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Zambian Maize Price and Production Analysis

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The purpose of this request is to provide information on the dynamics of the maize market and maize prices in Zambia. Specifically, we address four key questions from the research request. Some key points from our research include:

- The main drivers of production volatility in Zambia, based on available data and research, are rainfall or climate related factors and government maize policies.
- Maize production and prices have fluctuated since the 1990s. The domestic wholesale prices of maize in Zambia ranged from $100 to $350 per ton between 1994 and 2007.
- In drought years including 1998, 2001, 2002 and 2005, maize production fell considerably (see Chart 1). As shown in the chart, rainfall variability is likely the primary contributor to maize production volatility in Zambia.
- In years when maize production has fallen, domestic prices have risen, sometimes surpassing import parity prices.[1]
- Based on post-harvest data from 2001 and 2004, approximately 40 to 45 percent of the total marketed supply of maize from the smallholder farm sector was produced by only 2 percent of smallholder farms, suggesting high concentration of the marketed surplus during these years. These statistics suggest policies to support maize prices could have negative impacts on anti-poverty reductions in the smallholder sector, as most smallholders are net purchasers of maize.[2]
- In 2008/09, Zambian farmers produced 1.9 million tons of maize compared with 1.3 million tons in the previous year. The Minister of Agriculture recently stated that the government of Zambia would purchase maize at 65,000 Kwacha[1] per 50 kg bag. This purchase price reflects an 18 percent increase from the price in 2007/08.[3]

[1] 1 US Dollar (USD) = 4,645 Kwacha (ZMK) on September 2, 2009.

1. What is the breakeven price for maize farmers in Zambia? What are average production costs? Can we get specific data on this? If we have historical information, that would be very helpful too.

We were unable to find data on the breakeven price or average production costs for maize in Zambia. The FAO has data on maize production in Zambia. The Zambia National Farmers Union (ZNFU) has weekly maize price data by subscription to the database. The Foreign Agriculture Service at the United States Department of Agriculture has data on area harvested, production, exports, imports, supply, consumption, and yield for maize in Zambia.

Due to the lack of data on average full production costs, we attempted to examine the cost of inputs for maize production. Given that maize production is rather input intensive, we assumed that these statistics provide some insights into the costs to farmers. Due to data limitations, we are only able to provide information on the cost of fertilizer in Zambia.

Fertilizer: According to data provided in a country report by Matakala and Lungu, 36 percent of smallholder farmers in Zambia used fertilizer in maize production. This same report lists the market price for fertilizer at $67 USD per 50 kg bag during the 2002/03 and 2008/09 seasons. The article notes that smallholder farmers can obtain fertilizer through the Fertilizer Support Program (FSP) at a reduced price of $17 per 50 kg bag, which is 25 percent of the market price.[4]

Maize Price Floor

Though raw data were unavailable for most input costs in Zambia, we do have figures for the maize price floor set by the Zambian Food Reserve Agency (FRA). Presumably, this price is based on the cost of production, although information on the calculation process is unavailable. According to the FRA website, for the 2007/08 growing season, the government planned to purchase 400,000 tons of maize at 38,000 Kwacha per 50 kg bag. However, the website does not report actual government purchases for 2007/08.[5] Regardless, the price of 38,000 Kwacha per 50 kg bag (equivalent to $.16 per kg, $161.00 per ton, or $4.09 per bushel) effectively served as a price floor for government purchases, and an informal price floor for private markets during the 2007/08 season.

For the current 2009/10 growing season, the FRA had announced it would purchase 110,000 tons of maize after the 2009/10 harvest at 65,000 Kwacha per 50 kg bag ($.28 per kg, $275.00 per ton, or $7.00/bushel).[6] The buy-up program allows smallholders to sell up to 153 50-kg bags of maize at seven government depots throughout the country. In a statement released August 29, 2009, Zambian Minister of Agriculture Brian Chituwo announced that due to Zambia's better than expected maize harvest, the government would triple the amount of maize purchased from farmers, from the previously announced 110,000 tons to 341,000 tons.[7]

Despite the promise of a government market for their excess crops, some farmers are complaining that the price of 65,000 Kwacha ($14 USD) per 50 kg bag of maize is too low, and reflects the cost of production only for those farmers receiving subsidized fertilizer.[8] Information on the Zambian

government's calculations for setting the price floor is not available to substantiate or refute these claims.

