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Food Versus Fuel: How Biofuels Make Food More Costly and Gasoline Cheaper

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This paper describes forces behind rising food prices and presents a model to characterize the magnitude of biofuel impacts on food and gasoline prices. The results of this model are compared to other estimates. We argue that a renewed commitment to agricultural productivity growth is needed to overcome current food and fuel challenges.

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Special Issue: Causes and Consequences of the Food Price Crisis

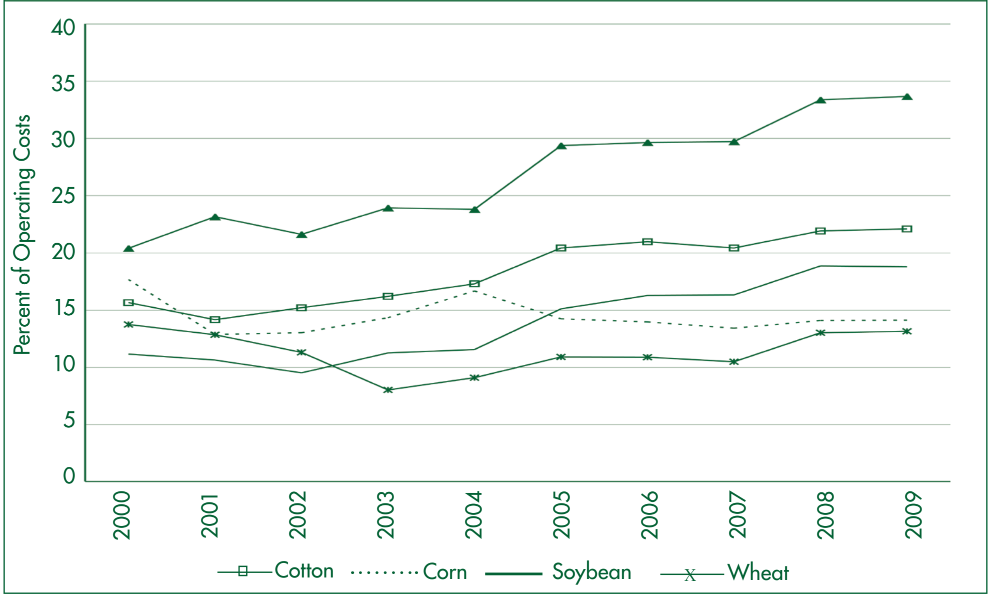
Biofuel production in the United States has been ridiculed in recent months, following the release of reports that suggest ethanol and biodiesel not only increase greenhouse gas emissions relative to fossil fuels, but also raise food prices and lower food production. The impact of biofuels on food markets came under particular scrutiny this year as the world entered its first food crisis in more than 30 years. It is certainly true that biofuels have increased the price of agricultural commodities, but the magnitude of biofuel impacts on food markets is unsettled. High food prices have been accompanied by record high oil prices, and, while biofuels have been blamed for exacerbating the former, they have not been credited with mitigating the latter. But just as surely as they have contributed to raising food prices, biofuels have helped reduce oil prices relative to prices that would prevail absent biofuel production. This article presents a model to demonstrate the effects of biofuels on corn, soybean, and gasoline prices, and to derive the distribution of benefits from U.S. biofuel production. We conclude that biofuels have a nontrivial impact on food security. We argue that underinvestment in research and overregulation of agricultural biotechnology led to a decline in productivity growth that is also responsible for higher prices and must be reversed if global food and energy security are to improve.

The rapid increases in food prices that began in 2007 have resulted in deadly food riots, increased robberies of food-aid caravans, export restrictions in grain-producing countries, and pleas for supplemental funding for food-aid programs. A 140 percent increase in food prices from 2002 to 2008 led humanitarian organizations to predict human suffering and starvation not seen in more than a generation. The Food and Agriculture Organization of the United Nations (FAO) reports food prices increased 53 percent in just one year from March 2007 to March 2008. Vegetable oils rose 97 percent, followed by grains, which rose 87 percent. Food price increases in the past year constitute the most rapid increase over a 12-month period in more than 30 years. The 55 percent increase in food prices in the past 12 months is exceeded only by their doubling from 1973 to 1974. The poor will suffer most from high prices because they devote large shares of their household budgets to food purchases. Even in countries where the rural poor benefit on average from higher prices for their agricultural output, the poorest of the poor will suffer.

Forces Driving Food Price Inflation

Biofuels are not solely responsible, nor necessarily principally responsible, for changes in the food security climate. A variety of supply-side and demand-side forces are at play. Among these is the

Figure 1. Fuel Costs as Share of Total Operating Costs



increase in oil prices in recent years. Oil prices have nearly doubled since 2006 from an average $66/barrel in 2006 to a forecasted average $116/barrel in 2008. Prices rose 60 percent in just the past year. These oil price increases raise the cost of agricultural production and transportation. Direct costs of fuel purchases have averaged about seven percent of farm operating costs since 1992, but have begun to rise as a share of costs in recent years. Figure 1 depicts the increasing fuel share of operating costs for five field crops (cotton, corn, soybeans, wheat, and rice) from 2000 to 2009 (data for 2007–2009 are forecasts). High fuel prices also raise the price of farm inputs, particularly those that are energy intensive, like fertilizers (70-90 percent of fertilizer costs are embodied in energy). As costs of production increase, the supply curve for agricultural commodities shifts up, raising market prices.

