestic activities. "Export intensity" is the share of exports in domestic output, and "import intensity" is the share of imports in total domestic demand.

As discussed earlier, higher fuel prices will reduce foreign exchange availability, forcing Mozambique to export more and import less. Accordingly, sectors with high trade shares (either a large share of production exported or a high degree of import competition) are expected to expand more than non-traded sectors. Fuel is especially crucial since it is entirely imported and does not have domestic or imported substitutes. The Mozambique model captures changes in international trade by allowing producers and consumers to shift between domestic and foreign markets depending on changes in the relative prices of imports, exports and domestic goods. Under a constant elasticity of transformation (CET) function, profit maximization drives producers to sell in markets where they achieve the highest returns based on domestic and export prices (where the latter is determined by the world price multiplied by the exchange rate adjusted for internal transaction costs). Conversely, under a CES Armington function, cost-minimization determines final and intermediate demand for imported and domestic goods based on relative prices (both of which include relevant taxes).⁹ Under a small country assumption, Mozambique faces perfectly elastic world supply and demand at fixed world prices.

Various institutions are identified in the model, including enterprises, the government, and ten representative household groups (that is, rural and urban households disaggregated across national income quintiles). Households and enterprises receive income in payment for producers' use of their factors of production, then pay direct taxes to the government (based on fixed tax rates) and save (based on marginal propensities to save). Enterprises pay their remaining income to households which, in turn, use their income to consume commodities under a linear expenditure system (LES) of demand. Each household in the CGE model is then linked to its corresponding households in the 2002 household survey (INE, 2003). Under this expenditure-side, micro-simulation module, changes in representative households' consumption and prices in the CGE model are imposed on the survey, where household consumption expenditures are recalculated. This new level of per capita expenditure for each survey household is compared to the official poverty line, and standard poverty measures are recalculated. The

⁹ Trade function elasticities are taken from the "Global Trade and Analysis Project" at Purdue (Dimaranan, 2006).

Mozambique model thus simultaneously accounts for wage- and price-effects in determining households' real incomes and poverty outcomes.

The government receives income from sales, direct taxes and import tariffs, which it uses to purchase commodities in the form of government recurrent expenditure. The remaining income of government is (dis)saved. All domestic and foreign savings (that is, foreign borrowing and assistance) are collected in a savings pool from which investment is financed. Here, three closure rules are used to capture the macroeconomic dimensions of the price shock. First, government recurrent expenditure is fixed and the fiscal deficit (that is to say, public savings or investment) adjusts to align revenues with total expenditures. Second, a savings-driven closure is assumed in order to balance the overall savings-investment account (meaning that household and enterprise savings rates are fixed and investment adjusts to changes in incomes and the fiscal deficit to ensure that the level of investment and savings are equal). Finally, for the current account, it is assumed that the exchange rate adjusts to maintain a fixed level of foreign savings (in other words, the external balance is held fixed in foreign currency). Together these three closure rules allow the model to capture the balance of payments constraint and absorption trade-offs discussed earlier.

Impact Simulations and Results

Simulation Descriptions

This paper focuses on the impact of the world price increases taking place between the second half of 2007 and into 2008. However, the CGE model is calibrated to a 2003 base social accounting matrix (SAM), raising the issue of what magnitude price shock should be imposed on the model. For instance, oil prices rose more than threefold during 2003-2008 (from US\$32 to greater than US\$100 per barrel), but this increase did not occur all at once. Between 2003 and 2006, the world price for oil doubled to US\$64 a barrel. This price rise is responsible for the higher fuel import shares shown in Table 5 for 2006, as compared to Table 6, which shows data for 2003 with a price rise of 10 to 12 percent. The intention of the modeling effort is to gain insights into the impacts of the recent price increases using available tools and data. For the purposes of the CGE model, tripling oil prices seems unrealistic. It was decided that the model should be shocked with only the 2007-2008 price increases. The "thought experiment" explored through the model thus considers what would have happened in 2003 had fuel and food prices increased in similar proportions to the recent world price increases.