2. Maize production volumes have been quite volatile over the past 10-15 years. What are the main drivers of this production volatility? What evidence exists to suggest that farmers are under-investing in production in years following abundant harvests?

Maize, in particular, is a vital crop in Zambia, accounting for over half of the calories consumed.[9] In general, maize consumption in Zambia has remained relatively stable. Between 1993 and 2003, consumption of maize (kg/capita/year) increased less than 5 percent and year-to-year changes were minimal.[10] Fluctuations in production appear to be primarily driven by factors other than demand.[11] Zambian agriculture has become increasingly diversified in recent years. Cassava, groundnuts, cotton, horticulture crops, animal products, and maize all play an important role in generating cash revenue, as well as food for home consumption, for farmers in Zambia. Increased production of alternative crops, however, does not appear to be driving maize production volatility.

Although maize consumption has remained relatively constant, maize production volumes in Zambia have fluctuated considerably in recent years, as shown in Chart 1 and the data provided in Tables 1 and 2. According to the available literature, the primary driver of maize production volatility is changes in rainfall patterns. As shown in Chart 1, maize production has historically dropped significantly during drought years. Rainfall has a significant impact on Zambian farmers because the majority of them depend heavily on rain fed agriculture. Data on irrigation levels in Zambia show that less than five percent of cropped land is irrigated.[12] These low irrigation levels and changes in rainfall patterns have led to differences in maize output of up to 100 percent between low and high rainfall years.[13] Though it seems likely that rainfall is the primary driver of production volatility in Zambia, we could not find studies that isolate the impact of weather.

