MSSD DISCUSSION PAPER NO. 48

IMPACT OF GLOBAL COTTON MARKETS ON RURAL POVERTY IN BENIN

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ABSTRACT

World cotton prices have fallen by about 40 percent over the last two years, focusing attention on the effect of subsidies for cotton growers in depressing prices. This paper combines farm survey data from Benin with assumptions about the decline in farm-level prices to estimate the direct and indirect effects of cotton price reductions on rural income and poverty in Benin. The results indicate that there is a strong link between cotton prices and rural welfare in Benin. A 40 percent reduction in farm-level prices of cotton results in an increase in rural poverty of 8 percentage points in the short-run and 6-7 percentage points in the long run. Based on the estimated marginal propensity to consume tradable goods, the consumption multiplier is in the range of 3.3, meaning that one dollar of reduced spending by cotton growers results in a contraction of 3.3 dollars in overall demand. Finally, econometric analysis of the determinants of the demand for hired agricultural labor suggests that falling cotton prices will not greatly reduce labor demand since the labor intensity of cotton is similar to that of competing crops in Benin. Overall, the study highlights the link between rising subsidies for cotton growers in the U.S. and rural poverty in cotton exporting countries such as Benin.

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IMPACT OF GLOBAL COTTON MARKETS ON RURAL POVERTY IN BENIN

Nicholas Minot[1] and Lisa Daniels[2]

1. INTRODUCTION

From January 2001 to May 2002, world cotton prices fell almost 40 percent, from 64 cents per pound to 39 cents per pound[3]. This decline is part of a longer downward trend from the mid-1990s when cotton prices were over 80 cents per pound (see Figure 1). One reason for the decline is that world demand for cotton has been stagnant at 20 million tons since the mid-1990s. Synthetics have increased their share of the textile fiber market from 48 percent in 1995 to 55 percent in 1999. In addition, the slowing of worldwide economic growth over the last two years has affected commodity markets, but cotton is particularly sensitive because textile demand is more income-elastic than the demand for grains (USDA, 2002a).

In addition to stagnant demand, cotton prices have been pushed down by increased government support to cotton growers. The International Cotton Advisory Committee (ICAC) estimates that world-wide direct assistance to cotton growers was US$ 4.9 billion in 2001/02. Of this amount, the United States accounted for US$ 2.3 billion, equivalent to 24 cents per pound of cotton produced. Other sources, using a broader definition of assistance, estimate that the government provides US$ 3.9 billion to

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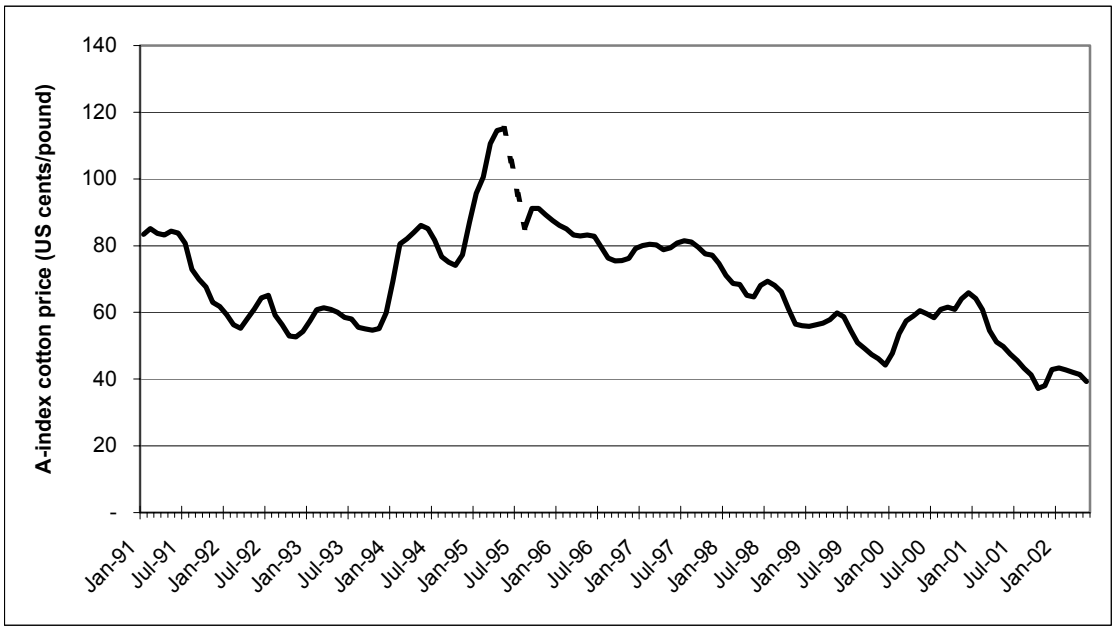
[3] These prices are based on the A-Index cotton price, calculated as the average of the five lowest prices for U.S. cotton in Northern European markets based on a grade of middling 1-3/32 inch fiber length.

Figure 1—Cotton prices in Northern Europe (A-Index)



the cotton sector (Oxfam, 2002, citing USDA). U.S. cotton policy consists of various programs[4], including two (the marketing loan program and loan deficiency payments) that ensure that farmers receive at least 52 cents/pound. This has the effect of insulating U.S. farmers from the falling world prices. In 2001, in spite of low world prices, the U.S. posted record cotton production and near-record export volumes.

China is the second largest provider of subsidies to its cotton growers. It maintains a reference price about 20 percent above the international price at a cost of

[4] The 1996 Farm Bill introduced production flexibility contract (PFC) payments, which were related to historical (not current) production and would decline over time as part of an effort to phase out farm subsidies. PFC payments to cotton farmers fell steadily from US$ 700 million in 1996 to US$ 474 million in 2002. Loan deficiency payments and marketing loan gains are, on the other hand, tied to current output and market prices. Low commodity prices over the last 3-4 years have sharply increased the cost of these programs. Payments to cotton growers were negligible in 1997, but rose to US$ 1.5 billion in 1999 and almost US$ 2.5 billion in 2002. In addition, Congress has authorized ad hoc market loss assistance (MLA) payments almost annually. MLA payments to cotton farmers were US$ 600 million in 1999 and US$ 650 million in 2002. Cotton exporters and U.S. mills also receive roughly US$ 200 million per year in "Step 2" payments, designed to keep U.S. cotton exports competitive (USDA, 2002b and Oxfam, 2002). Total assistance to the cotton sector in 2002 was US $ 3.9 billion (USDA, cited in Oxfam, 2002).

US$ 1.2 billion, or 10 cents/pound, as well as subsidizing exports and protecting domestic growers with import restrictions. The European Union spends US$ 700 million to provide generous support (over 50 cents/pound) to small numbers of cotton growers in Spain and Greece, while India spends US$ 500 million on its cotton subsidies. Other cotton producers such as Turkey, Brazil, Egypt, Mali, and Benin also provide subsidies to their farmers, totaling US$ 211 million (4 percent of the world-wide total), but the per-unit values are generally less then 10 cents/pound[5] (ICAC, 2002).

Although cotton subsidies in China are likely to decline as a result of on-going reforms to meet the requirements of the World Trade Organization, cotton subsidies in the U.S. will likely increase substantially in the coming year. The 2002 Farm Bill introduces target prices for the major commodities and programs that effectively pay farmers most of the difference between market prices and the target price. For upland cotton, the target price is 72 cents/pound. In addition, by allowing farmers to update their "base acreage", the new policy provides incentives for farmers to expand production[6].

Several recent studies have attempted to assess the impact of subsidies on world prices. The Centre for International Economics in Canberra uses a five region world

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[5] The only exception is Colombia, which provides assistance worth 16 cents per pound of production.

[6] The 2002 Farm Bill introduces two new commodity programs: direct fixed payments and counter-cyclical payments. In the case of upland cotton, the fixed direct payment is set at 6.7 cents/pound and is paid on the basis of 85 percent of the "base acreage". The counter-cyclical payments involve payments of up to 13 cents/pound on 85 percent of the base acreage depending on the gap between the market price (or the loan rate, whichever is higher) and the target price. These programs replace the production flexibility contract system and (supposedly) eliminate the need for the market loss assistance. The marketing loan and loan deficiency payments continue under the new Farm Bill with the same loan rate: 52 cents/pound for upland cotton. In addition, farmers are allowed to update their base acreage, providing them incentive to maintain or increase acreage in the event future opportunities to update acreage (USDA, 2002c).

model of fiber, textile, and garment markets in 2000-01 to simulate the impact of U.S. and European subsidies on cotton production and export. They find that removing U.S. and European subsidies to cotton growers would raise the world cotton price by 6 cents/pound or 11 percent. Removing import restrictions on textiles and clothing would independently raise cotton prices by 4 cents/pound or 2 percent (CIE, 2002). Another study[7], carried out by ICAC, estimates that the impact of removing U.S. production subsidies would have increased the world price by 3 cents/pound in 1999/00, by 6 cents/pound in 2000/01, and by 11 cents/pound in 2001/02. If all subsidizing countries are assumed to respond to subsidy removal in a similar way, the world price would be 31 cents/pound higher in 2001/02, according to ICAC estimates (ICAC, 2002).

The link between cotton subsidies (particularly in the U.S.) and incomes in poor cotton-exporting nations (particularly in West Africa) has been the topic of a study by the World Bank (Badiane *et al,* 2002), a provocative report by Oxfam (Oxfam, 2002), and a conference organized by the World Bank and ICAC (World Bank, 2002). The World Bank estimates that removing U.S. cotton subsidies would generate US$ 250 million per year in additional revenues for West African cotton farmers. The Oxfam report calculates the losses to three West African nations at 1-2 percent of gross domestic product. This report points out that, in Mali and Benin, losses in export revenue associated with U.S. cotton subsidies are greater than U.S. development assistance.

[7] The ICAC estimates are not based on a single market simulation model, but rather on calculations using results from three models: a model of textile demand, a model of cotton prices, and a model of cotton production in the United States (Carlos Valderama, ICAC, personal communication)..

The adverse impact of lower cotton prices on export revenue and GDP in cotton exporting nations is clear, but does this translate into higher incidence of rural poverty? If cotton is grown mainly by larger farmers with relatively high incomes, then the effect of changes in cotton prices on rural poverty may be modest. Even if cotton is grown primarily by small farmers, the magnitude of the effect on rural poverty will be small if few farmers grow cotton or if it accounts for a small share of rural income. Assessing the impact of changes in cotton prices on rural poverty requires detailed household survey data on incomes and expenditures, as well as information on linkages between cotton and other sectors in the economy.

This paper examines the impact of changes in cotton prices on rural poverty in Benin. In particular, it has four objectives:

- to describe the living conditions and level of poverty for cotton growers and other farmers in Benin;
- to estimate the short-run impact (before households adjust) of lower cotton prices on the income of cotton growers and on the incidence of poverty in rural Benin;
- to estimate the medium-run, direct impact (after household adjust variable inputs) of lower cotton prices on incomes and poverty in rural Benin; and
- to estimate the total impact of lower cotton prices including the effect on households that do not grow cotton but are affected indirectly by the reduced demand for labor and the reduced purchasing power of cotton farmers

2. BACKGROUND

The Republic of Benin is a small West African nation of about 6.0 million inhabitants, which covers an area 112 thousand square kilometers. Within this area, only 23 thousand km^2 (21 percent) is used for agriculture. The southern part of the country has a sub-equatorial climate with bi-modal rainfall averaging 1200 to 1500 mm per year. Maize and cassava are the staple food crops, and the area is densely populated, with up to 300 inhabitants/km^2. The center is drier (1000 to 1200 mm) and less densely populated, with a diversified agriculture that includes maize, cassava, cowpeas, groundnuts, and cotton. The north is semi-arid (800-1000 mm) and sparsely populated (less than 40 inhabitants/km2). Its rural economy is based on maize, sorghum, millet, yams, cotton, and livestock production.