The actual shocks applied are depicted in Table 7. The shocks applied tend to be somewhat smaller in magnitude than the price increases depicted in Table 1. Inflation explains a part of the difference. The shocks applied should reflect real price increases while the shocks in Table 1 reflect nominal price increases in U.S. dollars. Also, while the authors believe that the current higher price environment is likely to endure in the medium term (3-5 years), they also believed it was likely that commodity prices would come off of the peaks registered in the middle of 2008 (such as oil at US\$145 per barrel), which has indeed occurred. Overall, the objective of the shocks is to reasonably capture the shift in international relative prices that occurred in late 2007 and into 2008.

Table 7. World price shocks

Agriculture and food price simulations		Fuel price simulations	
Commodity	Shock (%)	Commodity	Shock (%)
<i>Agricultural commodities</i>		<i>Petroleum and petrochemicals</i>	
Maize	75	Gasoline	75
Sorghum	50	Diesel	75
Rice	75	Other fuels	75
Wheat	75	Other petrochemicals	25
Pulses and groundnuts	50		
Horticulture	25		
Raw tobacco	25		
Cotton	25		
Livestock	25		
<i>Processed agricultural commodities</i>			
Meat and fish products	40		
Other processed foods	40		
Grain flours	50		
Processed sugar	40		
Processed tobacco	25		
Processed cotton	25		

Note: Equivalent shocks are applied to world export and import prices.

Four simulations were run to analyze the impact of the price shocks. The first simulation (“Fuel”) uniquely shocks fuel prices. The second simulation (“Food–Fixed land”) considers the shocks to agriculture and processed food prices under the assumption that land allocations between crops cannot be altered (that is to say, it is a very short-run scenario with similar assumptions to the household survey analysis in Section 3). The third simulation (“Food– Flexible land”) considers the shocks to agriculture and processed food prices when assuming that farmers can reallocate land across crops (that is, when there is a stronger supply response). This implies a one to three year adjustment period. The fourth simulation (“Combination”) combines the first and third simulations.

Model Results

The impacts of the fuel and food price shocks are depicted in Tables 8-11. Macroeconomic impacts are shown in Table 8. As suggested by the structure of imports presented earlier in this section, the fuel shocks generate more severe impacts on the overall terms of trade. The decline in the terms of trade due to fuel price increases is more than double the decline due to food price increases. Macroeconomic impacts from higher fuel prices are commensurately larger than from food prices. Compared with the food price shocks, the fuel shocks force a larger increase in the quantity of exports and a larger decrease in the quantity of imports in order to balance the external account. Due principally to these changes in trade flows, the decline in total absorption (or overall welfare) under the “Fuel” simulation (3.5 percent) is approximately double the decline registered for either of the “Food” simulations.

Table 8. Macroeconomic results for world price shocks

		Change from base year value (%)			
		Fuel scenario	Food scenario		Combined scenario
			Fixed land	Flexible land	
Quantities	GDP	-0.6	-0.5	-0.5	-1.2
	Absorption (C+I+G)	-3.5	-1.8	-1.8	-5.1
	Consumption (C)	-5.8	-1.9	-1.8	-7.3
	Investment (I)	1.5	-2.5	-2.8	-1.2
	Recurrent public spending (G)	0.0	0.0	0.0	0.0
	Exports (E)	5.6	0.6	1.0	5.9
	Imports (M)	-6.4	-4.0	-3.7	-9.6
Prices	Nominal exchange rate	4.5	-5.0	-5.6	-1.5
	Real exchange rate	15.4	1.3	0.6	15.2
	Terms of trade	-12.9	-4.8	-4.8	-16.2

Source: Based on results from the Mozambique CGE model.

