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Impact of Rising World Rice Prices on Poverty and Inequality in Burkina Faso

Félix Badolo and Fousseini Traoré*

Between January 2006 and April 2008, the prices of most agricultural products rose considerably in international markets. Empirical studies show that this spike in world food prices increased the number of poor households in developing countries, but the extent was not the same in all countries. This article assesses the impact of rising rice prices on poverty and income inequality in Burkina Faso, using a methodology based on the concept of compensating variation combined with the net benefit ratio (NBR) developed by Deaton (1989) and a living standard survey (QUIBB, 2003). The results show that higher prices have a negative impact on income and poverty in the regions with a large proportion of households that are net buyers of rice. The poverty rate increases by 2.2 to 2.9 percentage points depending on the assumptions, the increase being higher in urban areas than in rural areas. Rising rice prices also increase income inequality, which increases particularly in urban areas and in relatively rich regions, but decreases in poor regions with a large proportion of rice producers.

Key words: Developing countries, market pricing, poverty, inequality

1 Introduction

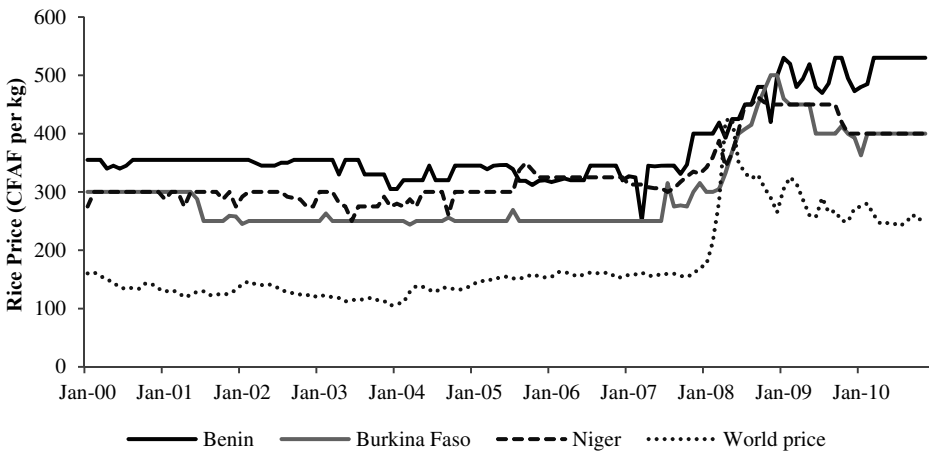
Between 2006 and 2008, the prices of most agricultural products increased considerably in international markets. The wheat price more than doubled between March 2007 and March 2008, the rice price tripled from January to April 2008, and the maize price doubled between July 2007 and June 2008 (World Bank, 2008). This increase in food prices was able to affect households' income in low-income countries since their food expenditures represent an important proportion of total expenditures. In addition, their income depends heavily on agricultural production. Farmers are expected to benefit from higher prices because they will see an increase in their income that can offset rising food prices. In contrast, consumers are likely to be adversely affected by rising food prices.

The nature and magnitude of the effects of higher world prices on producers and consumers in low-income countries depend on how these countries respond to spikes in prices. Indeed, these effects differ according to market structures and public intervention mechanisms. The spike in food prices in 2007-8 led to a 26% and 16% increase in prices in

*Respectively, Visiting Scientist, International Crops Research Institute for the Semi-Arid Tropics, BP 320 Bamako, Mali; and Research Fellow, International Food Policy Research Institute, 2033 K St, NW, Washington, DC (Fousseini.Traore@cgiar.org). They thank Catherine Araujo Bonjean and Nicolas Minot for their helpful comments.

Vietnam and Chile respectively. Even in countries where inflation was historically low (for example West Africa Economic and Monetary Union member countries),[1] prices increased significantly over the period (see Figure 1). Indeed, the increase in the world rice price over the period June 2007 to June 2008 led to an average increase of 30% in domestic prices in WAEMU countries. With regard to Burkina Faso, domestic prices increased by 27%, varying from 315 CFAF[2] per kg in June 2007 to 400 CFAF in June 2008. From 2007 to 2011, domestic prices increased by 33%. A recent study applied to Burkina Faso shows that 20% to 30% of the increase in world prices is transmitted to domestic markets in the short run (Badolo, 2012).

Figure 1: Evolution of domestic and international rice prices, January 2000-July 2010 (CFAF per kg)



Source: Authors'computation using data from RESIMAO (Réseau des Systèmes d'Information des Marchés en Afrique de l'Ouest).

For many analysts, the price increase is an opportunity for producers from the Southern countries which have long suffered from falling prices. In addition to the effect on income and poverty, it is appropriate to consider the potential impacts on income inequality. Indeed, in most of the sub-Saharan African countries, rice consumers are households living in urban areas and with intermediate incomes. Hence an increase in rice prices tends to reduce households' income and to increase poverty (Minot and Goletti, 2000; Nouve and Wodon, 2008; Simler, 2010). However, the majority of producers are rural poor households and rising rice prices tend to reduce income inequality as long as rice farmers represent a significant proportion of the total population. Curiously, most of the empirical studies have examined the short-run effects of higher prices and tend to neglect the long-run effects and the potential effects on income inequality.[3]

1. The WAEMU consists of Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo.
2. 1CFAF =0.002 US$.
3. To our knowledge, no study addresses this issue.

The objective of this article is to estimate the impact of higher rice prices in international markets on poverty and income inequality in Burkina Faso, which is a major rice consumer and imports more than 60% of its total consumption. The article is an extension of the study conducted by Badolo (2012) which highlights an almost complete transmission of higher international prices to local markets in Burkina Faso. The impact of higher prices will be estimated in two ways. First, we analyse the effects of higher prices on households in terms of poverty and income inequality by taking into account their social and economic characteristics.[4] Given that Burkinabe households are rice consumers and allocate a high proportion of their budget to rice, we expect a negative impact of higher prices on their income. This impact should be positive for the net producers of rice. Depending on whether the net producers have a high or low income, we expect an increase or decrease in income inequality in major rice-producing areas.

We use a methodology based on the net benefit ratio (NBR) developed by Deaton (1989) combined with the concept of compensating variation of income (Deaton and Muellbauer, 1980; Minot and Goletti, 2000). We use the living standard survey conducted by the National Statistics and Demography Institute (NSDI) over the period 2002-3 (QUIBB, 2003). The survey covers 8,500 households and contains information on income from rice and total consumption expenditures. We estimate the impact of higher food prices on households' income, poverty rate and income inequality.

This method is favourable for estimating, in addition to short-run effects, the long-run effects of rising food prices and distinguishing between net producers and net consumers. We estimate the impact of higher prices on poverty using the formula developed by Minot and Daniels (2002) which considers the impact on producers. We extend their formula by adding consumers to calculate the net impact on poverty indicators developed by Foster et al. (1984). Furthermore, unlike previous studies that have analysed the impact of higher food prices on poverty, in addition to this impact our article takes account of the effects on income inequality using Gini and Theil Indexes.

The results show that rising rice prices adversely affect households' income in the short and long run, and increase poverty in most of the regions except for rice-producing areas. The effect is higher in urban than in rural areas. Rising food prices also increase income inequality apart from a few regions.

The rest of the article is structured as follows. Section 2 provides a literature review on the impact of changes in food prices on households' income and poverty. Section 3 presents the methodology used to estimate the impact of higher food prices on households. Section 4 presents the descriptive statistics on consumption and production of rice in Burkina Faso, and Section 5 concludes.

2 Empirical literature review

There is an extensive literature on the impact of changes in food prices on households in low-income countries, but the results are sometimes mixed. We discuss the results of recent studies in this Section.

The findings of most of the studies depend on household profile, depending on whether the household is a net producer or a net consumer, and the proportion of net

4. Location, income group and region.

producers in the total population. Ulimwengi and Ramadan (2009) use a multi-market model and living standard survey (UNHS, 2006) to analyse the impact of higher food prices on consumption and profits in Uganda. The data show that on average 12% of households are net producers and 66% are net consumers. The authors conclude that households which depend on the agricultural sector and live in rural areas are positively affected by rising food prices. This might be explained by the fact that rural households are more likely to be net producers.