The per capita gross national product is US$ 380, placing Benin among the low-income countries of the world. Its per capita income is higher than that of its landlocked neighbors to the north (Niger, Mali, and Burkina Faso), but lower than that of Cameroon and Cote d'Ivoire (World Bank, 2000). The agricultural sector accounts for 38 percent of the gross domestic product and employs about 56 percent of the economically active population.

In 1974, the military government adopted the principles of socialism, nationalizing large formal-sector companies, establishing crop marketing boards with monopoly power, creating state farms, and attempting to organize farmers into cooperatives. By the end of the 1980s, an economic crisis was mounting due to falling

prices of cotton and oil, the collapse of the mismanaged banking sector, and growing debt. The president renounced Marxism and called for a constitutional convention. The convention drafted a constitution that featured democratically elected presidents with four-year terms. In what is considered a model of peaceful democratic transition, the 17-year military leader was voted out of office.

Political reforms coincided with economic reforms as Benin entered into the first of several structural adjustment programs with the International Monetary Fund and the World Bank. In the agricultural sector, state farms and cooperatives were disbanded, food crop prices and marketing were liberalized, and many state-owned enterprises, including agro-processing enterprises, were privatized or closed (République du Benin, 1997). In January 1994, after several years of signs that the franc CFA (FCFA) was overvalued, it was devalued from 50 FCFA/French franc to 100 FCFA/French franc. Although this imposed hardships on manufacturing firms and consumers that had become accustomed to cheap imports, it stimulated the local production of cotton, rice, and other tradable goods.

Although the cotton sector benefited from the 1994 devaluation, structural reform in cotton marketing was limited. The cotton sector in Benin remained under the control of the state-owned *Societé Nationale pour la Promotion Agricole* (SONAPRA). Private firms were allowed to enter the fertilizer import sector, but SONAPRA continued to manage the importation and distribution of inputs. In cotton marketing, private firms were allowed to compete in cotton ginning, but they continued to rely on SONAPRA to collect the cotton and allocate it among the gins. One of the advantages of retaining this system is that it made it easier for SONAPRA to provide free seed and fertilizer on credit,

since its monopsony power in cotton marketing allowed it to enforce repayment of input credits. According to a nationally representative farm survey[8] carried out in 1998, 97 percent of all cotton growers used fertilizer, all of which was purchased on credit. In contrast, only 24 percent of other farmers used fertilizer, and just 19 percent of these purchases were made on credit (see IFPRI, 2001). In the past two years, Benin has begun to implement more far-reaching reforms of the cotton sector that would reduce the role of SONAPRA and introduce competition in the distribution of inputs and the marketing of cotton. The fall in world cotton prices has led to political pressure for the government to support the domestic price or even to re-assume control of the sector to protect farmer interests. According to ICAC (2002), the government provides modest support for the cotton price, equivalent to 5 cents/pound.

Cotton production in Benin increased from 52 thousand tons of cotton lint in 1990/91 to 152 thousand tons in 1997/8. Since then, production has remained in the range of 130-150 thousand tons and exports have been around 100,000 tons, making it the 12 largest cotton exporter in the world. Even after declining somewhat from its peak in 1996, the average annual growth rate in cotton production over the 1990s was 10.7 percent. Some of this growth can be attributed to the devaluation of the CFA franc, which allowed farm-level cotton prices to double. It is important to note, however, that cotton production increased substantially even before the devaluation as a result of improvements in the organization of the system of input distribution and marketing.

[8] The IFPRI-LARES Small Farmer Survey is described in Section 3.

Currently, cotton represents 90 percent of agricultural exports and 60-70 percent of its total exports (excluding re-exports[9]).

The economic reforms carried out in the 1990s and the growth in cotton production during this period resulted in concrete benefits for rural households. The 1994-95 *Enquête sur les Conditions de Vie en Milieu Rura*l (Survey of Rural Living Conditions) estimated the poverty rate at 33 percent (UNDP-MDR, 1996: 13). Adopting a similar definition of expenditure and the same poverty line (adjusted for inflation), the poverty rate in the 1998 survey was 21 percent. Given differences in methods and samples, one should not put too much weight on this result. However, qualitative questions in the latter survey appear to support the view that rural conditions have improved. According to the IFPRI-LARES survey, 52 percent of the households reported that they were better off at the time of the survey (1998) than in 1992 and only 28 percent reported being worse off (see Table 1). Furthermore, those reporting improvement tended to attribute these gains to economic factors such as crop prices and off-farm income opportunities, while those reporting worsening conditions tended to cite health and weather factors (see Table 2). Cotton farmers, those in the north of the country, and poor households were more likely to report improved conditions than others.

These results suggest that there is a strong link between market-oriented policies and cotton expansion on the one hand and the living conditions of farmers in Benin on the other hand. The analysis presented in this paper will further examine this link, focusing on the impact of changes in cotton prices on rural income and poverty.

[9] Re-exports of manufactured goods to Nigeria and other countries accounts for a large share of total exports.

Table 1—Perceived change in overall living conditions since 1992 by expenditure category

	Expenditure category (quintile)					
	Poorest	**2**	**3**	**4**	**Richest**	**Total**
Better	50%	59%	59%	49%	44%	52%
No change	20%	15%	9%	15%	15%	15%
Worse	27%	18%	29%	32%	31%	28%
No opinion	2%	7%	2%	4%	11%	5%
Total	100%	100%	100%	100%	100%	100%

Source: IFPRI/LARES Small Farmer Survey.

Table 2—Main reason for the improvement in conditions

	Department						
	Atacora	**Atlantique**	**Borgou**	**Mono**	**Ouémé**	**Zou**	**Total**
Change in crop prices	36%	4%	20%	47%	33%	16%	27%
Change in prices or food availability	6%	68%	46%	2%	21%	27%	25%
Change in off-farm income	42%	13%	9%	15%	21%	15%	20%
Change in cash crop production	5%	3%	5%			27%	7%
Change in household health	8%		12%		11%	3%	6%
Change seeds and inputs	1%			23%		5%	5%
Change in soil fertility			0%			2%	1%
Change in access to land					2%	2%	1%
Change in weather				2%		1%	0%
Change in access to credit		2%		2%			0%
Other	3%	10%	8%	10%	12%	2%	7%
Total	100%	100%	100%	100%	100%	100%	100%

Source: IFPRI/LARES Small Farmer Survey.

3. METHODS

The data used in this paper come from the *Equate des Petites Agricultures* (EPP) or Small Farmer Survey, carried out in 1998 by the International Food Policy Research Institute (IFPRI) and the *Laboratoire d'Analyse Régionale et d'Expertise Sociale* (LARES). The survey instrument consisted of a 24-page questionnaire, divided into 16 sections[10]. The households were selected using a two-stage stratified random sample procedure based on the 1997 Pre-Census of Agriculture. In each of the six departments[11], villages were randomly selected, with the number of villages proportional to the volume of agricultural production, subject to a minimum of 10 villages per department. In total, one hundred villages were selected. In each village, nine households were randomly selected using lists prepared for the pre-Census of Agriculture. In a few villages, the number of interviewed households was eight or ten, resulting in a final sample size of 899 agricultural households. Sampling weights are used in calculating the results presented here. The survey was carried out from August to November 1998 (see IFPRI, 2000 for more detail).

The first objective, to describe living conditions and poverty among cotton growers and other farmers, is based on descriptive statistics from the EPP. In this analysis, we use per capita expenditure as our measure of poverty and well-being, and as

[10] The 16 sections are household characteristics, housing characteristics, land, agricultural production, labor use, input use, changes regarding input use, credit, crop marketing, storage, sources of information, food and non-food consumption, allocation of time, asset ownership, sources of income, and perceptions of farmers.

[11] Since this study was carried out, an administrative reorganization has resulted in an increase in the number of departments from 6 to 12. The analysis in this report retains the old definitions of departments because this was the basis for the sampling design of the survey.

a proxy for income. Per capita expenditure is calculated as cash expenditure on consumption goods, the imputed value of home-produced food, and the rental equivalent of owner-occupied housing[12].

In order to describe poverty, we must adopt a poverty line. One commonly-used international standard is US$ 1 per person per day. Although this poverty line has the advantage of being internationally comparable, it results in a very high estimate of the incidence of poverty in Benin. According to the EPP, 95 percent of rural households in Benin live below this poverty line. Alternatively, we could adopt the poverty line identified by the 1994 *Enquête sur les Conditions de Vie en Milieu Rural* (ECVR). After adjusting for inflation between 1994 and 1998, the poverty line is 79,155 FCFA/adult equivalent, resulting in a rural poverty rate of just 21 percent[13]. This poverty line appears to define poverty too narrowly for our purposes. Since the main objective of this analysis is to compare the incidence and severity of poverty before and after a simulated reduction in world prices of cotton, we adopt a *relative* poverty line, set at the 40th percentile of per capita consumption expenditure.

The second objective is to estimate the short-run direct impact of lower cotton prices. The short-run direct impact refers to impact on cotton farmers in the first year,

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[12] The advantages of expenditure over income as a measure of well-being are well-known: respondents are less likely to under-report expenditure, it is easier to measure when farming and other types of self-employment are widespread, and it varies less across seasons and from one year to the next, giving a better estimate of the long-run average standard of living.

[13] The price level during the ECVR was taken to be the consumer price index (base December 1991) for August 1994, the mid-point of the ECVR data collection. The price level for the IFPRI-LARES Small Farmer Survey was assumed to be the price index for June 1998, the mid-point of the reference period for the survey. Thus, the ECVR poverty line of 56,500 FCFA/adult equivalent was increased by a factor of (200.2/142.9) = 1.40, yielding a 1998 poverty line of 79,155 FCFA/adult equivalent. See UNDP-MDR, 1996 and IFPRI, 2000 for more detail.

before they have an opportunity to change their decisions regarding input use and crop mix. We simulate the impact of various percentage reductions in cotton prices on the incomes of rural households. In particular, the per capita income of household i after the price change can be calculated as follows:

$$y_{1i} - y_{0i} = (Q_{ci}\Delta P_c) / H_i \quad (1)$$

where y_{1i} is per capita income[14] of household i after the shock, y_{0i} is per capita income before the shock, Q_c is the quantity of cotton produced by household i, ΔP_c is the change in the price of cotton, and H_i is the number of members in household i. If a household does not grow cotton, then $Q_{ci}=0$ and the direct effect of lower cotton prices is zero ($y_{1i} = y_{0i}$). But if $Q_{ci} > 0$, then a price reduction ($\Delta P_c, < 0$) implies that income will fall ($y_{1i} \leq y_{0i}$).

The simulations are run with farm-level reductions in cotton price (ΔP_c) of 10%, 20%, 30%, and 40%. The other variables (y_{oi} and Q_{ci}) are all defined at the household level, allowing the changes in per capita income to be calculated for each household in the sample. This "micro-simulation" approach allows us to estimate the change in income for any sub-group in rural areas, defined by income, farm-size, or other variables.