Table 1. Elasticity Assumptions for Simulations

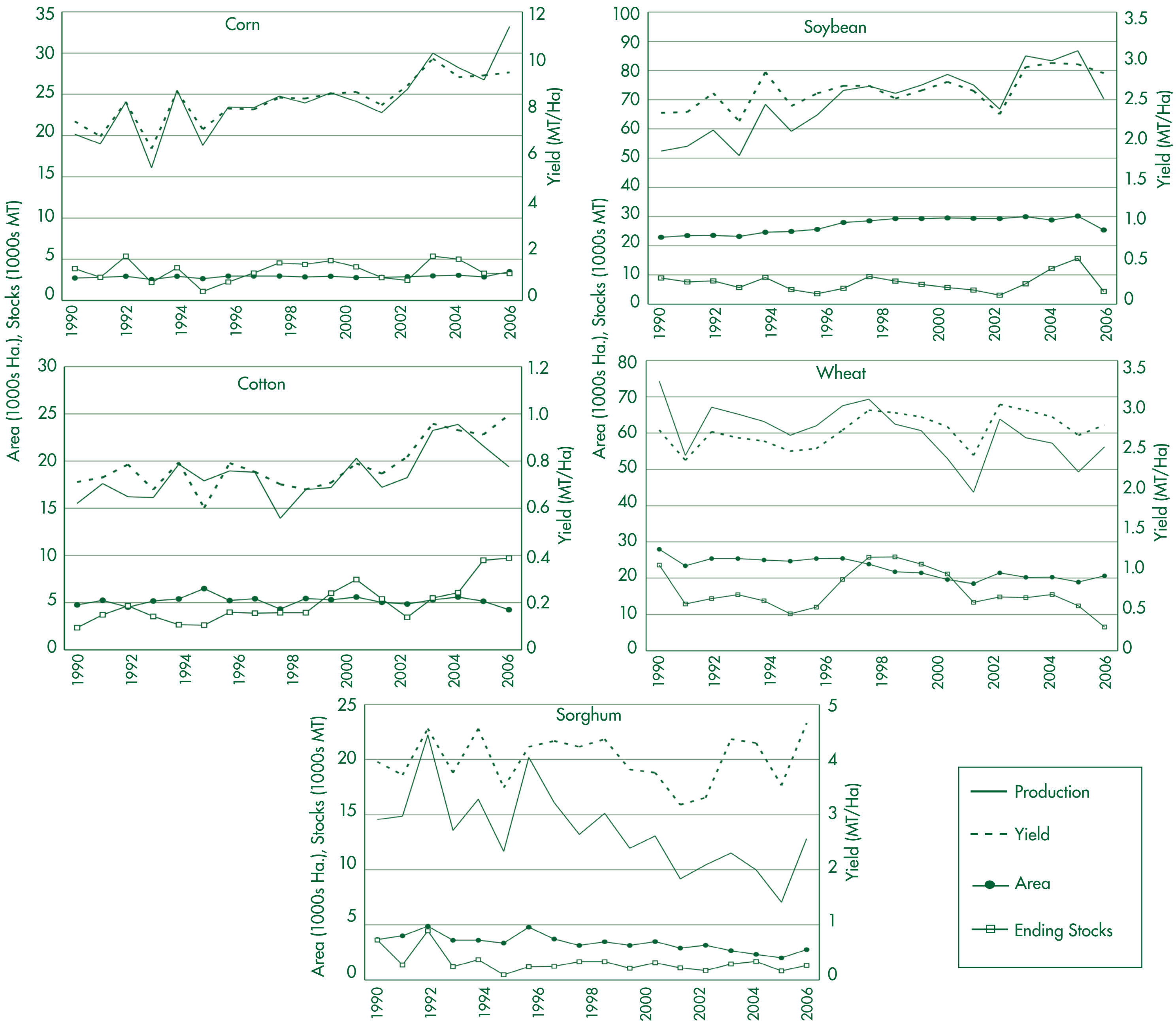
	Scenarios		
Own price supply elasticities	High	Mid	Low
Corn	0.5	0.4	0.3
Soy	0.5	0.4	0.3
Gas	0.3	0.4	0.5
Own price demand elasticities			
Corn	-0.5	-0.4	-0.3
Soy	-0.5	-0.4	-0.3
Gas	-0.3	-0.4	-0.5

On the demand side, population growth and income growth generate sustained upward pressure on prices. By 2050, the world population is expected to grow by half. Historically, such a rate of population growth was exceeded by agricultural productivity growth. From 1950 to 2000, for instance, per capita food production increased even as the world population doubled. This improvement in per capita food production occurred despite a shrinking agricultural land base because adoption of farming technologies like mechanization, irrigation, and chemicals promoted significant productivity gains. There is, however, little capacity for additional gains from these technologies, particularly in the developed world. New sources of productivity growth are needed to reverse a trend of stagnating yield gains. Agricultural biotechnology is one source of yield improvements, though it is underutilized and overregulated. Still, the effect of biotechnology cannot be missed when comparing yield trends for commodities planted to genetically modified (GM) seed and commodities not produced from agricultural biotechnology. Figure 2 shows persistent gains in productivity for corn, soybeans, and cotton—crops for which GM technology has been employed. Yields for staple crops like wheat and sorghum, however, are shown to have stagnated since 1990, as gains from the Green Revolution are exhausted. With slow productivity growth, food prices will be propelled higher by a rising world population and a shift toward meat-intensive diets induced by rising incomes.

Biofuels also increase demand for agricultural production. Biofuels have been supported by governments despite their inflationary effect on food prices because they are perceived to reduce greenhouse gas emissions relative to fossil fuels, improve energy independence, and spur rural development. As a consequence of favorable government intervention and energy prices that make biofuels cost-competitive with gasoline, global biofuel production has grown markedly in recent years, reaching 6,500 billion gallons in 2007—four times the production of 2000.

Existing biofuels are produced from agricultural crops traditionally used for food or feed. Ethanol, which dominates biofuel production in the United States and Brazil (and India to some extent), is presently produced from corn and sugarcane. Biodiesel, produced mainly in the E.U., is made from soybeans and rapeseed. Biofuel, therefore, increases demand for these staple crops so long as crop prices are not too high to make biofuels unprofitable. In 2007, 20 percent of the U.S. corn harvest was used in ethanol production and farmers planted the largest crop in 63 years—93 million acres—nearly a 20 percent increase from 2006. A second generation of biofuels will make use of energy-specific cellulosic crops that can be grown on marginal land. Cellulosic biofuels would reduce the diversion of food crops for

Figure 2. Production, Area Harvested, Inventories, and Yield for Staple Crops, 1990–2006