Ivanic and Martin (2008) estimate the short-run effects on poverty of higher food prices for seven commodities,[5] using the living standard survey in nine developing countries, and the method developed by Singh et al. (1986) and Deaton (1989; 1997). They conclude that on average a 10% increase in food prices leads to an increase in poverty. However, an analysis by product and by country gives different results. For example, in the case of Vietnam, a 10% increase in the rice price reduces rural poverty by 1 percentage point and increases urban poverty by 0.2 percentage points, but there is a decline of 0.5 percentage points in poverty at the national level. This might be explained by the fact that net producers who benefit from higher food prices are more important than net consumers. In Zambia and Malawi, a 10% increase in the maize price increases rural poverty by 0.8 and 0.5 percentage points, and urban poverty by 0.2 and 0.3 percentage points, respectively. In the two countries, both urban and rural households are net consumers of maize.

The study conducted by Minot (2010) is one of the few studies that have examined the long-run effects of rising food prices on poverty in low-income countries. The author uses the Ghana Living Standard Survey (2005-6) and the method developed by Deaton (1989) to analyse the impact of higher food prices on poverty in Ghana. He shows that on average 21% and 46% of households are producers and consumers of maize respectively, and an 81% increase in producer and consumer prices leads to an increase in poverty by 0.6 percentage points in the short run. However, if the increase in the producer price is higher than in the consumer price, poverty falls by 1.2 percentage points in the short run. Urban households (7% of net producers and 56% of net consumers) lose both in the short and long run, but the losses are less important in the long run. In contrast, rural households (31% of net producers and 39% of net consumers) win in the long run and in the case where producer prices rise more than consumer prices. In regions where the proportion of net producers of rice is almost equal to that of net consumers, poverty falls in the long term if producer prices rise more than consumer prices.

Beyond the household profile, some empirical results are explained by the social and economic situation of each country and region. The study conducted by Wodon and Zaman (2008) highlights this aspect. Using the method developed by Deaton (1989), the authors estimate the short-run impact of food-import prices on poverty in twelve West and Central African countries. They conclude that an increase in food prices leads to a more important increase in poverty in rural areas than in urban areas in Ghana, Senegal and Liberia. The case of Ghana might be explained by the fact that poverty was initially lower there than in the other two countries. The results obtained in Senegal and Liberia are due to the importance of imported food in household consumption, so that the gains of net producers are low.

5. Rice, maize, wheat, dairy, poultry, beef and sugar.

Finally, the findings of studies on the effects of rising food prices depend on the magnitude of the increase in prices, the social and economic characteristics of households and the social and economic situation of the country. Many of these studies focus on analysis of the short-run effects and tend to neglect the long-run effects. None of these studies has considered the impact on inequality. Our article contributes to the literature by assessing the long-run effects and the impact on inequality.

3 Methodology and data

3.1 Methodology

We use the method developed by Deaton (1989) and extended by Minot and Goletti (2000). This method does not impose any particular structure on the data and does not require a significant amount of information. In addition, it has the advantage of allowing the identification of net producers and net consumers and of distinguishing between the short- and long-run impacts using the supply and demand elasticities. We use the concept of compensating variation to calculate the income loss of consumers related to higher food prices. We analyse the short- and long-run effects on real income, poverty and income inequality.

Measuring the impact of rising rice prices on real income. The impact of price changes on household welfare is often calculated using the consumer surplus (CS)[6] or the equivalent variation (EV)[7] or the compensating variation (CV). In this article, we use the concept of compensating variation as it was developed by Deaton and Muellbauer (1980) and Minot and Goletti (2000). The compensating variation is defined as the amount of money needed to compensate a consumer for the price change and restore the original utility level. So in the case of rising food prices, the compensating variation is the most relevant measure (Varian, 2008). In addition, unlike the two other measures, it requires fewer assumptions as one needs only the original level of the data before the price change. The compensating variation change can be written as the difference between two values of the expenditure function:

$$CV = e(p_1, u_o) - e(p_o, u_o) \tag{1}$$

where CV is the compensating variation, $e(.)$ is the expenditure function, p is the vector of prices, p_0 and p_1 are before (0) and after (1) the price change, and u is utility. Using a second-order Taylor series expression and Shephard's lemma on Equation (1), we obtain the effect of price changes on the consumer:[8]

$$\frac{CV}{x_0} \cong \frac{p_{0i} q_i(p_0, x_0)}{x_0} \frac{\Delta p_i}{p_{0i}} + \frac{1}{2} \varepsilon_d \frac{p_{0i} q_i(p_0, x_0)}{x_0} \left(\frac{\Delta p_i}{p_{0i}} \right)^2 \tag{2}$$

6. If there is a price change, the consumer surplus is limited because it is based on the implicit hypothesis of constant marginal utility of money along the integration path (Deaton and Muellbauer, 1980).
7. The equivalent variation is the willingness to pay. It measures the maximal amount to pay to prevent an increase in prices and requires the price and quantity levels of the initial situation.
8. The detailed derivation is available on request.

where q_i and p_i are the quantity demanded and the rice price respectively, x_0 is the original income and ε_d is the own-price elasticity of demand for rice. Equation (3) can be rewritten in its reduced form:

$$\frac{CV}{x_0} \cong CR_r \frac{\Delta p_i}{p_{0i}} + \frac{1}{2}\varepsilon_d CR_r \left(\frac{\Delta p_i}{p_{Oi}}\right)^2 \quad (3)$$

CR_i is the consumption ratio for rice which is defined as the proportion of the budget affected by rice consumption.

The impact of rising prices on the household as producer is determined using the profit variation which is defined as the following:

$$\Delta\pi = \pi(p_1, w_0, z) - \pi(p_0, w_0, z) \quad (4)$$

where $\Delta\pi$ is the profit variation, $\pi(.)$ is the profit function, p is the vector of output prices,[9] p_0 and p_1 are the before (0) and after (1) the price change, w is the vector of input prices, and z is the vector of fixed factor quantities. By applying the same procedure used in the case of consumers, we obtain the effect of rising prices on the household as producer[10] which is defined as the following:

$$\frac{\Delta\pi}{x_0} \cong \frac{p_{0i}s_i(p_0, w_0, z_0)}{x_0}\frac{\Delta p_i}{p_{0i}} + \frac{1}{2}\varepsilon_s \frac{p_{0i}s_i(p_0, w_0, z_0)}{x_0}\left(\frac{\Delta p_i}{p_{0i}}\right)^2 \quad (5)$$

where s_i and p_i are the supply quantity and the price of rice, and ε_s is the own-price elasticity of the supply of rice. Equation (5) can be rewritten in its reduced form:

$$\frac{\Delta\pi}{x_0} \cong PR_r \frac{\Delta p_i}{p_{0i}} + \frac{1}{2}\varepsilon_s PR_i \left(\frac{\Delta p_i}{p_{0i}}\right)^2 \quad (6)$$

PR_i is the production ratio of rice which is defined as the value of rice production as a proportion of income (or total expenditure). Combining equations (3) and (6), the following expression is obtained:

$$\frac{\Delta w^2}{x_0} \cong \frac{\Delta p_i^p}{p_{0i}^p} PR_i + \frac{1}{2}\left(\frac{\Delta p_i^p}{p_{0i}^p}\right)^2 PR_i\varepsilon_s - \frac{\Delta p_i^c}{p_{0i}^c} CR_i - \frac{1}{2}\left(\frac{\Delta p_i^c}{p_{0i}^c}\right)^2 CR_i\varepsilon_d \quad (7)$$

9. Here we focus only on rice.
10. The detailed derivation is available upon request.

where Δw^2 is the second-order of the net welfare effect of a rice-price change on the household, and p^c and p^p are the consumption and production prices respectively. Equation (7) takes into account the response of producers and consumers to the rice-price change. The immediate welfare impact of the price change is obtained by setting the elasticities equal to zero:

$$\frac{\Delta w^1}{x_0} \cong \frac{\Delta p_i^p}{p_{0i}^p} PR_i - \frac{\Delta p_i^c}{p_{0i}^c} CR_i \tag{8}$$

where Δw^1 is the first-order approximation of the net welfare effect of a rice-price change.

