Farm Program Payments and Economies of Scale

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Introduction

The Congressional debate leading up to the 2002 farm bill—officially entitled the Farm Security and Rural Investment Act (FSRIA) of 2002—consisted of several controversial issues, perhaps none more contentious than setting tighter limits on the level of farm program payments. The general public became more aware of this issue due to the efforts of interest groups such as the Environmental Working Group (EWG). Through freedom of information laws, EWG obtained data from the U.S. Department of Agriculture about individual recipients of farm program payments and created a searchable database. EWG made this database available to the public, which was soon discovered by major national news organizations. As news coverage of the issue increased, some members of Congress were compelled to respond with proposals for new, lower limits on individual farm program payments. Ultimately, Congress did not incorporate these provisions in the farm bill that became FSRIA. The issue is far from dead, however, as Congressional supporters have vowed to continue the fight to lower payment limits. Furthermore, as a compromise measure, FSRIA included language requiring the creation of a special commission to investigate the potential impact of payment limits.

The rationale for and against payment limits appears to have never been clearly defined during the farm bill deliberations. The debate about payment limits appears to largely be a discussion of equity among producers. Proponents of greater limitations frequently suggest that by limiting payments smaller and perhaps less financially sound farms will be put on more equal footing with larger and more profitable farms. Thus, most of the payment limit proposals are implicitly attempting to shift the structure of agricultural production to smaller and more "family farm-sized" operations.

Background

While specific limits exist on the three major payment programs—fixed direct payments, counter-cyclical payments, and loan deficiency payments—FSRIA also authorized the continuing use of generic commodity certificates. These commodity certificates allow producers of the crops that receive the largest relative share of loan deficiency payments to effectively bypass the annual limit on these payments. Hence, the continuation of commodity certificates from the previous farm bill was a significant defeat for supporters of further limitations on government payments.

The previous farm bill, the Federal Agriculture Improvement and Reform (FAIR) Act of 1996, was historic in its changes to U.S. agricultural policy. The legislation eliminated deficiency payments and included decoupled, fixed payments to farmers—officially known as production flexibility contract (PFC) payments—that were scheduled to decline over the life of the bill and end with its expiration. Substantial limits were included under the FAIR Act for PFC payments and loan deficiency payments, although commodity certificates were authorized. However, once commodity prices fell from the high levels that were present when the FAIR Act became law, farm groups sought more financial support from Washington. Congress responded by doubling the level of PFC payments and doubling the annual limit on loan deficiency payments. In addition, Congress began approving ad hoc disaster assistance packages of several billion dollars in 1998, until FSRIA replaced the FAIR Act in 2002. Even after the passage of FSRIA, the $3.1 billion Agricultural Assistance Act of 2003 provided farmers with funds for weather-related disasters and became part of the FY2004 appropriations approved by Congress and signed by President Bush.

Thus, since 1996 federal farm policy has gone from having plans—at least on paper—for substantially reducing the level of support to dramatically escalating it. Table 1 below lists the limits on farm program payments since 1996, including the limits set in FSRIA. The total limits under the three-entity rule, which allows a farmer to collect up to half the individual payment limit on two additional "entities," are also included.

Table 1. Total farm program payment limits, 1996-2002

Payment	FAIR 1996	FAIR 2000	FSRIA 2002
PFC/Direct payments	$40,000	$80,000	$40,000
Counter-cyclical payments	*na*	*na*	$65,000
Loan Deficiency Payments	$75,000	$150,000	$75,000
Total Limit with single entity	**$115,000**	**$230,000**	**$180,000**
Total Limit under 3-entity rule	**$225,000**	**$460,000**	**$360,000**
Commodity Certificates	**Yes**	**Yes**	**Yes**

An important aspect of table 1 to clarify is the difference in the total limits from 2000 to 2002. As listed, the total limit of support is $50,000 ($100,000 with three entities) less under FSRIA. However, since the authorization of commodity certificates effectively negates the limit on loan deficiency payments, FSRIA would actually provide $25,000 ($50,000 with three entities) more when market prices fall below loan rates because of its additional counter-cyclical payments.

Given these recent trends in agricultural legislation, calls for tighter limits on government support may seem out of place. However, pressure created by interest groups as well as increasing budget constraints have created divisions that are more regional than political. Generally, members of Congress representing the Midwest from both parties have been stronger supporters of tighter payment limits than their Southern counterparts. These bi-partisan groups exist because farmers in the Midwest typically produce commodities that receive levels of loan deficiency payments that are comparatively well below those of other commodities.

Additionally, many members have concerns about deficit spending and the overall size of the federal government. Members of Congress from the South, however, are another generally bi-partisan group representing farmers who produce commodities that receive relatively higher levels of loan deficiency payments and are therefore concerned with sustaining this support.

Hence, these divisions formed the backdrop for the payment limitation provisions that were introduced in the Senate version of the bill that became FSRIA. These provisions took the form of the Grassley-Dorgan amendment, named for the respective Iowa Republican and North Dakota Democratic senators who introduced it. These provisions were subsequently removed in conference, but Sen. Grassley has continued to advocate them. In March 2003, Grassley introduced bill S. 667, which contains provisions similar to those of the original Grassley-Dorgan amendment. These provisions are summarized in table 2 below.

Table 2. Government program payment limits proposed in S. 667.

Payment	S. 667
Fixed direct payments	$20,000
Counter-cyclical payments	$30,000
Loan deficiency payments	$87,500
Total limit with single entity	**$137,500**
Total Limit under 3-entity rule	**$275,000**
Commodity Certificates	**Limited**

Several important observations should be made about the provisions in S. 667. First, the current limit on fixed direct payments is halved, and counter-cyclical payments are reduced by more than half. The limit on LDPs actually increases, but commodity certificates are allowed only up to this limit. The three-entity rule is retained under S. 667; effectively doubling each payment limit for a total annual limit of $275,000. This total limit, in fact, is the same as that proposed in the Senate version of FSRIA, S. 1731. While the total annual amount allowed as proposed by S. 667 is greater than originally specified in the FAIR Act ($225,000), it would effectively be much tighter due to counting commodity certificates towards the limit on LDPs. As evidenced by S. 667, Sen. Grassley and other supporters continue to seek Congressional approval of payment limit provisions similar to those found in S. 1731.