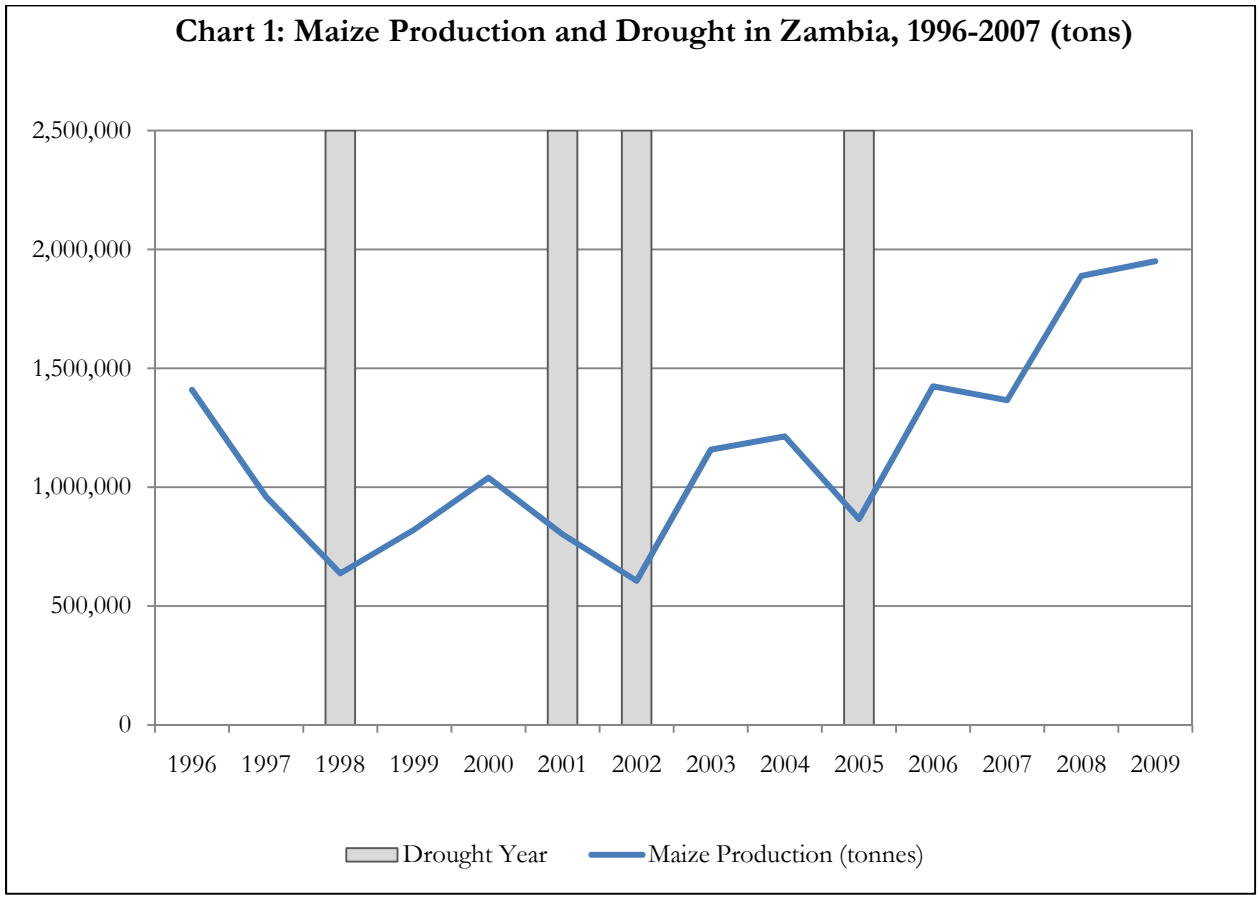
As shown in Chart 1, all significant declines in maize production since 1996 have coincided with drought years with the exception of the small decline from 2006 to 2007. Several news publications note that the 2006/07 drop was due to flooding, logging and inadequate access to extension services and inputs.[14] Over the past three years, Zambian maize production has been increasing. In 2008/09, Zambian farmers produced 1.9 million tons of maize compared with 1.3 million tons in the previous year. This increase in production is likely due to good rainfall and possibly several recent government interventions. The Zambian government has recently implemented programs to make seeds available to peasant farmers. In addition, the government doubled the number of farmers receiving fertilizer subsidies to 500,000 in the last year of production and Zambian policies have significantly restricted external trade flows in recent years.[15] Despite the potential impact of these interventions, the literature does not offer clear econometric evidence to confirm that the GOZ's policies have been a major source of support for increased production levels over the past three years.

In addition to these policies, the Minister of Agriculture recently stated that the government of Zambia would be purchasing 341,000 tons of maize from farmers, which is an increase from the

110,000 that was originally planned. The government will purchase this maize at 65,000 Kwacha per 50 kg bag, a price that reflects an 18 percent increase from last year. This increased purchase price suggests that the Zambian government's efforts could be contributing to the apparent discrepancy between Zambian and global maize prices.[16] This increased price could also reflect changes in input prices and rising inflation in Zambia.[17] More historical background and recent information on Zambia's interventions into the maize market is provided in the following section.

Furthermore, some discussions around maize production suggest that endogenous reactions to changes in price, or behavior related to price risk, also contribute to production instability. Some researchers at Michigan State University suggest that during a deficit season, prices increase and provide an incentive for increased production. Farmers face the risk that prices will be depressed when increased production in the following year results in a surplus. Farmers depend on export opportunities and advantageous import policies to mitigate the risk of depressed market prices.[18] Although this type of market behavior driven by reactions to price risk is noted in policy briefs, we were unable to find published research studies showing these dynamics in Zambian maize markets through econometric analysis.