There are two major issues in this analysis. The first is the relationship between producer and consumer prices. The second is the use of appropriate supply and demand elasticities.

The first issue is related to the fact that it is rarely possible to obtain data on producer prices of commodities, particularly in sub-Saharan African countries. To avoid this problem, most of the studies suppose that producer and consumer prices increase in the same proportion, which is equivalent to assuming a marketing margin that is a fixed proportion of the consumer price. However, the assumption of a fixed marketing margin is more plausible, implying that the percentage increase will be greater in the producer price than in consumer price. Such assumptions make sensitive the estimation of the impact of higher prices on welfare (see Dawe and Matsoglou, 2009). For example, if the consumer price is twice the producer price and the marketing margin is fixed in absolute terms, the percentage increase in the producer price will be twice that in the consumer price.

Regarding the elasticities, most of the studies assume no household responses (for example, Deaton, 1989; Ivanic and Martin, 2008), which means that the elasticities are equal to zero. However, in the long run, households may be able to respond both as consumers and as producers. In this article, we consider two assumptions. First, we assume that the value of demand and supply elasticities is equal to zero, which corresponds to the short-run impact. Second, that the value of elasticities is different from zero. We assume own-price demand elasticities of -0.20 and -0.40 and supply elasticities of 0.20 and 0.40, and perform a sensitivity analysis using elasticities in these ranges by random draws from a uniform distribution.

The estimation of the short-run impacts of higher prices on poverty and inequality is based on two simulations. *In simulation 1*, we assume that households do not respond to higher prices (zero elasticities) and that producer and consumer prices rise by the same percentage (15%). *In simulation 2*, we assume that households do not respond to higher prices (zero elasticities) and that the percentage increase in producer prices is twice that in consumer prices (30% and 15%). The simulations for the long-run impacts are defined as follows. *In simulation 1*, we assume that households respond to price changes (demand elasticity is of -0.20 and supply elasticity of 0.20) and that producer and consumer prices rise by the same percentage (15%). *In simulation 2*, we assume that households respond to price changes (-0.20 and 0.20) and that the percentage increase in producer prices is twice that in consumer prices (15% and 30%). *In simulation 3*, we assume that households respond to higher prices (-0.40 and 0.40) and that producer and consumer prices rise by the same percentage (15%). *In simulation 4*, we assume that households respond to higher

prices (-0.40 and 0.40) and that the percentage increase in producer prices is twice that in consumer prices (15% and 30%).

Measuring the impact of rising rice prices on poverty. The impact of rising rice prices on poverty is estimated using the approach developed by Minot and Daniels (2002) to examine the impact of cotton price variations on producers in Benin. We extend their formula by taking into account the consumers to determine the overall impact. We compare the poverty measures before and after the price has changed.

We calculate the impact of higher prices on poverty using the income expression defined as follows:

$$x_{i1} = x_{i0} + \Delta\pi - CV \tag{9}$$

where x_1 and x_0 are the consumption expenditures of households before and after the price change, respectively and $\Delta\pi$ and CV are the profit variation and compensating variation, respectively. By replacing $\Delta\pi$ and CV by their expressions, we obtain:

$$x_1 = x_0 + s_i(p_0, w_0, z)\Delta p_i + \frac{1}{2}\varepsilon_s \frac{s_i(p_0, w_0, z)}{p_{0i}}(\Delta p_i)^2$$

$$-[q_i(p_0, x_0)\Delta p_i + \frac{1}{2}\varepsilon_d \frac{q_i(p_0, x_0)}{p_{0i}}(\Delta p_i)^2] \tag{10}$$

The impact of higher prices on poverty is examined using the poverty measures developed by Foster et al. (1984) defined as follows:

$$P_\alpha = \frac{1}{N}\sum_{n}^{1}\left[\frac{\bar{x} - x_j}{\bar{x}}\right]^\alpha \tag{11}$$

where P_α is the measure of poverty, N is the number of households, $\bar{x}$ is the poverty line, and x_j is the consumption expenditure of household j. If $\alpha = 0$, P_0 measures the poverty headcount, i.e. the proportion of households with an expenditure level below the poverty line. If $\alpha = 1$, P_1 measures the poverty gap. This measure takes into account the number of poor and the severity of poverty. If $\alpha = 2$, P_2 measures the poverty gap squared. This measure takes into account inequality between the poor and gives more weight to the poorest.

The poverty analysis raises an important issue, namely, the choice of the variable of interest used to calculate the poverty indicator. The variables frequently used in the empirical literature on poverty are the total consumption of households, per capita consumption and per adult equivalent consumption. The total consumption of households does not take into account the size of the household and tends to overestimate the welfare of individuals who are in large households. Per capita consumption takes into account the size of the household but does not consider differences in size and composition by sex and

age. To calculate per adult equivalent consumption, we convert households in adult equivalents using the equivalence scales and divide the total consumption of households by the number of adult equivalents. Per adult equivalent consumption takes into account both the size and composition by age of households, but there is the issue of choice of equivalence scales. We use the two last variables in our estimations. The simulations defined above are used to analyse the impact of higher rice prices on poverty.

Measuring the impact of higher prices on income inequality. The increase in rice prices should benefit net producers and particularly farmers whose rice sales are significant. This would reduce income inequality between rice-producing areas and regions where rice consumption is important. Income inequality would also be reduced between rural and urban areas. To estimate the effect of higher rice prices on inequality, we compare the inequality indicators before and after the price changes.

There are many indicators of income inequality. Two are used in this article: the Gini index and the Theil index. The Gini index is the one most used in empirical studies on income inequality. It is defined in its reduced form as the covariance between the income (Y) of a person or household and his rank (F) in the distribution (the rank is equal to zero for the poorest and one for the richest). If $\bar{y}$ is the average level of income, the Gini index is defined as follows:

$$Gini = 2\,\mathrm{cov}(Y, F)/\bar{y} \tag{12}$$

The Gini index takes values between zero and one, with higher values indicating more inequality. In contrast, values close to zero reflect an egalitarian distribution of income. Although the Gini index is the one most used in empirical work, it does not satisfy all the desirable properties of a good indicator of income inequality.[11]

Many inequality indices have recently been developed, and some of them satisfy all the desirable properties. One important example is the Theil index which is now widely used in empirical work. It is defined as follows:

$$T = \frac{1}{N}\sum_{i=1}^{N}\frac{y_i}{\bar{y}}\ln\left(\frac{y_i}{\bar{y}}\right) \tag{13}$$

where $\bar{y}$ is the average per capita income (or per capita consumption expenditure). A zero value of the index indicates perfect equality, with higher values of the index indicating greater inequality.

11. These criteria are: independence of average, independence of population size, symmetry, decomposition of the inequality indicator, statistical significance of the change in the inequality indicator over time. The Gini index does not meet the last two criteria.

3.2 Data

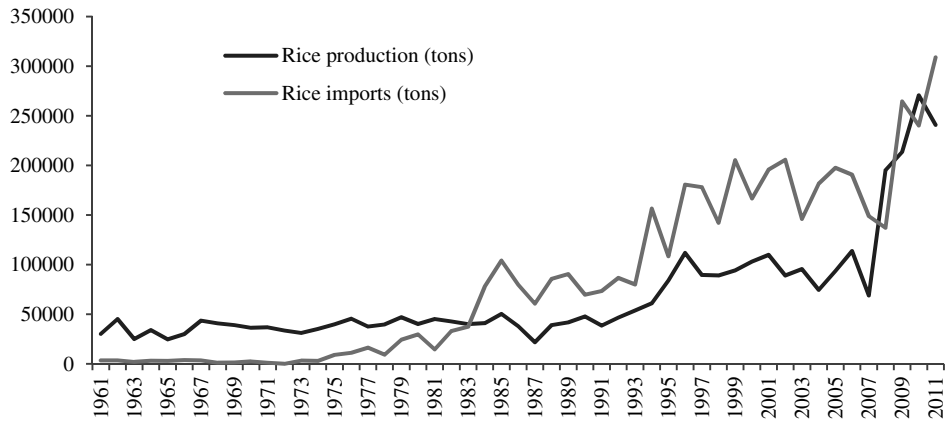
We estimate the impact of higher rice prices on poverty and income inequality in Burkina Faso using a living standard survey (QUIBB, 2003), conducted by the National Statistics and Demography Institute (NSDI) of Burkina Faso over the period 2002-3. The survey covers 8,500 nationally representative households and contains information on income and consumption expenditures.

