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**Measuring the Relative Profitability of Mid-South Cotton Production from an Alternative  
Gin Seed Rebate Model**

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## **Introduction**

The purpose of this paper is to assess the opportunity returns forgone to cotton producers in the lower Mid-South region of the United States for growing cotton, compared to alternative commodities. We calculate the actual net returns per acre for selected cotton-producing counties in Arkansas, Louisiana, and Mississippi. In addition, we calculate the opportunity returns per acre if the acres planted in cotton were planted in the highest net return commodity per acre between corn and soybeans during the period 1997 through 2008.

Our results find that producers in these cotton producing-counties faced sizeable opportunity revenues foregone averaging 43% between 2003 and 2008. Most observers of the cotton industry would argue that these foregone revenues are a function of historical cotton producers not planting a higher proportion of their acreage in the more-profitable corn enterprise in 2007 and 2008. However, opportunity revenues per acre foregone averaged 37% in the 2007-08 period. This finding suggests that cotton producers recognized a few years prior to the corn price spike in 2007 that alternative commodities, such as corn and soybeans, would generate greater returns on their land. Our research suggests that the higher corn price helped push cotton producers over the edge into planting a greater percentage of their acreage in alternative commodities.

## **Background**

Cotton production in the Mid-South faced two major shocks that have changed the dynamic of the industry. The 1996 Farm Bill, titled at the time “Freedom to Farm” decoupled farm subsidy payments from the base acreage commodity in which producers had been enrolled (USDA/ERS, 1996). This change was meant to allow producers to move acreage into the most profitable commodity in a given year, based on supply and demand conditions of the market.

Hence, the outcome of such a policy change was intended to increase earnings for farm households, but with a possible side effect of increased volatility in commodity production from year to year. The second major policy shift was the role the renewable fuels standard mandates the federal government was imposing to increase use of alternatives to fossil fuel production (USDA, Westcott). Corn was the primary commodity to benefit from this policy mandate because of its existing mature starch-based ethanol production technology.

How has cotton fared in the Lower Mid-South since the 1996 Farm Bill? In Table 1, we evaluate total production of cotton, corn, and soybean planted acres in Arkansas, Louisiana, and Mississippi between 1997 and 2007. While we see some volatility in commodities prior to 2007, we see major reductions in cotton acreage planted and increases in production of corn and soybeans planted during in 2007 and 2008. What are the implications for the major reduction in cotton on the Mid-South region?

Some of our previous research has attempted to address the consequences of this acreage reduction. In Fannin, Paxton, and Barreca (2008), we found out that the net effect to Louisiana's economy from the almost 300,000 acre switch from cotton to corn was only \$700,000, or 0.57% greater output impact and a value-added effect reduced by only 0.89% if cotton would have been produced. The benefits were driven primarily by the increased farm household income spending in the state economy from increased net returns from corn. On the other hand, the input supply industries and processing industries were negatively impacted because it cost more to grow an acre of cotton than corn and there were greater processing costs locally for cotton (ginning) than for corn (elevator handling).

In Fannin, Paxton, and Niu (2010), we evaluated the cotton ginning industry by looking at the changes in transportation logistics brought about by the reduced cotton acreage and

reduction in gins that operated between 2006 and 2009. In this study, we evaluated how far cotton would be transported if 2006 cotton acreage in Louisiana would have to be ginned by the reduced gin infrastructure of 2009. While 2006 cotton fields would be on average just under 9 miles away from a cotton gin operating in 2009, these same fields would be 14 miles away from the second closest cotton gin and 21 miles away from the third closest cotton gin. Almost 30 percent of cotton fields in 2006 would be more than 25 miles from their third nearest cotton gin in 2009.

While these studies suggest that some of the cotton infrastructure has been challenged under the reduced cotton acres planted and harvested, what are the motivations for producers in this region to continue to plant alternative commodities to cotton? Was the move to corn in 2007 a last-minute decision based on the high price of corn at the time of planting? What might the future hold for cotton acreage in future years?

In the next section, we evaluate the opportunity returns that cotton producers have foregone from growing cotton over a recent 12-year period. In particular, we evaluate what net returns producers would have received if they had planted their cotton acres in either corn or soybeans.

## **Methods**

To calculate opportunity returns for the region from producing commodities other than cotton, we first create a baseline based on actual production. This baseline is achieved by calculating net returns per acre for selected counties in Arkansas, Louisiana, and Mississippi that had yields of cotton sufficiently high to be reported in all 12 years between 1997 and 2008 from National Agricultural Statistics Service (NASS) surveys (USDA/NASS). We calculate the revenue per acre per county as the average statewide price per unit recorded by NASS times the

county (parish) yield per unit per acre. This is performed for cotton, corn, and soybeans. We then subtract the average statewide (or in a few cases multi-state region) variable costs per acre obtained from the Economic Research Service (USDA/ERS) from the revenue per acre to receive a net returns per acre above variable costs (or simply net returns per acre). We calculate this for each county (parish) for each of the three commodities and calculate a weighted average return per acre based on the proportion of each county's production in cotton, corn, and soybeans.