As emphasized above, the components of absorption are influenced by economic structure and macroeconomic closure rules. The heavy dependence of Mozambique on foreign savings implies that real investment depends in part on the nominal exchange rate. <<Depreciation (appreciation) of the nominal exchange rate increases (decreases) the local currency value of investment and can lead to a real increase (decrease) in investment under a savings-driven closure. While the “Food” and “Fuel” simulations lead to a real depreciation of the currency, the nominal currency value moves in opposite directions between the two sets of simulations. In the two “Food” simulations, the increases in world prices for agricultural and processed commodities automatically shift relative prices towards tradeable commodities. The relative price shift towards tradeables generated by the world price increases is in fact so strong that the nominal currency actually appreciates in order to reestablish external balance. By contrast, in the “Fuel” scenario, the world price increases do little to shift the price ratio between tradeable and non-tradeable sectors, because both sectors use fuel as an intermediate input (and there is very little domestic production of fuel and petrochemicals). As a result, a strong nominal depreciation is required to balance the external account.

Principally as a result of opposing movements in the nominal exchange rate, real investment rises under the “Fuel” simulation (because foreign assistance lays greater claim to domestic resources, due to the depreciated currency) and decreases in the two “Food” simulations (for the same reasons, but in an opposite direction). Since real government consumption is fixed in real terms across all scenarios, the decline in absorption in the “Fuel” scenario is borne entirely by household consumption, and household consumption must decline further to accommodate the rise in the real value of investment. Overall, real household consumption in the “Fuel” scenario falls by more than three times the declines registered in the two “Food” simulations due to a larger decline in absorption overall, and differential movements in the components of absorption, particularly investment.

The differences between the “Fixed” and “Flexible” food simulations manifest themselves primarily through the production response. With flexible land, agricultural production can be reallocated towards export crops, particularly those whose world prices are rising, permitting a greater increase in exports than in the fixed land simulation. Furthermore, the export stimulus and import compression are achieved with a smaller decline in the real exchange rate.

The combined effects of the “Fuel” and “Food” scenarios, which are the actual shocks that Mozambique received, are considerable. The “Combined” scenario shows effects that are roughly the sum of the two preceding scenarios. Terms of trade decline by more than 16 percent and, in order to balance the external account, exports increase by nearly 6 percent and imports decline by almost 10 percent.

These shifts in production generate a decline in GDP of slightly more than 1 percent. All of these adjustments imply a reduction in the quantity of goods and services in the economy, resulting in a reduction in absorption of more than 5 percent. Since recurrent government expenditure is assumed to be fixed, and investment declines by only 1.2 percent, household consumption bears the bulk of the adjustment, declining by more than 7.0 percent. This is a substantial decline in a country where approximately half of all households are considered absolutely poor (meaning they experience difficulty meeting caloric needs).

The implications of the world price shocks for production are presented in Table 9. The table shows, in the first column, the share in value-added of each sector depicted at base 2003 values. For ease of interpretation, most depicted sectors are aggregates of the sectors available in the 2003 SAM, and employed in the CGE model. In the columns under each simulation, the percentage change in the real output of each sector relative to the base can be seen. Across all simulations, exporting and import-competing sectors are favored. The food price shocks particularly favor export products that experience price increases. In the combined scenario, particularly strong growth is registered in “Export crops,” led by tobacco and cotton; and “Processed products,” led by processed cotton and processed sugar. Production of non-tradeables, such as root crops (which are dominated by cassava, the largest single crop in value-added terms) and services (which represent about half of the economy) decline in all scenarios. These declining sectors free resources that permit the tradeables’ sectors, particularly the export sectors, to expand.

