ECONOMIC EFFECTS OF ALTERNATIVE FARM PROGRAM PAYMENT LIMITATIONS

A Thesis

by

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ABSTRACT

The objective of this thesis is to quantify the effects of alternative farm program payment limitations policies on the efficiency and viability of farms in the U.S. This objective will be achieved by identifying the payment limitations alternatives to be evaluated and applying those scenarios to various representative farms. The effects of the payment limitations will be estimated using FLIPSIM and representative farm financial data. The financial data will be obtained from the Agricultural and Food Policy Center at Texas A&M University, and the remainder of the relevant data will come from USDA's Economic Research Service. The results of the research will be used to determine whether changes in payment limitations would affect the economic efficiency of U.S. farms by incentivizing farms to reorganize and avoid payment limitations, or affect farm viability by changing net farm income or returns on investment.

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Contributors

This work was supervised by a thesis committee consisting of committee chair Dr. James W. Richardson and committee member Dr. Joe L. Outlaw of the Department of Agricultural Economics, and committee member Dr. Monty C. Dozier of the Department of Texas Agrilife Extension.

The FLIPSIM farm simulations included in this work were performed by Dr. James W. Richardson in collaboration with Dr. Henry Bryant of the Department of Agricultural Economics. The data from the Agricultural Resource Management Survey was collected by Dr. James W. Richardson and James Marc Raulston of the Agricultural and Food Policy Center.

All other work for the thesis was completed by the student, under advisement of Dr. James W. Richardson of the Department of Agricultural Economics.

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CHAPTER I

INTRODUCTION

Farm program payment limitations are not a new concept; the first Agricultural Act to include payment limitations was passed in 1970. However, starkly opposed positions on what level of limits should be imposed and how they should be administered have caused debate to persist since the inception of payment limitations. Recently, debate has specifically spiked over whether to reduce payment limitations from their current levels for the next Farm Bill. The purpose of conducting this study is to inform the debate over farm program payment limitations for future Farm Bills, specifically in relation to crop commodity programs.

Current Payment Limitations and Eligibility

As of the 2014 Farm Bill, farm operators are eligible to receive a maximum of $125,000 per person in program payments for all crop programs, except peanuts. A single separate limitation for peanuts is set at $125,000 per person. Additionally, farmers must prove that they are "actively engaged" in farming to receive program payments, a provision which was introduced in the 1987 Farm Bill and has since become more strict. The current legislation also allows only individual "persons" to receive payments; any payments that would be made to a business entity must instead be attributed to a specific individual involved in the operation. Finally, the 2014 Farm Bill included a rule that anyone with an adjusted gross income (AGI) of more than $900,000 is not eligible to receive farm program payments.

Objectives

In light of the debate ongoing with regard to the 2018 Farm Bill legislation, it is beneficial to attempt an objective evaluation of the possible effects that various payment limitations might have on the United States farm economy. Pursuant to that goal, the objective of this study is to quantify the economic effects of alternative farm program payment limits on farm efficiency and viability for representative crop farms.

Literature

The primary bodies of literature reviewed were related to farm economies of scale and farm program payment limits. Studies on the presence of economies of scale in farming operations were reviewed and were useful in determining the best way to estimate the effect of farm program payment limits on economic efficiency of representative farms. Several studies were conducted in the 1970's and 1980's related to the effects of farm program payments on farm efficiency, and some even included various effects on viability. However, recent research has focused more on other aspects of farm programs and payment limits, leaving a gap in information on the effects of payment limits on farm efficiency and viability.

Methodology

To determine the effects of alternative payment limits on the viability of representative crop farms, the FLIPSIM simulation model was used to simulate output variables for representative farms. The output variables were used as measures of farm economic viability, and different scenarios were simulated to determine the effects on the representative farms given different payment limits. Efficiency ratios were then calculated for representative farms and additional sample farms obtained from USDA data to compare the efficiency of different farm sizes. The differences in efficiency ratios indicated how the efficiency of one of the representative farms would be affected if it were to reduce its acreage to avoid payment limits.