4 Consumption and production of rice in Burkina Faso

Burkina Faso is a rural country with almost 80% of its population living in rural areas (CIA, 2005). The agricultural sector plays a major role in the economy; it represents 45% of GDP and a significant proportion of the population depends on agriculture (INSD, 2006). Grains play a major role in terms of food security since they represent 90% of food needs in the country. Among these grains, millet, maize, sorghum and rice are the most important in terms of food consumption.

Rice is produced throughout the country. However, this production represents only 40% of consumption needs, and huge quantities of rice are imported to satisfy demand. In 2005, imports cost approximately CFAF 36.6 billion (or US$73 million) (INSD, 2006). However, it is noteworthy that, in the wake of this crisis, the government adopted an 'Emergency Programme for Food Security', under which measures consisting of the distribution of improved seeds (2,750 tons) and a 50% subsidy on fertilisers were taken to support agricultural production, with a focus on rice. The high level of prices and the measures adopted by the government gave a stimulus to local production, and as a result rice production considerably increased over the period 2006-10 (Figure 2).

Figure 2: Evolution of rice production and imports in Burkina Faso, 1961-2011



Source: Authors' computation using FAOSTAT.

Survey data (QUIBB, 2003) indicate that almost 15% of rural households in Burkina Faso are rice producers and 13% of these derive their income from rice production. Figure 3a shows that in the South-Western and Central-Eastern regions, rice production, more than 40% for each region, is more important than in other regions, where it amounts to 10% - 35%, except for the Sahel where it is less than 5%. In nine regions, the income of about half the rice producers derives from rice production, except for the Boucle du Mouhoun, Sahel, North and Central regions. Figure 3b shows that in all income groups there are rice producers. In the intermediate income group, the number of rice producers is more important.

Figure 3a: Proportion of rural households growing and selling rice – by region

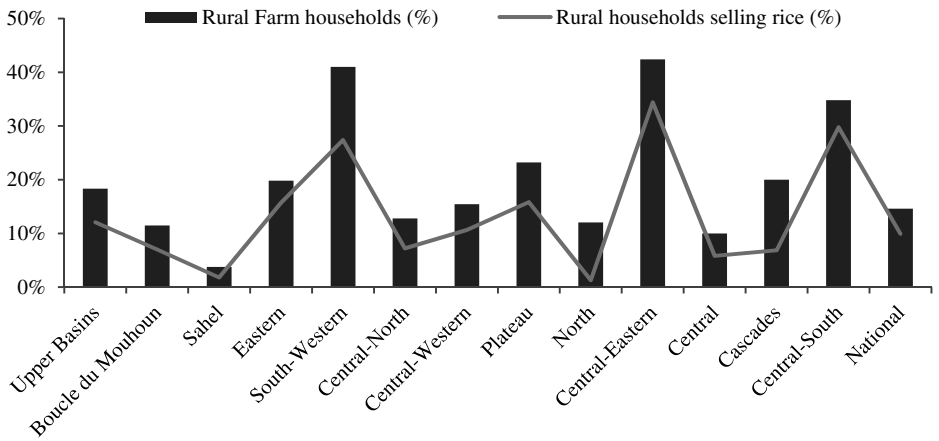
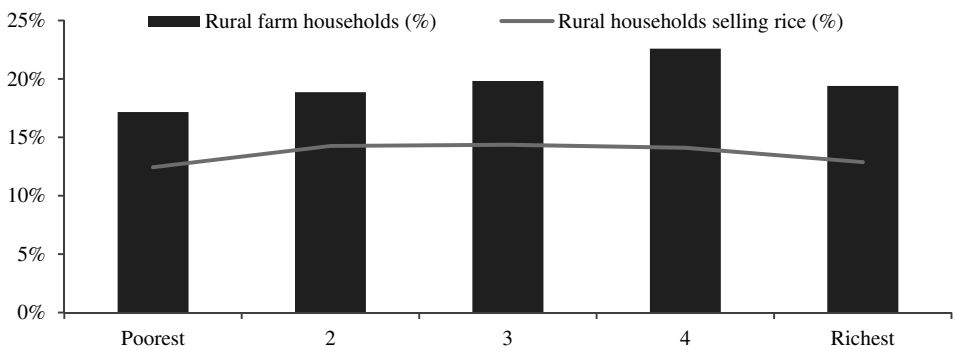


Figure 3b: By income group



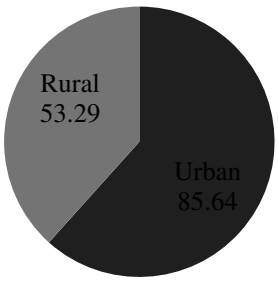
Source: Calculated using survey data of household living standards (QUIBB, 2003).

According to the living standard survey (QUIBB, 2003), more than 63% of the population consume rice. Figure 4 shows that rice is consumed more in urban (85%) than in rural areas. An analysis by region shows that rice consumption is more important in

Cascades (88%), Central (85%), Upper Basins (78%) and Central-Eastern (72%) regions. In other regions, the proportion of rice consumers is between 40% and 70% of the population.

Rice consumption also varies considerably by income group. The proportion of rice consumers is more important in the high-income group (82%) than in the poorest group (38%), with the national average amounting to 63%.

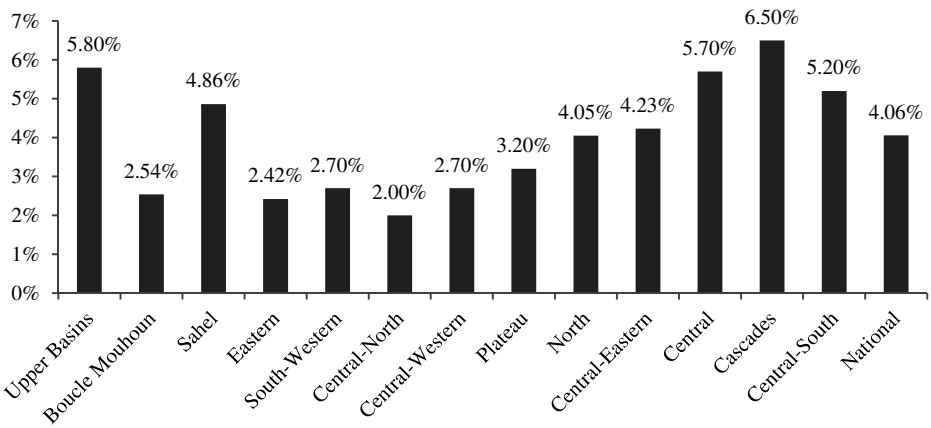
Figure 4: Proportion of rice consumers by location



Source: Ibid.

On average, each household devotes 4.06% of its budget to rice consumption, with the share of urban households being more important (6.05%) than that of rural households (3.2%). The budget shares vary across regions (see Figure 5), the regions with the largest budget shares being Cascades (6.5%), Upper Basins (5.8%), Central (5.7%), Central-South (5.2%), Sahel (4.86%) and Central-Eastern (4.23%).

Figure 5: Average budget share by region



Source: Ibid.

The budget shares also vary by income group, with the richest households devoting 4.8% of their budget to rice consumption compared with 2.9% for the poorest households.