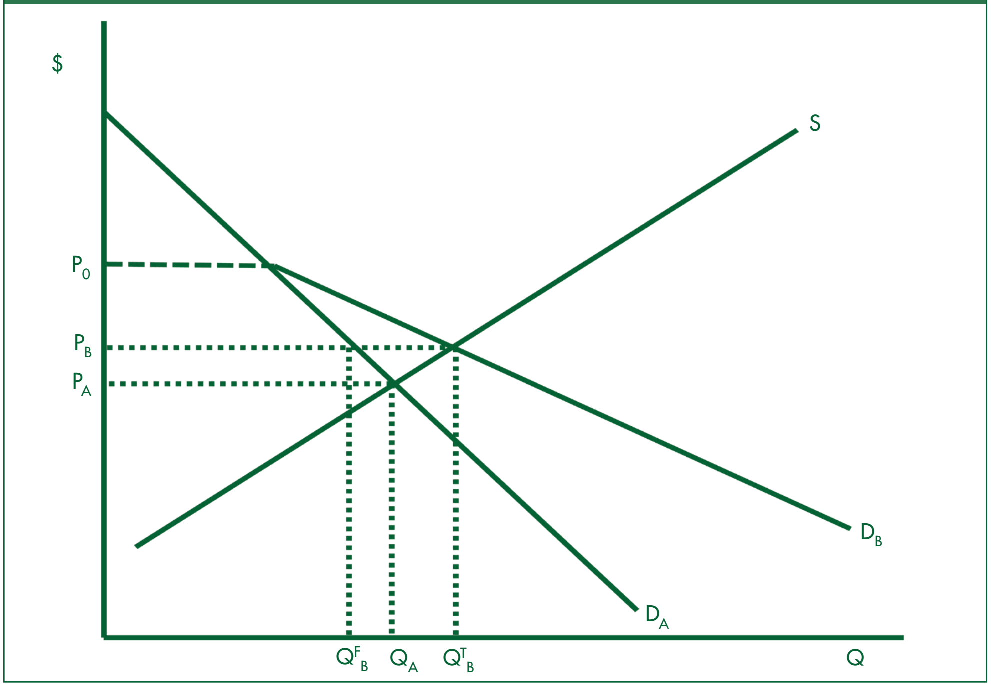


corn-ethanol and soybean-biodiesel, but they are yet to be commercially viable.

Biofuels also raise the costs of agricultural commodities not directly used in energy production. By raising demand for inputs in farm production, from tractors and fertilizer to water and land, biofuels raise production costs throughout agriculture. Perhaps nowhere is the pressure exerted by biofuels felt more acutely than in livestock production, a sector that faces rising costs for its primary input—feed. As biofuel raises the rental rate of land, feedstocks displace food crops and recruit idled land back into production. In doing so, it reduces the supplies of food and environmental preservation. The price boom since 2006 is also the result of tight markets with grain inventories at historic lows. A number of negative supply shocks to wheat and rice in recent years led to production shortfalls and caused a drawdown in crop inventories. Inventories act as a buffer to random shocks to markets, such as floods, droughts, or unusual pest pressure. When inventories are low, food prices are susceptible to any deviation in production from long-term trends, which may explain why wheat and rice prices increased more than corn prices in the past year.

Amid such tight markets and considerable uncertainty, rice-producing countries imposed export controls to protect domestic prices. Had production not exceeded expectations in 2008, the constrained international markets could have collapsed as more and more countries sought to insulate themselves

Figure 3. U.S. Corn Market



from higher and higher prices with greater export restrictions.

Quantifying the Effects

To estimate the impact of U.S. biofuel production on food and fuel markets and to determine the magnitude of welfare effects, we developed a global multi-market partial equilibrium model constituted by markets for corn, soybeans, biofuel and gasoline. We consider two regions, the United States and the Rest of the World (ROW), but assume that the responsiveness to prices of quantity supplied and demanded (elasticities) does not vary across regions. Using observed prices and quantities from 2007—when there was demand for biofuels—and assumptions on supply and demand elasticities, we constructed the counterfactual prices and quantities that would have prevailed absent biofuel demand.

Specifically, we assume demand for corn in the United States is composed of domestic ethanol demand, domestic demand for other uses (such as food and feed), and world excess demand. Figure 3 depicts the U.S. market for corn where demand is given by $\mathbf{D_A}$ with no demand for ethanol and $\mathbf{D_B}$ with demand for biofuel. $\mathbf{D_A}$ represents domestic demand for corn for uses other than biofuel and world excess demand. $\mathbf{D_B}$ also includes demand for ethanol, which is assumed to be zero above $\mathbf{P_0}$. We assume linear supply and demand for simplicity. Without biofuel demand, price is $\mathbf{P_A}$ and production is $\mathbf{Q_A}$. The quantity of corn for food and feed is $\mathbf{Q_A}$. With biofuel demand, the price is $\mathbf{P_B}$, production is $\mathbf{Q^T_B}$ and production for food and feed is $\mathbf{Q^F_B}$. The quantity of corn for ethanol is $\mathbf{Q^T_B} - \mathbf{Q^F_B}$. As can be seen by comparing equilibria with and without biofuel demand, biofuel demand increases the price of corn ($\mathbf{P_B} > \mathbf{P_A}$) and reduces the quantity of corn for other uses ($\mathbf{Q^F_B} < \mathbf{Q_A}$). We assume the U.S. market clears and determines the price for traded corn; the U.S. supplies 70 percent of traded corn. The soy, ethanol, and gasoline markets are modeled as described in Rajagopal et al. (See references on page 6.)

We provide results for three scenarios, which we call high, mid, and low, depending on the change in net consumer (surplus) due to biofuels. The high scenario is characterized by an elastic (price responsive) food market and inelastic (unresponsive to price) gasoline market. It is in this scenario that biofuel supply has the largest positive impact on gasoline consumers and smallest negative impact on food consumers. In the opposite scenario, characterized by a highly inelastic food market and a highly elastic gasoline market, food consumers suffer the most and gasoline consumers benefit the least. The mid scenario lies in between. The elasticities we use in the three scenarios are reported in Table 1.

Research suggests our "high" scenario may not be too optimistic and may, in fact, be conservative: elasticities for gasoline, soy, and corn tend to be less than 0.25 in the short run. Although we include the impact of biodiesel on the soy market, we do not estimate the impact of biodiesel production on diesel prices, which also serves to make our estimate of the fuel market impact of biofuels a conservative one.

Table 2. Price Changes from U.S. Biofuel Production

	Corn Price Changes		Soybeans Price Changes		Gasoline Price Changes	
	Percent	$/ Bushel	Percent	$/ Bushel	Percent	$/Gallon
High	-15%	-0.72	-10%	-1.00	2.4%	0.07
Mid	-20%	-0.92	-13%	-1.34	1.8%	0.05
Low	-28%	-1.31	-20%	-2.02	1.4%	0.04

Results and Discussion

Using data from 2007, in which 18.3 percent of U.S. corn production was used for ethanol, we find that ethanol raised corn prices at least 18 percent and perhaps as much as 39 percent, depending on elasticity assumptions. These results are summarized in Table 2, along with dollar savings per bushel, based on an average price of corn in the United States of $4.72/bushel in 2007. Under reasonable estimates, we find that U.S. ethanol production in 2007 (4.4 billion gallons on an energy-equivalent basis) reduced gasoline prices at least 1.4 percent and as much as 2.4 percent, or $0.04 to $0.07 per gallon. These results are also reported in Table 2. The Energy Information Administration has estimated savings as high as $0.11 per gallon.