We then calculate opportunity returns per acre in a similar fashion. We first identify in each year the alternative commodity between corn and soybeans that would have generated the highest net returns per acre. This commodity's acreage is then increased by the number of acres of cotton grown in that year and a new weighted average net return per acre is calculated that represents the opportunity returns per acre. In a county in a given year where net returns per acre for corn and soybeans are less than cotton, the opportunity returns per acre would be less than the actual net returns per acre. For years when corn or soybeans had greater net returns than cotton, then the opportunity returns per acre would be greater than the actual returns per acre.

## **Results**

### *Aggregate*

Aggregate findings for the 54 counties in the three state-region are presented in Table 2. It should be noted that all prices and costs were measured in nominal terms and not adjusted for inflation. As can be seen from the table, estimated net revenue per acre averaged just over \$100 in the 12-year period. However, this net return was influenced by greater net returns in later years with the 2003-08 period averaging \$130 per acre. The 2007-08 period with high corn prices resulted in net returns exceeding \$200 per care.

When comparing the opportunity revenue foregone, we see that over the 12-year period, counties in these cotton producing areas gave up \$35 per acre or 35% of their potential net returns by growing cotton rather than either the more profitable corn or soybean commodity. The foregone opportunity cost for the 1997-2002 period was only 21% compared to the 2003-08 period of 43%.

How might we evaluate the foregone returns? That is, why might these producers have chosen a lower net return commodity in cotton than corn or soybeans over the period if producers are profit maximizers? The first reason may have been incomplete information. Producers may have expected a given price for their commodity with a given yield and a given production cost per acre at planting that did not come to fruition by harvest time. Producers may have made a correct assessment of the profit maximizing commodity to grow, but external forces impacting prices, or adverse weather patterns affecting yields made the end result appear as if they chose the lower-profit commodity at the outset.

Second, producers may have chosen to produce cotton because they receive additional income streams from growing cotton. The most common income stream that cotton producers receive is a gin seed rebate. Most ginners in the Mid-South gin for seed that means the net returns to ginning is the difference in the revenues received from marketing seed from the costs to operate the gin. Returns from the gin are divided between the owners of the gin (who are often cotton producers in the Mid-South) and cotton producers as a gin seed rebate. Gin seed rebates are not guaranteed in every year and can range from being very minimal to being a measurable percentage of the overall return per acre. However, their volatility makes it difficult for producers to use this rebate in evaluating net returns for planting decisions. Anecdotal evidence from guided conversations with cotton ginners regarding gin seed rebates suggests few ginners in

the Mid-South have producers come to them requesting a guaranteed gin seed rebate level ahead of the planting season. Likewise, very few ginners in the Mid-South promise gin seed rebate levels in advance of planting or harvest to recruit acreage to their facility to gin.

Third, producers use cotton as legitimate part of a risk minimization strategy. While some growers may purchase crop insurance to mitigate yield risk, other producers diversify their acreage into different commodities to avoid a catastrophic negative yield outcome on all acreage planted. Still others plant cotton because they have sunk fixed cost in cotton production and harvesting equipment that needs to be spread out over many production seasons.

One of the interesting questions that stakeholders in the industry may argue is that the six year, 43% opportunity cost foregone in the 2003-08 period would have been primarily influenced by the high net returns primarily to corn in the 2007-08 period. We calculated the opportunity returns per acre and found that the opportunity returns forgone in this period only reached 37% above actual net returns. Given that the 2003-08 period is a weighted average of returns over six years, it suggests that opportunity returns per acre were even greater than 43 % during a portion of the preceding 2003-06 period.

What does this finding suggest about producers' decisions? We believe this simple opportunity cost analysis shows that producers did not simply make a last-minute decision to grow corn when corn prices were firm during the planting window of 2007. In particular, we believe producers actually evaluated the foregone returns to growing alternative commodities to cotton for several years prior to 2007 and were considering a greater proportion of their acreage in commodities other than cotton. The increasing price of corn helped these Mid-South producers get pushed "over the edge" to planting these alternative commodities at greater levels.



How much of the switch was due to the decoupling of federal farm subsidy payments to commodity acreage allotments versus increases in demand for alternative fuels brought about by renewable fuels standards? While this is not a parametric analysis that attempts to tease out the marginal effects, Table 2 does provide some insights. The first six years after the 1996 Farm Bill passed (1997-2002) showed that the opportunity revenue gained was just over 1/5<sup>th</sup> above actual returns per acre. Much of these opportunity returns could have simply been changes in expected returns per acre for commodities at the beginning of the planting season and actual net returns or the result of crop mix diversification strategies. The 20 % foregone earnings may have simply been returns given up to avoid greater downside return risk.