Maize is the dominant food crop in most of the region, and most farmers grow maize for subsistence. A paper from the Food Security Research Project – Zambia, at Michigan State University shows that based on post-harvest data from 2001 and 2004, approximately 40 to 45 percent of the total marketed supply of maize from the smallholder farm sector was produced by only 2 percent of smallholder farms, suggesting high concentration of the marketed surplus.[19] These considerations suggest that interventions designed to raise market prices of maize could have negative consequences for the majority of rural households, especially the poor, who are net purchasers of maize in Zambia.



Note: Maize production data for 2009 are estimates provided by the Zambian Minister of Agriculture and Cooperatives.
Sources: FAO and the Zambian Minister of Agriculture and Cooperatives: http://www.znfu.org.zm/index.php?option=com_content&view=article&id=118:zambia-in-203-271-mt-maize-surplus&catid=1:latest-news&Itemid=78.

Table 1 and Table 2 show information on maize production and prices in Zambia provided by researchers at Michigan State University. The data show the significant variability in production and prices in good versus bad harvest years.

Table 1. Historical Maize Production and Price Data by Harvest			
Year	**Harvest**	**Production tons**	**$/ton**
1994	Good	1,020,749	$150
1995	Moderate	737,835	$208
1996	Excellent	1,409,485	$127
1997	Moderate	960,188	$173
1998	Bad	638,134	$183
1999	Moderate	822,056	$135
2000	Moderate	1,040,000	$116
2001	Bad	802,000	$192
2002	Bad	606,172	$244
2003	Good	1,157,860	$169
2004	Good	1,214,000	$150
2005	Moderate	866,187	$236

Table 2. Averages 1994-2008			
	Production	**$/ton 1994-2005**	**Percent change in price from moderate year**
Excellent	1,409,485	$127	-27%
Good	1,098,555	$156	-10%
Moderate	853,564	$174	0%
Bad	613,913	$206	19%

Source: Haggblade, S. (2006). Maize price projections for Zambia's 2006/2007 marketing season. Food Security Research Project Policy Synthesis No. 15. Lusaka: FSRP.

Over the last several decades, the Zambian government has taken several different approaches to policy interventions through marketing, pricing, importing, and exporting policies in attempts to stabilize prices. These government interventions have also influenced production and price volatility in Zambian maize markets. A brief review of government policies and impacts is provided in the following section.

3. There is quite a discrepancy between Zambian Maize prices and global prices. What are the key factors driving the difference between these prices? To what extent are policies of the Zambian government contributing? (i.e. What have their trade policies been and what are their implications on both farmer production and prices?) What other factors, e.g. lack of infrastructure, are influencing local prices?

The Zambian government has been active in maize markets since the 1930s. Maize pricing policies heavily favored white farmers prior to independence in 1964. Since independence, policies have focused on smallholder farmers through uniform pricing, expansion of government purchases to remote areas and input subsidies for smallholder farmers.

Prior to 1990, the Government of Zambia (GOZ) controlled all pricing and marketing of maize, including setting a uniform price for all regions of Zambia for the entire growing season. The GOZ controlled procurement, distribution, and processing of marketed maize through its network of government owned marketing agencies and cooperatives.[20] Beginning in 1991, the GOZ, newly headed by the Movement for Multi-Party Democracy (MMD), opened domestic markets to private traders but kept control of international trade through tariffs and import and export bans. This liberalization was part of the new government's general reform process.[21] By 1993, the GOZ had removed all price controls in the maize pricing and marketing system.

Beginning in the 1998/99 growing season, however, the GOZ indirectly subsidized maize through exchange rate depreciation. The Food Reserve Agency (FRA) imported maize to sell to millers at a constant Kwacha price, even though the Kwacha depreciated against the USD during this time. Thus, maize was sold to millers at less than market price.[22]

The GOZ provided subsidized maize to selected millers during the 2001/02 growing season. Other millers not receiving the subsidized maize were effectively pushed out of the market. Although the maize market price to millers dropped 75 percent, maize meal prices to consumers dropped 15 percent during the same time period.[23] This suggests that the benefits of the subsidy were split between the millers and the consumers. When reported in the media, however, the discrepancy in price declines appeared to suggest that millers disproportionately benefitted from the subsidy. Without data on how much the subsidy reduced the total cost of milling (including labor and capital costs), one cannot determine whether millers or consumers benefited more.