Theoretical Background

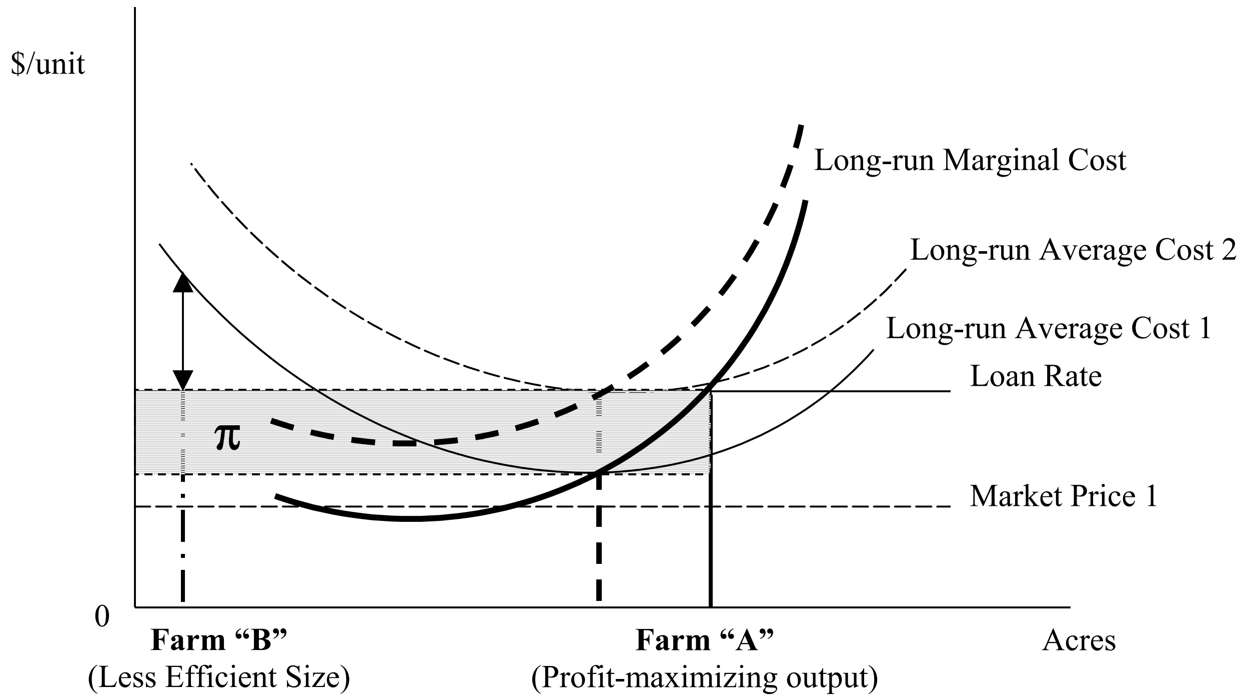
Our investigation of this issue suggests that little empirical analysis exists regarding the relative effect of commodity program benefits and payment limits on operations of various sizes and cost structures. Economic theory and empirical evidence both suggest that not all farm sizes are able to breakeven at the same price level, as well as a vein of literature that empirically demonstrates the existence of economies of scale in the U.S. agricultural sector (Batte and Sonka; Cooke and Sundquist; Moschini; Peterson; Sumner and Leiby). Equally well known are the tremendous technological changes that have taken place in U.S. agriculture over the past 50 years. This technological change often has the effect of improving technical efficiency and lowering the breakeven cost. However, these technological changes are typically capital intensive and not size-neutral, so that adopters of the technology must farm additional acres to achieve the cost efficiency gains afforded by the technology.

The impacts of payment limits on farm efficiency and producer survivability are illustrated in the following figures. These figures are hypothetical but illustrate why technological efficiency and the cost structure of a farm operation have profound implications on what may occur if payment limitations are implemented.

Figure 1 illustrates the average cost curve representing the total cost per unit of output. The cup-shaped line in this graph is the shape economists typically expect the long-run average cost curve to take. This means that when one looks on the *x*-axis at the size of farms (measured by acres) and on the *y*-axis at the cost per unit of output, small farms tend to be higher-cost producers and unable to spread costs across a sufficient number of acres. Traditional economic theory suggests this curve declines until it reaches some point where it begins to turn upward. For a cup-shaped cost curve as drawn in this figure, one can find the minimum cost point representing the most efficient farm size, where production can occur at the lowest cost level. We also identify two farm sizes: A, the most efficient farm size, and B, a less-than-efficient farm size. In our example, when the loan rate for a particular crop creates an effective price floor, farm A is able to earn economic profits for some period, denoted by the shaded area marked π. The crop's market price is driven below the minimum average cost, illustrated by the line Market Price 1. However, assuming farm program benefits become capitalized into the cost of land and other fixed costs, the long-run average cost curve will eventually shift up to Long-run Average Cost 2. Once this occurs, farms earn zero economic profit at the loan rate and production returns to the most efficient farm size, indicating an upward shift in the supply curve. The market price returns to the level it would have assumed prior to the introduction of the government program, intersecting the minimum point of Long-run Average Cost 1. Furthermore, the shaded area up to the heavy dashed line indicating the most efficient farm size can now be seen as the portion of normal profit derived from government payments from the loan program.

Figure 2 begins to address the implications of payment limits and has the same long-run average cost curve and horizontal price line as figure 1. We now consider farm program payment limits, or caps, of sizes A and B, represented in figure 2 by corresponding vertical lines. This means that government payments to each farm under the loan deficiency payment program cease once an individual receives the amount of money represented by the payment caps. This would include commodity certificates and other benefits that have been used to supplement farmers' income. Following from figure 1, the loan rate is assumed to be an effective price floor