One of the drawbacks of the methodology used was that we could not incorporate an accurate number of persons actively engaged in farming on a given farm due to lack of data and the complexity that such a method would require. It was assumed that there were two persons actively engaged in farming on each representative farm, which is not a realistic assumption. This limits the realistic applicability of the research, but allows for a demonstration of the effects of an extremely restrictive limit.

Farm Model

The Farm Level Income and Policy Simulation Model (FLIPSIM) designed by Richardson and Nixon in 1981 was used to estimate the effects of alternative payment limits on representative farms. FLIPSIM "is a Fortran computer program designed to simulate the effects of alternative commodity programs and income tax regulations on the survival, growth, and success of typical farms" (Richardson and Nixon, 1981). FLIPSIM is capable of incorporating risk into farm simulations, and of incorporating a multi-year planning horizon. It can simulate different sizes of farms across most major crops for the United States, making it a useful model for this research.

Data

Farm financial data from representative crop farms was used in the simulation of the viability output variables for the different payment limit scenarios. The farm data included represents different farm types, farm sizes, and crop production regions. The data is recent within the last year, and price data used in the simulation was from the August 2018 FAPRI Baseline. The data used for the efficiency output variable came from the representative farms, as well as the USDA Agricultural Resource Management Survey (ARMS).

CHAPTER II

REVIEW OF LITERATURE

The prior research related to this study can be organized into four general categories: 1) the history of payment limitations; 2) recent studies on the effects of payment limitations; 3) reorganization of farms and economies of scale, and; 4) the applications of FLIPSIM and how it is used. To best quantify the possible effects of changes in today's farm payment limitations, we need to understand how payment limits began, how they have changed since their inception, and how they have affected farmers in recent history. In addition, we need an understanding of the mechanics of FLIPSIM, which will be used to simulate the effects of alternative policies on various farm scenarios.

History of Farm Program Payment Limitations

The tradition of the Agricultural Adjustment Act, more commonly referred to as the Farm Bill, began in 1933 as part of a response to the effects of the Great Depression. Written roughly every four years, each individual Farm Bill has had varying degrees of success, and each new bill always brings with it a unique set of changes necessary to maintain the stability and viability of U.S. agriculture.

While the history of government payments to farmers can be traced back to the first Agricultural Adjustment Act in 1933, the history of limitations on those payments only goes back as far as 1970 (see Appendix A for a detailed summary of payment limitations history). The Agricultural Adjustment Act (or Farm Bill) of 1970 set an initial payment limit of $55,000 per program crop. This limitation was placed in response to growing concerns that farmers were being paid too much in direct payments, which began in the 1960's (Outlaw et al. 2008). The Farm Bills written since 1970 have often included major changes in farm program payment limitations, and it is important that we understand how limitations have evolved to their current form if we are to effectively analyze the possible outcomes of changing limitations.

After the initial establishment of separate payment limits for each program crop, changing market conditions and high government expenditures prompted Congress to instead limit total payments to $20,000 per producer (Bowers et al. 1984). This form of payment limit—combining all crop program payments under one limit—has become the norm, with a handful of specialty commodities retaining their own separate limit, such as rice in 1975, honey, wool, and mohair in 1990, and peanuts in 2002 (Congressional Research Service 2017). Along with this type of limit, it has been customary to exclude Marketing Assistance Loan (MAL) benefits from the set of payments subject to limitation. Both the combined payment limit for all program crops and the exclusion of MAL benefits from the set of programs subject to limits are features of the 2014 Agricultural Act, which is currently in effect.

It is worth noting that the Omnibus Reconciliation Act of 1987 introduced some significant changes to the language of payment limitations, rather than the limits themselves. These changes have shaped much of the current debate over farm program payment limitations. The 1987 Omnibus Act did three things: 1) it implemented the "three-entity rule;" 2) it added a requirement for program payment recipients to be "actively engaged" in farming (AEF requirement); and 3) it defined what constitutes a "person" (Congressional Research Service 2017). These changes in terminology and requirements aimed to reduce the misuse of program payments and ensure that only agricultural producers were benefitting from the programs.