5 Poverty distribution in Burkina Faso

The absolute poverty line in Burkina Faso in 2003 was estimated to be CFAF 82,672 per person and per year (INSD, 2003), representing the level of food and non-food expenditures below which a person is considered to be poor. This poverty line represents about two-fifths of $US1 per day per capita,[12] which is the poverty line defined by the international community.

Table 1: Poverty profile by location and by region (per capita and an adult equivalent consumption)

		Poverty indexes			Contribution to national poverty		
Household category	**Population (%)**	***P0***	***P1***	***P2***	***P0***	***P1***	***P2***
National	100.00	51.60	23.26	13.55	100.00	100.00	100.00
		(31.72)	(12.10)	(6.35)	(100.00)	(100.00)	(100.00)
Location							
Urban	30.60	38.01	15.21	8.07	22.54	20.01	18.22
		(21.19)	(7.05)	(3.41)	(20.44)	(17.83)	(16.43)
Rural	69.40	56.65	26.24	15.60	76.19	78.29	79.90
		(35.62)	(13.97)	(7.44)	(77.93)	(80.13)	(81.31)
Regions							
Upper Basins	11.80	44.72	18.75	10.27	10.23	9.51	8.94
		(26.83)	(9.00)	(4.36)	(9.98)	(8.78)	(8.10)
Boucle du Mouhoun	10.35	64.72	32.37	20.14	12.98	14.40	15.38
		(44.28)	(18.62)	(10.36)	(14.45)	(15.93)	(16.89)
Sahel	7.02	47.42	17.44	8.57	6.45	5.26	4.44
		(23.01)	(6.60)	(2.95)	(5.09)	(3.83)	(3.26)
Eastern	7.34	49.39	19.78	10.27	7.03	6.24	5.56
		(27.04)	(8.15)	(3.61)	(6.26)	(4.94)	(4.17)
South-Western	6.10	60.47	28.45	16.72	7.15	7.46	7.53
		(40.40)	(14.80)	(7.28)	(7.77)	(7.46)	(6.99)
Central-North	7.33	42.90	16.34	8.31	6.09	5.15	4.50
		(21.61)	(6.63)	(2.77)	(4.99)	(4.02)	(3.20)
Central-Western	7.50	53.82	24.32	14.47	7.82	7.84	8.01
		(31.18)	(12.86)	(7.20)	(7.37)	(7.97)	(8.50)
Plateau	4.50	60.46	29.40	18.10	5.27	5.69	6.01
		(41.36)	(16.77)	(9.21)	(5.87)	(6.24)	(6.53)
North	7.74	68.31	32.85	20.38	10.25	10.93	11.64
		(45.13)	(19.00)	(10.52)	(11.01)	(12.15)	(12.82)
Central-Eastern	7.20	52.40	25.06	15.48	7.31	7.76	8.23
		(33.68)	(14.42)	(8.10)	(7.64)	(8.58)	(9.18)
Central	16.27	35.15	15.05	8.30	11.08	10.53	9.97
		(20.13)	(7.32)	(3.73)	(10.33)	(9.84)	(9.56)
Cascades	3.05	43.00	20.21	12.46	2.54	2.65	2.80
		(25.44)	(11.60)	(6.79)	(2.45)	(2.92)	(3.26)
Central-South	3.80	61.73	28.29	16.38	4.55	4.62	4.59
		(40.10)	(14.93)	(7.45)	(4.80)	(4.69)	(4.46)

Note: Figures for per adult equivalent are in brackets.
Source: Calculated using survey data of household living standards (QUIBB, 2003).

12. $US1 = CFAF 565 in August 2003.

Table 1 shows the poverty index by location and by region for per capita expenditure and per adult equivalent expenditure, respectively, calculated using the living standard survey (QUIBB, 2003). The results obtained with per capita consumption show that 51.6% of households in Burkina Faso are below the poverty line. The result becomes lower if we use per adult equivalent expenditure (31.72%). The results differ across regions. The poorest regions are Boucle Mouhoun, South-West, Plateau, North and Central-South, with poverty lines above the national average. The least poor regions are Upper Basins, Central-North and Central, with poverty lines well below the national average.

The poverty gap (P1) is 23.26% and 12.10% with per capita expenditure and per adult equivalent expenditure, respectively. On average, the poverty gap is relatively less high in Burkina Faso. However, an analysis by region shows that it is more important in the Boucle Mouhoun, North and Plateau regions. The results for the severity of poverty (P2) are relatively less high.

Furthermore, poverty is more pronounced in rural than in urban areas, amounting to 56.65% and 38.01% respectively. If we use per adult equivalent expenditure, we obtain rates of 35.62% in rural and 21.19% in urban areas.

6 Results

6.1 Net benefit ratio by region and location

The net position in a commodity refers to the net sales or purchases of the commodity for a household or group of households. The net benefit ratio (NBR) is the value of net sales of a commodity as a percentage of household income, and is defined as the difference between the sales value and the purchases value. If the NBR is positive (negative), the household is considered as a net seller (buyer) of the commodity. As discussed above, a positive NBR means that a household or group of households will gain from higher prices of the commodity in the short run, while a negative NBR means that it will lose.

Table 2 shows the net position in rice of different types of households in Burkina Faso. On average, rice production accounts for 7% of households' income and rice consumption represents 4% of the total. This implies an average NBR of -0.033 or -3.3%. The negative NBR is related to the fact that Burkina Faso is a net rice importer. The NBR is negative in rural areas (-2.2%), indicating that rural households are adversely affected by higher rice prices on average. It is not surprising that most urban households are net buyers, with a strongly negative NBR (-5.7%). Rice is more important to urban households, as a component in their expenditure.

Across the 13 administrative regions of Burkina Faso, the Cascades, Central and Upper Basins regions have the most negative NBRs (-6.5%, -5.6% and -5.1% respectively). In all three regions, households which are net buyers of rice account for over 75% of the total. Only one region (Plateau) has a positive NBR, which indicates that a large proportion of households are net rice sellers and would be less affected by an increase in the rice price. The results presented by quintile of income show that the NBR is more negative for the richest quintile of households (-4.4%) than for the poorest (-1.9%), implying that the adverse effect of higher rice prices would be greatest for the rich.

Table 2: Rice production, consumption and net position

Household Category	Population (%)	Production Ratio (PR)	Consumption Ratio (CR)	NBR (PR – CR)	Net Seller	Neutral	Net Buyer
		(as proportion of total expenditures)			(as proportion of households)		
National	100.00	0.007	0.040	-0.033	2.320	37.920	59.760
Location							
Urban	30.60	0.003	0.060	-0.057	0.380	16.100	83.410
Rural	69.40	0.009	0.031	-0.022	3.170	47.390	49.340
Region							
Upper Basins	11.80	0.007	0.058	-0.051	1.300	23.420	75.280
Boucle du Mouhoun	10.35	0.001	0.025	-0.024	0.570	51.650	47.780
Sahel	7.02	0.001	0.048	-0.047	0.830	42.500	56.670
Eastern	7.34	0.008	0.024	-0.016	1.130	50.480	48.390
South-Western	6.10	0.020	0.027	-0.007	10.380	54.040	35.580
Central-North	7.33	0.008	0.019	-0.011	3.550	53.550	42.900
Central-Western	7.50	0.001	0.026	-0.025	1.100	44.290	54.620
Plateau	4.50	0.047	0.031	0.016	9.500	36.940	53.560
North	7.74	0.000	0.040	-0.040	0.150	52.580	47.270
Central-Eastern	7.20	0.018	0.042	-0.024	6.450	29.840	63.710
Central	16.27	0.000	0.056	-0.056	0.150	17.040	82.810
Cascades	3.05	0.000	0.065	-0.065	0.000	14.230	85.770
Central-South	3.80	0.012	0.052	-0.040	1.570	39.120	59.250
Quintile							
Poorest	13.45	0.009	0.028	-0.019	2.450	62.380	35.170
2	16.02	0.010	0.034	-0.024	3.240	51.100	45.660
3	17.73	0.010	0.037	-0.027	2.920	44.020	53.050
4	20.60	0.008	0.045	-0.037	2.570	35.730	61.690
Richest	32.20	0.003	0.047	-0.044	1.320	19.170	79.520

Source: Ibid.