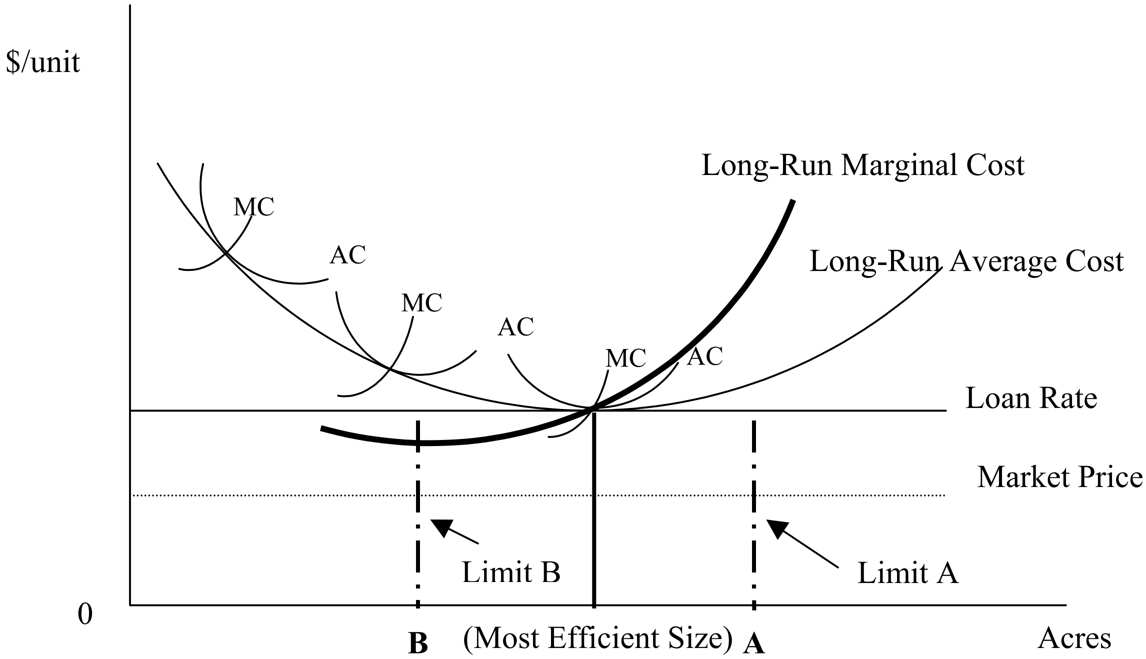
Figure 1. Theoretical Long-run Average Cost Curve for a Competitive Farm.



and becomes the equilibrium price over time. If payment caps of sizes A and B are superimposed on the cost curves defined in figure 2, the payment cap represented by line A would appear to have no major impact, if any, on the structure of the farm because the payment limit occurs at a point well beyond the most efficient farm size. For a stable cost curve, economic theory would predict a migration to the optimal farm size over time. However, for the payment limit represented by line B in this figure, the payment limitation is much more stringent. It would constrain the farm from operating at optimal size, so that the farm is forced to the minimum point of an average cost curve associated with a farm size that will incur losses in the long run.

These figures illustrate the inherent relationship between the size of farm operations and payment limits for the various commodity programs. The payment caps that currently exist are total caps for an entity, which means the commodity payments for all crops on the farm

Figure 2. Farm Program Payment Caps and Farm Size.



contribute to the payment limit. The impact that payment limits have depends on economies of scale and how constraining the caps are on efficiently sized producers.

Our objective in this analysis is to investigate the economies of scale for cotton and soybeans in the Mid-South and understand the implications of farm program payment limitations for producers of these two crops. In the analysis that follows we overlay the current payment limitations and those proposed in S. 667 on estimates of the scale economies for the cost of producing cotton and soybeans in Mississippi. These payment limits are assumed to be the best approximation of what Congress may propose in the future, perhaps before FSRIA is scheduled to expire in 2008. Our estimates of the per-unit cost of producing cotton and soybeans are estimated from six annual producer surveys eliciting cost and yield information. By bringing these two sets of information together, our goal is to provide an understanding of the implications and potential producer responses to various payment limits.

Data and Methods

In order to investigate how a farm's cost structure changes as acreage varies, our econometric model considers how production costs change across farms of different scale. Spline estimation is used to test for changes in the slope of the cost curve. By examining the cost data for a large cross-section of farms of various acreages, certain patterns become evident. In the data we analyze, for example, the average size of a cotton farm in Mississippi is 761 acres, and the average soybean farm is 640 acres. In order to determine a threshold acreage that significantly affects the cost per unit of cotton and soybean farmers, we employ a spline regression estimator. The spline regression basically divides the data sample into two sub-samples, e.g., farm sizes below and above *n* acres. However, this neglects the continuity of the cost function. Continuity of the spline regression can be ensured by estimating the following function:

(1)
$$E(Cost) = \mathrm{A}_0 + \mathrm{A}_1 ACRES + BzMz \quad if \;\; ACRES < X_0$$
$$E(Cost) = \mathrm{B}_0 + \mathrm{B}_1 ACRES + BzMz \quad if \;\; ACRES \geq X_0$$

X_0 becomes the spline function "knot" where the expected value of the cost function is a function of acreage and a vector of other variables M_z. The knot is defined by a dummy variable *D* equal to 1 if *ACRES* is greater than or equal to X_0.

The Mississippi Agriculture and Forestry Experiment Station's annual cropping practice survey generated the cotton and soybean cost data used in this study, which is administered by Mississippi State University's Department of Agricultural Economics (Spurlock and Gillis). Each year this survey collects detailed information on producers' production costs. The cost functions we estimate represent the cost of producing each crop individually, or the cost of producing only cotton or soybeans.

The dependent variable used in this study is unit cost. This variable was constructed by dividing the total cost of production by the total production for both cotton and soybeans.

Heteroskedasticity was found to be conditional on farm size so weighted least squares was used with the square of acreage used for the transformation.

The long run average cost curves estimated in this study were constructed using the cost information of 756 cotton producers and 772 soybean producers surveyed between 1996 and 2001 in the state of Mississippi. Several linear forms of the long run average cost curves for cotton and soybean producers in Mississippi were estimated in order to gain a better understanding of the economies of scale. The spline regression curves were tested for multiple knots in order to detect statistically significant changes in scale. No statistical evidence of diseconomies of scale was found for the range of the data; therefore, single-knot spline regression curves for cotton and soybeans are reported.

Independent variables in this study include acres, one regional dummy variable to incorporate the Mississippi Delta production region, and five time dummy variables to include technological change and weather patterns observed during the last five years (1996 is used as default). Table 4 provides a description of the variables involved in this study. Tables 5 and 6 provide summary statistics on the dependent and independent variables. Table 7 provides the spline regression results for each cost curve. For the cotton and soybean data, the regional dummy variable and four of the five year dummy variables are significant.