As laid out in the 1987 Omnibus Act, the "three-entity rule" allowed producers to receive payments for their primary farm operation, as well as 50 percent of the payments attributed to two other entities in which they had ownership interest (Omnibus Budget Reconciliation Act

1987). Producers who used this provision would be able to effectively double their payment limitation. However, it should be noted that prior to 1985, administrators of farm program payments were not required to determine attribution of corporation shares to individual producers, so it is likely that producers would have been able to achieve payments in excess of the limits prior to 1985.

In addition to the "three-entity rule," the AEF requirement supported the goal of reducing misuse of government payments. The Omnibus Act required that a payment recipient have a substantial stake in an operation, contribute labor or management, and that their contribution be "at risk." This helped ensure that parties not actively or substantially engaged in the production process, and not beholden to the associated risks, did not receive payments.

Finally, the Omnibus Act was the first to define the term "person" in relation to payment limits. It defined a person as an individual, a business entity, or a State. Though still relatively vague, the definition was a first step towards clearer interpretation and effective administration of payment limitations.

Following the 1987 Omnibus Act, the remainder of the history of payment limitations is highlighted by a few key events. In 2002, Congress included an adjusted gross income (AGI) threshold above which farmers would be ineligible to receive program payments (Congressional Research Service 2017). An exception was also included for farmers whose income came primarily from farm operations. However, the 2014 Farm Bill removed this exception and reduced the income cap from $2.5 million to $900,000 per person. Additionally, in 2008, the "three-entity rule" was eliminated, the definition of a "person" was changed to mean only a natural person, and the requirement of direct attribution was introduced. Narrowing the scope of what constitutes a person and the elimination of the "three-entity rule" served to reduce the effective limit on farmers' program payments, and direct attribution required payments to be made to a specific individual rather than a business entity. This marked reduction in limits was followed by a further cut in 2014 when Congress set the total program payment limitation at $125,000 per person for the combination of all programs (Congressional Research Service 2017). These key changes in payment limitations have led to the current debate over reducing limits further.

The intent of this research is to use economic tools to estimate the effects that different levels of payment limits would have on farm economies. However, payment limits are not an economic issue; they are a social engineering issue. The first payment limit was implemented in response to concerns that farmers were paid "too much" in direct payments (Outlaw et. al, 2008). The idea of farmers being paid "too much" is a value judgement, not an economic problem. It is important to recognize that payment limits are set because of a *belief* that farmers should be limited on how much they receive in commodity program payments, and the specific amount that they should be limited to is often contested. This research recognizes the social engineering aspect of payment limits and does not claim to provide a simple economic solution to the problem of how high payment limits should be set.

Recent Studies

Much of the literature related to the current thesis comes from research done in the 1970's and 1980's, and may appear to be outdated. However, much of this work explains the economic theories behind the factors that affect farm efficiency and viability, and the research shows how efficiency and viability were affected by farm program policies at that time. These studies give a framework to follow in conducting the current research, and provide insight into the general expectations we should have prior to conducting the research. However, it is also important to know that more recent research has been conducted on the general subject of farm program policy, and that the current study is distinct from other recent work.

One of the more recent studies that has been conducted regarding effects of farm program payment limitations came from the Commission on the Application of Payment Limitations for Agriculture, which was established by the Farm Security and Rural Investment Act of 2002 (Collins et al. 2003). The study covered a relatively broad spectrum of effects of payment limitations, including total reduction in payments, farm structure, land values, administrative costs, farm income, and several others. The conclusions offered in the report mention that a lack of information on how farms would react to lower payment limits prevents any kind of anticipation of how economic efficiency might be affected, or how rural economies would be affected in the long run (Collins et al. 2003). The Commission called attention to the need for further in-depth study of the effects of payment limitations, leading to further subsequent research on the subject.