Based on this analysis, we find that under the most optimistic assumptions on biofuel impacts (our "high" scenario), gasoline consumers around the world benefited from lower gasoline prices by $41.7 billion. Consumers of soybeans and corn, however, lost $40.6 billion from higher food prices. On net, consumer welfare declined by $2.6 billion from U.S. ethanol production in the best-case scenario (after deducting the taxpayer cost of ethanol subsidies from the net consumer benefits). In the worst-case scenario, world consumers lost $54.8 billion in surplus. These results are summarized in Figure 4, while Table 3 summarizes welfare gains to U.S., foreign, and all producers and consumers under the three sets of elasticity assumptions. The total welfare in the United States (net U.S. consumer benefit + net U.S. producer benefit) improves by $0.9 billion with biofuel production under our optimistic ("high") scenario. But it declines under the other two scenarios. Likewise, total global welfare is improved under the "high" and "mid" scenarios by $1.7–18.2 billion, but falls under the "low" scenarios by $16 billion.

Our analysis demonstrates that biofuels reduce the price of gasoline to the benefit of gasoline consumers and confirms other reports that biofuels hurt food consumers. Ours is the only analysis to consider distributional concerns, which suggest a trade-off between fuel for the rich and food for the poor. Our analysis suggests biofuels are responsible for between 25–60 percent of recent corn price increases, which is consistent with reports from the President's Council of Economic Advisors (CEA), the USDA, and the Farm Foundation. These other studies generate a range in the share of food price increases attributable to biofuels of 23–61 percent.

Table 3. Welfare Effects of U.S. Biofuel Production (in billions of dollars)

	High	Mid	Low
Welfare Change			
World consumers*	-2.5713	-25.2875	-54.8611
U.S. consumers*	-3.8153	-10.2098	-19.1565
U.S. consumers net of tax*	-7.5303	-13.9248	-22.8715
ROW consumers*	4.959	-11.3627	-31.9896
World gas consumers	41.695	31.2709	25.0166
U.S. gas consumers	9.6271	7.2203	5.7762
ROW gas consumers	32.0678	24.0506	19.2404
World food consumers	-40.5513	-52.8434	-76.1627
U.S. food consumers	-13.4424	-17.4301	-24.9326
ROW food consumers	-27.1089	-35.4133	-51.23
World corn and soy producers	20.7519	27.016	38.8874
U.S. corn and soy producers	8.4425	10.9703	15.7465
ROW corn and soy producers	12.3095	16.0457	23.1408
Total U.S. Welfare Change	0.9122	-2.9545	-7.125
Total World Welfare Change	18.1806	1.7285	-15.9737

** Total consumer welfare change is the net effect of food and gas price effects. By region, the change in welfare for food consumers is added to the change in welfare for gas consumers.*

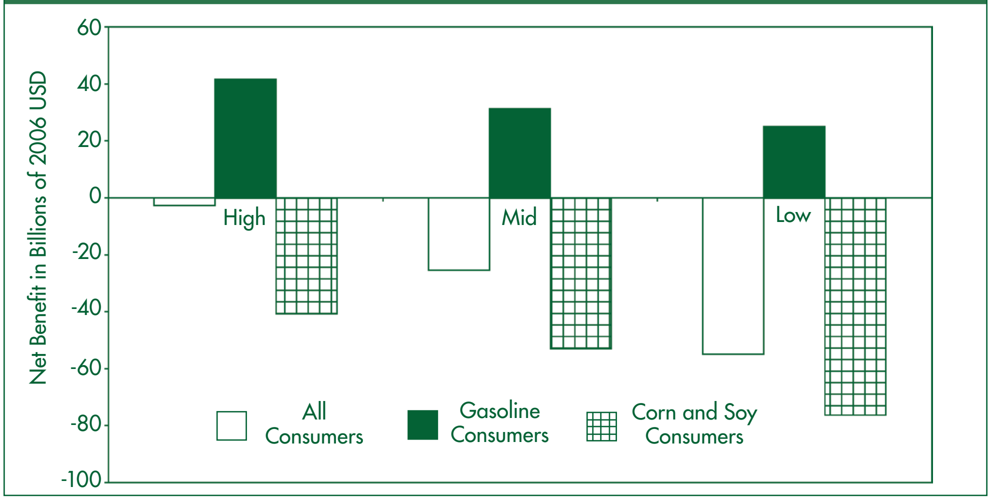
A report by the World Bank identified much larger impacts from biofuels on food markets. It found that biofuels were responsible for three-fourths of a 140 percent increase in food prices from 2002 to 2008, or roughly a 50 percent increase in the past year. This estimate is considerably higher than an estimate by the CEA that biofuels raised food prices 1.5 percent from 2007 to 2008. The World Bank analysis included indirect effects and long-term trends, while others did not. This may account for the magnitude of the World Bank estimate. The fall in stockpiles since 1990 can be seen in Figure 2 for five crops.

Depletion of stocks may be particularly responsible for remarkable price spikes since 2007. Biofuel production increased most dramatically in 2006 and 2007, and has not grown considerably in 2008. Yet food prices have risen most quickly and become most volatile in 2008. Interestingly, inventories for non-biofuel crops have fallen as much as or more than the stocks of biofuel crops (corn and soybeans), as seen in Figure 2. This suggests that slow productivity growth is an important factor in the decline of food security.

Biotechnology and the Food-Fuel Trade-off

Investment in agricultural research has declined in recent years, perhaps the result of complacency during a period of stable food prices. A lack of commitment to research and development can be blamed for declining rates of yield growth. Productivity growth since 1990 has been half as fast as it was from 1970–1990. It is expected to continue declining over the next ten years, according to the U.S. Department of Agriculture. From 1990–2007, the world population grew at a rate of 1.4 percent per year. Yields in grains and oilseeds grew at only 1.1 percent per year. Until 2017, yields are expected to grow at 0.8 percent, 0.3 percentage

Figure 4. Net Benefits to Gasoline and Food Consumers from Ethanol Supply in 2006



points less than forecasted population growth. These trends are ominous, given expectations for income growth and expansion of biofuel production.