Payment Limits

We determine how a farm's costs are affected by different limits on government payments by overlaying the cost curves with several parameters from the current farm legislation, FSRIA, and comparing these results with what would occur if the payment limits in bill S. 667 were imposed. In order to obtain a reasonable estimate of per acre farm program payments, yield information must be used. We utilize per acre county yield information available from the National

Agricultural Statistics Service from 1998 to 2001 for Bolivar County, Mississippi, a large cotton and soybean-producing county located in the Delta region. The 2001 county yield is used as the expectation of actual farm yield for the purpose of estimating LDPs. Program yields were estimated by dividing the average national yield from 1981-1985 by the average national yield from 1998-2001. This ratio—0.89 for cotton and 0.78 for soybeans—was multiplied by the average county yield for Bolivar County from 1998-2001. (This procedure was employed by FSRIA in order to establish soybeans as a program crop.) FSRIA also allowed producers to update their program yield for counter-cyclical payments based on their 1998-2001 production. We utilize the "70 percent method" to create counter-cyclical program yields, adding to the current program yield 70 percent of the difference between the average yield from 1998-2001 and the current program yield. In total, we obtain three different yields for both cotton and soybeans in calculating three types of government payments: fixed direct, counter-cyclical, and loan deficiency payments. These yields are listed in table 3.

Table 3. Representative Government Payment Yields, Estimated from Bolivar County, Mississippi, Yields, 1998-2001.

	Cotton (lbs./acre)	Soybeans (bu./acre)
Fixed direct payment yield	660	24
Counter-cyclical payment yield	717	29
Loan deficiency payment yield	742	31

Figures 1a and 1b illustrate the impacts of the current payment limit provisions under FSRIA based on the representative yields in table 3. Since FSRIA continued the authorization of commodity certificates, only two payment limits are calculated for each graph. Figure 1a is the plot of the cotton cost curve with several FSRIA parameters, including the cotton target price

($0.724 per lb.) and the national loan rate ($0.52 per lb.). The 52-cent-per-pound loan rate becomes the effective price because the producer can essentially sell all of his or her production at this price by using commodity certificates. For the purposes of illustration, one further assumption made in this figure is that the market year average (MYA) price is below the loan rate, which allows the producer to receive the maximum possible counter-cyclical payment. Based on the current limit of $80,000 per year under the three-entity rule of FSRIA, a producer with a 660-pound fixed direct payment yield would maximize the annual direct payment with approximately 2,138 base acres. Similarly, under the current limit of $130,000 per year under FSRIA's three-entity rule, a producer with a 717-pound per acre counter-cyclical payment yield could maximize the counter-cyclical payment with a lower limit of 1,554 acres, when the MYA price is below the loan rate. Despite the fact that the annual counter-cyclical payment limit is $50,000 higher than the fixed direct payment limit, this limit is reached with a smaller acreage because the per pound payment rate is twice as high ($0.1373 per lb. versus $0.0667 per lb.) and in our example the counter-cyclical program yield is higher than the fixed direct program yield. We illustrate both of these payments on the figure with shaded areas with dimensions equal to the per pound payment rate by the maximum possible number of acres. These payments are illustrated in this manner for ease of exposition; we recognize their decoupled nature and in so doing reiterate that the effective price received for all production remains $0.52 per pound. These payments would be received irrespective of the current year's production, whether or not cotton or another program crop is grown or the land is idle. Furthermore, we also emphasize that these payments are based on two different payment yields—660 pounds per acre for fixed direct payments and 717 pounds per acre for counter-cyclical payments, which are both less than the yield assumed for actual production, 742 pounds per acre. An important additional observation from figure 1a is that the cost per pound remains above the effective price line of $0.52 throughout the range of the data used in this study.

Figure 1b illustrates similar information for soybeans. The target price for soybeans is $5.80 per bushel under FSRIA, and the national loan rate is $5.00 per bushel. Based on the current limit of $80,000 per year under the three-entity rule of FSRIA, a producer with a 24-bushel per acre fixed direct payment yield would maximize the annual direct payment with approximately 8,912 base acres—a much larger number relative to cotton. Similarly, subject to the current limit of $130,000 per year under FSRIA's three-entity rule, a producer with a 29-bushel per acre counter-cyclical payment yield would maximize the counter-cyclical payment with a lower limit of 14,650 acres, when the MYA price is below the loan rate—an extremely large number for base acreage and almost ten times the acreage required to reach the counter-cyclical payment limit for cotton. (The portion of the soybean cost curve above 10,000 acres is indicated by a dashed line to illustrate that beyond this acreage the data are out of sample. The curve is continued in this fashion so that the acreage at which the counter-cyclical payment limit occurs can be indicated on the graph.) An important contrast between cotton and soybeans is that while the maximum number of base acres necessary to reach the counter-cyclical payment limit for cotton is less than the number needed to reach the fixed direct payment limit, the opposite occurs with soybeans. This would indicate that cotton receives a higher counter-cyclical payment relative to soybeans, which is reflected by the respective payment rates. As noted above, the maximum counter-cyclical payment rate for cotton is $0.1373 per pound—double the fixed payment rate—while the maximum counter-cyclical payment rate for soybeans is $0.36 per bushel—$0.08 less than the fixed payment rate for soybeans of $0.44 per bushel. Another contrast between figures 1a and 1b is the relative difference between costs and the effective price. In figure 1b, the cost curve for soybeans remains well below the effective price for soybeans, the national loan rate of $5.00 per bushel—a much different case than the cotton cost curve. A soybean producer with a cost curve similar to that in figure 1b would be profitable at the loan rate of $5.00 for essentially all acreages considered. The shaded areas in figure 1b as in figure 1a represent the fixed direct and counter-cyclical payments, although once again we recognize their decoupled nature and the fact that the effective price for all soybeans sold is $5.00 per bushel.

Figures 2a and 2b also illustrate parameters from FSRIA, but include the payment limit provisions proposed by S. 667. In figure 2a the same cost curve for cotton as in figure 1a is again overlaid with several parameters of FSRIA, including the target price and the loan rate. An addition to this graph is the selection of a harvest price of $0.45 per lb. for illustration of the loan rate. Since S. 667 would count commodity certificates towards the total dollar limit on LDPs, these payments would be effectively limited under this bill. Hence, figure 2a also illustrates the farm size at which LDPs would be limited.