6.2 Impact of higher rice prices on the welfare of households

Impact on real income. Equations 8 and 9 are used to estimate the impact of higher rice prices on real income. Table 3 shows the results of the impact in the short and long run. On average, the increase in rice prices adversely affects the real income of households in Burkina Faso. The income losses are estimated to be 0.49% and 0.3% in the short and long run, respectively. Urban households are more negatively affected than rural households. This might be explained by the fact that most urban households are net buyers of rice (84%) and a more important share of their budget is spent on rice consumption than in rural households. If we assume a 15% increase in consumer price and a 30% increase in producer price, three regions benefit from these increases in the short and long run (South-Western, Plateau and Central-South). This is related to the fact that in these regions there is a more important proportion of rice producers (more than 60%) and a proportion of these producers derive their income from production. Looking at the impact by quintile of income, both poor and rich households are adversely affected by rising rice prices, but the losses are higher for rich households than for poor ones. Overall, higher rice prices are detrimental to a large majority of households since they are net buyers of rice.

Table 3: Impact of higher rice prices on real income

Household Category	Initial NBR	Short-run Impact		Long-run Impact			
		Simulation 1 P_c↑15% P_p↑15%	Simulation 2 P_c↑15% P_p↑30%	Simulation 1 P_c↑15% P_p↑15% ε^d= -0.20 ε^s= 0.20	Simulation 2 P_c↑15% P_p↑30% ε^d= -0.20 ε^s= 0.20	Simulation 3 P_c↑15% P_p↑15% ε^d= -0.40 ε^s= 0.40	Simulation 4 P_c↑15% P_p↑30% ε^d= -0.40 ε^s= 0.40
National	-3.3	-0.49	-0.37	-0.49	-0.37	-0.47	-0.35
Location							
Urban	-5.7	-0.76	-0.72	-0.76	-0.72	-0.74	-0.70
Rural	-2.2	-0.37	-0.22	-0.37	-0.20	-0.35	-0.19
Regions							
Upper Basins	-5.1	-0.69	-0.57	-0.69	-0.57	-0.67	-0.54
Boucle du Mouhoun	-2.4	-0.44	-0.42	-0.44	-0.42	-0.43	-0.41
Sahel	-4.7	-0.59	-0.57	-0.59	-0.57	-0.58	-0.55
Eastern	-1.6	-0.20	-0.01	-0.20	-0.01	-0.19	0.01
South-Western	-0.7	-0.1	0.14	-0.10	0.14	-0.08	0.17
Central-North	-1.1	-0.22	-0.11	-0.22	-0.11	-0.21	-0.09
Central-Western	-2.5	-0.39	-0.35	-0.39	-0.35	-0.38	-0.34
Plateau	1.6	-0.15	0.25	-0.10	0.25	-0.13	0.30
North	-4	-0.58	-0.52	-0.58	-0.52	-0.56	-0.50
Central-Eastern	-2.4	-0.50	-0.3	-0.50	-0.30	-0.48	-0.27
Central	-5.6	-0.82	-0.79	-0.82	-0.79	-0.80	-0.77
Cascades	-6.5	-0.83	-0.82	-0.83	-0.82	-0.81	-0.80
Central-South	-4	-0.16	0.31	-0.16	0.31	-0.14	0.37
Quintile							
Poorest	-1.9	-0.37	-0.19	-0.37	-0.19	-0.35	-0.16
2	-2.4	-0.48	-0.40	-0.48	-0.40	-0.47	-0.38
3	-2.7	-0.42	-0.29	-0.42	-0.29	-0.41	-0.27
4	-3.7	-0.44	-0.29	-0.44	-0.29	-0.42	-0.26
Richest	-4.4	-0.60	-0.52	-0.60	-0.52	-0.59	-0.50

Source: Ibid.

Impact on poverty. Equations 10 and 11 are used to estimate the impact of higher rice prices on the three poverty indicators: headcount poverty (P0), poverty gap (P1) and severity of poverty (P2). We discuss the impact of higher rice prices on headcount poverty in this subsection.[13] The poverty line used is equal to CFAF 82,672 per capita and per year (NSDI, 2003), corresponding to $US146 per capita per year.

Table 4 shows the effect of higher rice prices on poverty in Burkina Faso under different assumptions about household responses and about the margin between producer and consumer prices. At the national level, an increase in both consumer and producer prices in the short and long run increases the poverty rate which varies between 2.2 and 2.6 percentage points, depending on simulations. These percentages correspond to increases in the number of poor by 268,334 and 317,122. In the long run, the effects are less negative as

13. The results for P1 and P2 indicators are available on request.

households adapt to the price increases. For example, if the producer price rises more than the consumer price, the poverty rate increases by 2.25 percentage points in the long run, which is less important than in the other simulations.

Table 4: Impact of higher rice prices on headcount poverty index (per capita and per adult equivalent consumption)

Household Category	Initial Poverty Rate	Short-run Impact		Long-run Impact			
		Simulation 1 P_c↑15% P_p↑15%	Simulation 2 P_c↑15% P_p↑30%	Simulation 1 P_c↑15% P_p↑15% ε^d= -0.20 ε^s= 0.20	Simulation 2 P_c↑15% P_p↑30% ε^d= -0.20 ε^s= 0.20	Simulation 3 P_c↑15% P_p↑15% ε^d= -0.40 ε^s= 0.40	Simulation 4 P_c↑15% P_p↑30% ε^d= -0.40 ε^s= 0.40
National	51.60	2.61	2.27	2.54	2.27	2.55	2.25
	(31.72)	(2.97)	(2.82)	(2.88)	(2.73)	(2.81)	(2.66)
Location							
Urban	38.01	3.98	3.94	3.99	3.92	3.95	3.91
	(21.19)	(5.79)	(5.73)	(5.56)	(5.50)	(5.40)	(5.34)
Rural	56.65	2.09	1.76	2.00	1.64	2.00	1.62
	(35.62)	(1.93)	(1.74)	(1.89)	(1.70)	(1.86)	(1.66)
Region							
Upper Basins	47.72	0.49	0.16	0.42	0.08	0.43	0.08
	(26.83)	(2.92)	(2.78)	(2.64)	(2.50)	(2.64)	(2.50)
Boucle du Mouhoun	64.72	2.43	2.43	1.77	2.18	2.18	2.17
	(44.28)	(2.84)	(2.84)	(2.84)	(2.84)	(2.84)	(2.84)
Sahel	47.42	2.52	2.38	2.58	2.38	2.53	2.38
	(23.01)	(3.88)	(3.88)	(3.70)	(3.70)	(3.70)	(3.70)
Eastern	49.39	1.16	0.28	1.16	0.06	1.16	0.06
	(27.04)	(1.01)	(0.86)	(1.01)	(0.86)	(1.01)	(0.68)
South-Western	60.47	-0.10	-1.08	-0.07	-1.07	-0.09	-1.34
	(40.40)	(0.03)	(-1.05)	(0.03)	(-1.05)	(-0.39)	(-1.28)
Central-North	42.89	1.55	1.55	1.55	1.56	1.56	1.56
	(21.61)	(1.11)	(1.11)	(1.11)	(1.11)	(1.11)	(1.11)
Central-Western	53.82	2.58	2.43	2.23	2.08	2.23	2.08
	(31.18)	(2.38)	(2.22)	(2.38)	(2.22)	(2.38)	(2.22)
Plateau	60.46	2.99	2.76	2.99	2.62	2.99	2.61
	(41.36)	(1.12)	(0.60)	(1.12)	(0.60)	(1.12)	(0.60)
North	68.31	2.67	2.67	2.69	2.69	2.67	2.67
	(45.13)	(5.37)	(5.05)	(5.37)	(5.05)	(5.37)	(5.05)
Central-Eastern	52.40	3.09	2.75	3.10	2.75	3.09	2.75
	(33.68)	(2.00)	(2.00)	(2.00)	(2.00)	(2.00)	(2.00)
Central	35.15	3.62	3.62	3.65	3.63	3.62	3.62
	(20.13)	(6.14)	(6.14)	(5.82)	(5.82)	(5.53)	(5.53)
Cascades	43.00	4.18	4.18	4.20	4.19	4.18	4.18
	(25.44)	(5.63)	(5.63)	(5.63)	(5.63)	(5.63)	(5.63)
Central-South	61.73	3.27	2.44	3.27	2.45	3.27	2.44
	(40.09)	(0.84)	(0.84)	(0.84)	(0.84)	(0.84)	(0.84)

Note: As for Table 1.