Though prior research has been conducted regarding the economic effects of farm program payment limitations (Knutson et al. 1987), the most recent studies have focused on other aspects of payment limits. Goodwin (2008) focused on determining the frequency with which payment limits become binding for farm producers, as well as the "likely effects that tighter and more strongly enforced payment limits could conceivably have on the acreage of program crops in the United States" (2009). According to Goodwin's 2008 research, "cotton, rice, and peanuts are the only commodities that would be likely to be significantly impacted by binding constraints on farm program payments." The overlap between the current research and Goodwin's research will help inform the discussion to follow and help illuminate potential concerns if any discrepancies arise. Goodwin's 2009 research should also help to discern the potential magnitude of farms that would likely shift acres out of production of a particular crop and into another. If this is found to be a possibility, Goodwin's research may be further discussed. Goodwin's studies can also be observed in conjunction with the current research to inform Congress of the various effects that the current and proposed payment limits are likely to have on U.S. producers.

In addition to Goodwin's research, Higgins (2005) evaluated the equitability of farm program payments with some attention to payment limitations, especially in relation to economies of scale that are often achieved by larger farms. The current research will have a heavy focus on economies of scale in agriculture, but it should be noted that this study will not attempt to determine the equitability of program payments. In this way, Higgins' research is quite distinct from the current research.

Reorganization of Farms

Reasons for Farm Growth

The estimation of the effects of reorganizing farms was included in this research because farms have a tendency to grow in size the longer they remain in operation. The reduction in costs-per-acre that can be achieved from spreading the cost of fixed assets such as machinery and structures gives farms incentive to operate a greater number of acres. Having the ability to spread fixed costs over more acres discourages farms to reorganize into smaller units, as doing so would increase the costs per acre of the newly formed farms.

Farm growth has given society the benefit of more affordable food. When many farms increase in size and reduce their costs per acre, the supply of agricultural commodities naturally increases, putting downward pressure on prices. Farmers are able to operate at these prices because they have gained the benefits of spreading fixed costs of production over additional acres. When farms are reorganized into smaller units, they lose the benefit of lower production costs per acre and it is more difficult for them to operate at market prices.

One of the major problems with tightening payment limitations that has been observed in the past is an increase in the number of farm reorganizations. According to Brian Crowley's statement to the House Subcommittee on Wheat, Soybeans, and Feed Grains, a trend of farm reorganizations was observed from 1984 to 1986 "that may have been related to the $50,000 payment limitation" (*Farm Reorganization and Payments* 1987). The combined effect of those reorganizations was an added $328 million in costs to the government during that time. In addition, the Commission on the Application of Payment Limitations for Agriculture, established by the 2002 Farm Bill, found that while the $40,000 payment limit on direct payments at the time should have reduced payments by about 3-4 percent, Farm Service Agency data showed that payments had only been reduced by about 1.6 percent, which "suggests that many farms are structured or have restructured to reduce the effects of payment limitations" (Collins et al. 2003).

Given that past reductions of payment limitations have caused farm operators to reorganize their businesses, it is important that we understand and analyze the potential effect of reorganization on the individual farm. The primary effect of reorganization to avoid payment limits is to diminish the economic efficiency of farms. To understand what this means, this section will first define economic efficiency in general and subsequently describe the factor that determines whether a farm is efficient, which is the presence of economies of scale. Finally, we will identify the methods by which previous authors have drawn long run average cost (LRAC) curves, which are used to discern the presence of economies of scale.