Continued biofuel production and ongoing growth in food demand could cause a persistence of food security challenges. The food insecurity observed today is not a matter of inevitability, however. It can likely be overcome today and avoided in the future without abandonment of biofuels if the world regains its commitment to agricultural productivity growth and harnesses the potential of agricultural biotechnology. In the past 15 years, genetically modified (GM) crops have increased yields of cotton, rice, and corn 30–50 percent. GM crops are infused with genes to kill certain pests or provide immunity to common herbicides. They reduce the share of crops that is damaged and, thereby, improve productivity. With the demand pressures facing agriculture, biotechnology is an valuable mechanism for resolving an untenable food and energy situation. GM crops lessen the land constraint and permit greater production of food and energy crops on the existing agricultural land base.

Though GM crops have been adopted around the world at an astonishing rate, regulation, particularly in Europe, has reduced the market for agricultural biotechnology in recent years. This has not only slowed yield growth from existing technologies, but also slowed development of next generation genetically modified seed that is expected to introduce drought-tolerant plants and staple crops infused with additional nutrients like beta-carotene. Without a market for their innovations, however, there is little incentive for firms to invest in agricultural biotechnology R&D.

Conclusion

World agriculture is facing great challenges as growing demand for food and fuel creates scarcity and induces hunger. Even when considering just U.S. biofuel production, it is clear biofuels have significantly reduced gasoline prices, but at the expense of contributing to food shortages. The challenge for agriculture to meet growing food demand and growing energy demand requires all the tools available to improve productivity, including agricultural biotechnology. It also creates urgency for the development of commercially viable cellulosic biofuel technologies that reduce demand for staple crops and make more efficient use of resources than current technologies.

The development of second generation biofuels may take some time and productivity gains from biotechnology may be gradual. Therefore, it will be necessary to develop mechanisms to fight food shortages in the short-run. One mechanism that should be considered is a food fund that could be tapped into to buy food for the poor in crisis situations. Another option may be to tie government support for biofuel to food market outcomes. When food production falls too low, subsidies and mandates should be scaled back to protect against hunger. Policymakers may also find it necessary to reconsider existing policies in light of the current food situation. They and researchers must recognize that the management of agriculture is increasingly becoming a balancing act between energy, environment, and food objectives.

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For more information, the authors recommend the following:

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Mitchell, Donald. "A Note On Rising Food Prices." The World Bank Policy Research Working Paper 4682. The World Bank: Washington (DC). July 2008.

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How Can We Avoid Another Food Crisis in Niger?

Jenny C. Aker

With increasing concerns over the impact of higher global food prices on poor countries, lessons learned from previous food crises can be instructive. This research analyzes grain market performance in Niger during its 2005 food crisis. The research provides evidence that local grain markets are highly responsive to national and sub-regional production and price shocks. This suggests local early warning systems should monitor the spatial impact of drought and prices in key national and sub-regional markets. In addition, policies regarding the impact of local purchases and regional trade need to be carefully examined and discussed.

Since early 2008, a variety of international actors have expressed concern over higher global and regional food prices. The average world price for rice has risen by 217 percent since 2006, with wheat and maize prices increasing by 136 percent and 125 percent, respectively. Food price increases have also been associated with violence; since January 2008, riots and demonstrations protesting higher food prices have taken place in numerous countries in West Africa.

Will higher global food prices translate into a regional food crisis in West Africa? As governments and international organizations prepare for a potential food crisis, it is important to review the lessons learned from previous food crises. This research focuses on the case of Niger, a landlocked country in West Africa that was affected by a severe food crisis in 2005. As Niger's rainfall patterns, agro-pastoral systems and history of food crises are similar to that of other Sahelian countries in West Africa, the Niger case study is instructive for donors, international organizations, and host country governments who are preparing to face possible food crises.

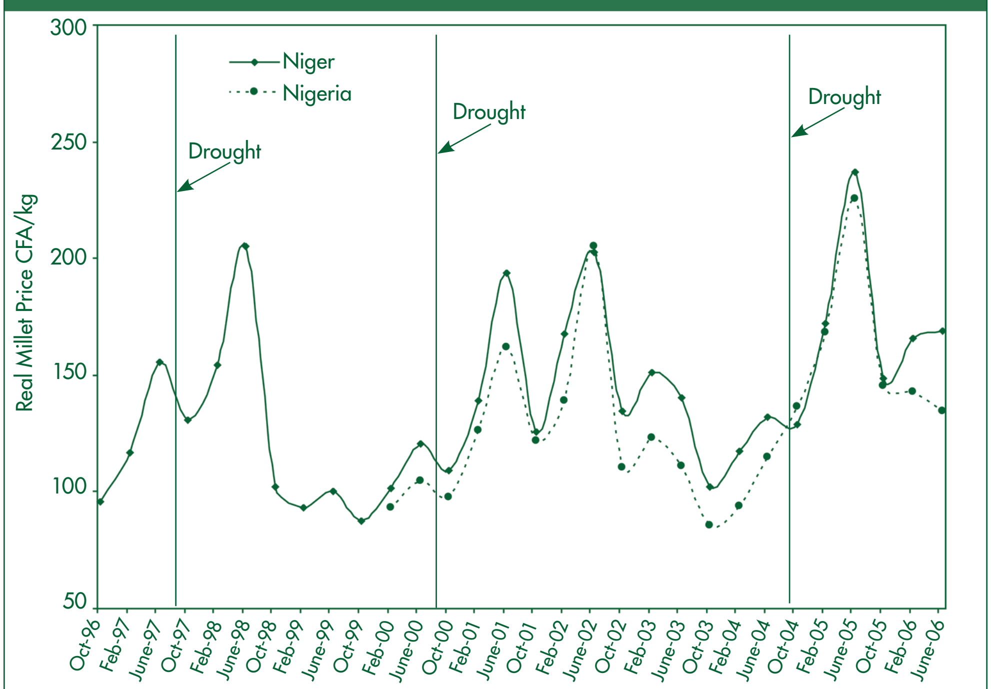
Drought and Food Crises in Niger

With a per capita GNP of US$230 and an estimated 62 percent of the population living below the poverty line, Niger is one of the lowest-ranked countries on the United Nations' Human Development Index. Grains represent approximately 75 percent of per capita caloric consumption. Annual rainfall ranges from 200-800 mm, with strong inter-annual fluctuations. While drought often coincides with lower levels of production and higher grain prices, drought does not always result in famine.