Table 9. Sectoral production results for world price shocks

	Base value-added share (%)	Change from base year value-added (%)			
		Fuel scenario	Food scenario		Combined Scenario
			Fixed land	Flexible land	
Agriculture	25.9	0.2	0.6	0.5	0.7
Cereal crops	5.3	-0.8	3.1	3.2	2.9
Roots crops	7.2	-0.9	0.3	-0.9	-1.8
Pulses and groundnuts	2.3	1.1	1.4	3.0	4.2
Horticulture	3.3	-1.2	0.6	-0.7	-1.7
Export crops	1.1	9.4	5.3	11.9	21.2
Livestock	1.7	-0.4	3.9	4.1	4.2
Forestry	2.7	-0.3	-1.1	-1.2	-1.9
Fishery	2.3	3.8	-7.2	-7.9	-5.9
Nonagriculture	74.1	-0.2	-0.3	-0.3	-0.5
Industry	23.1	1.0	0.2	0.3	1.4
Mining	0.3	-0.1	-0.3	-0.4	-0.5
Manufacturing	13.7	1.0	1.7	2.1	3.2
Primary product processing	7.4	1.3	3.3	4.1	5.7
Other industry	9.1	1.1	-2.0	-2.3	-1.2
Electricity	1.9	1.7	-1.3	-1.5	0.2
Water	0.3	-2.2	-0.1	0.0	-2.1
Construction	7.0	1.0	-2.3	-2.6	-1.5
Services	50.9	-0.7	-0.5	-0.6	-1.4

Source: Results calculated from the Mozambique CGE model.

These results highlight the importance of export supply response, with particular emphasis on the agricultural sector. Agriculture and derived products comprise the large bulk of the export response with particular emphasis on cashew, tobacco, cotton, sugar, and other processed foods. Exports from these sectors are projected to approximately double, although the increases take place from relatively small

bases. Biofuels represent another export potential that is not modeled here but is considered in detail in Arndt et al. (2008).

A robust export response is crucial to avoid severe import compression. Even with the export response attained, the onus of adjustment is already taking place, largely on the import side. This can be seen from the macroeconomic impacts shown in Table 8. Import values are about double those of exports, and the percentage decline in imports is greater in absolute value than the relative expansion of exports. While export responses tend to concentrate in specific sectors, imports decline across the board. Particularly large declines in imports are registered in products where domestic sectors compete strongly with imports, such as maize, grain milling, and meats.

Implications for factor prices are shown in Table 10. As discussed above, both shock vectors stimulate tradeable agriculture and processed foods. These sectors use unskilled (primarily rural) labor intensively, though the stimulus to these sectors is much more pronounced in the “Food” simulations. In nearly all cases, urban wages decline more than rural wages. The exception is urban skilled labor in the “Fuel” scenario, which benefits from a fairly broad-based expansion of traded nonagriculture. Relative to other factors, the food shocks favor unskilled rural labor and land. Under the “Fixed land” scenario, the returns to rural labor and land are lower than under the “Flexible land” scenario. The relatively large differential impacts across factors in the food simulations carry over into the “Combined” simulation, where rural labor, especially unskilled labor, fares better than urban labor and capital. There is also a pronounced positive impact on economic returns to agricultural land.

Table 10. Factor price results for world price shocks

		Change from base year factor prices (%)			
		Fuel scenario	Food scenario		Combined Scenario
			Fixed land	Flexible land	
Rural labor	Skilled	-5.2	2.9	3.3	-1.6
	Semi-skilled	-5.8	0.7	0.9	-4.6
	Unskilled	-5.3	3.7	4.2	-0.7
Urban labor	Skilled	-4.0	-1.6	-1.5	-5.7
	Semi-skilled	-7.4	-1.1	-0.9	-8.2
	Unskilled	-6.8	-0.9	-0.7	-7.3
Capital		-5.5	-1.5	-1.5	-6.4
Agricultural land		-4.2	11.4	12.4	9.5

Source: Results are derived from the Mozambique CGE model.

Welfare implications, measured as the percent change in equivalent variation, are presented in Table 11. As discussed in Section 3, substantial home consumption among rural households provides considerable insulation from both fuel and food price shocks. In addition, as shown in Table 10, rural wages rise relative to urban wages, particularly in response to food price shocks. As a result of these consumption and income impacts, rural households are less strongly affected than urban households in all simulations. The stimulating effect of improved agricultural terms of trade for the rural economy does not outweigh the negative impacts of the fuel shock, and in the “Combined” simulation, welfare declines for all households. The degree of land ownership is the primary factor differentiating outcomes across quintiles in rural areas. The results for the “Fixed land” scenario are consistent with the household-level analysis in Section 3, which showed middle-quintile rural households faring better than others under the food price shock. In urban areas, welfare losses are large in magnitude and relatively constant across the income distribution.