The impact of price changes on poverty is measured using the Foster-Greer-Thorbecke measures of poverty, defined as follows:

$$P_\alpha = \frac{1}{N}\sum_i \left[\frac{\mu - y_i}{\mu}\right]^\alpha \quad (2)$$

where P_a is the poverty measure, N is the number of households, μ is the poverty line, and y_i is the income or expenditure of poor household i (the summation occurs only over poor

[14] As mentioned above, we use per capita expenditure as a proxy for per capita income.

households). When $\alpha=0$, the poverty measure, P_0, is the incidence of poverty, that is, the proportion of households whose income is below the poverty line. When $\alpha=1$, the poverty measure, P_1, is the poverty-gap measure. The poverty gap is equal to the incidence of poverty multiplied by the average gap between the poverty line and the income of a poor household, expressed as a percentage of the poverty line. Thus, it takes into account the depth of poverty as well as the percentage of the households that are poor. If $\alpha=2$, then the poverty measure, P_2, takes into account the degree of inequality among poor households, as well as the depth of poverty and the number of poor households. P_2, sometimes called the poverty-gap squared, will be referred to as a measure of the severity of poverty (see Foster, Greer, and Thorbecke, 1984).

The third objective, to estimate the long-run, directs impact of lower cotton prices. Since this analysis takes into account the fact that farmers will substitute away from cotton and reduce input use, the long-run direct impact is smaller (in absolute terms) than the short-run direct impact of the change in cotton prices. One approach would be to sum the welfare effect of the change in cotton price and those associated with price changes in other markets (such as those for inputs and competing crops). Just et al (1982) show that the impact can also be measured by focusing exclusively on the original (cotton) market, but using general equilibrium elasticities that take into account the feed-back effect of other markets on cotton markets. In this analysis, we adopt the second approach. In particular, we use the following equation to describe the welfare impact of the change in cotton price:

$$y_{1i} - y_{0i} = (Q_{ci}\Delta P_c)/H_i + \left(\frac{1}{2}(\Delta P_c)^2 \varepsilon_c \frac{Q_{ci}}{P_c}\right)/H_i \quad (3)$$

where ε_c is the general equilibrium supply elasticity of cotton and Pc is the price of cotton[15]. Note that the second term is positive regardless of whether the price change is positive or negative. This implies that the long-term welfare effect of an increase (decrease) in price is more positive (less negative) than the short-term effect (see Minot and Goletti, 2000 for derivation). It is also worth noting that the long-run effect of the price change is simply a multiple of the short-run effect, where the multiplication factor is a function of the size of the price change and the supply elasticity[16].

In the absence of estimated elasticities of supply for cotton in Benin, we use a range of plausible elasticities to calculate the range of plausible welfare impacts[17]. The elasticities used are 0.5, 1.0, and 1.5. As in the analysis of the short-run effect, we simulate the impact of these changes on the income of each household in the sample (micro-simulation) in order to estimate the impact on different types of households in terms of income and poverty.

The fourth objective is to estimate the *total* impact of lower cotton prices. This analysis estimates the effect of lower cotton prices on both cotton farmers and other households. We focus on two types of indirect effects. First, the reduced income of cotton farmers implies reduced demand for consumer goods and services produced by

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[15] This expression is more accurate for small changes in price than large ones. These are third-order effects in that they would be captured by the third term in a Taylor-series expansion. It will be shown later that the results are not very sensitive even to second-order effects (alternative assumptions about supply elasticities).

[16] More specifically, the long-run impact is equal to the short-run impact times $(1+ 0.5(\varepsilon_c)(\Delta P_c/P_c))$.

[17] Two studies have estimated the supply elasticity of cotton in Tanzania. Dercon (1993) estimated an elasticity of 0.63, while Delgado and Minot (2000), using more recent data, obtained an estimate of 1.0.

other households and firms in the economy. We estimate this indirect effect by calculating the multiplier associated with consumer spending by cotton farmers. The multiplier is calculated based on the marginal propensity of cotton farmers to consume tradable goods. This marginal propensity to consume tradable goods is, in turn, calculated from the expenditure data in the IFPRI-LARES Small Farmer Survey and some assumptions about the tradability of the 33 expenditure categories in the survey.

The second type of indirect effect on households outside the cotton sector is the reduced demand for labor. Cotton is more labor-intensive than many other crops, so a reduction in cotton area is expected to reduce the demand for agricultural labor, thus reducing the wage income of households that depend on agricultural labor. We use data from the EPP to assess the magnitude of the change in demand for agricultural labor associated with reduced cotton output.

4. CHARACTERISTICS OF FARMERS IN BENIN

Before estimating the impact of changing cotton prices on rural households, it is useful to provide some background on the agricultural economy of Benin and the role of cotton. This provides some context for understanding and interpreting the results presented later.

According to the IFPRI-LARES Small Farmer Survey, the most widely grown crop in Benin is maize, cultivated by 89 percent of the farm households (see Table 3). Cowpeas are grown by almost half the farms, and manioc, yams, sorghum/millet, and cotton are each grown by roughly one third of the farm households.

Although cotton is grown by barely one third of the farmers in Benin, it plays an important part of the rural economy. If we average across all farmers, the average cotton area is 0.79 hectares and the average gross value of cotton production is 193,000 FCFA per farm. These figures imply that cotton accounts for about 18 percent of the area planted by farm households and 22 percent of the gross value of crop production. In value terms, cotton is the second most important crop, after maize.

Table 3—Agricultural production patterns by crop

	Percent of farms growing (%)	Area (ha per farm)	Percent of total area	Quantity (tons per farm)	Yield (tons per ha)	Value (1000 FCFA per farm)	Percent of total value
Maize	89%	1.58	37%	1.56	.98	237	27%
Sorghum/millet	36%	.26	6%	.28	1.05	37	4%
Rice	7%	.02	1%	.03	1.27	4	0%
Cowpeas	48%	.31	7%	.17	.55	34	4%
Groundnuts	27%	.23	5%	.28	1.21	31	4%
Manioc	35%	.40	9%	1.92	4.75	154	18%
Yams	34%	.10	2%	1.02	9.77	98	11%
Sweet potatoes	5%	.01	0%	.04	3.38	2	0%
Tomatoes	19%	.07	2%	.33	4.63	26	3%
Okra	17%	.06	1%	.05	.89	4	0%
Hot pepper	14%	.06	1%	.05	.92	10	1%
Other vegetables	14%	.04	1%	.07	1.70	21	2%
Cotton	34%	.79	18%	.91	1.16	193	22%
Other crops	20%	.32	7%	.20	.63	28	3%
Total		4.27	100%	6.91	1.62	880	100%

Source: IFPRI-LARES Small Farmer Survey.
Note: Intercropped area divided equally among crops. Area, quantity, and value averages include non-growers.

If we focus on the averages among cotton farmers, the average area planted with cotton is 2.32 hectares, producing 2.67 tons of seed cotton[18]. The value of this output is 568,000 FCFA (or US$ 901) per cotton farm[19].

Another measure of the importance of cotton in the rural economy is its contribution to cash income. Benin farmers are quite market oriented, selling over half the output of cowpeas, groundnuts, manioc, and sweet potatoes, and selling almost half of the output of the "staple" foodcrop, maize (see Table 4). Nonetheless, cotton accounts for about one-third of the value of crop sales carried out by farm households in Benin.

Who grows cotton and how do cotton farmers differ from other farmers in Benin? As mentioned earlier, cotton production is concentrated in the north and center of Benin. About two-thirds of the farmers in the large department of Borgou grow cotton, as do 37 percent of those in Atacora and 64 percent of those in the central department of Zou. By contrast, in the three departments in the south (Atlantique, Mono, and Ouémé), the percentage ranges from zero to 25 percent (see Table 5). If we divide the farm households into quintiles, the proportion of farmers growing cotton does not seem to vary consistently across quintiles. If anything, the proportion of cotton growers is lower (28 percent) in the richest quintile (see Table 6).

Cotton growers tend to have farms that are, on average, twice as large as those of non-growers (5.3 hectares compared to 2.3 hectares). Based on this fact alone, one might

[18] It is worth noting that the average yield is calculated at the household level and aggregated, so it is not necessarily equal to the average quantity divided by the average area. A similar qualification applies to production, price, and value of output.

[19] When the Small Farmer Survey was carried out, the exchange rate was around 630 FCFA/US$, so that the value of cotton production was US$ 901 per cotton farm.

expect cotton growers to be better off than non-growers. Nonetheless, cotton growers are similar to other farmers in terms of various measures of well-being. The incidence of poverty rate is slightly lower among cotton farmers (37 percent) than among other farmers (42 percent), but the per capita expenditure of cotton growers is about 8 lower than that of others, and the budget share allocated to food is almost identical to that of non-growers (see Table 7). The reason that the larger farms do not translate into a higher standard of living is that cotton growers are concentrated in the more arid north, where the agricultural potential is lower and where opportunities for non-farm employment are more scarce.

Table 4—Agricultural marketing patterns by crop

	Share of households growing (%)	Share of growers selling (%)	Share of households selling (%)	Value of production (1000 F/farm)	Value of sales (1000 F/farm)	Sales as percentage of production
Maize	89%	66%	58%	237	109	46%
Sorghum/millet	36%	34%	13%	37	4	11%
Rice	7%	69%	5%	4	1	43%
Cowpeas	48%	66%	32%	33	17	53%
Groundnuts	27%	95%	26%	31	23	74%
Manioc	35%	76%	27%	154	129	84%
Yams	34%	54%	18%	97	10	11%
Sweet potatoes	5%	67%	3%	2	1	71%
Tomatoes	19%	97%	19%	26	23	91%
Okra	17%	69%	12%	4	2	69%
Hot pepper	14%	93%	13%	10	8	85%
Other vegetables	14%	88%	12%	21	20	95%
Cotton	34%	100%	34%	192	192	100%
Other crops	20%	75%	15%	27	23	85%
Total	.	.	.	880	570	65%

Source: IFPRI/LARES Small Farmer Survey.

Table 5—Proportion of households growing each crop by department

	Department					
	Atacora	Atlantique	Borgou	Mono	Ouémé	Zou
Maize	76%	100%	96%	83%	91%	95%
Sorghum/millet	96%	.	85%	.	3%	18%
Rice	32%	.	14%	.	1%	4%
Cowpeas	63%	17%	66%	42%	42%	67%
Groundnuts	34%	5%	23%	11%	21%	63%
Manioc	40%	79%	59%	56%	83%	49%
Yams	96%	2%	79%	4%	13%	27%
Sweet potatoes	2%	2%	5%	3%	18%	2%
Tomatoes	2%	25%	31%	26%	24%	18%
Okra	29%	.	70%	6%	4%	22%
Hot pepper	7%	8%	17%	27%	19%	20%
Other vegetables	6%	.	20%	26%	12%	12%
Cotton	37%	.	68%	25%	4%	64%
Other crops	41%	20%	33%	16%	21%	22%

Source: IFPRI-LARES Small Farmer Survey.

Table 6—Proportion of households growing each crop by expenditure category

	Expenditure category (quintile)				
	Poorest	**2**	**3**	**4**	**Richest**
Maize	91%	93%	90%	88%	90%
Sorghum/millet	41%	30%	33%	30%	20%
Rice	7%	6%	7%	9%	7%
Cowpeas	53%	53%	55%	52%	41%
Groundnuts	23%	23%	32%	37%	27%
Manioc	62%	52%	61%	61%	67%
Yams	37%	39%	37%	34%	26%
Sweet potatoes	3%	4%	6%	7%	7%
Tomatoes	10%	25%	21%	28%	23%
Okra	21%	20%	23%	27%	16%
Hot pepper	12%	16%	19%	26%	14%
Other vegetables	11%	10%	16%	19%	12%
Cotton	35%	30%	44%	38%	28%
Other crops	24%	21%	22%	26%	29%

Source: IFPRI-LARES Small Farmer Survey.