On the other hand, the 2003-08 period shows that producers' foregone earnings more than doubled from the previous six-year period. The large switch to corn in 2007 was enabled by renewable fuels standards, but increased in large percentages from the decoupling legislation of the previous decade. That is, "Freedom to Farm" did not see its greatest influences on the Mid-South in terms of volatility of commodity production pressure on grain handling infrastructure and overcapacity challenges to the cotton industry until more than a decade had past. Yet, as Fannin, Paxton, and Barreca (2008) argue, farmers were able to cash in on that switch at the expense of the cotton input and processing infrastructure that was penalized.

### *County Analysis*

When evaluating individual counties, we evaluated the net returns foregone from the 54 counties that were uniquely identified as growing a sufficient threshold of cotton to be reported by NASS for 12 consecutive years between 1997 and 2008. Corn was the most profitable commodity to plant 72% compared to soybeans if cotton was not planted.<sup>1</sup> Since the 2003-08

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<sup>1</sup> Alternative commodities other than corn and soybeans were not considered in the set of alternatives. Commodities such as rice are not as easily substitutable across all cotton acreage in the Mid-South cotton counties and parishes.

period was the time period with the greatest foregone earnings, we evaluated the percent of county earnings per acre foregone when cotton was grown other than the more profitable commodity between corn and soybeans. These results are shown in Figure 1.

The results indicate that only 6, or 12.5% of all counties analyzed had foregone earnings that were less than 33%. Second, 20, or 37% of counties could have doubled their net earnings per acre if they had grown a more profitable commodity other than cotton. What is most interesting about the figure is there is not real pattern to the foregone earnings. There counties with low and high foregone earnings both near the Mississippi River as well as those counties on the edges of the alluvial plain.

## **Conclusions**

This simple research exercise evaluated the level of opportunity revenues foregone by cotton producers from selected counties and parishes in three Mid-South States. We calculated county-level net returns per acre from actual levels of production for cotton, corn, and soybeans over a twelve year period. We then calculated the opportunity returns per acre by substituting the acres planted in cotton with the acres planted in the most profitable commodity between corn and soybeans for each county in each year.

Our results showed that over the 12-year period, opportunity returns foregone exceeded estimated returns by 35%. In the first six years (1997-02), the opportunity returns exceeded actual returns by just over 20% and by 43% for the 2003-08 period. The 2007-08 period showed opportunity returns foregone by 37%. These results point to a likelihood that cotton producers recognized that they were foregoing measurable returns per acre by staying in cotton. The price spike for corn in 2007 helped push many Mid-South cotton producers toward planting more profitable alternative commodities than cotton.

What does the most recent pattern project for future planting decisions by Mid-South producers? First, producers have a primary interest in return on investment. This net returns analysis suggests that producers are very aware of the relative profitability of all commodities that are available for them to produce. Today's producer is much less loyal to a particular commodity than he/she is to a higher net return. Relative prices will be combined with relative costs in producers' minds when choosing among competing commodities. Also, there may a small level of "stickiness" in planting the previous year's commodity if the relative returns are sufficiently close to the highest net return commodity. This is especially the case if we are talking about switching acreage from corn or soybeans to cotton when that producer has not grown cotton in two or three years. If the returns for these commodities are sufficiently close to cotton, the lower cost per acre to grow the crop may come into play, favoring corn or soybeans. Further, as cotton production technology shifts, such as the adoption of the combination cotton picker module builder, the fixed cost investment to get back into cotton production may be prohibitive even if returns over variable costs suggest planting cotton. In those cases, only a major exogenous shock to commodities where cotton soars upward and corn and soybeans simultaneously drop will be one of the few opportunities for major swings upward in cotton production.