Table 11. Change in equivalent variation and poverty for world price shocks

		Base year value	Change from base year (%)			Combined Scenario
			Fuel scenario	Food scenario		
				Fixed land	Flexible land	
Equivalent variation						
National			-5.9	-2.1	-2.0	-7.4
Rural households	Quintile 1		-3.4	-0.7	-0.9	-3.9
	Quintile 2		-3.6	-0.1	-0.1	-3.2
	Quintile 3		-3.7	0.3	0.4	-2.7
	Quintile 4		-4.2	-0.1	0.2	-3.4
	Quintile 5		-5.1	-0.3	0.1	-4.4
Urban households	Quintile 1		-5.4	-5.3	-5.8	-11.1
	Quintile 2		-6.2	-5.6	-5.8	-11.6
	Quintile 3		-6.0	-5.0	-5.3	-10.9
	Quintile 4		-7.1	-4.5	-4.5	-11.1
	Quintile 5		-7.1	-2.8	-2.7	-9.4
Poverty headcount						
National		54.1	57.6	55.1	54.9	58.2
Rural households		55.3	58.3	55.4	55.2	57.7
Urban households		51.5	56.2	54.3	54.2	59.5

Source: Results were calculated from the Mozambique CGE model.

Poverty impacts are significant, particularly in urban areas. Table 11 shows that the combined shocks result in a percentage increase of four points in the national poverty headcount rate. The effect is much stronger in urban areas where the poverty rate increases by eight percentage points. In fact, the “Combined” simulation sets the urban poverty rate above the rural rate. Fuel price increases are the principal driver of increased poverty in both rural and urban zones. As would be expected, the capacity to reallocate land reduces poverty, with the effect being slightly stronger in rural zones.

5. POLICY RESPONSES

A number of policy responses to the rising food and fuel prices are simulated in this section using the Mozambique CGE model. First, in the “Subsidies” scenario, we examine the impact of applying fuel and food subsidies at the Mozambican border. These subsidies are designed to eliminate 25 percent of the international price increases for all of the commodities shown in Table 7. Secondly, in the “Liberalization” scenario, we eliminate import tariffs on agricultural products and processed foods. However, fuel taxes, which generate significant revenues, are maintained. Finally, in the “Agricultural technology” scenario, we model investments in the agricultural sector that are presumed to lead to a 10 percent improvement in total factor productivity across all agricultural sectors. A primary difficulty in analyzing such a policy revolves around uncertainty as to the costs and institutional arrangements required to achieve the productivity gains. These issues are not addressed here. However, in order to emphasize that costs will be incurred, a 10 percent increase in recurrent government spending is imposed on the model alongside the agricultural productivity gains. Consistent closure rules are applied, implying that the incremental spending is deficit-financed. Tables 12-15 present results of the three policy response simulations, and are in the same format as Tables 8-11, which presented the price impact results. All three policy simulations are compared to the “Combined” simulation, which depicts the price shocks under the assumption of a constant policy environment.

Table 12. Macroeconomic results for policy responses

		Change from base year value (%)			
		Combined scenario	Subsidies (food and fuel)	Liberalization (food only)	Agricultural technology
Quantities	GDP	-1.2	-1.1	-1.2	1.2
	Absorption (C+I+G)	-5.1	-5.3	-5.2	-3.1
	Consumption (C)	-7.3	-5.3	-7.1	-3.9
	Investment (I)	-1.2	-8.2	-2.0	-7.8
	Recurrent public spending (G)	0.0	0.0	0.0	10.0
	Exports (E)	5.9	7.6	6.7	7.1
	Imports (M)	-9.6	-9.5	-9.4	-8.8
Prices	Nominal exchange rate	-1.5	0.5	-0.7	13.5
	Real exchange rate	15.2	17.4	16.2	-2.9
	Terms of trade	-16.2	-16.2	-16.2	3.5

Source: Results are derived from the Mozambique CGE model.