Source: Simulations based on survey data of household living standards (QUIBB, 2003).

Both urban and rural households lose from higher rice prices in both the short and long run, but the average losses are more important for urban households (almost equal to 4 percentage points) than for rural ones (about 2 percentage points). Indeed, urban households devote a large part of their budget to rice consumption. The increase in rice prices will lead to a decline in their purchasing power and this will result in an increase in the number of poor which is more important in urban areas than in rural areas.

The poverty impact is quite varied across regions. The increase in rice prices leads to an increase in poverty that varies between 0.16 and 4 percentage points in most of the regions. The poverty rate decreases only in the South-Western region (1.07 percentage points in the short run and 1.34 percentage points in the long run). The decline in poverty is greater in this region when the producer price increases faster than the consumer price and when the elasticities are high. Indeed, the South-Western has an initial poverty rate of 60.47% and a large proportion of rice producers who benefit from higher rice prices. This contributes to reducing the poverty rate in this region.

The results on poverty using per adult equivalent expenditure differ from those obtained in the previous case. The impact is high in the short and long run. At the national level, the poverty rate increases and varies between 2.6 and 2.9 percentage points, depending on simulations.

The increase in rice prices raises the poverty rate by 5 and 2 percentage points in urban and rural areas, respectively. The Eastern, Plateau and Central-South regions are less adversely affected by higher rice prices because the number of rice producers is relatively more important in these three regions than in the other regions. The South-Western is the only region where the poverty rate declines in the short and long run, depending on simulations. This result is almost similar to that found with the variable of per capita consumption and the explanation given above is equally applicable here.

We perform a sensitive analysis by taking the supply elasticities in the range of 0.20 and 0.40 and demand elasticities in the range of -0.40 and -0.20 from a uniform probability distribution. The results (minimum and maximum values) do not differ significantly from those found previously.[14]

Impact on income inequality. We estimate the impact of higher rice prices on inequality using the Gini and Theil Indexes. Table 5 shows the results for the Gini index with per capita and per adult equivalent consumption. On average, rising rice prices lead to an increase in inequality that varies between 0.4 and 0.5 percentage points, depending on the simulations (with per capita consumption). This might be explained by the fact that a large proportion of rice producers are in the intermediate income group. These producers benefit from higher rice prices and this contributes to increase income inequality. Confirmation of this result is that rising inequality is as important as when the producer price increases faster than the consumer price (simulation 2 versus simulation 1 in the short run and simulation 2 versus simulation 1 and simulation 4 versus simulation 3 in the long run).

The impact is greater in urban areas (1.3 percentage points on average) than in rural areas (varying from 0.3 to 0.6 percentage points). Indeed, urban areas have an initial index of income inequality higher than that of rural areas. In addition, the gap between the proportions

14. The results for sensitivity analysis are available on request.

of net consumers of rice in low-income groups (9.6%) and in high-income groups (12.45%) is not very large in urban areas. Regarding rice producers who live in urban areas, the income from rice production of rich households represents four times that of poor households. In addition, the proportion of net producers is lower in urban than in rural areas.

Table 5: Impact of higher rice prices on income inequality (per capita and per adult equivalent consumption)

Household Category	Initial Gini Index	Short-run impact		Long-run impact			
		Simulation 1 P_c↑15% P_p↑15%	Simulation 2 P_c↑15% P_p↑30%	Simulation 1 P_c↑15% P_p↑15% ε^d= -0.20 ε^s= 0.20	Simulation 2 P_c↑15% P_p↑30% ε^d= -0.20 ε^s= 0.20	Simulation 3 P_c↑15% P_p↑15% ε^d= -0.40 ε^s= 0.40	Simulation 4 P_c↑15% P_p↑30% ε^d= -0.40 ε^s= 0.40
National	55.76	56.19	56.32	56.18	56.31	56.16	56.31
	(53.22)	(53.7)	(53.84)	(53.68)	(53.83)	(53.67)	(53.83)
Location							
Urban	58.19	59.51	59.55	59.48	59.52	59.45	59.5
	(55.44)	(56.83)	(56.87)	(56.79)	(56.84)	(56.76)	(56.81)
Rural	51.76	52.10	52.39	52.10	52.40	52.09	52.42
	(49.80)	(50.16)	(50.45)	(50.15)	(50.47)	(50.15)	(50.48)
Regions							
Upper Basins	51.04	51.38	51.44	51.36	51.43	51.32	51.42
	(48.64)	(49.05)	(49.15)	(49.04)	(49.15)	(49.02)	(49.14)
Boucle du Mouhoun	51.55	51.53	51.64	51.53	51.64	51.52	51.64
	(49.49)	(49.60)	(49.72)	(49.60)	(49.72)	(49.60)	(49.73)
Sahel	46.72	47.03	47.04	47.02	47.03	47.01	47.02
	(44.05)	(44.36)	(44.37)	(44.35)	(44.36)	(44.33)	(44.35)
Eastern	48.00	48.11	48.37	48.11	48.39	48.11	48.41
	(45.98)	(46.14)	(46.43)	(46.14)	(46.45)	(46.14)	(46.47)
South-Western	50.23	49.79	49.83	49.79	49.84	49.79	49.85
	(47.49)	(46.95)	(46.98)	(46.95)	(47.00)	(46.95)	(47.01)
Central-North	46.34	46.50	47.00	46.50	47.00	46.51	47.03
	(43.97)	(44.11)	(44.58)	(44.12)	(44.61)	(44.12)	(44.64)
Central-Western	53.72	54.02	54.12	54.02	54.12	54.01	54.12
	(51.66)	(51.99)	(52.08)	(51.98)	(52.08)	(51.98)	(52.08)
Plateau	52.91	53.88	54.84	53.88	54.89	53.88	54.94
	(51.54)	(52.50)	(53.43)	(52.50)	(53.48)	(52.50)	(53.53)
North	49.06	48.85	48.83	48.84	48.82	48.82	48.81
	(46.31)	(46.21)	(46.21)	(46.19)	(46.20)	(46.18)	(46.18)
Central-Eastern	54.87	55.56	55.82	55.55	55.83	55.53	55.83
	(53.13)	(53.86)	(54.12)	(53.85)	(54.12)	(53.83)	(54.12)
Central	60.80	62.44	62.40	62.40	62.36	62.36	62.32
	(58.02)	(59.78)	(59.75)	(59.73)	(59.70)	(59.69)	(59.65)
Cascades	55.30	56.74	56.72	56.71	56.69	56.68	56.66
	(53.28)	(54.78)	(54.76)	(54.75)	(54.73)	(54.72)	(54.70)
Central-South	52.19	54.74	56.67	54.75	56.76	54.76	56.85
	(50.30)	(52.86)	(54.73)	(52.86)	(54.82)	(52.87)	(54.91)

Note: As for Table 1.