As in figure 1a, the limit on counter-cyclical payments would be reached with the smallest number of base acres by the farm when the MYA price is below the loan rate. However, S. 667 imposes a limit of $60,000 per year on counter-cyclical payments, and as a result the farm would reach this limit with 717 base acres, less than half the number under current FSRIA provisions. The limit on fixed direct payments would be halved under S. 667 to $40,000 per year, which approximately halves the base acreage to 1,069 acres. The shaded areas represent the decoupled fixed direct and counter-cyclical payments, as in figure 1a. S. 667 would also effectively limit LDPs to $175,000 per year. At a harvest price of $0.45 per pound, this limit would occur at 3,369 acres for a farm with an average yield of 742 pounds per acre.

Unlike decoupled payments, this acreage is actual acreage harvested, not a base acreage. Beyond 3,369 acres, all cotton sold would be subject to the market price of $0.45 per pound. However, as noted in figure 1, based on the cost curve all cotton produced would have a per-unit cost above the effective price of $0.52 per pound. This situation, of course, would only be exacerbated once the effective price fell to the market price of $0.45 per pound.

Figure 2b uses the same cost curve for soybeans as in figure 1b, and includes the current target price and loan rate from FSRIA. Additionally, an assumed harvest price of $4.40 per bushel is included on the graph, as are the payment limits that would be imposed under S. 667. Once again, when the MYA price is below the loan rate the number of base acres necessary to reach the limit on fixed direct payments for soybeans is less than the number of base acres needed to reach the limit on counter-cyclical payments. Approximately 4,456 base acres in soybeans would maximize the annual fixed direct payment. Counter-cyclical payments, however, would need 6,761 base acres to reach their limit. Shaded areas are also used in figure 2b to illustrate the size of these decoupled payments. The number of actual acres harvested that would be required to reach the $175,000 annual limit on LDPs is 9,409, which assumes a harvest yield of 31 bushels per acre. This acreage is also very large relative to cotton; however, beyond 9,409 acres a producer would still be subject to the market price of $4.40 per bushel. As can be observed for figure 1b, figure 2b illustrates how the per-unit cost of soybeans remains below—and for large acreages well below—the loan rate throughout the observed data. Furthermore, the cost per unit also remains below the market price of $4.40 throughout the range of the data.

Policy Implications

Several observations can be made from figures 1a-2b in terms of changes to farm policies. The most obvious implication of tighter limits on government payments is that in

Mississippi, cotton producers will be affected much more than soybean producers. Indeed, in figures 2a and 2b under the provisions of S. 667, a cotton farm would exhaust all payment limits before a soybean farm reached any payment limit. Specifically, a 3,500-acre cotton farm would exceed all payment limits but a 3,500-acre soybean farm would not exceed any. As noted previously, counter-cyclical payment rates are higher relative to fixed direct payment rates for cotton, while the opposite occurs for soybeans. Hence, when the maximum possible counter-cyclical payment rate is received, these payments are exhausted first for a cotton farm, while fixed direct payments are exhausted first for a soybean farm.

Another important implication from figures 1a-2b is that target prices and loan rates for soybeans are much higher relative to those for cotton. This situation would seem to be consistent with cotton producers' use of commodity certificates. If the loan rate is closer to the cost of production as appears to be the case for cotton, then producers would be expected to be more concerned about limits on LDPs than soybean producers, for whom the loan rate appears to be relatively higher than the per unit cost of production.

Therefore, for soybeans, payment limits do not appear to have large impacts on economies of scale. Based on the cost curve for Mississippi Delta producers, production can remain profitable at larger acreages with or without government payments, particularly LDPs. These payments appear to only add to profit margins. Cotton producers, on the other hand, may be constrained by tighter payment limits. These producers would be subject to the market price beyond 3,369 acres of production, although the cost curve remains above the loan rate of $0.52 per pound throughout the data used in this study. The receipt of decoupled fixed direct and counter-cyclical payments may afford producers the opportunity to operate despite what the loan rate would dictate.

Conclusions

This study has focused on one important aspect of the payment limitation issue—the effect of tighter payment limits on the efficient scale of the farm operation. Our results suggest several implications that counter conventional wisdom on some of these issues while confirming it on others. Clearly, the implications of modifying payment limits vary significantly across crops with different per acre payment rates. Thus, the political differences that have proliferated across regions are likely to persist as U.S. farm policy is debated.

Another conclusion from our analysis is that very broad ranges of farm sizes exist where significant economies or diseconomies of scale are not present in either cotton or soybeans. Contrary to our expectations, cost curves with the shape found in our study suggest that larger farms may not have the economies of size advantage often suggested by proponents of tighter payment limits. Thus, efforts to "level the playing field" between small family farms and larger operation may not be particularly relevant. While it has been suggested that perhaps larger farms have other advantages besides size economies—such as greater access to capital—we believe that perceived size economies have motivated many advocates of tighter payment limits.

At the same time, this study does not confirm the possibility that reduced payment limits might induce farms to operate at a scale that is significantly less than optimal. The data analyzed here appear to indicate that even if payment restrictions could induce smaller farm sizes, the restrictions would not have a profound effect on farm cost efficiency.

Ultimately, examining other crops and locations to investigate whether these findings are robust would be more revealing. We also expect to pursue other approaches to estimate the cost structure of these farms. The continuing political debate about payment limits warrants further research to provide policy makers and the public with more information on this issue.

Table 4. Description of variables in cotton and soybean cost regression model.

Variables	Description
Dependent Variables	
Cotton unit cost	Total cost of cotton production per acre divided by total cotton production per acre.
Soybeans unit cost	Total cost of soybean production per acre divided by total soybean production per acre.
Independent Variables	
Acres	Total amount of acres devoted to producing the commodity.
Cotton Knot (400)	Spline regressor knot set at 400 acres of production.
Soybeans Knot (1200)	Spline regressor knot set at 1,200 acres of production.
Mississippi Delta	Dummy variable = 1 if the farm is located in the Mississippi Delta region.
Year 2001	Dummy variable = 1 if production occurred in 2001.
Year 2000	Dummy variable = 1 if production occurred in 2000.
Year 1999	Dummy variable = 1 if production occurred in 1999.
Year 1998	Dummy variable = 1 if production occurred in 1998.
Year 1997	Dummy variable = 1 if production occurred in 1997.