Table 7—Characteristics of cotton growers and other farmers

	Cotton growers	Other farmers	Total
Household size	10.1	8.1	8.8
Dependency ratio	49	48	48
Sown area (ha)	6.5	3.2	4.4
Farm size (ha)	5.3	2.3	3.3
Expenditure (FCFA/person/year)	99,437	108,315	105,203
Food share	57	56	57
Home production share	35	24	28
Percent growing cotton	100	0	35
Cotton area (ha)	2.3	0	0.8
Cotton output (kg)	2,559	0	897
Cotton yield (kg/ha)	1,084		1,084
Cotton sales (FCFA)	505,584	0	177,217
Poverty measures			
P0	0.37	0.42	0.40
P1	0.095	0.103	0.100
P2	0.033	0.037	0.036

Source: IFPRI-LARES Small Farmer Survey.

Table 8—Characteristics of rural households by department

Department	Atacora	Atlantique	Borgou	Mono	Ouémé	Zou	Total
Household size	8.8	7.6	11.3	7.4	8.4	9.1	8.8
Dependency ratio	48	46	50	45	50	49	48
Sown area (ha)	3.3	4.2	5.4	3.2	2.7	6.7	4.4
Farm size (ha)	3.3	2.5	5.4	1.8	1.9	4.8	3.3
Expenditure (F/person/year)	84,672	139,290	94,803	88,034	116,479	110,108	105,203
Food share	66	48	64	60	53	51	57
Home production share	44	16	47	28	16	24	28
Percent growing cotton	37	0	68	25	4	64	35
Cotton area (ha)	0.4	0	2.1	0.3	0	1.7	0.8
Cotton output (kg)	492	0	2,450	193	12	1,849	897
Cotton yield (kg/ha)	1,152		1,167	744	503	1,143	1,084
Cotton sales (FCFA)	84,480	0	488,585	38,537	2,419	369,372	177,217
Poverty measures							
P0	0.54	0.14	0.44	0.50	0.44	0.33	0.40
P1	0.161	0.034	0.098	0.131	0.110	0.071	0.100
P2	0.065	0.012	0.031	0.046	0.042	0.022	0.036

Source: IFPRI-LARES Small Farmer Survey.

As mentioned in Section 2, there are sharp differences across regions in Benin. As shown in Table 8, the northern department of Atacora has the lowest average expenditure, the highest poverty rate, and the highest food share. In contrast, the coastal department of Atlantique (which includes the largest city) has the highest expenditure, the lowest poverty rate. Farmers in Borgou and Zou produce more than 1.8 tons of cotton per household, compared to less than 500 kg per household in Atacora and even less on the three coastal departments.

Table 9—Characteristics of rural households by expenditure category

	Poorest	2	3	4	Richest	Total
Household size	9.9	10.8	8.4	7.6	7.2	8.8
Dependency ratio	55	51	46	44	44	48
Sown area (ha)	3	4.2	4.2	5.1	5.2	4.4
Farm size (ha)	2.4	3.1	3.3	4.1	3.9	3.3
Expenditure (FCFA/person/year)	47,702	68,355	89,394	116,400	204,550	105,203
Food share	64	61	55	56	47	57
Home production share	35	31	29	28	19	28
Percent growing cotton	35	30	44	38	28	35
Cotton area (ha)	0.5	0.6	1	1.2	0.7	0.8
Cotton output (kg)	497	706	1,037	1,227	1,020	897
Cotton yield (kg/ha)	919	1,064	1,070	1,123	1,281	1,084
Cotton sales (FCFA)	94,699	139,742	206,002	244,279	201,711	177,217
Poverty measures						
P0	1.00	1.00	0	0	0	0.40
P1	0.38	0.12	0	0	0	0.10
P2	0.160	0.018	0	0	0	0.036

Source: IFPRI-LARES Small Farmer Survey.

5. DIRECT IMPACT OF LOWER COTTON PRICES

In this section, we use the data from the IFPRI-LARES Small Farmer Survey to estimate the *direct* impact of lower cotton prices in Benin. The direct impact refers to the effect of the cotton price changes on Benin cotton farmers. First, we examine the impact of lower prices on the income and poverty of cotton farmers in the short-run, before they have an opportunity to respond to the lower prices. Next, we estimate the impact on cotton farmers in the longer run, after they have responded to the shock.

SHORT-TERM IMPACT

As described in Section 3, we estimate the short-term change in income associated with lower cotton prices using household-level information on per capita expenditures and the volume of cotton production, combined with different assumptions about the reduction in cotton price. The results of these calculations are shown in Table 10. A 40 percent reduction in the farm-gate price of cotton reduces the income of cotton growers from 99,437 FCFA/person to 78,730 FCFA/person, a reduction of 21 percent. Taking into account the incomes of non-growers, which do not change in this simulation, the average income falls from 105,203 FCFA/person to 97,944 FCFA/person., or 7 percent. Smaller reductions in the cotton price cause roughly proportionate changes in income (see Figure 2).

Figure 2—Short-run direct impact of lower cotton prices on per capita income

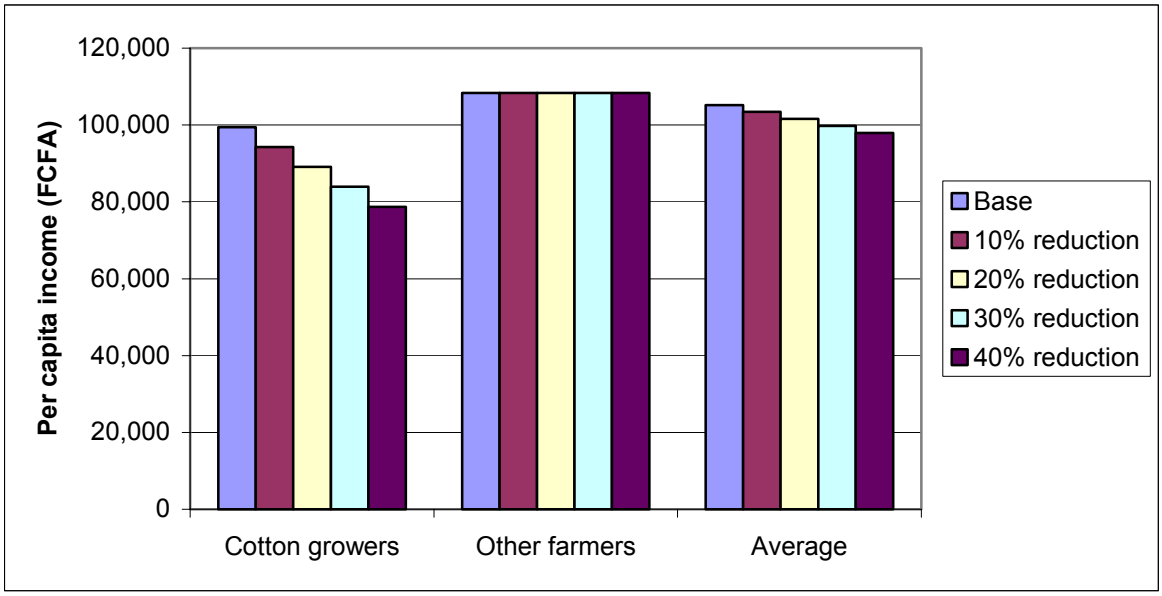


Table 10—Short-term direct impact of reductions in cotton prices on income and poverty

	Cotton growers	Other farmers	Average
Per capita expenditure			
Base	99,437	108,315	105,203
10% reduction	94,260	108,315	103,388
20% reduction	89,083	108,315	101,574
30% reduction	83,907	108,315	99,759
40% reduction	78,730	108,315	97,944
Incidence of poverty (P0)			
Base	0.37	0.42	0.40
10% reduction	0.42	0.42	0.42
20% reduction	0.49	0.42	0.44
30% reduction	0.55	0.42	0.46
40% reduction	0.59	0.42	0.48
Poverty gap (P1)			
Base	0.10	0.10	0.10
10% reduction	0.11	0.10	0.11
20% reduction	0.14	0.10	0.12
30% reduction	0.17	0.10	0.13
40% reduction	0.20	0.10	0.14
Severity of poverty (P2)			
Base	0.033	0.037	0.036
10% reduction	0.041	0.037	0.038
20% reduction	0.053	0.037	0.042
30% reduction	0.071	0.037	0.049
40% reduction	0.096	0.037	0.058

Source: IFPRI-LARES Small Farmer Survey.

With a 40 percent fall in the cotton price, the incidence of poverty (P_0) among cotton farmers rises from 37 percent to 59 percent. The average incidence of poverty, including both cotton growers and other farmers rises 8 percentage points, from 40 percent to 48 percent (see Figure 3). In absolute terms, this implies that about 334 thousand people would fall below the poverty line as a result of a 40 percent reduction in cotton prices[20].

A 40 percent decrease in the price of cotton results in a doubling of the poverty gap (P_1) among cotton farmers, from 0.10 to 0.20, and a 40% increase in the poverty gap for all farm households in Benin. The poverty gap squared (P_2) or severity of poverty increases almost three-fold among cotton farmers and by 61 percent across all farm households.

This analysis can be broken down by department to evaluate regional differences in the impact of falling cotton prices[21] (see Table 11 and Figure 4). In Atlantique and Ouémé, the reduction in cotton prices has negligible effects on income and poverty because there are virtually no cotton farmers in these departments. On the other hand, the impact on the departments of Borgou and Zou are large. In Zou, a 40 percent reduction in cotton prices results a 15 percent fall in per capita income and a 17 percentage point increase in the incidence of poverty. In Borgou, the same decrease in cotton prices causes an 18 percent reduction in per capita income and a 18 percentage point increase in

[20] This estimate is obtained by multiplying the percentage point increase in poverty (.08), the number of farm households in Benin based on the sum of the sampling weights (474,964), and the average household size of farms in Benin according to the survey (8.8).

[21] As mentioned earlier, since the survey was carried out, the number of departments has increased from 6 to 12. The sample size of the survey is too small to allow disaggregation of results by the newly defined departments.

the incidence of poverty. In fact, the department of Borgou moves from having an "average" poverty rate (greater than in two departments and less than in two others) to having the highest incidence of poverty, 62 percent. Similarly, the poverty-gap (P_1) in Borgou increases by a factor of three and the severity of poverty (P_2) doubles as a result of the 40 percent reduction in cotton prices.