Because of the predicted deficit in maize production during the 2001/02 growing season, the GOZ announced its intention to import maize from South Africa to sell at subsidized prices to consumers. Financing difficulties delayed imports, and by the end of May 2002, only 130,000 tons of the promised 200,000 tons had been imported. This temporary import market paralysis caused maize grain and meal shortages and high prices.[24]

In response to a moderate harvest in 2005, the GOZ implemented a ban on exports. During the 2006/07 growing season, the GOZ banned maize exports in order to ensure adequate supply in country.[25] The government continued its ban on exports into the 2007/08 growing season despite the previous year's surplus, citing the risk of flooding which could potentially damage the year's

harvest.[26] Even after the 2008/09 bumper crop, the Ministry of Agriculture limited exports to 100,000 tons of the 203,000 tons surplus.[27]

Effects of these price controls and trade policies are difficult to assess. In general, the export ban helped prevent domestic maize prices from increasing on par with international prices by restricting Zambian farmers' access to international markets. Even if allowed to export, Zambian farmers' access to markets was constrained by poor transportation infrastructure.[28] Yet these export bans are put in place to, in part, ensure food security for the Zambian people.

Zambia's Food Reserve Agency (FRA), established in 1996, administers the national food reserves and manages food storage. More specifically, the FRA plays a key role in influencing maize prices through purchases and sales of maize. In a recently released study, Chapoto and Jayne (2009) examined the impact of the Zambian government's interventions to influence maize prices for several regional markets from 1994 to 2008.[29] The authors used monthly maize prices from January 1994 to May 2008 in reduced form models with auto-distributed lags for the four major food markets, Lusaka, Chipata, Choma and Kabwe. The Chipata, Choma and Kabwe markets are regional while Lusaka is the capital city. Their study yielded four findings relevant to the questions in this research request:

1. Maize prices generally fluctuate throughout the year, with lowest prices occurring immediately after harvest (May and June), while prices tend to peak during the lean season (December thru March). The Government of Zambia's sales of maize at below-market prices during the lean season artificially distorted the market. The subsidized maize undercut farmers and merchants who stored grain for sale during the lean season to attain peak prices. Farmers and merchants thus had less of an incentive to invest in storage and transportation technologies, even though investment in storage and efficient forms of transportation have the potential to help stabilize prices, increase production and reduce costs over the long-run.

2. Maize import tariff rates, export bans, and other trade policy tools have a negligible effect on mean prices suggesting that informal trade is circumventing the policies.

3. The regression findings highlight the effects of lags between the announcement and implementation of policy changes. These results suggest that such lags can have negative and disruptive effects on maize prices, stock levels, and production. For example, delays in government planned imports caused significant increases in market prices in Zambia in early 2002, early 2003 and in the 2008/2009 marketing season.

4. Models of maize prices under varying policy regimes showed that the variability of maize prices is higher with government marketing and trade policies compared to the counterfactual maize prices with no government intervention. The evidence suggested that trade policies and government intervention in Zambia may have played a role in price instability in some cases.

Fertilizer Support Program

Beginning in 2002, the Fertilizer Support Program (FSP) subsidized 50 percent of the cost of fertilizer for a targeted 120,000 smallholders.[30] The GOZ fertilizer subsidies accounted for a significant majority of public expenditures. In 2005, more than half of Zambia's agricultural budget was spent on the FSP. This is compared to three percent of the agriculture budget spent on irrigation development and other rural infrastructure, and 11 percent on operating costs, including agricultural research and extension.