Table 5. Cotton data summary statistics of variables.

Variable	N	Mean	Minimum	Maximum
Cotton unit cost	756	0.649	0.186	8.350
Acres	756	780.10	3	7,979
Cotton Knot (400)	756	464.18	0	7,579
Mississippi Delta	756	0.564	0	1
Year 2001	756	0.150	0	1
Year 2000	756	0.197	0	1
Year 1999	756	0.198	0	1
Year 1998	756	0.156	0	1
Year 1997	756	0.171	0	1

Table 6. Soybean data summary statistics of variables.

Variable	*N*	Mean	Minimum	Maximum
Soybeans unit cost	772	5.45	1.36	19.07
Acres	772	671.46	5	10,000
Soybean Knot (1,200)	772	156.89	0	8,800
Mississippi Delta	772	0.515	0	1
Year 2001	772	0.143	0	1
Year 2000	772	0.165	0	1
Year 1999	772	0.183	0	1
Year 1998	772	0.169	0	1
Year 1997	772	0.181	0	1

Table 7. Cotton and soybean spline regression model results.

Variable	**Cotton Spline set at 400 acres of cotton**	**Soybeans Spline set at 1,200 acres of soybeans**
Intercept	0.8045 ***	5.3347 ***
	(0.053)	(0.2860)
Acres	- 0.00073 ***	- 0.00164 ***
	(0.00012)	(0.0002)
Spline Knot (400; 1,200)	0.00074 ***	0.00162 ***
	(0.00013)	(0.0010)
Mississippi Delta	- 0.0859 ***	- 0.6240 ***
	(0.0294)	(0.2090)
Year 2001	0.0956 *	- 0.3605
	(0.0564)	(0.3718)
Year 2000	0.2295 ***	2.9497 ***
	(0.0533)	(0.3623)
Year 1999	0.1891 ***	2.3344 ***
	(0.0517)	(0.3517)
Year 1998	0.1203 **	1.3840 ***
	(0.0546)	(0.3577)
Year 1997	0.0433	1.0257 ***
	(0.0532)	(0.3546)
R^2	0.741	0.813

Numbers in parentheses are standard errors. Single, double, and triple asterisks indicate statistical significance at the α = 0.1, 0.05, and 0.01 levels, respectively.

Figure 1a. Mississippi Cotton: Estimated Per Unit Cost for Alternative Acreages, 1996-2001, FSRIA 2002 Payment Limits

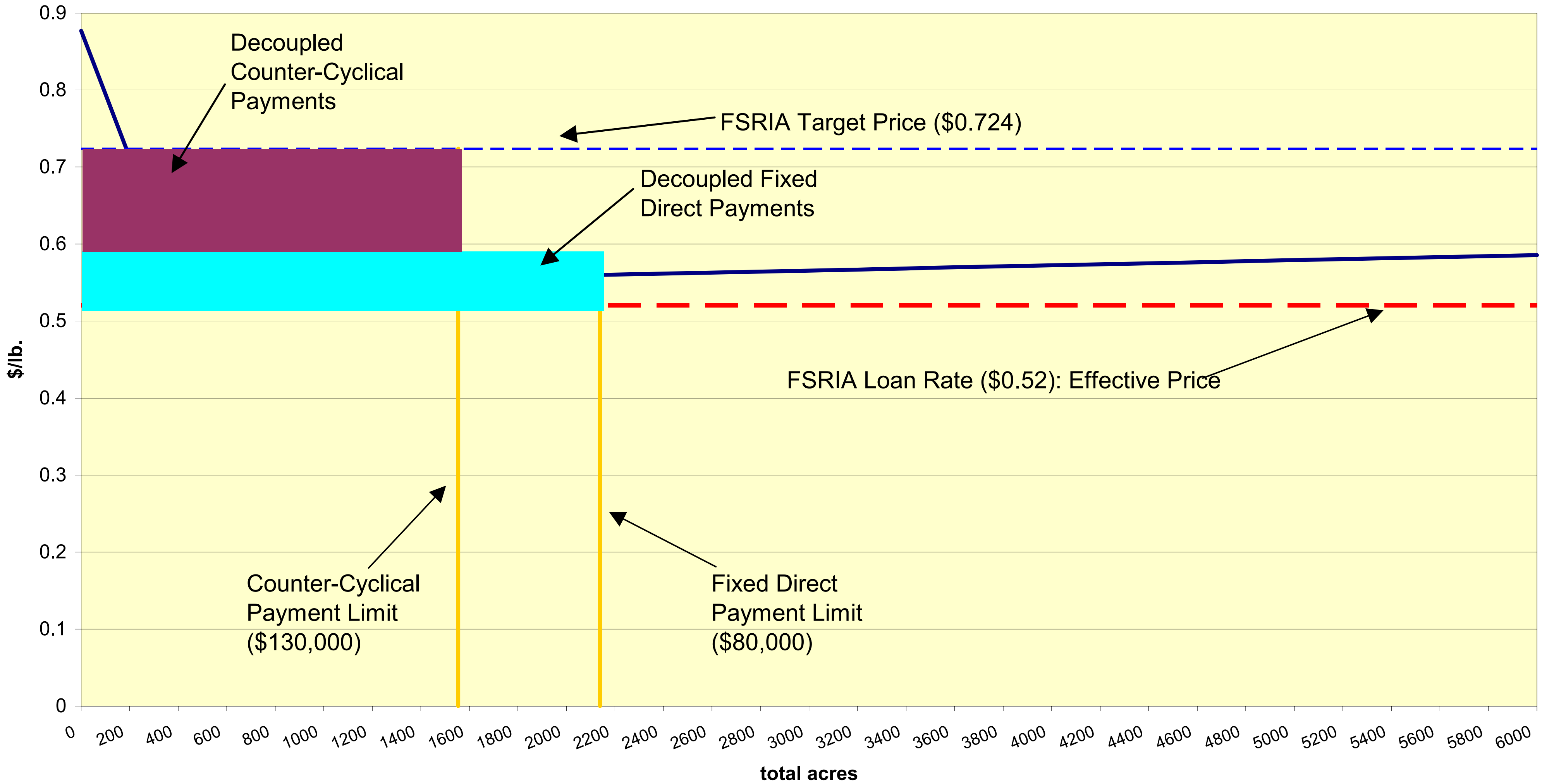


Figure 1b. Mississippi Soybeans: Estimated Per Unit Cost for Alternative Acreages, 1996-2001, FSRIA 2002 Payment Limits