Table 13. Sectoral production results for policy responses

	Base value-added share (%)	Change from base year value-added (%)			
		Combined scenario	Subsidies (food and fuel)	Liberalization (food only)	Agricultural technology
Agriculture	25.9	0.7	1.0	0.7	8.7
Cereal crops	-0.9	2.9	3.0	2.7	11.6
Roots crops	1.1	-1.8	-1.6	-1.9	6.8
Pulses and groundnuts	-1.2	4.2	4.4	4.5	14.5
Horticulture	9.4	-1.7	-1.4	-1.7	7.4
Export crops	-0.4	21.2	20.3	22.1	37.1
Livestock	-0.3	4.2	4.4	3.8	10.7
Forestry	3.8	-1.9	-1.4	-1.8	-2.6
Fishery	-0.2	-5.9	-4.0	-5.2	3.0
Nonagriculture	1.0	-0.5	-0.6	-0.5	0.4
Industry	-0.1	1.4	-0.1	1.2	0.4
Mining	1.0	-0.5	-0.1	-0.4	-1.5
Manufacturing	1.3	3.2	3.6	3.2	4.8
Primary product processing	1.1	5.7	6.5	5.6	8.7
Other industry	1.7	-1.2	-5.8	-1.6	-6.0
Electricity	-2.2	0.2	0.6	0.4	-1.3
Water	1.0	-2.1	-1.7	-2.2	-1.5
Construction	-0.7	-1.5	-7.6	-2.2	-7.4
Services	0.0	-1.4	-0.9	-1.4	0.4

Source: Results calculated from the Mozambique CGE model.

Table 14. Factor price results for policy responses

		Change from base year factor prices (%)			
		Combined scenario	Subsidies (food and fuel)	Liberalization (food only)	Agricultural technology
Rural labor	Skilled	-1.6	1.5	-1.5	0.4
	Semi-skilled	-4.6	-2.9	-4.7	-0.5
	Unskilled	-0.7	2.4	-0.6	-1.4
Urban labor	Skilled	-5.7	-3.8	-5.6	0.7
	Semi-skilled	-8.2	-6.0	-8.2	-1.8
	Unskilled	-7.3	-5.6	-7.4	-3.2
Capital		-6.4	-5.0	-6.4	-7.0
Agricultural land		9.5	13.3	9.8	5.5

Source: Results calculated from the Mozambique CGE model.

Table 15. Change in equivalent variation and poverty for policy responses

		Base year value	Change from base year (%)			
			Combined scenario	Subsidies (food and fuel)	Liberalization (food only)	Agricultural technology
Equivalent variation						
National			-7.4	-5.4	-7.2	-4.1
Rural households	Quintile 1		-3.9	-1.8	-3.6	0.0
	Quintile 2		-3.2	-0.8	-2.8	-0.2
	Quintile 3		-2.7	-0.3	-2.3	0.3
	Quintile 4		-3.4	-0.8	-3.0	-0.9
	Quintile 5		-4.4	-1.9	-4.1	-2.9
Urban households	Quintile 1		-11.1	-9.8	-10.9	-4.5
	Quintile 2		-11.6	-9.9	-11.4	-6.2
	Quintile 3		-10.9	-9.4	-10.7	-5.3
	Quintile 4		-11.1	-9.2	-10.9	-6.9
	Quintile 5		-9.4	-7.7	-9.3	-6.0
Poverty headcount						
National		54.1	58.2	56.8	58.0	55.7
Rural households		10.7	57.7	55.9	57.3	56.1
Urban households		9.6	59.5	58.6	59.5	54.9

Source: Results are derived from the Mozambique CGE model.