Figure 3—Short-run impact of lower cotton prices on the incidence of poverty

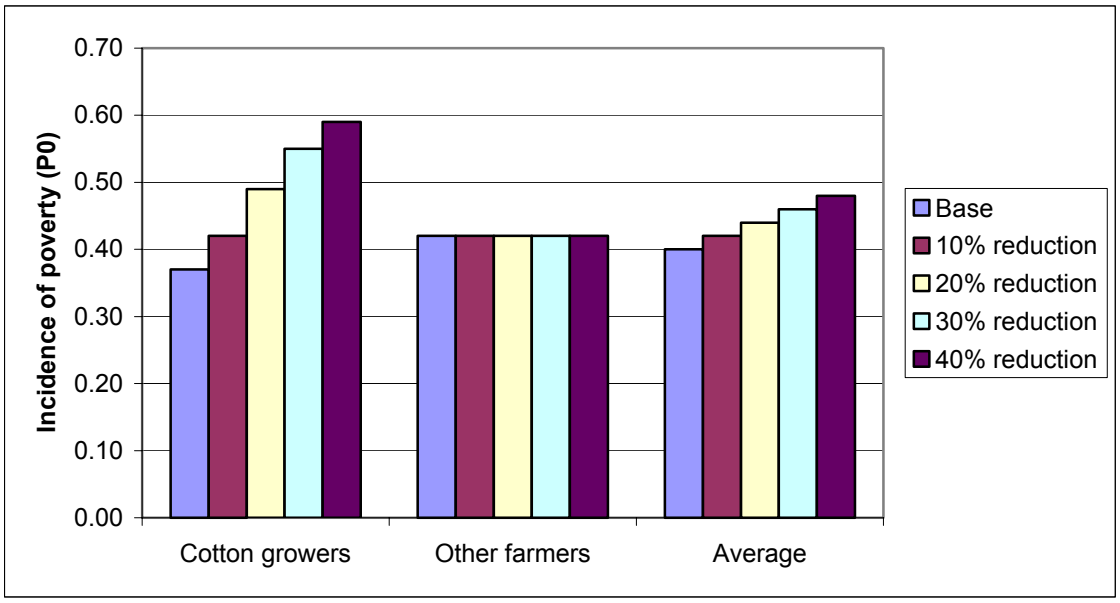
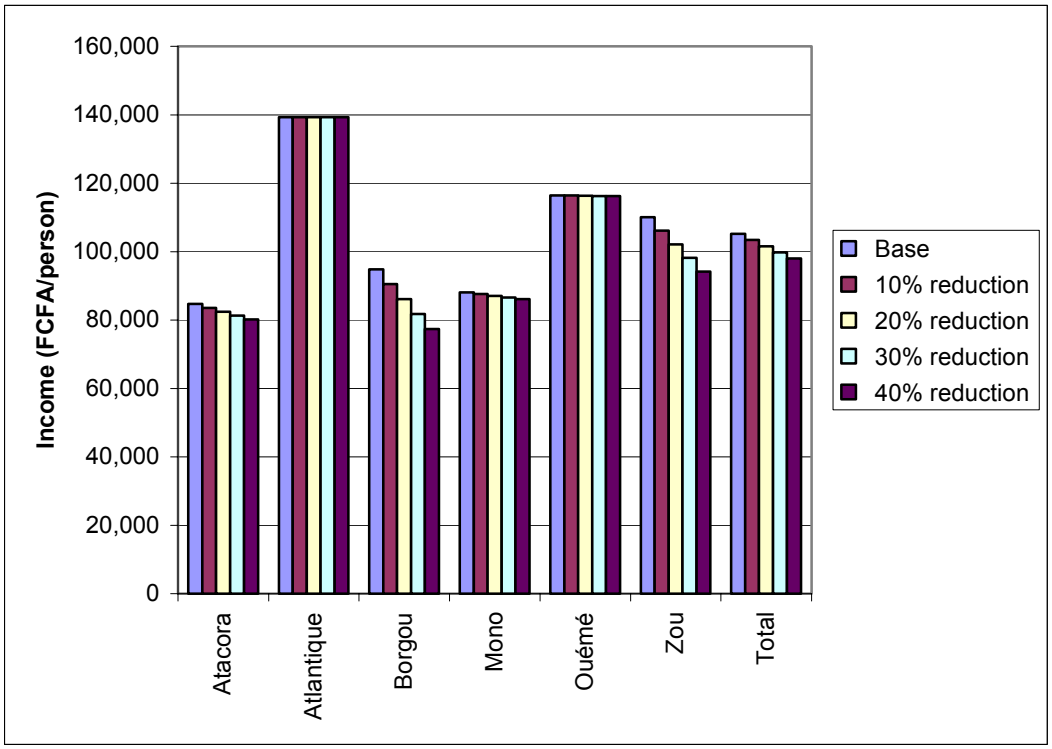


Table 11—Short-run direct impact of reductions in cotton prices by department

	Atacora	Atlantique	Borgou	Mono	Ouémé	Zou	Total
Per capita expenditure							
Base	84,672	139,290	94,803	88,034	116,479	110,108	105,203
10% reduction	83,559	139,290	90,455	87,547	116,414	106,115	103,388
20% reduction	82,446	139,290	86,106	87,060	116,349	102,123	101,574
30% reduction	81,333	139,290	81,758	86,573	116,284	98,130	99,759
40% reduction	80,219	139,290	77,409	86,086	116,219	94,137	97,944
Incidence of poverty (P0)							
Base	0.54	0.14	0.44	0.50	0.44	0.33	0.40
10% reduction	0.55	0.14	0.46	0.50	0.44	0.37	0.42
20% reduction	0.56	0.14	0.53	0.50	0.44	0.43	0.44
30% reduction	0.56	0.14	0.58	0.52	0.44	0.47	0.46
40% reduction	0.57	0.14	0.62	0.53	0.44	0.50	0.48
Poverty gap (P1)							
Base	0.161	0.034	0.098	0.131	0.110	0.071	0.100
10% reduction	0.166	0.034	0.114	0.134	0.110	0.081	0.106
20% reduction	0.172	0.034	0.137	0.137	0.111	0.097	0.115
30% reduction	0.178	0.034	0.167	0.140	0.111	0.118	0.126
40% reduction	0.185	0.034	0.202	0.143	0.111	0.144	0.138
Severity of poverty (P2)							
Base	0.065	0.012	0.031	0.046	0.042	0.022	0.036
10% reduction	0.068	0.012	0.039	0.048	0.042	0.025	0.038
20% reduction	0.070	0.012	0.052	0.050	0.042	0.031	0.042
30% reduction	0.074	0.012	0.071	0.052	0.042	0.041	0.049
40% reduction	0.078	0.012	0.100	0.055	0.042	0.057	0.058

Source: IFPRI-LARES Small Farmer Survey.

Figure 4—Short-run direct impact of lower cotton prices on income by department



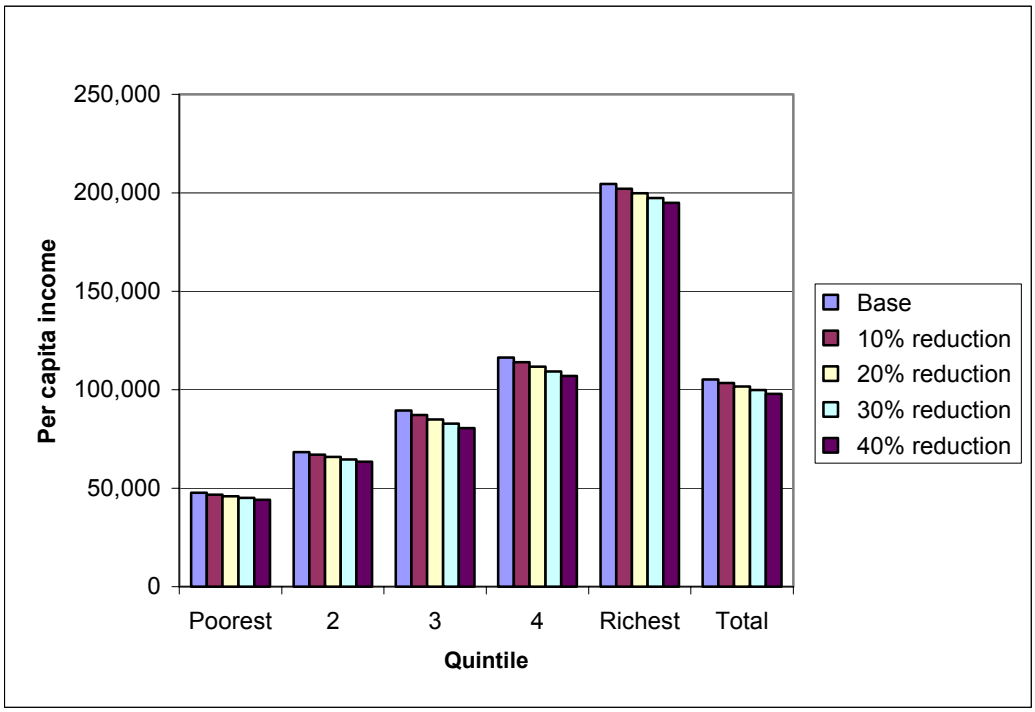
Similarly, we can examine the impact of reductions in cotton prices on different income categories (see Table 12 and Figure 5). The absolute reductions in income are greater for the high-income households, but all income categories show similar percentage reductions in per capita income as a result of a 40 percent decrease in cotton prices. By definition, all the households in the bottom two quintiles are poor so the incidence of poverty (P0) is 100 percent. However, the analysis indicates that about 30 percent of those households in the third quintile and 8 percent of those in the fourth quintile drop below the poverty line as a result of the 40 percent decrease in cotton prices.

Table 12—Short-run direct impact of reductions in cotton price by expenditure category

	Poorest	2	3	4	Richest	Total
Per capita expenditure						
Base	47,702	68,355	89,394	116,400	204,550	105,203
10% reduction	46,833	67,122	87,182	114,030	202,154	103,388
20% reduction	45,964	65,889	84,970	111,659	199,759	101,574
30% reduction	45,095	64,657	82,758	109,289	197,363	99,759
40% reduction	44,226	63,424	80,546	106,918	194,968	97,944
Incidence of poverty (P0)						
Base	1.00	1.00	0.00	0.00	0.00	0.40
10% reduction	1.00	1.00	0.08	0.00	0.00	0.42
20% reduction	1.00	1.00	0.19	0.01	0.00	0.44
30% reduction	1.00	1.00	0.26	0.05	0.00	0.46
40% reduction	1.00	1.00	0.30	0.08	0.00	0.48
Poverty gap (P1)						
Base	0.38	0.12	0.00	0.00	0.00	0.10
10% reduction	0.40	0.13	0.00	0.00	0.00	0.11
20% reduction	0.41	0.15	0.02	0.00	0.00	0.12
30% reduction	0.42	0.17	0.04	0.01	0.00	0.13
40% reduction	0.43	0.18	0.06	0.02	0.00	0.14
Severity of poverty (P2)						
Base	0.160	0.018	0	0	0	0.036
10% reduction	0.169	0.023	0	0	0	0.038
20% reduction	0.179	0.030	0.002	0	0	0.042
30% reduction	0.191	0.040	0.009	0.003	0	0.049
40% reduction	0.204	0.054	0.021	0.010	0	0.058

Source: IFPRI-LARES Small Farmer Survey.

Figure 5—Short-run direct impact of lower cotton prices on income by income category

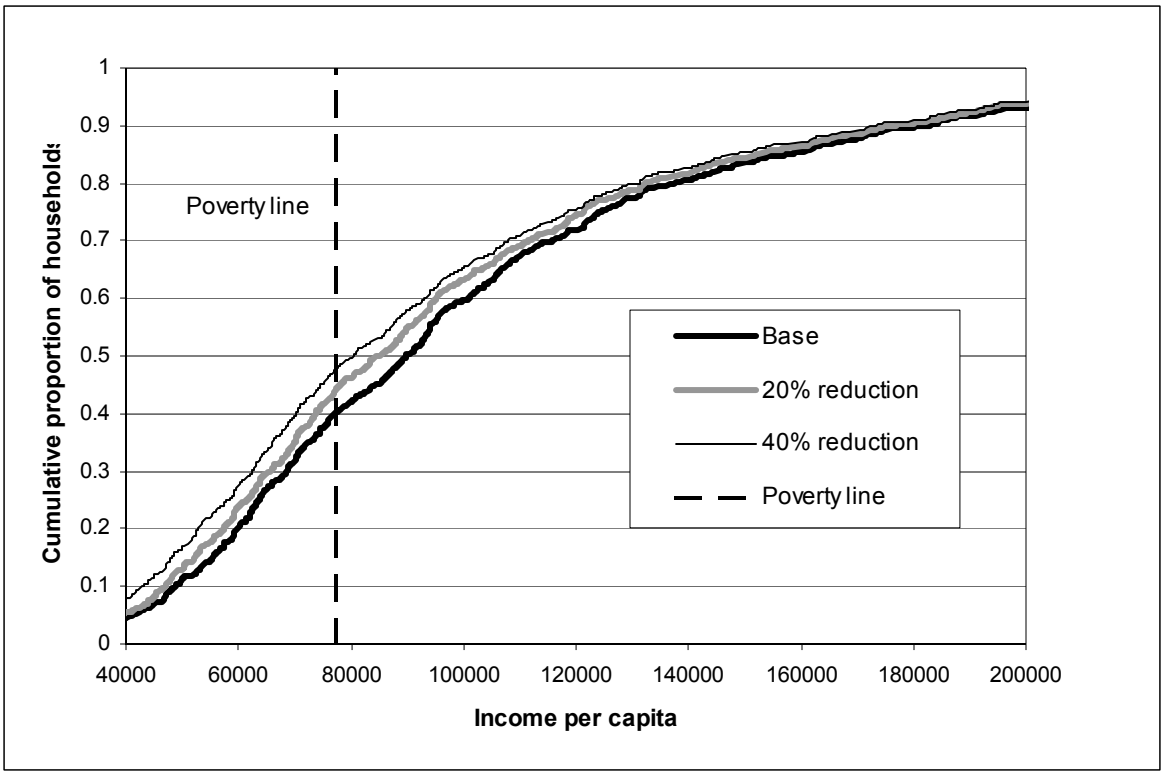


Although the incidence of poverty in the bottom two quintiles cannot rise above 100 percent, the poverty gap measure (P1) and the severity of poverty (P2) can and do increase. In particular, a 40 percent drop in cotton prices causes the depth of poverty to rise from 0.38 to 0.43 and the severity of poverty to increase from 0.16 to 0.20.