An evaluation of the fertilizer program in 2007/08 found that of the intended 120,000 only 56,271 smallholders received subsidized fertilizer.[31] Anecdotal evidence suggested that a substantial amount of FSP fertilizer was sold illegally to traders who subsequently sold it at market prices to farmers.[32] Additional studies show that of the 29 percent of farmers in Zambia that acquired fertilizer, 36 percent of them obtained it through the government and 59 percent through private dealers. Regardless of the source, farmers who received fertilizer were shown to have relatively high incomes and were close to roads or district centers. Those who received fertilizer from the government were predominantly civil service workers.[33] Together, these statistics suggest that the primary beneficiaries of the fertilizer subsidy program were not poor, smallholder farmers. In 2008/09, the program was expected to provide subsidized fertilizer to 200,000 smallholders at a discount of 75 percent, though data on actual distributions is unavailable. The program was further expanded in 2009/10 to provide fertilizer to 500,000 farmers. Analysis of the program suggests that the FSP fertilizer supply chain is wrought with rampant corruption and serious structural inefficiencies in the distribution network.[34]

Regional Demand

The USAID funded Famine Early Warning System Network (FEWS NET) predicts general food security in the Southern Africa region, which limits export potential for Zambian maize. However, FEWS NET predicts widespread food insecurity in Eastern Africa, most notably in Somalia, Ethiopia, and Kenya, for the current growing season. These countries could potentially be markets for Zambian maize.

Since 1990, Zambia's population has steadily increased two to three percent each year. In 1990, Zambia's population was 8.1 million, and has risen to a reported 11.9 million in 2008.[35] Per capita yearly maize consumption fluctuated in the decade from 1993 to 2003 from a low of 121 kg/person/year in 2001 to a high of 140 kg/person/year in 1995.[36] Consumption trends did not follow a linear pattern, but rather, fluctuated up and down from year to year during this time. Data for later years are unavailable. This relatively constant per capita consumption rate suggests that maize production is keeping up with population increases in Zambia.

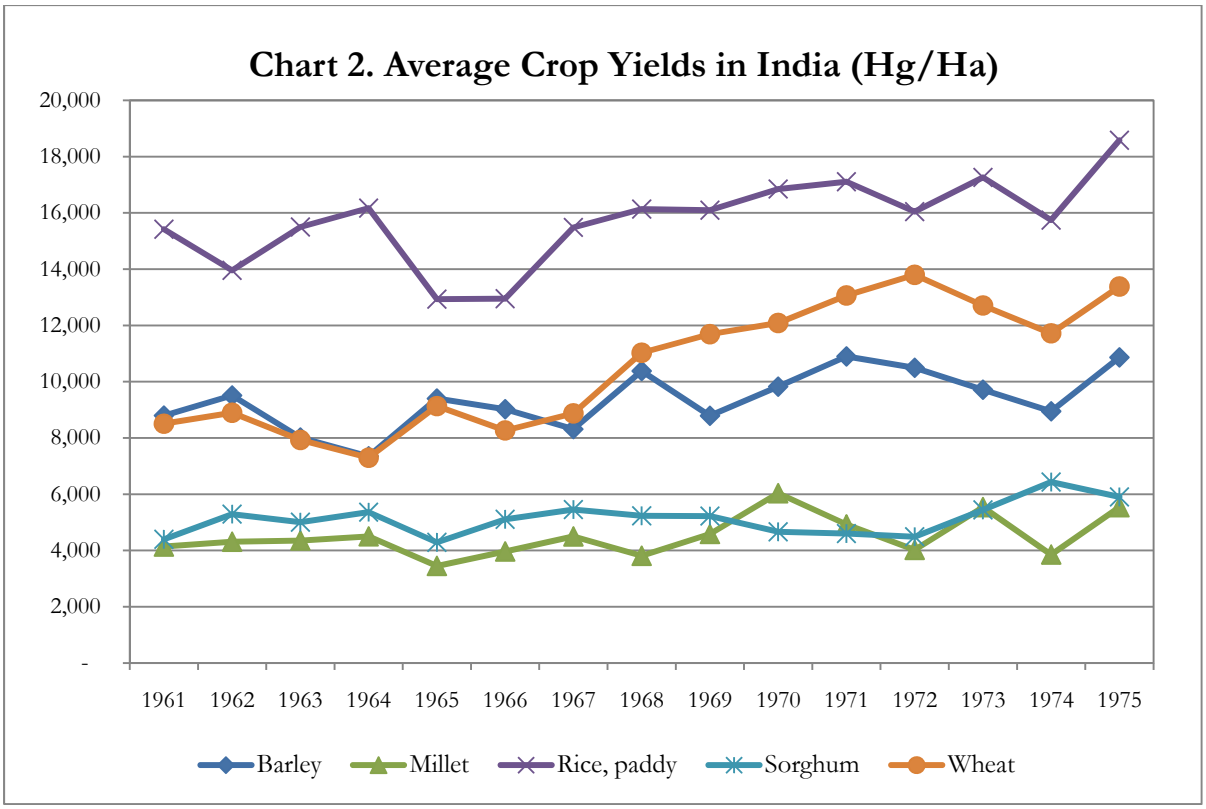
4. During their green revolution, the Indian government backed some price stabilization mechanisms. We would like to understand in what ways these policies contributed to increased farmer productivity. Specifically, we would like to know if there is evidence that suggests that these price stabilization mechanisms resulted in yield improvements and/or reduced production volatility.