Food and Fuel Subsidies

As discussed earlier, the food and fuel subsidies provide benefits to consumers, but these short-term gains come at the expense of investment for the future. Table 12 indicates that household consumption declines by two percentage points less than in the “Combined” simulation. However, investment declines by a further six percentage points due to the finance required for subsidization. Consistent with the household consumption aggregate, household welfare analysis, shown in Table 15, illustrates a percentage gain of two points relative to the “Combined” scenario. Interestingly, rural households gain relatively more than urban households across all quintiles, even though urban households are by far the principal consumers of imported foods. This is also reflected in the poverty rates, which show a larger mitigation effect for rural than urban households. Within each zone, the incidence of the subsidy is relatively even across household expenditure quintiles, with a slight tendency for higher-income households to benefit more.

The relatively larger gains registered by rural households in the “Subsidy” scenario stem from second-order macroeconomic impacts. By subsidizing expensive fuel and food imports, the subsidy effectively increases the macroeconomic burden of adjustment, particularly with respect to the balance of payments. Greater imports of fuel and food imply increased foreign currency needs that, in turn, require an even more dramatic export response and/or greater import compression in non-subsidized sectors. From Table 12, one sees that the subsidy forces the largest cut in absorption (the best economywide indicator of welfare) of any scenario. This is because it requires the largest increase in exports and a reduction in imports. These adjustments are achieved via a substantial depreciation of the real exchange rate, which provides even greater stimulus to agricultural exports.

Overall, while large-scale subsidies enhance household welfare in the short run, they are expensive, not particularly well targeted, and they exacerbate the burden of macroeconomic adjustment. If financing the subsidies reduces the investment budget, future growth is likely to be sacrificed. Although we do not model subsidy policies in this study, they can sometimes prove difficult to administer and are often subject to fraud. Finally, international experience indicates that, once enacted, general subsidies can prove to be exceedingly difficult to remove, thus generating a long-term drain on government finances.

Trade Liberalization

Trade liberalization is the second policy response considered. In principle, trade liberalization is equivalent to subsidization at the Mozambican border if the subsidy simply offsets the tariff. However, because tariffs are relatively low in Mozambique, the subsidy analyzed above brought domestic prices below world price equivalents. Hence, trade liberalization implies a much smaller loss in revenue. In addition, a zero tariff is much easier to administer than an overlapping tax and subsidy policy. Though not modeled here, reduced border tariffs also tend to reduce evasion, thus providing a further cushion to the revenue effect of reduced border tariffs through greater collection of VAT (value-added tax) at the border.¹⁰ Finally, reduced or eliminated tariffs are consistent with Mozambique’s fundamental open economy policy stance.

Since tariff rates are already relatively low (though effective protection rates for some processing sectors, such as grain milling, are high), the economywide impacts of reducing tariffs are relatively small. Household welfare, shown in Table 15, increases marginally with the gains fairly evenly distributed across rural and urban areas and across expenditure quintiles. A shift in the components of absorption (that is to say, a reduction in investment) contributes to these gains. Trade liberalization also opens the economy to the world, engendering an increase in exports and a decrease in imports. These adjustments may be unwelcome during a period when similar adjustments are required to confront the commodity price shocks.

In summary, the world price shocks may provide an opportunity to undertake selected trade liberalization that should be done anyway, particularly reducing high, effective protection rates afforded

¹⁰ See Arndt and Tarp (2008), and van Dunem and Arndt (2006) for a discussion on the relationship between tax rates and tax evasion in Mozambique.

to some food processing sectors. Given the regional differentiation of the Mozambican economy, these tariff reductions may provide some relief to consumers in urban centers, particularly in Maputo where the import intensity of demand is highest. However, at the same time, the moment is likely inopportune for a policy-induced shutdown of some food processing factories. The prudent way forward is likely to involve incremental liberalization and thus commensurately smaller gains for consumers.

Agricultural Technology

The final policy scenario indicates that improved agricultural technology is the preferable policy response to higher world prices. Agricultural technology improvements represent a powerful impetus to the economy (see Table 12). As a result of the productivity gain and associated increase in agricultural production, the economy achieves substantial gains in exports and a reduction in imports. Unlike in previous scenario, the real exchange rate actually appreciates due to better export performance. The reduction in absorption is about 40 percent smaller than in the “Combined” scenario. In addition, by increasing marketed surplus, agricultural technology gains reduce agricultural commodity prices. Thus, the gains from agricultural technology accrue primarily to urban households (see Table 15). This usefully offsets the impacts of the world price shocks, whose adverse effects are concentrated on urban households. Despite the domestic commodity price declines, rural households also experience significant gains in welfare. Within rural and urban zones, the registered gains are strongly progressive across income quintiles.