Economic Efficiency

The term "efficiency" can be defined as the ability to perform some task or produce some product while minimizing the amount of waste involved in the process. Waste can be measured as time, materials, or effort, or a combination of all three. Economic efficiency is typically defined as being able to minimize production costs per unit of output (Knutson et al. 1987). However, according to Knutson et al (1987), this definition precludes the "consideration of economies of size associated with larger farms being able to market larger quantities at higher prices than smaller farms." In light of this information, the method set forth by Knutson et al. will be used to determine economic efficiency, which uses unit cost ratios calculated as production cost per dollar of revenue, a method also used by Madden (1965). Consequently, economic efficiency will be defined as operation at the lowest possible cost of production per dollar of revenue (unit cost ratio).

Economies of Scale

Due to the ease of access to material defining the concept of economies of scale, this thesis contains only a brief description of the theory and focuses on the application of the concept to the research instead. Economies of scale—also known as economies of size—can simply be defined as "the relation between level of output and unit cost of production" (Madden 1965). Most discussions involving economies of size are held in respect to the benefits that we typically associate with the operation of a firm that is large relative to other firms in the industry. These benefits come in a number of forms, and could include greater marketing power, lower input prices offered for buying in bulk, and lower production costs per unit of output.

Faris (1961) defines three categories of economies of scale: "(1) those arising from technical relationships, (2) in the acquisition of inputs, and (3) arising from vertical integration of the farming operation." However, Smith et al (1984) states that "pecuniary economies are defined as lower costs of purchased inputs or higher returns to marketings as farm size increases." The research done by both Madden and Smith shows that pecuniary economies of size are not achieved by farms by means of volume discounts; however, Smith found that economies of size were achieved through vertical integration, especially by large size farms through corporate integration. Smith's research (see Table 15 in Smith et al. 1984) found that by vertically integrating (in this case, obtaining full or partial ownership of a cotton gin), farmers could reduce their per-unit production costs by anywhere from about one to three percent, conservatively speaking. Smith found it more likely that producers would be able to obtain a 7.6 percent cost reduction, equaling a benefit of $30,000-$65,000 for the largest farms. In addition to cost reduction from vertical integration, Smith found pecuniary economies of scale to exist for larger farms in the form of higher market prices: "Data obtained from the producer survey indicate 1,601 acre or larger farms received 1.7 to 3.4 cents per pound more for their 1979-1980 cotton crop than smaller farms… These pecuniary marketing economies yield increased revenue which ranged from $7,800 for the 1,600-2,500 acre farm to $17,800 for the largest farm size categories" (1984).

Given these considerations, two categories of economies of scale will be recognized: technical economies and pecuniary (monetary) economies. Technical economies are those that arise from more efficient operation that tends to occur as the firm increases in size. For example, a farm that is able to increase the number of acres it farms might have to incur more seed, fertilizer, and irrigation costs, but it can spread its machinery costs over a larger volume of output produced, causing its per unit production cost to fall. As discussed in the "Economic Efficiency" subsection, this is part of what we consider efficiency. Pecuniary economies, as previously defined by Smith et al. (1984), are achieved when a firm is able to take advantage of its size during some segment of the marketing process, whether that involves obtaining lower prices for inputs or higher prices for outputs, or even reducing overall costs through vertical integration. In an effort to include all potential effects on agricultural producers that might occur subsequent to the reduction of farm program payment limitations, both technical and pecuniary economies of scale will be included in the analysis.

If economies of scale as identified by Smith et al. (1984) are present in the U.S. farm economy, then restructuring of farms causes an additional problem. According to Knutson et al., "farms that cannot survive outside the farm program are forced to restructure into smaller, less efficient units or to liquidate. Reduced efficiency makes U.S. production less competitive in world markets and results in increased pressure for higher levels of government subsidies." If payment limitations are binding for farms, they are likely to reorganize to capture the full amount of payments they previously received if they are dependent upon government payments to survive. This causes the farm to lose valuable economies of scale in terms of marketing power and possibly even some technical economies of scale. The current research aims to quantify these potential economic costs using the methods set forth in the Methodology section.