In 1965, the Agricultural Price Commission (APC) was established to set minimum support prices for wheat and rice in India.[37] This was done in an attempt to decrease price uncertainty and consequently increase adoption of newly available high-yielding varieties (HYVs) and other modern agricultural technology.[38] It is widely accepted that price supports have had at least some role in increased investment in rice and wheat. Since the introduction of price supports in the 1960s, rice production has more than doubled and wheat production has increased sixfold in India.[39] DeJanvry and Subbarao (1986) note that price supports, along with availability of high-yielding variety seeds and promotion of wheat-oriented irrigation, encouraged a shift in the use of land from pulses to wheat.[40] However, understanding exactly how much technology adoption (and therefore, yield increases) can be attributed to price supports is complicated and underlines the difficulty in measuring the effectiveness of agricultural price policies.[41]

Yield Improvements

As seen in Chart 2, Indian food grain yields were quite variable in the period from 1961 to 1975. This is normal when considering the effects of climate and other natural impacts on crop yields. However, wheat and barley yields before and after the price support policy are a telling example of how investment in wheat increased. Before 1965, the two crops have nearly identical trajectories but after 1965 when wheat was being supported with a minimum support price, their yields diverge and wheat's yield remains above that of barley's. Similarly, yields of sorghum and millet (not supported by minimum prices) remain fairly flat after 1965 while rice yields continued to rise.

When comparing average rates of yield growth before and after the price supports in Table 3, we see additional evidence, although certainly not proof, of the policy's success. In the three seasons before the price supports, wheat yields were decreasing at an average of 4.75 percent per year. In the five years following the new policy, yields were growing at 9.82 percent annually. For rice, yields were growing at 0.02 percent annually before the price supports but were averaging 0.06 percent immediately following. While these statistics give some initial support for the effectiveness of the policy, FAOSTAT's initial datapoint of 1961 is limiting when looking at a measure as volatile as crop yield.