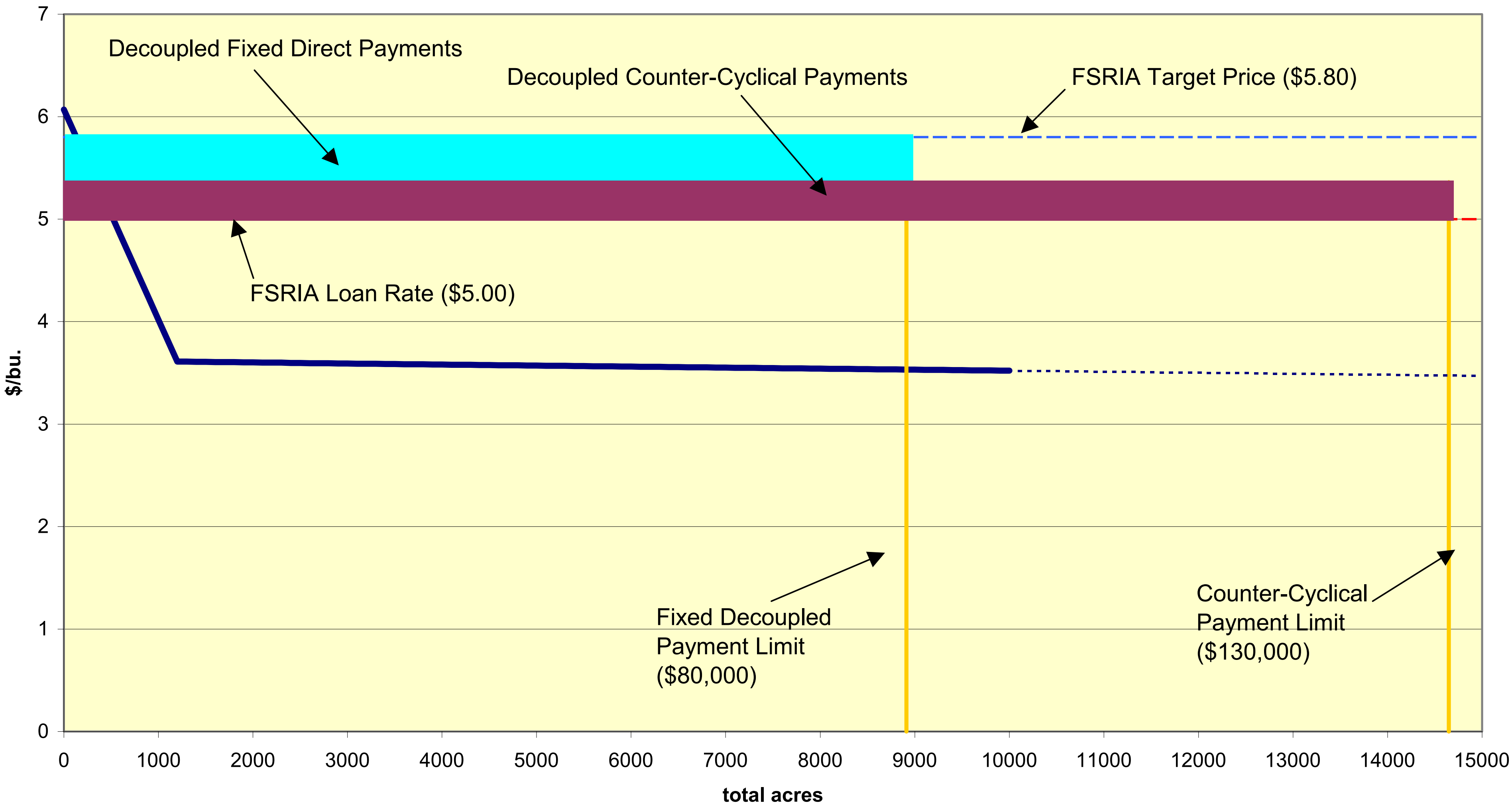


Figure 2a. Mississippi Cotton: Estimated Per Unit Cost for Alternative Acreages, 1997-2000, Compared to S. 667 Proposed Payment Limits