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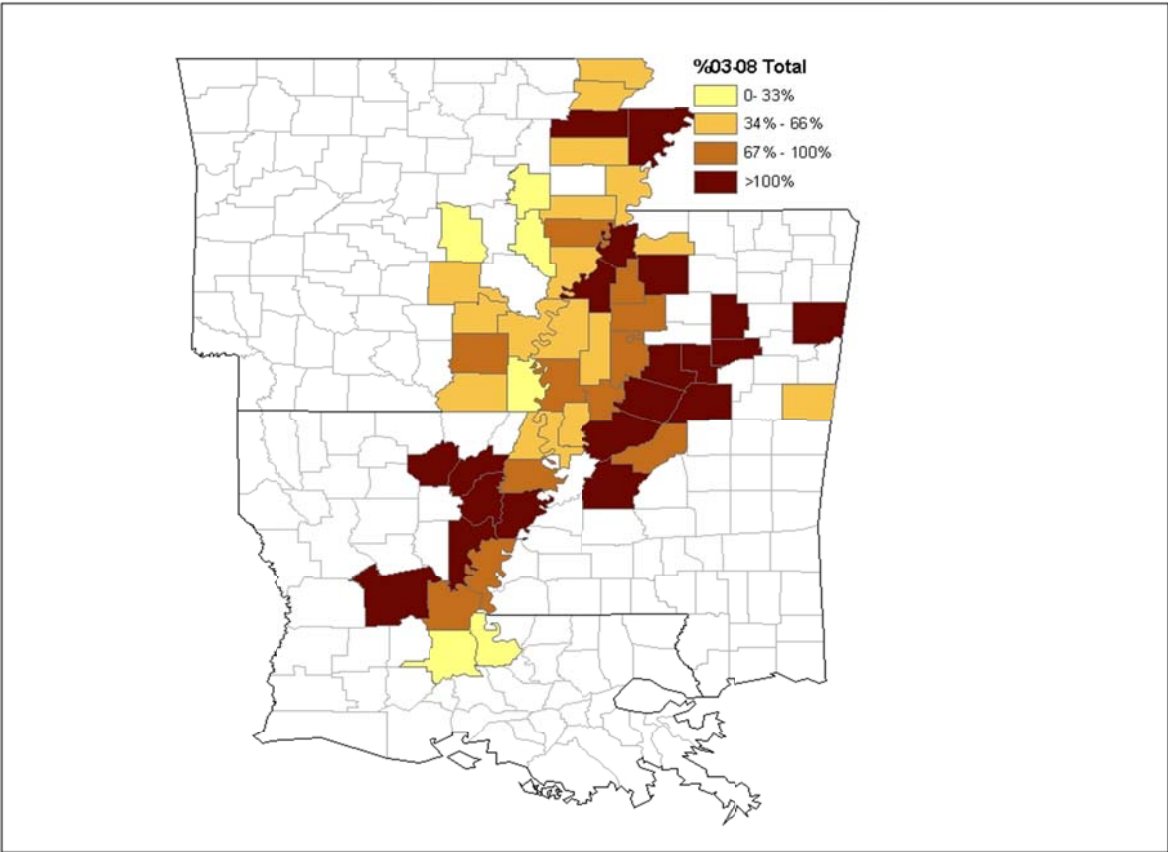
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**Table 1. Commodity Acres Planted for Selected States in Selected Years (Thousands of Acres).**

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>AR- TOTAL</b>	4,820	4,705	4,475	4,490	4,170	4,175	4,265	4,430	4,320	4,470	4,320	4,360
<b>CORN</b>	190	235	105	180	190	265	365	320	240	190	610	440
<b>COTTON</b>	980	920	970	960	1,080	960	980	910	1,050	1,170	860	620
<b>SOYBEANS</b>	3,650	3,550	3,400	3,350	2,900	2,950	2,920	3,200	3,030	3,110	2,850	3,300
<b>LA -</b>												
<b>TOTAL</b>	2,485	2,435	1,975	2,020	1,825	1,900	1,805	2,020	1,830	1,805	1,690	1,870
<b>CORN</b>	430	700	340	380	315	580	520	420	340	300	740	520
<b>COTTON</b>	655	535	615	710	870	520	525	500	610	635	335	300
<b>SOYBEANS</b>	1,400	1,200	1,020	930	640	800	760	1,100	880	870	615	1,050
<b>MS- Total</b>	3,545	3,550	3,490	3,390	3,180	3,160	3,100	3,240	3,200	3,240	3,080	3,085
<b>CORN</b>	460	550	340	390	400	550	550	460	380	340	960	720
<b>COTTON</b>	985	950	1,200	1,300	1,620	1,170	1,110	1,110	1,210	1,230	660	365
<b>SOYBEANS</b>	2,100	2,050	1,950	1,700	1,160	1,440	1,440	1,670	1,610	1,670	1,460	2,000

**Table 2. Estimated Net Returns per Acre for Selected Mid-South Counties and Parishes.**

	12 Year Average (1997-2008)	6 Year Average (1997-2002)	6 Year Average (2003-2008)	2 Year Average (2007-2008)
Estimated Net Revenue Per Acre	\$100.11	\$70.40	\$130.40	\$207.25
Opportunity Revenue Per Acre	\$135.57	\$85.36	\$186.72	\$283.87
Opportunity Revenue Lost	\$35.46	\$14.96	\$56.32	\$76.62
% Revenue Lost	35.42%	21.25%	43.19%	36.97%



**Figure 1. Percent of Foregone Earnings Between 2003 and 2008 from Growing Cotton Compared to Growing Corn or Soybeans.**