Finally, we look at the effect of falling cotton prices on the cumulative distribution of income per capita (see Figure 6). Among other things, it gives us information about the sensitivity of the results to alternative poverty lines, an important consideration given that our poverty lines is relative (set at the 40th percentile in the base distribution). The point where the cumulative distribution cross the poverty line is the poverty rate (note that the base distribution cross the poverty line at the 40th percentile).

It is clear from the graph that similar results would have been obtained for higher and lower poverty lines.

Figure 6—Short-run impact of lower cotton prices on the cumulative distribution of income



LONG-TERM IMPACT

In the previous section, the welfare impact of cotton price decreases was calculated assuming that cotton farmers do not adjust their production patterns. While this is valid for estimating the short-run impact (less than one year), it is not realistic in the longer run (more than one year). In response to lower cotton prices, farmers will reallocate their land, labor, and other inputs to other crops and perhaps to livestock and non-farm activities. The income level of farmers after this adjustment is generally

higher than before adjustment (otherwise, they would not adjust), but lower than before the price shock (otherwise, they would have adopted the new crop mix even without the price shock). The greater the price-responsiveness of cotton farmers, the less the long-run adverse impact of the cotton price decrease.

Because of uncertainty regarding the supply elasticity of cotton, we carry out this analysis using three elasticities: 0.5, 1.0, and 1.5. In order to simplify the discussion, we present only the impact of a 40 percent reduction in cotton prices. These results are presented with the base levels and with the short-run impact. Since the assumption behind the short-run impact is that the supply elasticity is zero ($\varepsilon=0$)., they are labeled as such.

As described in Section 5.1, the short-run impact of the lower cotton price is to reduce average per capita income from 105,203 FCFA to 97,944 FCFA, or 7 percent. If the general equilibrium supply elasticity of cotton is 0.5, the average income is 98,670 FCFA/person, a decline of 6 percent from the base. At the other extreme, if the supply elasticity is 1.5, then the average income is 100,122 FCFA/person, a reduction of 5 percent from the base (see Table 13).

In the long run, a reduction of 40 percent in the price of cotton is associated with a 20-21 percentage point increase in the incidence of poverty among cotton growers and a 6-7 percentage point increase in the overall rural poverty rate, depending on the assumption regarding the supply elasticity. The depth of poverty (P_1) rises from 0.10 to 0.12 - 0.13, again depending on the elasticity assumption. And the severity of poverty (P_2) increases from 0.036 to 0.047 - 0.058 (see Table 13). As expected, the long-run impact of the 40 percent reduction in cotton prices is somewhat less adverse than the

short-run impact. It is notable, however, that the results are not very sensitive to the elasticity assumption.

Table 13—Long-term direct impact of a 40% reduction in cotton prices on income and poverty

	Cotton growers	Other farmers	Average
Per capita expenditure			
Base	99,437	108,315	105,203
ε = 0	78,730	108,315	97,944
ε = 0.5	80,800	108,315	98,670
ε = 1.0	82,871	108,315	99,396
ε = 1.5	84,942	108,315	100,122
Incidence of poverty (P0)			
Base	0.37	0.42	0.40
ε = 0	0.59	0.42	0.48
ε = 0.5	0.58	0.42	0.47
ε = 1.0	0.56	0.42	0.47
ε = 1.5	0.55	0.42	0.46
Poverty gap (P1)			
Base	0.10	0.10	0.10
ε = 0	0.20	0.10	0.14
ε = 0.5	0.19	0.10	0.13
ε = 1.0	0.17	0.10	0.13
ε = 1.5	0.16	0.10	0.12
Severity of poverty (P2)			
Base	0.033	0.037	0.036
ε = 0	0.096	0.037	0.058
ε = 0.5	0.085	0.037	0.054
ε = 1.0	0.075	0.037	0.050
ε = 1.5	0.066	0.037	0.047

Source: IFPRI-LARES Small Farmer Survey.

The long-run effects on each department are given in Table 14. For example, in Borgou, per capita income falls 18 percent (from 94,803 FCFA to 77,409 FCFA) in the short-run, but rebounds 4 percentage points (to 80,888 FCFA) if the supply elasticity is 1.0 and 7 percentage points (to 82,627 FCFA) if the elasticity is 1.5. Similarly, the per capita income in Zou falls 15 percent in the short-run, but rebounds 3 percentage points in the long-run if the elasticity is 1.0.

The poverty rates in each department follow the same pattern in reverse. In the short-run, they rise as a result of the 40 percent fall in cotton prices, but in the long-run they fall back down part of the way. In Borgou, the poverty rate rises from 44 percent to 62 percent in the short run, falling back to 58-60 percent in the long run, depending on which elasticity assumption is used. Similarly, the incidence of poverty in Zou increases from 33 percent to 50 percent in the short run, then falls to 47-49 percent in the long run. As described above, there is little or no change in poverty in the three southern departments (Atlantique, Mono, and Ouémé) because there are very few cotton growers in these departments.

Looking at the patterns by expenditure category, we see similar patterns (see Table 15). Among the poorest 20 percent of farm households, the 40 percent fall in cotton price results in a 7 percent decline in income in the short-run, followed by a 1-2 percent rebound in the long run as households respond to the new price. Among the richest 20 percent, income initially falls 5 percent, before going back up 0.5-1.5 percent.

Table 14—Long-run direct impact of a 40% reductions in cotton price by department

	Atacora	Atlantique	Borgou	Mono	Ouémé	Zou	Total
Per capita expenditure							
Base	84,672	139,290	94,803	88,034	116,479	110,108	105,203
ε = 0	80,219	139,290	77,409	86,086	116,219	94,137	97,944
ε = 0.5	80,665	139,290	79,149	86,280	116,245	95,734	98,670
ε = 1.0	81,110	139.290	80,888	86,475	116,271	97,331	99,396
ε = 1.5	81,555	139,290	82,627	86,670	116,297	98,928	100,122
Incidence of poverty (P0)							
Base	0.54	0.14	0.44	0.50	0.44	0.33	0.40
ε = 0	0.57	0.14	0.62	0.53	0.44	0.50	0.48
ε = 0.5	0.57	0.14	0.60	0.53	0.44	0.49	0.47
ε = 1.0	0.57	0.14	0.59	0.52	0.44	0.48	0.47
ε = 1.5	0.56	0.14	0.58	0.52	0.44	0.47	0.46
Poverty gap (P1)							
Base	0.161	0.034	0.098	0.131	0.110	0.071	0.100
ε = 0	0.185	0.034	0.202	0.143	0.111	0.144	0.138
ε = 0.5	0.182	0.034	0.188	0.142	0.111	0.133	0.133
ε = 1.0	0.179	0.034	0.174	0.140	0.111	0.123	0.128
ε = 1.5	0.177	0.034	0.161	0.139	0.111	0.113	0.123
Severity of poverty (P2)							
Base	0.065	0.012	0.031	0.046	0.042	0.022	0.036
ε = 0	0.078	0.012	0.100	0.055	0.042	0.057	0.058
ε = 0.5	0.077	0.012	0.088	0.054	0.042	0.050	0.054
ε = 1.0	0.075	0.012	0.076	0.053	0.042	0.044	0.050
ε = 1.5	0.073	0.012	0.067	0.052	0.042	0.039	0.047

Source: IFPRI-LARES Small Farmer Survey.

Table 15—Long-run direct impact of a 40% reduction in cotton price by expenditure category

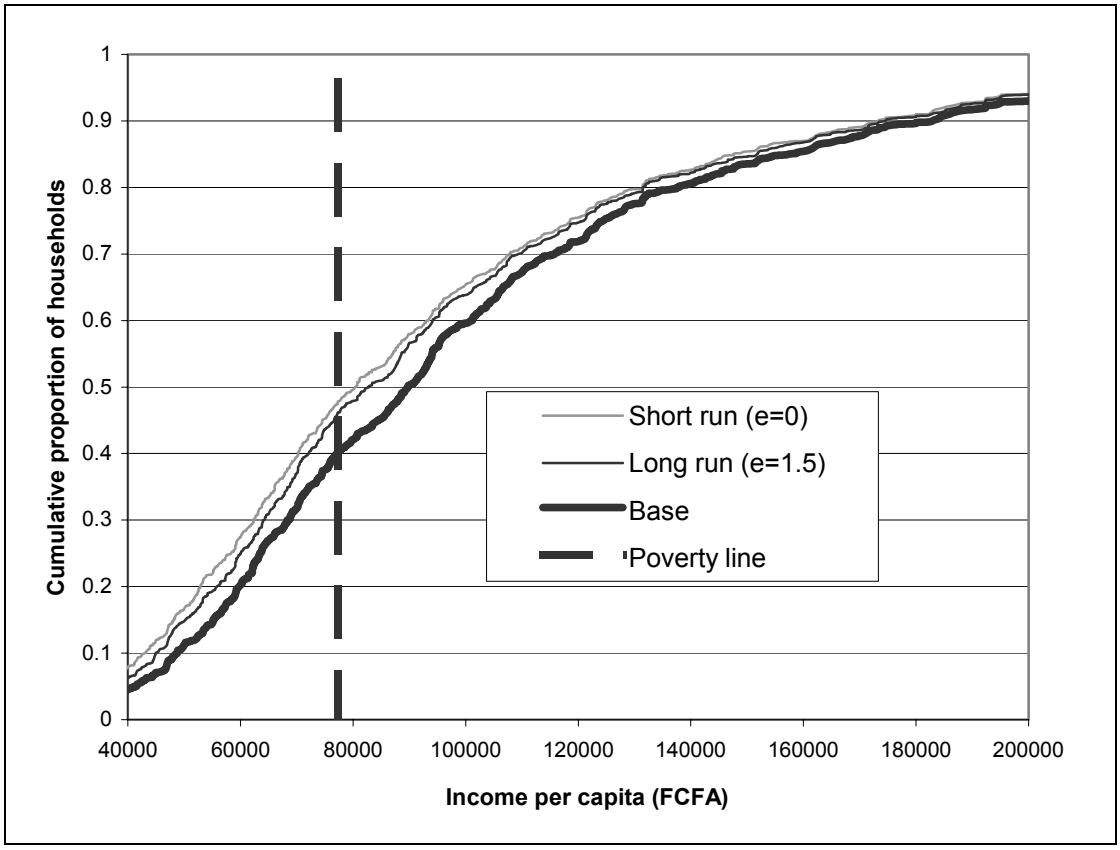
	Poorest	2	3	4	Richest	Total
Per capita expenditure						
Base	47,702	68,355	89,394	116,400	204,550	105,203
ε = 0	44,226	63,424	80,546	106,918	194,968	97,944
ε = 0.5	44,573	63,917	81,431	107,866	195,926	98,670
ε = 1.0	44,921	64,410	82,316	108,915	196,884	99,396
ε = 1.5	45,269	64,903	83,200	109,763	197,842	100,122
Incidence of poverty (P0)						
Base	1.00	1.00	0.00	0.00	0.00	0.40
ε = 0	1.00	1.00	0.30	0.08	0.00	0.48
ε = 0.5	1.00	1.00	0.29	0.06	0.00	0.47
ε = 1.0	1.00	1.00	0.27	0.06	0.00	0.47
ε = 1.5	1.00	1.00	0.26	0.05	0.00	0.46
Poverty gap (P1)						
Base	0.38	0.12	0.00	0.00	0.00	0.10
ε = 0	0.43	0.18	0.06	0.02	0.00	0.14
ε = 0.5	0.42	0.17	0.05	0.02	0.00	0.13
ε = 1.0	0.42	0.17	0.04	0.01	0.00	0.13
ε = 1.5	0.41	0.16	0.03	0.01	0.00	0.12
Severity of poverty (P2)						
Base	0.160	0.018	0.000	0.000	0.000	0.036
ε = 0	0.204	0.054	0.021	0.010	0.000	0.058
ε = 0.5	0.199	0.048	0.015	0.006	0.000	0.054
ε = 1.0	0.194	0.043	0.011	0.004	0.000	0.050
ε = 1.5	0.189	0.038	0.007	0.002	0.000	0.047