In 2004, Niger experienced a drought, followed by a reduction of its per capita staple grain (millet and sorghum) production of 12 percent as compared to the ten-year average. Millet prices were 25 percent higher than the ten-year average. By June 2005, an estimated 2.4 million Nigerians were affected by severe food shortages, with more than 800,000 of these classified as critically food insecure. In 2000 a drought also occurred, with per capita grain production 21 percent lower than the ten-year average. Yet, according to the local early warning systems, a severe food crisis did not occur in 2001.

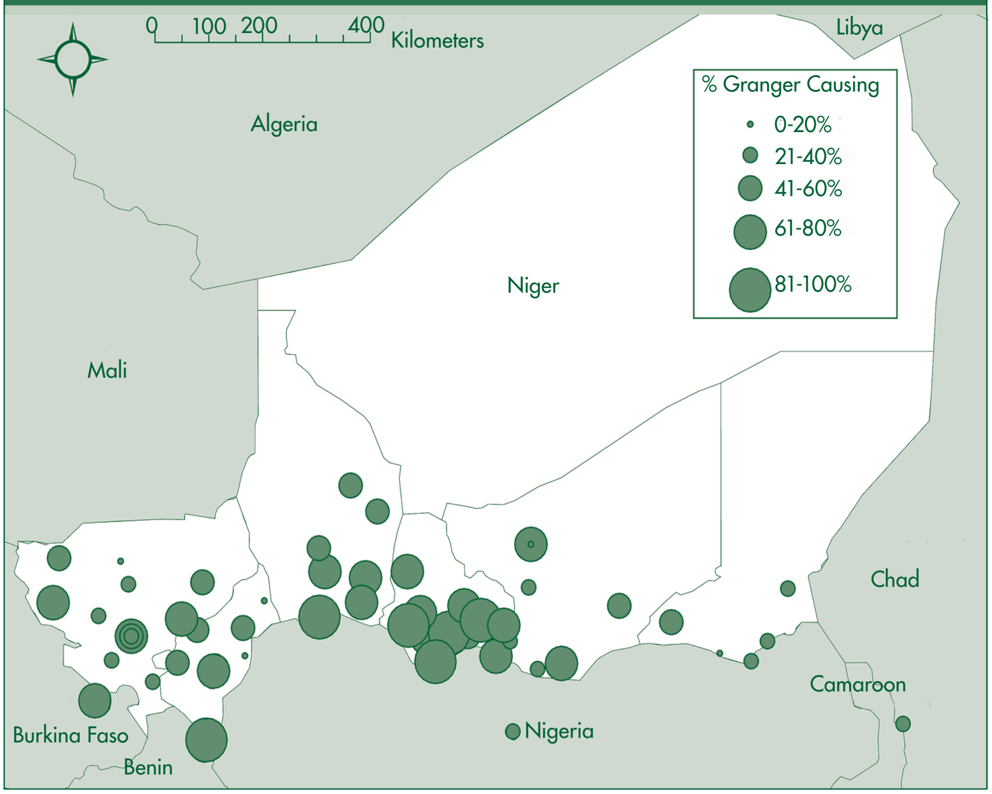
Several sources blamed grain traders for the 2005 crisis. The *Washington Post*, for example, stated that "In (Niger)… the suffering caused by a poor harvest has been dramatically compounded by a surge in food prices and….profiteering by a burgeoning community of traders…". Similarly, the Oakland Institute stated that the 2005 food crisis was a "free-market famine," blaming higher prices on trader hoarding and lower national reserves. While these factors can contribute to higher prices, they do not explain why a food crisis occurred in 2005 and not in 2001. In addition,

Figure 1. Average Monthly Grain Prices in Niger and Nigeria, 1996–2006



Notes: Prices are deflated monthly grain prices in CFA/kg over a ten-year period. The vertical lines represent the timing of drought.

Figure 2. Markets That Forecast Price Movements in Niger



these claims could lead to well-intentioned but potentially harmful policies for responding to future food crises.

Facts about Grain Markets in Niger

Fact 1. Grain prices in Niger fluctuate on an intra- and inter-annual basis. Grain prices in Niger are subject to a high degree of inter- and intra-annual variation. Figure 1 shows deflated average monthly grain prices in Niger and Nigeria between 1996–2006. High-production years in Niger are followed by relatively lower prices, and low-production years are followed by relatively higher prices. The seasonal variation of prices is also important. While the average intra-seasonal price difference for millet is 44 percent, millet prices increased by 89 percent between October 2004 and August 2005, and by 75 percent between October 2000 and August 2001. One of the key reasons for high price instability in Niger is the fairly inelastic regional supply of food, as climatic shocks in the sub-region are not easily complemented by extra-regional imports.

Fact 2. Grain markets in Niger are well-integrated with markets in northern Nigeria and Benin. Staple food crop markets in Niger are relatively well-integrated, with an average correlation coefficient of .55. On average, grain markets in Niger are more integrated during low production years, as traders, farmers, and consumers buy and sell from more markets. The degree of integration between markets in Niger and border countries follows a similar pattern: markets in Niger are highly integrated with those in Benin and Nigeria, and are more integrated during drought years. This suggests that grain markets in Benin and Nigeria have important implications for grain market performance in Niger.

Fact 3. Grain prices in Niger respond to supply shocks in the Niger-Nigeria production basin. Price movements within Niger follow well-defined paths: they start in production centers (the southeast) and spread across the country. This implies that grain prices in Niger respond to supply shocks, rather than demand shocks. Figure 2 shows the percentage of times that a market is useful for forecasting price changes, using Granger causality tests for all market pairs. Markets located in surplus regions of the country are useful for predicting price changes in a high number of markets in the country. In addition, markets in Benin and northern Nigeria forecast price changes in over 75 percent of the markets in Niger.