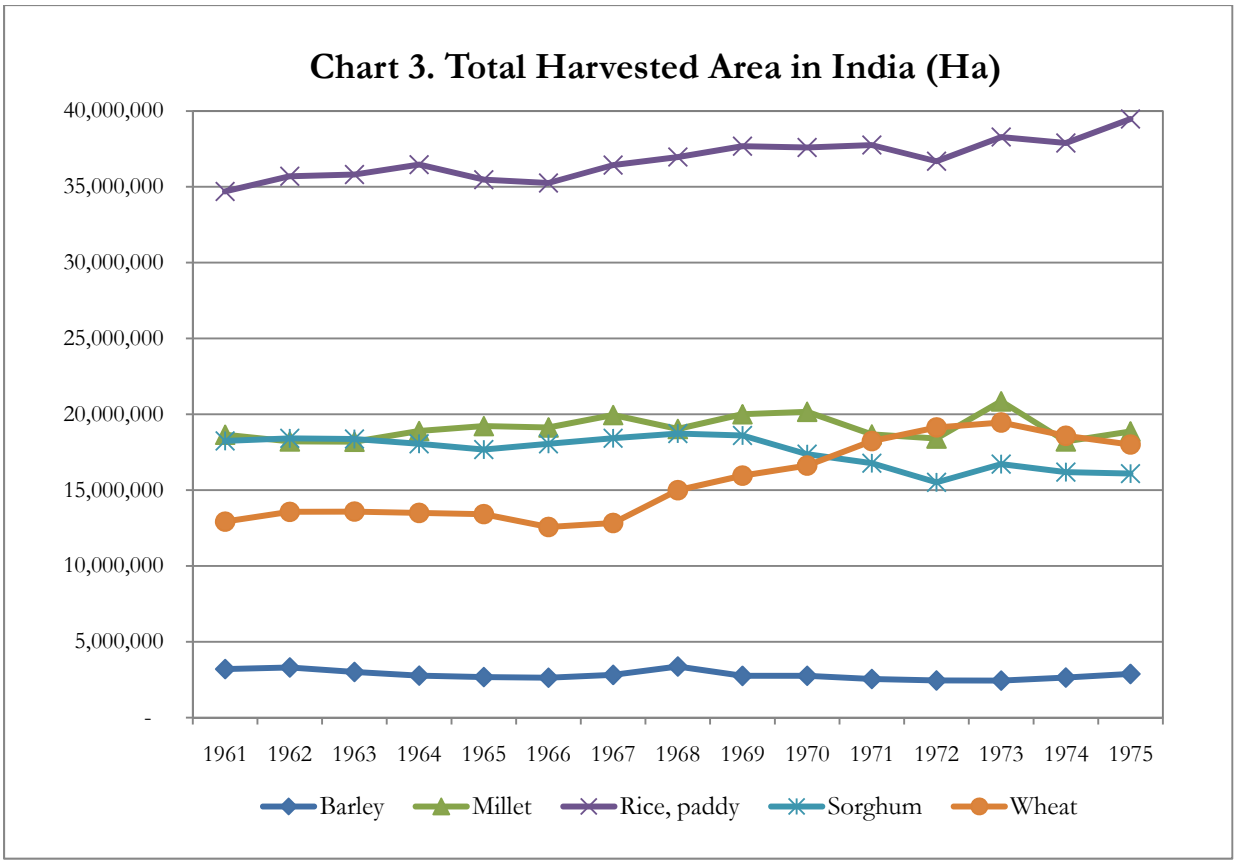
Data Source: FAOSTAT

Table 3: Average yearly rates of growth in wheat and rice yields in India (% change)		
	Before price supports: 1961–62 to 1963–64	**After price supports: 1966–67 to 1970–71**
Wheat Yields	-4.75	+9.82
Rice Yields	+0.02	+0.06

Data Source: FAOSTAT

Production Volatility

When examining production volatility, a focus on changes in the crop's harvested area eliminates the variability of production due to natural factors and simply examines farmers' voluntary response to price changes (or decreased price uncertainty).[42] Chart 3 shows that while farmers greatly increased area harvested to wheat (and rice, to a lesser degree) in the years after 1965, the policy does not appear to have significantly changed volatility when examining yearly changes in total area harvested. To verify this observation, Table 4 compares the standard deviations of rice and wheat total areas harvested in the periods before and after the price support policy implementation. Variation actually increases in the period after the price supports for both crops, further rejecting the hypothesis that the price supports decreased production volatility in India.



Data Source: FAOSTAT

In conclusion, preliminary support exists for the hypothesis that India's price supports had a role in increasing yields of wheat and rice during the Green Revolution. In contrast, the minimum support prices appear to have had no role in decreasing production volatility. This offers some illustration of how Zambia may be affected by maize price supports but obvious differences in the two countries and time periods limit the applicability of India's experience to that of Zambia today.

Endnotes

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