Source: IFPRI-LARES Small Farmer Survey.

The incidence of poverty among the bottom two expenditure groups cannot increase (it is already 100 percent), but the other poverty measures (P_1 and P_2) follow the expected pattern of rising and then falling part-way back. As noted earlier, 30 percent of those in the middle expenditure group fall into poverty in the short run as a result of the falling cotton price, but in the long run 1-4 percent of the group rises back out of poverty.

In Figure 7, we show the cumulative distribution of income in the base scenario, with a 40 percent reduction in cotton prices in the short run (ε=0), and with a 40 percent reduction in cotton prices in the long run (ε=1.5). Although the long-run supply elasticity used in this figure is at the upper end of what we believe is plausible, the difference between the short-run and long-run results is not very large. In other words, the long-term results are not very sensitive to the assumption regarding the supply elasticity of cotton. even with a relatively elastic supply (ε=1.5), the response of farmers only offsets about one-third of the initial negative short-run impact.

Figure 7—Long-run impact of a 40% reduction in cotton prices on the cumulative distribution of income



6. INDIRECT IMPACT OF LOWER COTTON PRICES

In Section 6, we described the long-run *direct* impact of falling cotton prices on farmers in Benin. The analysis was based on the impact of lower prices on the incomes of cotton farmers themselves, after they respond to the lower price but excluding any indirect effects on farmers who do not grow cotton. Although a general equilibrium analysis is beyond the scope of this paper, we examine two types of indirect effects. First, since the income of cotton farmers declines, their spending on other goods and services declines, leading to reduced prices of non-tradable goods and reduced income for household that produce them. We use data on the composition of spending by cotton farmers to estimate the multiplier effect of lower spending by cotton growers. Second, as cotton farmers scale back cotton production in response to the lower prices, they also reduce the demand for agricultural labor. This has indirect effect on households that earn income from agricultural labor. .

IMPACT OF LOWER COTTON PRICES ON OTHER SECTORS

The direct effect of lower cotton prices is on cotton farmers, but other households are affected indirectly. As cotton farmers reduce their spending, the demand for other goods and services contracts, affecting the incomes of households that produce those goods and services and, in turn, their spending patterns. A complete analysis of these effects would require a computable general equilibrium model, for which parameter estimates are not available. In contrast, multiplier analysis uses a simplifying assumption to obtain an approximation based on data that are available. Multiplier

analysis assumes that prices are fixed and that production and income are constrained only by demand. Under these assumptions the total (direct and indirect) impact of an exogenous shock to demand, is affected by the composition of demand between tradable and non-tradable goods and services. In particular, the total effect is $1/(1-MPC_n)$ where MPC_n is the marginal propensity to consume non-tradables (see Delgado et al, 1999). In the extreme, if cotton growers buy all imported or tradable goods ($MPC_n = 0$), then the decline in cotton prices will have no effect on domestic incomes. If, on the other hand, cotton growers buy primarily non-tradable goods, then the reduction in cotton prices will have a large multiplier effect within the country.

This section estimates the multiplier effect associated with changes in income of cotton growers. In particular, a regression analysis is used to estimate the marginal propensity to consume tradable goods. We begin by making some assumptions about the tradability of goods and services. For this study, the following goods were considered non-tradable: maize, sorghum, beans, cassava, cassava flour (*gari*), yams, potatoes and other tubers, vegetables, fruit, meat, fish, eggs, dairy products, meals consumed outside the home, home repairs or expansion, school-related expenses, medical service fees, and expenses for funerals, marriages, or religious causes. Tradable goods included most manufactured goods and some food products such as rice, groundnuts, salt, sugar, and beverages. It is worth noting that most of the tradable goods must be purchased, while many of the non-tradables can be obtained from own production.

According to the EPP data, cotton growers allocate about one third (33.4 percent) of their consumption expenditure to tradable goods. But we are interested in their *marginal* propensity to consume tradable goods, that is, the share of each unit of

additional income that is spent on tradables. The marginal propensity to consume tradables is estimated with the EPP data by regressing tradable goods expenditure by cotton growing household on total expenditure. We also control for a series of other variables that might affect household demand for tradable goods or their ability to purchase them: the size and composition of the household, ownership of land and other assets, distance to an all-season road, and dummy variables to represent four of the six regions[22]. To reduce heteroskedasticity and improve the fit, the continuous variables are expressed in logarithms and a squared logarithm of expenditure is included[23]. And to take into account any remaining heteroskedasticity or non-normality of the error term, we use the Huber-White sandwich estimators of the standard errors. Table 16 shows the results of the regression analysis, while Table 17 provides descriptive statistics on the variables used. The coefficients on the two expenditure variables imply that the marginal propensity to consume tradable goods is 0.303, implying that for every additional dollar that cotton growers spend, 30.3 percent is allocated to tradable goods and services[24]. This is somewhat higher than the share of tradable goods in the budgets of cotton farmers (.334), implying that the income elasticity of tradable goods and services is somewhat less than unity (0.91).

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[22] The department of Mono is excluded because it is the reference region, while Atlantique is excluded because the EPP sample has no cotton growers.

[23] If the regression is run without logarithms, the Breush-Pagan test indicates the presence of heteroskedasticity. After transformation of the variables, we cannot reject the null hypothesis of constant variance across the fitted values even at the 10 percent level (p=0.2005). Similarly, the Ramsey RESET test indicates that we cannot reject the null hypothesis of no omitted variables. An F-test confirms the joint statistical significance of the two expenditure terms.

[24] The elasticity of tradeable expenditure with respect to total expenditure (ε_{tx}) is calculated as $\beta_1 + 2\ \beta_2$ avglnexp, where β_1 and β_2 are the coefficients on expenditure and expenditure squared, respectively, and avglnexp is the average value of ln(expenditure). The marginal propensity to consume tradeables is $\varepsilon_{tx}T/(N+T)$, where T is tradeable expenditure and N is nontradeable expenditure.

Table 16—Estimation of expenditures on tradable goods by cotton growers

Dependent variable: log of nontradeable expenditure
Number of obs = 395
F(15, 379) = 76.00
Prob > F = 0.0000
R-squared = 0.7299
Root MSE = .33896

	Coefficient	Standard error	t statistic	Prob
ln(expenditure)	-1.434	1.090	-1.32	0.19
ln(expenditure)^2	0.086**	0.040	2.15	0.03
female head	0.182*	0.101	1.81	0.07
ln(nbr children 0-14 yrs)	0.000	0.012	-0.04	0.97
ln(nbr adults 16-65 yrs)	-0.137***	0.043	-3.19	0.00
ln(nbr elderly +65 yrs)	-0.007	0.009	-0.75	0.45
ln(sown area)	0.097***	0.033	2.93	0.00
ln(value of house)	0.496**	0.229	2.17	0.03
ln(value of house)^2	-0.034**	0.014	-2.37	0.02
ln(value of assets)	0.016**	0.008	1.95	0.05
ln(distance to road)	-0.014	0.010	-1.45	0.15
Atacora	-0.246***	0.071	-3.47	0.00
Borgou	-0.241***	0.064	-3.79	0.00
Oueme	0.037	0.115	0.32	0.75
Zou	0.013	0.069	0.19	0.85
constant	14.185	7.242	1.96	0.05

*** Significant at the 1% level, ** at the 5% level, * at the 10% level.
Ramsey RESET test using fitted values. Ho: no omitted variables
F(3,376) = 1.17 Prob > F = 0.3208
Beusch-Pagan test using fitted values. Ho: constant variance
chi2(1) = 1.64 Prob > chi2 = 0.2005
F-test. Ho: lnexpend coefficient = 0 and lnexpend2 coefficient = 0
F(2,379) = 188.81 Prob > F = 0.0000

Source: Regression analysis of IFPRI-LARES Small Farmer Survey

Table 17—Descriptive statistics for variables in model of tradeable expenditure

Variable	N	Mean	Standard deviation	Minimum	Maximum
ln(tradeable expenditure)	395	12.425	0.640	10.7	14.7
ln(expenditure)	395	13.636	0.581	12.1	15.3
ln(expenditure)^2	395	186.264	15.876	147.3	233.0
female head	395	0.038	0.191	0.0	1.0
ln(nbr children 0-14 yrs)	395	1.248	1.339	-4.6	3.2
ln(nbr adults 16-65 yrs)	395	1.504	0.541	0.0	2.8
ln(nbr elderly +65 yrs)	395	-3.739	1.824	-4.6	1.1
ln(sown area)	395	1.631	0.704	-0.4	3.4
ln(value of house)	395	7.965	0.974	6.0	10.5
ln(value of house)^2	395	64.380	15.642	35.9	109.5
ln(value of assets)	395	11.361	2.323	-2.3	15.9
ln(distance to road)	395	0.109	2.038	-2.3	4.3
Atacora	395	0.144	0.352	0.0	1.0
Borgou	395	0.524	0.500	0.0	1.0
Oueme	395	0.015	0.122	0.0	1.0
Zou	395	0.243	0.429	0.0	1.0

Source: IFPRI-LARES Small Farmer Survey

The multiplier associated with the spending patterns of cotton farmers is 3.3 (1/.303). In other words, for every dollar change in spending by cotton farmers, there is a total change in spending of 3.3 dollars[25]. Of course, any *reduction* in spending by cotton growers also has multiplier effects, reducing the income of other households, particularly those that produce non-tradable goods consumed by cotton growers.

[25] This analysis was repeated for different household groups to examine variations in the multiplier effect across the six (former) departments and across expenditure quintiles. The results did not show any distinct pattern. Within the department of Borgou, the multiplier for non-cotton growers was quite large, 8.06, compared to the other departments where the multiplier ranged from 2.19 to 4.08. Within the income quintiles, the multiplier rose slightly from the poorest quintile the third quintile and then decreased among the fourth and wealthiest quintiles for both cotton and non-cotton growers.