However, while the benefits of improved agricultural productivity are pronounced, the potential source of these gains remains unclear. Enhancing agricultural productivity in Mozambique has been on the policy agenda since the end of the civil war in the early 1990s. Unfortunately, little has been achieved to date (Uaiene, 2008), and whatever gains have taken place are difficult to ascribe to actions undertaken by the government (Arndt et al. 2006). Thus, while this policy scenario underlines the long-term importance of expanding agricultural production, experience suggests that this will be difficult to achieve and is unlikely to address the immediate impacts of the current food and energy crisis.

Some other policy responses are also being considered, but are not examined here. For example, a common recommendation from the World Bank to low-income countries is to expand social protection programs. Mozambique has an existing social protection program, which distributes cash to poorer families. However, this program is already set to expand in 2008-09, and extending it further would place considerable pressure on administrative capacity. Moreover, even with the planned expansion, the program will remain very small from an economywide perspective.¹¹ Subsidizing urban public transport is also being considered as a means of offsetting the increased costs necessitated by higher fuel prices. However, public transport passengers, while not necessarily rich, are also not typically among the most vulnerable groups. Transport subsidies can also become expensive and difficult to administer. Nevertheless, directing public funds to urban transport can be desirable, although the overall goal is to integrate transport subsidies within a more comprehensive urban investment plan.

¹¹ CGE models are well suited to examining large-scale social protection programs as there is a strong likelihood of economywide impacts. The current program in Mozambique is too small to generate substantial general equilibrium impacts; hence, there is limited value to analyzing the program in a CGE framework.

6. CONCLUSION

The impacts of rising world fuel and food prices were analyzed using three approaches aimed at capturing the short-term and longer term effects as well as differential impacts across rural and urban households in different regions of the country. The findings indicate that the world price increases registered in international markets since October 2007 represent a substantial negative terms-of-trade shock for Mozambique. Moreover, significant policies to insulate domestic fuel and food markets from the international price increases have not been put into place. Evidence from domestic price series indicates that the world price rises are being transmitted to the domestic economy. A poor person's consumer price index (PCPI), developed for this analysis, indicates that the increase in the cost of the basket of commodities consumed by lower income households is similar to the increases registered for the average economywide basket. However, regional differences were observed. Net benefit ratio analysis indicates that urban households and households located in the South are generally more vulnerable to food price increases, while rural households often benefit from their net seller position, particularly those in the middle of the income distribution.

Analysis using a CGE model of Mozambique indicates that the fuel price shock is more important from both macroeconomic and poverty perspectives. The CGE model simulations also highlight the importance of agricultural production response in general, and export response in particular. The findings from all approaches conclude that the macroeconomic and poverty impacts of the world price increase will be negative and substantial, particularly for urban households. The analysis of policy responses points to difficult trade-offs between short-run mitigation and long-run growth. Moreover, while improving agricultural productivity is most effective in addressing the adverse effects of higher food (and fuel) prices, expanding agricultural production will remain difficult despite improved agricultural terms of trade.

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2033 K Street, NW
Washington, DC 20006-1002 USA
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Fax: +1-202-467-4439
Email: ifpri@cgiar.org

IFPRI ADDIS ABABA

P. O. Box 5689
Addis Ababa, Ethiopia
Tel.: +251 11 6463215
Fax: +251 11 6462927
Email: ifpri-addisababa@cgiar.org

IFPRI NEW DELHI

CG Block, NASC Complex, PUSA
New Delhi 110-012 India
Tel.: 91 11 2584-6565
Fax: 91 11 2584-8008 / 2584-6572
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