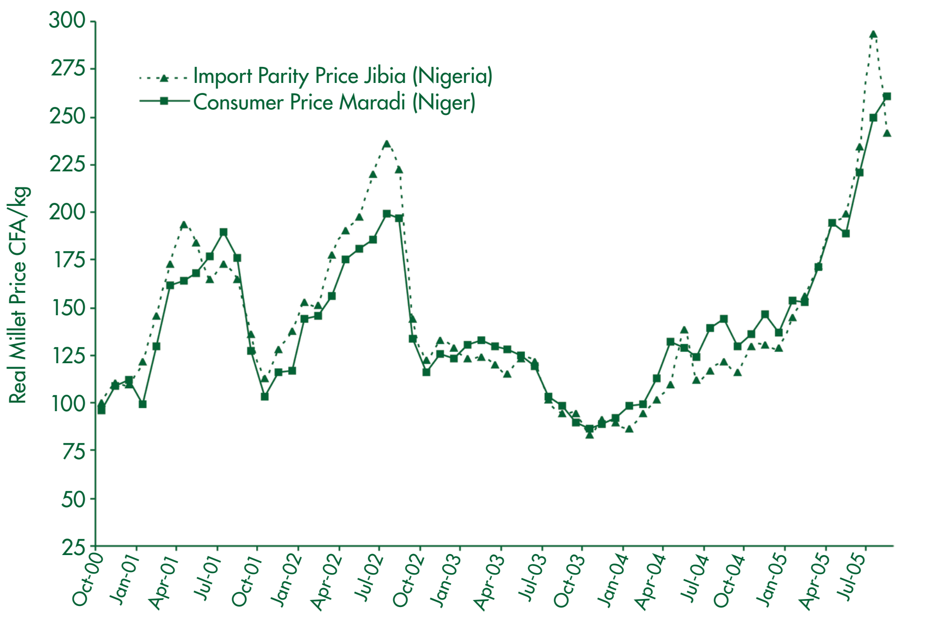
Fact 4. Niger needs to import, yet marketable surpluses depend heavily upon Nigeria. In light of the strong intra-annual variation in staple food crop production, total food supply in Niger depends upon commercial imports, imported food aid, and public stocks. However, unlike other countries in Sub-Saharan Africa, imported food aid has not played an important role in Niger's total food availability since the mid-1990s. While Niger imports grains from its neighboring countries, Nigeria plays a dominant role: on average, Nigeria supplies 75 percent of Niger's millet and sorghum imports and 35 percent of total maize imports. Consequently, potential and actual imports from Nigeria play an important role in grain market performance in Niger.

Fact 5. Storage is necessary…but is it excessive? As Niger's agricultural system relies upon one agricultural season, storage is crucial for stabilizing domestic grain supply. As 20 percent of farmers sell their staple grain production after the harvest, traders either sell the product immediately or engage in storage. Nevertheless, traders store for a relatively short period in Niger, averaging 45 days during normal years and 30 days during the 2005 food crisis. This suggests that excessive hoarding was not a primary factor contributing to food price increases in 2005.

Why a Food Crisis in 2005?

While droughts are often associated with production shocks in Niger, the relationship between drought and food crises is not well-understood. During the previous drought year (2000) staple

Figure 3. Comparison of Deflated Millet Prices in Niger and Nigeria, 2000–2005



food crop production was lower than in 2004, yet a severe food crisis did not occur. Consequently, understanding the factors that contributed to the 2005 food crisis is important for preparing for and responding to future food crises in Niger and the Sahel.

Factor 1. A higher percentage of regions were affected by drought in 2004. Most early warning systems in Niger rely upon climatic indicators to predict potential food crises. Nevertheless, relying primarily upon national-level production indicators may not accurately indicate a potential food crisis. In 2000, only 15 percent of the departments in Niger experienced a per capita decrease of more than 50 percent. By contrast, in 2004, over 25 percent of departments suffered a per capita decrease in grain production of more than 50 percent. This suggests that the percentage of departments affected by production shocks—as opposed to national-level production—is more relevant for grain market performance in Niger.

Factor 2. Key production areas in Niger and Nigeria were affected by drought in 2004. Since prices in Niger respond to supply shocks, drought in forecasting markets will have a larger impact on price levels. In 2004, the markets affected by drought were key forecasting markets in Niger and the sub-region. For example, average deflated millet prices in these markets were 17 percent higher in October 2004 as compared to October 2000. This suggests that monitoring prices on these markets during the harvest period could have served as an indication of a potential food crisis.

Factor 3. Prices were higher in northern Nigeria, making it unprofitable to import. On average, domestic millet prices in Niger are lower than prices in Nigeria from October until May. This pattern changes between June and August, when prices in Niger are higher than those in northern Nigeria, thereby making imports profitable. The situation in 2005, however, was markedly different. Figure 3 shows millet prices between Jibia (Nigeria) and Maradi (Niger) for several years. Millet prices in Nigeria were higher than domestic millet prices in Niger for the entire 2004–2005 marketing season, implying that it was unprofitable to import grains from Nigeria.

Factor 4. Grain prices reached record levels during the hungry season. Average grain prices in 2004–2005 were 25 percent higher than the ten-year average, with grain prices representing more than 27 percent of per capita income by July 2005. This period also coincided with the height of the food crisis. Although grain prices in 2004–2005 followed a similar pattern to that of other drought years, prices increased significantly between June and August 2005. As markets in Niger were very thinly supplied during this period, it is likely that the expectations of local purchases of food aid in Niger and Nigeria may have exacerbated the situation.

What Does This Mean for Future Crises?

Based upon the lessons learned during the 2005 crisis, several factors should be considered when preparing for and responding to a potential food crisis in the future. This section provides some recommendations in the short and long-term.

Recommendation 1. Local early warning systems should look beyond national-level production indicators to analyze climatic shocks at the sub-national level. In early 2008, a mission to Benin, Niger and Nigeria noted that lower sorghum production and reduced stocks in Nigeria, combined with high global food prices, were factors of concern in the Sahel. In addition to national-level production, local early warning systems should assess the spatial distribution of regions in Niger and northern Nigeria affected by production shocks, with a particular focus on forecasting markets. Deflated prices on several forecasting markets in Niger and northern Nigeria in October 2007 were similar to the price levels of the 2004 harvest.

Recommendation 2. Local early warning systems should monitor prices in the sub-region between June–September 2008 in order to determine whether imports will be profitable. In 2005, grain prices in northern Nigeria were above those in Niger for the entire marketing season. In order to determine whether imports from Nigeria will be profitable, local early warning systems should monitor grain prices on cross-border markets. If prices in northern Nigeria are higher than those in Niger, this suggests that Niger would need to import from other countries. Between October 2007 and May 2008, grain prices in Nigeria were relatively higher than those in Niger, but fell in June 2008.

Recommendation 3. Host country governments, international organizations, and bilateral donors should carefully consider whether local or triangular purchases are appropriate. In an effort to respond to a potential crisis, the government of Niger and international organizations have proposed a variety of interventions, many of which involve the use of food aid. While local purchases have been strongly supported by the international community, it is not clear that they are always a first-best option. If local food supplies are thin, then such purchases can increase prices. In light of relatively higher food prices in the sub-region, governmental and international organizations using food aid should strongly prioritize imported food aid. If this is not feasible, then such organizations should consider purchases from Benin, Mali, or Burkina Faso. If purchasing grains from these countries is not feasible, then local purchases should only occur in areas where production is significantly above average and should be limited in quantity (i.e., less than 5,000 MT). In all cases, grain prices should be monitored before and after the local purchase takes place.