IMPACT OF LOWER COTTON PRICES ON LABOR DEMAND

As the price of cotton falls, farmers can be expected to shift their resources away from cotton into other crops, livestock, or non-farm activities. The impact of this substitution depends on the labor intensity of cotton production relative to that of the alternative crops or activities. If cotton is more labor intensive than the substitution away from cotton will reduce the demand for labor and adversely affect the income of households that depend on wage labor. According to the EPP, the poorest quintile of Benin farmers earn 14 percent of their income from wages, compared to 7 percent among the richest quintile. We can address this question in two ways: by examining the labor intensity of cotton compared to other crops and by estimating demand for hired labor as a function of various explanatory factors including cotton production[26].

Table 18 shows that the labor intensity for the main crops grown in Benin, based on data collected by the IFPRI-LARES Small Farmer Survey. Maize is the least labor intensive crop, requiring 121 person-days per hectare planted, while yams and vegetables are the most labor intensive, requiring over 250 person-days per hectare. The hired-labor intensity follows roughly the same pattern. The table also shows that cotton requires 186 person-days per hectare, of which 46 person-days are provided by hired laborers. Cotton is 15 percent more labor-intensive than the area-weighted average of other crops and uses 23 percent more *hired* labor per hectare than the average of other crops. Furthermore,

[26] The overall labor intensity of cotton production (including family labor) is less important in this context because we are trying to measure the impact of lower cotton prices on non-cotton growers. Thus, we are interested in how substitution away from cotton might affect the use of hired labor and, indirectly, the incomes of households that depend on income from agricultural wage labor.

cotton accounts for about 21 percent of the demand for hired agricultural hired labor. Thus, a 10 percent reduction in cotton production might lead to a 2 percent reduction in the demand for hired agricultural labor, but this would be mostly offset by the demand for labor on the crops that replace cotton. These figures suggest that the indirect effects of cotton price reductions via the labor market are likely to be modest.

The alternative approach is to use regression analysis to examine the impact of changes in cotton production on demand for hired labor. In the absence of time-series data, we are forced to infer from cross-sectional data in the EPP how households would adjust the demand for hired labor in response to changes in cotton output. The dependent variable is the number of person-days of hired agricultural labor used by households. We restrict the sample to households in survey clusters where at least one household grows cotton. The purpose of this is to exclude agro-ecological zones that are entirely different (and thus may be affected by other variables such as crop mix and population density) without necessarily excluding households that do not grow cotton. Of the 513 households living in cotton-growing villages, 302 hired some agricultural labor, while 211 did not. The large number of zeroes suggest that ordinary least squares (OLS) regression would result in severe heteroskedasticity and non-normality of the error terms. For this reason, we adopt the censored regression model, also known as the Tobit model. The Tobit model uses the independent variables to predict both the probability that the dependent variable will be positive (not zero) and the value of the dependent variable if it is positive.

Table 18—Labor use by crop

Crop	Labor intensity (person-days/hectare/season)			Share of total hired labor
	Family labor	Hired labor	Total labor	
Maize	84	37	121	34%
Sorghum/millet	148	21	169	3%
Rice	184	34	218	1%
Cowpeas	146	33	179	6%
Groundnuts	124	35	159	5%
Manioc	118	47	165	12%
Yams	429	87	516	6%
Sweet potatoes	129	77	206	1%
Tomatoes	186	52	238	2%
Okra	270	45	315	2%
Hot pepper	217	69	287	2%
Other vegetables	265	35	300	1%
Other crops	140	46	186	5%
All other crops	124	38	162	79%
Cotton	140	46	186	21%
All crops	127	40	167	100%

Source: IFPRI-LARES Small Farmer Survey.

Table 19 shows the Tobit regression analysis of the demand for hired labor, while Table 20 gives the descriptive statistics on the variables in the model. The regression results indicate that the demand for hired labor is, as expected, positively (but weakly) associated with per capita expenditure and positively related to sown area, the value of consumer assets, and the value of the house. The demand for hired labor is negatively related to the village-level average wage rate and the number of adults in the household, as we would expect. The marginal effect of wages on the demand for hired labor (not

shown in the table[27]) is -0.366, implying that the price elasticity of demand for agricultural labor is –0.48. The effect of cotton production on the demand for hired labor is positive but statistically insignificant. These results are expected, given both the higher labor intensity of cotton and the fact that the difference is relatively small. The coefficient on cotton production would imply an elasticity of demand for hired labor with respect to cotton production of 0.02. This suggests that, other things being equal, farms growing less cotton do not use noticeably less hired labor. Presumably, although they use less labor to grow cotton, this is almost entirely offset by labor that they hire to work on crops that are grown instead of cotton.

Two qualifications need to be made about this conclusions. First, cotton production is clearly a choice variable and hence not exogenous. Crop decisions may be jointly decided along with labor hiring decisions. In the absence of good instruments for cotton production, we are not able to adjust for this potential source of bias. Second, the analysis focuses on crop substitution, ignoring possible substitution of land and labor toward livestock production or non-farm activities. To the extent that the economically relevant alternatives to cotton production are other crops, however, it seems clear that substitution away from cotton will little or no effect on labor demand and hence on the livelihood of households that depend on agricultural wage-labor income.

[27] In a Tobit model, the marginal effect of an independent variable (x) on the unconditional expected value of the dependent variable (y) must take into account both the effect of x on y conditional on y being greater than zero (as reflected in the coefficient in the table) and the effect of x on the probability that y will be greater than zero. We used the "dtobit" command in Stata to calculate these marginal effects.

Table 19—Tobit regression model of demand for hired labor

Dependent variable: Person-days of labor hired per household per year
Number of obs = 513
LR chi2(15) = 184.26
Prob > chi2 = 0.0000
Log likelihood = -2150.5459
Pseudo R2 = 0.0411

	Coefficient	Standard error	t statistic	Prob
ln(per capita expenditure)	43.978*	26.892	1.64	0.10
female head	44.312	48.121	0.92	0.36
nbr children (0-14 yrs)	1.363	3.546	0.38	0.70
nbr adults (15-65 yrs)	-12.165**	5.282	-2.30	0.02
nbr elderly (over 65 yrs)	-32.142	21.119	-1.52	0.13
sown area (ha)	18.206***	3.227	5.64	0.00
cotton production (mt)	1.256	1.816	0.69	0.49
wage (FCFA/day)	-0.075**	0.033	-2.25	0.03
distance to road (km)	-0.255	0.667	-0.38	0.70
ln(value of house)	28.862**	12.279	2.35	0.02
ln(value of assets)	22.624***	8.394	2.70	0.01
Atacora	-98.519	64.677	-1.52	0.13
Borgou	16.352	60.536	0.27	0.79
Mono	-0.648	67.548	-0.01	0.99
Zou	82.534	61.567	1.34	0.18
constant	-973.748***	310.758	-3.13	0.00
se	204.272	8.565		

*** Significant at the 1% level, ** at the 5% level, * at the 10% level.

211 censored observations (days=0), 302 uncensored observations (days>0)
F-test. Ho: All dept coefficients = 0
F(4,498) = 5.88 Prob > F = 0.0001

Source: Regression analysis of IFPRI-LARES Small Farmer Survey

Table 20—Descriptive statistics for variables in model of hired labor

Variable	N	Mean	Standard deviation	Minimum	Maximum
hired labor (person-days)	539	76.625	171.462	0.0	1211.0
ln(per capita expenditure)	539	11.373	0.469	9.8	13.0
female head	539	0.041	0.198	0.0	1.0
nbr children (0-14 yrs)	539	4.753	3.407	0.0	30.0
nbr adults (15-65 yrs)	539	4.779	2.762	0.0	16.0
nbr elderly (over 65 yrs)	539	0.236	0.490	0.0	3.0
sown area (ha)	539	5.540	4.595	0.0	30.2
cotton production (mt)	539	2.299	5.400	0.0	103.7
wage (FCFA/day)	539	999.237	328.006	490.9	2065.7
distance to road (km)	539	7.261	15.654	0.0	100.0
ln(value of house)	527	7.930	1.005	5.3	10.6
ln(value of assets)	525	11.367	1.632	3.2	15.9
Atacora	539	0.184	0.388	0.0	1.0
Borgou	539	0.449	0.498	0.0	1.0
Mono	539	0.083	0.277	0.0	1.0
Zou	539	0.250	0.434	0.0	1.0

Source: IFPRI-LARES Small Farmer Survey

7. CONCLUSIONS

This paper analyzes the impact of changes in world cotton prices on farmers in Benin. Both quantitative measures of per capita expenditure from household surveys and qualitative responses to a nationally representative survey suggest that rural living conditions improved over the 1990s. Furthermore, farmers tend to attribute this improvement in rural living conditions to economic factors such as crop prices, availability of food, and access to non-farm employment. Although the causal link is difficult to establish with certainty, it appears the economic reforms of the 1990s (including the 1994 devaluation) and the growth of cotton production during this period contributed to the improvement in rural standards of living.

The link between cotton markets and rural living conditions can, however, work against farmers as well. The analysis in this paper is motivated by the recent 39 percent decline in the world price of cotton. We combine farm survey data from 1998 with assumptions about the decline in farm-level prices to estimate the short- and long-term direct effects of cotton price reductions on rural income and various measures of poverty. We also use the survey data to study two types of indirect effects: the impact of lower incomes of cotton farmers on other households through the consumption multiplier and the impact on the demand for agricultural labor by cotton growers.

The results indicate that there is a strong link between cotton prices and rural welfare in Benin. A 40 percent reduction in farm-level prices of cotton is likely to result in a reduction in rural per capita income of 7 percent in the short-run and 5-6 percent in the long-run. Furthermore, poverty rises 8 percentage points in the short-run, equivalent to an increase of 334 thousand in the number of individuals in families below the poverty line. In the long run, as household adjust to the new prices, the poverty rate settles down somewhat, remaining 6-7 percentage points higher than originally.

In order to explore the magnitude of the indirect effects of lower cotton prices, we estimate econometrically the marginal propensity to consume tradable goods. According to this analysis, for every additional dollar of income, cotton growers spend about 30 percent on tradable goods and the remaining 70 percent on non-tradable goods. Thus, a crude estimate of the multiplier is 3.3, meaning that one dollar of reduced spending by cotton growers results in a contraction of 3.3 dollars in overall demand.

We also examine the potential effect of a reduction in cotton production on the demand for hired labor and hence the income of households that depend on wage income. We do not find evidence of a strong adverse effect of reduced cotton production on demand hired agricultural labor. First, cotton accounts for just 21 percent of hired labor demand and is only somewhat more labor intensive than the average of other crops grown in Benin. Second, regression analysis to estimate the farm-level demand for hired agricultural labor identifies a number of significant coefficients with expected signs, but there was no statistically significant link between cotton production and demand for hired labor. More information on the degree of segmentation of labor markets and on the possibility of substitution into livestock and other non-crop activities would be needed, however, to answer this question more definitively.

Overall, the results in this paper challenge the stereotype of the rural poor in developing countries as consisting of subsistence farmers that are relatively unconnected to, and thus unaffected, by swings in world commodity markets. At least in the case of Benin, to the extent that fluctuations in world cotton prices are transmitted to farmers, they will have a significant effect on rural incomes and poverty. The broader implication is that policies that subsidize cotton production in the United States and elsewhere, dampening world prices, have an adverse impact on rural poverty in Benin and (by extension) other poor cotton-exporting countries.

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