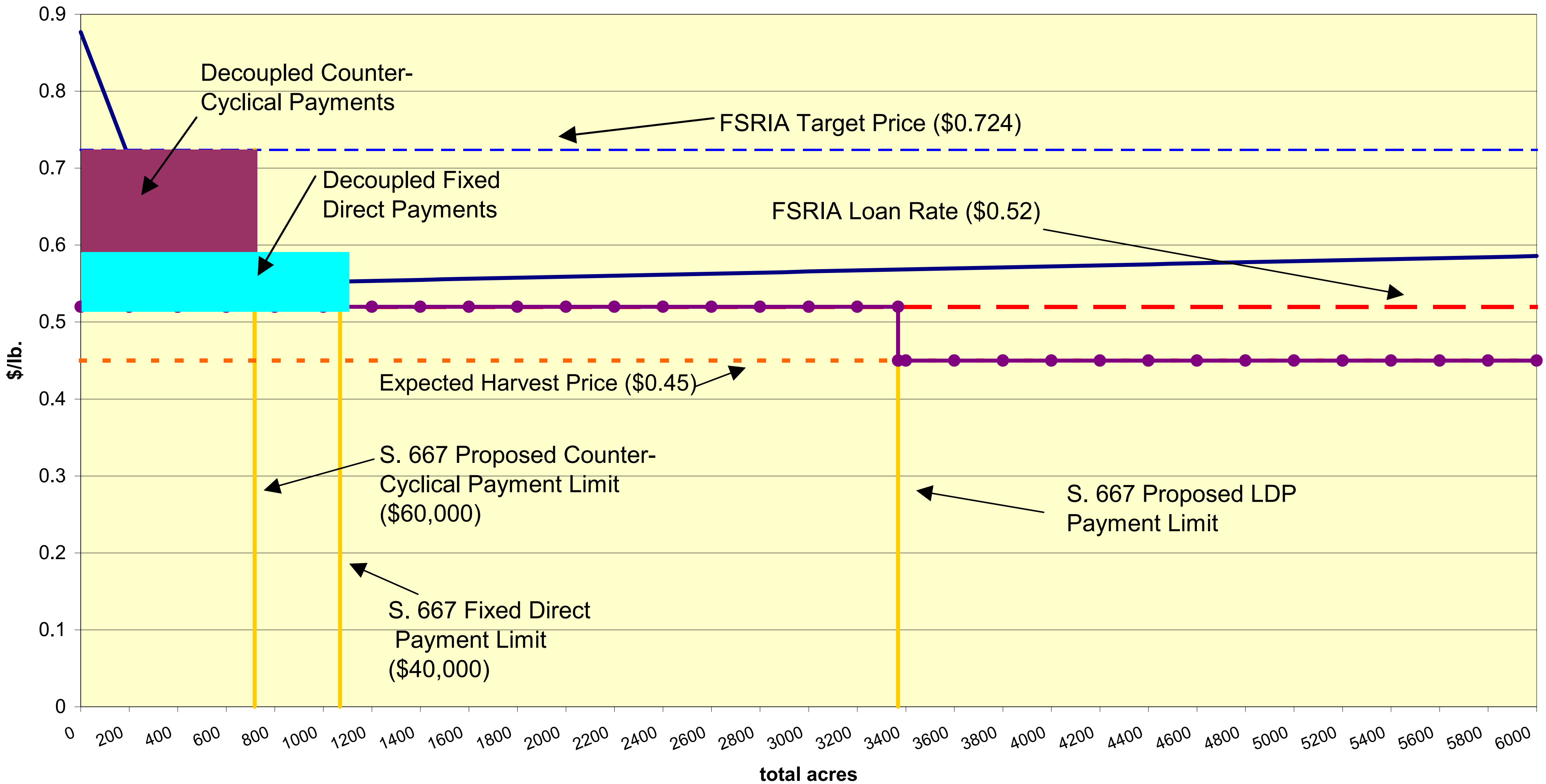
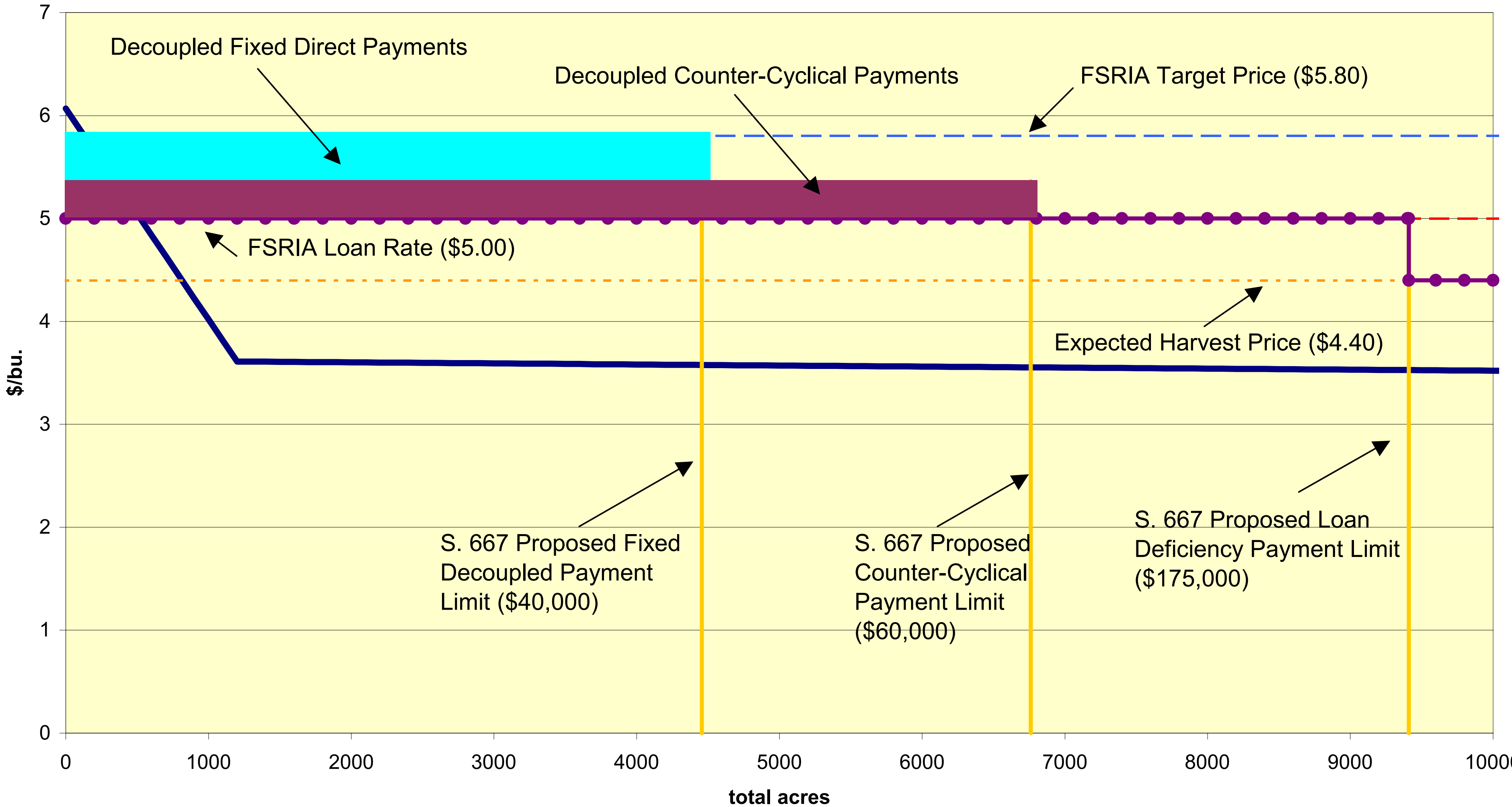


Figure 2b. Mississippi Soybeans: Estimated Per Unit Cost for Alternative Acreages, 1996-2001, Compared to S. 667 Proposed Payment Limits



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