Table 6: Impact of higher rice prices on income inequality (per capita and per adult equivalent consumption)

Household Category	Initial Theil Index	Short-run impact		Long-run impact			
		Simulation 1	Simulation 2	Simulation 1	Simulation 2	Simulation 3	Simulation 4
		P_c↑15% P_p↑15%	P_c↑15% P_p↑30%	P_c↑15% P_p↑15% ε^d= -0.20 ε^s= 0.20	P_c↑15% P_p↑30% ε^d= -0.20 ε^s= 0.20	P_c↑15% P_p↑15% ε^d= -0.40 ε^s= 0.40	P_c↑15% P_p↑30% ε^d= -0.40 ε^s= 0.40
National	66.03	67.45	67.66	67.42	67.64	67.38	67.63
	(57.78)	(59.14)	(59.37)	(59.11)	(59.36)	(59.07)	(59.35)
Location							
Urban	72.73	76.43	76.50	76.36	76.44	76.29	76.38
	(62.49)	(65.85)	(65.92)	(65.79)	(65.86)	(65.72)	(65.81)
Rural	53.06	54.08	54.74	54.06	54.77	54.04	54.80
	(48.45)	(49.50)	(50.14)	(49.48)	(50.17)	(49.47)	(50.20)
Regions							
Upper Basins	51.42	52.82	52.77	52.78	52.74	52.73	52.71
	(45.18)	(46.61)	(46.65)	(46.57)	(46.62)	(46.52)	(46.60)
Boucle du Mouhoun	53.01	53.44	53.69	53.43	53.69	53.42	53.70
	(48.42)	(48.95)	(49.22)	(48.94)	(49.22)	(48.93)	(49.22)
Sahel	46.24	47.83	47.77	47.78	47.73	47.74	47.69
	(41.04)	(42.64)	(42.59)	(42.6)	(42.55)	(42.56)	(42.51)
Eastern	43.35	43.48	44.22	43.48	44.28	43.48	44.33
	(39.16)	(39.45)	(40.26)	(39.45)	(40.32)	(39.45)	(40.37)
South-Western	56.43	55.94	55.53	55.92	55.51	55.90	55.49
	(50.17)	(49.52)	(49.11)	(49.50)	(49.10)	(49.48)	(49.08)
Central-North	41.42	41.98	43.22	42.00	43.31	42.01	43.40
	(36.11)	(36.50)	(37.53)	(36.51)	(37.61)	(36.53)	(37.68)
Central-Western	56.51	57.47	57.73	57.45	57.73	57.44	57.73
	(51.05)	(52.02)	(52.25)	(52.01)	(52.25)	(51.99)	(52.25)
Plateau	56.40	58.28	60.03	58.26	60.13	58.24	60.24
	(52.87)	(54.69)	(56.23)	(54.67)	(56.32)	(54.64)	(56.42)
North	47.34	47.07	46.97	47.04	46.94	47.02	46.92
	(41.50)	(41.59)	(41.52)	(41.56)	(41.49)	(41.53)	(41.47)
Central-Eastern	57.92	59.59	60.22	59.56	60.23	59.53	60.25
	(52.78)	(54.50)	(55.06)	(54.46)	(55.07)	(54.43)	(55.08)
Central	77.81	82.07	81.96	82.00	81.87	81.92	81.79
	(66.91)	(70.84)	(70.74)	(70.77)	(70.66)	(70.70)	(70.58)
Cascades	63.97	68.34	68.31	68.26	68.23	68.18	68.15
	(56.40)	(60.47)	(60.44)	(60.40)	(60.36)	(60.32)	(60.29)
Central-South	59.10	64.92	72.74	64.95	72.15	64.99	72.56
	(55.43)	(61.05)	(67.29)	(61.07)	(67.66)	(61.10)	(68.03)

Note: As for Table 1.

Source: Ibid.

Rising rice prices increase inequality in most of the regions. We note that income inequality declines in the South-Western region where the proportion of net producers of

rice is most important. In this region, all income groups derive income from rice production, but the proportion is higher for poor households (about 25%). However, on average, households in South-Western region are net consumers of rice; analysis by income group shows that poor households in this region are net producers while rich households are net consumers. In addition, rich households allocate a larger share of their budget to rice consumption than poor households. Rice producers from South-Western region and particularly poor farmers benefit from higher prices. This contributes to reducing the income inequality gap.

Rising rice prices also lead to a decrease in inequality in the North and Boucle du Mouhoun regions in the short and long run. These two regions have the same characteristics in terms of the number of rice farmers (about 10%) and of rice consumers (less than 50% of the population). In addition, in these two regions, the budget devoted by rich households to rice consumption is greater than that of poor households. Indeed, the negative effect of higher rice prices on purchasing power will be more important for rich households than for poor. Furthermore, the proportion of rice producers is higher than the national average, which decreases with the income level, particularly in the North.

The use of per adult equivalent consumption to calculate income inequality indexes gives results almost similar to those obtained with per capita consumption. We observe a decrease in inequality in the South-Western and North regions. In contrast, inequality increases in the Boucle du Mouhoun.

Table 6 shows the results for the Theil index with per capita and per adult equivalent consumption. The results are higher than those obtained for the Gini index in the two cases. Rising rice prices lead to an increase in income inequality at the national level that varies between 1.4 and 1.6 percentage points (with per capita consumption). The increase in income inequality is higher in urban areas (between 3.5 and 3.7 percentage points) than in rural areas (between 1 and 1.7 percentage points). We also observe an increase in income inequality in most regions except for South-Western and North regions where income inequality decreases. The use of per adult equivalent consumption gives almost similar results.

7 Conclusion

This article estimates the impact of higher international rice prices on poverty and inequality in Burkina Faso. The determination of production and consumption ratios using the living standard survey (QUIBB, 2003) shows that most households are net consumers of rice. A great majority of these consumers live in urban areas. In addition, there are rice producers in all income groups, but the proportion in the intermediate and high-income groups is the most important.

Simulations based on the concept of compensating variation of income and the indicator of net benefit ratio developed by Deaton (1989) show that higher rice prices have a negative effect on real income in the short and long run. This effect is higher in urban than in rural areas. It is also high for higher-income groups and in the regions where rice production is very low. If we assume an increase in the producer price (30%) more important than in the consumer (15%), the effect is positive for the South-Western, Plateau and Central-South regions because they have a larger proportion of rice producers than the

other regions and they benefit from higher rice prices. The effect is more interesting in the long run for these regions.

The effect of higher rice prices on poverty is negative in the short and long run. If we use per capita consumption, an increase in rice prices leads to an increase in poverty that varies between 2.2 and 2.6 percentage points, depending on simulations. The variation is from 2.6 to 2.9 percentage points with per adult equivalent consumption. The negative effect on poverty is higher in urban areas than in rural areas. Rising rice prices increase poverty in most of the regions except for the South-Western where there is a large proportion of rice producers who benefit from higher prices. Furthermore, the rise in rice prices increases inequality, except for the rice-producing areas, as the increase is higher in urban than in rural areas. Indeed, the proportion of net producers of rice in the population is not significant and there is not a clear relationship between this proportion and income level at the aggregated level.

Overall, the results of this article show that the changes in world rice prices have a significant impact on households' income, poverty and inequality in Burkina Faso. This highlights the country's vulnerability to food-price shocks on international markets. In terms of policy recommendations for the government, one can suggest various avenues in order to mitigate this vulnerability. The first group of approaches consists of implementing economic policies in order to limit price variability, while the second consists of dampening the impact of the price shock. Regarding the first group, in the short run, the government could implement sound subsidy policies of grain prices by region. Another option would be to cut import tariffs on rice. However, these tariffs are pretty low and the oligopoly structure of the domestic market for imported rice may stress the impact of price shocks and reduce the impact of tariff cuts. In the long run the government could invest in developing the local rice industry in order to meet domestic demand and encourage exports. As to managing the impact of price shocks on vulnerable households, this could be achieved by using safety-nets such as social cash transfers targeted at poor households. The main advantage of this option compared with the first group, is that it does not distort relative prices in the economy.

The methodology used in this article corresponds probably to the maximum effect that would be observed following an increase in rice prices. As mentioned earlier, the focus here is solely on rice and does not take into account the cross price impacts as we derived the welfare effects. Indeed, one can expect that if there are major changes in the rice price, households will substitute other grains for rice. However, we generally observe that the price of locally produced cereals tends to follow the same trends as those that are imported.

Finally, note that we did not take into account the impact of higher prices on the wage rates in rural areas (general equilibrium effects). We focused only on households' net sales position. Accounting for such wage gains would certainly increase the benefits received by households. A recent study in India (Jacoby, 2013) showed that these benefits could be large.

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