Recommendation 4. The relative merits of food versus cash interventions should be evaluated. In recent years, cash-based interventions (cash transfers, cash vouchers, CFW) have been used with increasing frequency by international organizations in Niger and in other countries. Yet cash-based interventions can exacerbate an inflationary problem if sufficient goods are unavailable. In general, cash-based interventions are preferred if food is available on the local markets, distribution channels and marketing systems are functioning well, and there is little inflationary pressure.

Recommendation 5. Donors should fund initiatives that protect productive assets in the short-term, while supporting longer-term strategies. Natural disasters, production shocks and low agricultural productivity are not new concerns in the Sahel. While short-term responses might be required to support food insecure populations in West Africa, they should not disrupt agricultural and marketing systems in the longer-term. For example, while marketing boards might stabilize prices in 2008, they could irrevocably affect the grain marketing system in the future.

And What about the Future?

Recommendation 6. Guidelines for local and regional purchases should be developed. These guidelines should provide criteria to determine whether local purchases are appropriate during a particular year, and if so, from where, at what price, and in what quantities. These guidelines should be adopted by governmental, international, and non-governmental actors operating in the Sahelian region.

Recommendation 7. Long-term and sustainable strategies for increased food production and marketing in the Sahel should be developed. In response to the global food crisis, donors and international organizations have supported initiatives to increase agricultural production in the Sahel (such as subsidized fertilizers). Such short-term interventions are needed. However, a focus on production—to the exclusion of marketing—will not resolve the Sahel's food security problem. Agro-food markets play a crucial role in producers' and consumers' welfare in Niger and West Africa. Increasing local and regional grain production will not result in higher incomes unless farmers can receive higher prices for their output. This not only means choosing the most appropriate varieties to respond to local demand, but also ensuring that the commodity value chains for these crops are competitive and efficient.

Jenny Aker received her Ph.D. (2008) in the Department of Agricultural and Resource Economics at UC Berkeley. She is currently a post-doctoral fellow at the Center for Global Development. Jenny willl join the faculty of Tufts University (Economics Department and the Fletcher School of Law and Diplomacy) as an assistant professor in 2009. She can be contacted by e-mail at jaker@cgdev.org.

For additional information, the author recommends:

Aker, Jenny C. (2008). "Does Digital Divide or Provide? The Impact of Cell Phones on Grain Markets in Niger." BREAD Working Paper No. 177. http://ipl.econ.duke.edu/bread/abstracts/177.html

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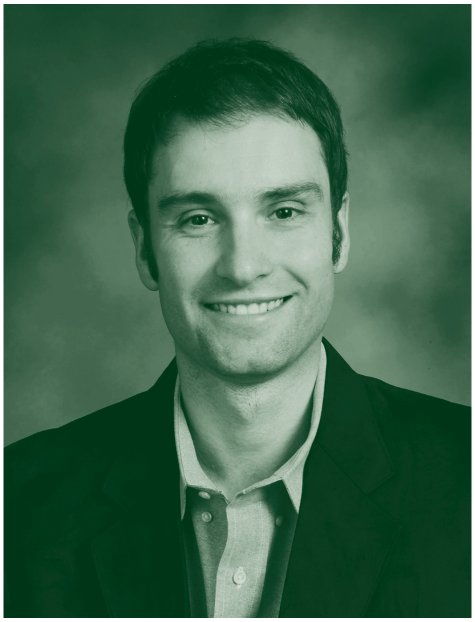
Faculty Profile: Pierre R. Mérel



Pierre Mérel
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Pierre Mérel joined the faculty at the Department of Agricultural and Resource Economics at UC Davis as an assistant professor in September 2007, and is a Provost Fellow of the UC Davis Agricultural Sustainability Institute. Pierre earned his Ph.D. degree in agricultural and resource economics from UC Davis in June 2007. Before coming to UC Davis to study agricultural economics, Pierre earned engineering degrees from École Polytechnique (1999) and École Nationale des Eaux et Forêts (2001), France, and worked for two years as a civil servant for the French Ministry of Agriculture and Fisheries. There, he was in charge of the development and negotiation of food standards at the national, EU, and international levels (Codex Alimentarius).

Pierre's primary fields of interest include industrial organization, agricultural policy, and the interface between agriculture and the environment. His dissertation work addresses the economics of geographical indicators, with a particular look at the French Comté cheese market, characterized by vertical integration and supply control. His main dissertation chapter uses the New Empirical Industrial Organization framework to measure the intensity of seller market power exercised in the Comté market. Pierre was granted the award for best contributed paper by a young economist at the last Congress of the European Association of Agricultural Economists in Ghent, Belgium, for this work. He has been invited to present his results to policymakers and representatives of the French dairy industry on several occasions. Hopefully, they will contribute to informing policy at the French and EU level, at a crucial time where the EU dairy quota system is being dismantled, and producers located in regions with higher costs of production—who were thus far benefiting from the non-transferability of milk quotas—are starting to face tougher competition. In a related line of research, Pierre has investigated the social desirability of strengthening production requirements as a way to limit supply, when direct output control is not feasible.

A second field of research that is still ongoing relates to spatial competition in horizontal models of product differentiation with outside good, with a particular focus on the transition regime that appears between strict price competition among neighboring sellers and monopoly competition, where sellers' price is independent of that charged by neighbors. As demonstrated by Pierre and his coauthors Richard Sexton and Aya Suzuki, the existence and characteristics of this transition regime have relevant policy implications for investments in transportation infrastructure, especially in a developing-country context where the government is often unable or unwilling to intervene, and farmers may collectively fund transportation improvements, for instance, by purchasing transportation equipment.

Pierre is also developing a research project in the area of environmental and sustainability labels. The main purpose of this research is to inform policy with respect to the development of harmonized sustainability standards.

During his first year as an assistant professor, Pierre has developed a graduate course in applied microeconomics intended for first-year Ph.D. students. He is currently devising an undergraduate course in economics and agricultural sustainability, to be part of the core requirements for the agricultural sustainability major developed by the Agricultural Sustainability Institute.

Pierre lives in Sacramento with his husband Jeffrey and their dog Massimo, and hopes to still be married on November 5.

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