Long Run Average Cost Curve

Two primary bodies of literature exist in regard to economies of scale in agriculture: those studies utilizing the synthetic approach to calculating a LRAC curve and those using the composite approach. The primary distinction between the two is that the composite approach incorporates all economies of scale, while the synthetic approach, used by Madden (1965), only addresses technical economies of scale, those brought about by spreading fixed costs over a greater volume of output. Madden's study ignores all pecuniary economies, claiming that "pecuniary economies were found to be virtually nonexistent in the study area" (1965). However, Smith et al. (1984) did a study in the same sample area of the Texas High Plains that focuses on determining whether pecuniary economies were present, and found that "marketing economies of approximately 4.2 percent were achieved when farms reach the 2,000 acre range." It should also be noted that Madden measured the size of a farm by its output, which he considered to be gross income. It is a more standard practice to use farmed acres as a measure for farm size, as Smith et al. did.

Additionally, the results of these studies do not necessarily stand in contrast to each other. Since Madden only studied technical economies, and the largest farm size he studied was 1,800 acres, it is likely that, given the methods and constraints he used, his results are accurate. However, to properly quantify the effects of a reduction in farm program payment limits on individual farmers, it is important that this research account for all potential lost benefits, which could include the benefit of operating a large farm as opposed to a small or moderate size farm.

The LRAC curve is an important tool for evaluating the presence of economies of scale and, consequently, economic efficiency. As previously mentioned, the two popular methods of estimating long run average costs are the synthetic approach and the composite approach. Madden (1965; 1967) concluded that the synthetic approach was the most reliable, and claimed that composite farms "do not accurately reflect the actual average cost of farms in their respective size classes." He criticized the composite approach for also being subject to potentially faulty or incomplete data, and instead preferred the synthetic approach's use of hypothetical farms to establish a LRAC curve. Madden's synthetic method is as follows: "By creating an average total cost curve for each of several sizes of farm and by drawing a curve that is tangent to these short-run curves, the resulting relationship approximates the long-run economies of size curve" (1965). Because of the hypothetical nature of the synthetic approach, this thesis will employ the composite approach to estimating long run average costs, gathering real farm data to estimate the farm's average total cost (total cost per dollar of revenue).

As the purpose of the research is not to define a LRAC curve, but to determine policy effects of representative farms, no theoretical LRAC curve will be needed. However, it is possible that by plotting the average total costs of the representative farms, a realistic LRAC curve for the farms included may be estimated.

Farm Model

The goal of this study is to quantify the possible effects of various farm program payment limitations on farm efficiency and viability. In pursuit of this goal, the Farm Level Income and Policy Simulation Model (FLIPSIM) will be utilized to simulate the effects that various payment limitations would have on alternative sizes and types of farms. FLIPSIM is a firm level policy simulation model that was developed by Richardson and Nixon in 1981, and has been utilized in multiple studies and dissertations to analyze the effects of various marketing strategies and farm policies on representative farms (Richardson and Nixon, 1986). According to Duffy et al. (1986), FLIPSIM "is capable of simulating different size crop farms under alternative farm programs and price probability distributions." For this thesis, the model will be used to simulate crop farms to simulate net cash income and other financial indicators needed to estimate the effects of alternative payment limitations. While the application of FLIPSIM to the current research will be discussed in further detail in the Methodology section, the basic mechanism of FLIPSIM should first be understood.

The function of the FLIPSIM model is to simulate various possible outcomes given a set of data inputs and assumptions. The final result is not optimization, but an attempt to create an estimate of the most likely outcomes of the given scenario. The outputs that will be obtained from the model are best suited to the current research as the objective of the research is to determine the most likely effects of alternative policies. The model uses inputs for all of the necessary variables for estimating the outcome of a given agricultural production year, such as variable costs, fixed costs, depreciation, receipts, loan repayments, etcetera. In addition to the variables directly related to farm production, the model also includes the option to include policy variables, including price support, target price, crop insurance, marketing loan, and payment limitation, which serves the purposes of the current study (Richardson and Nixon, 1986). The model has been modified and expanded to include currently policy tools, including options for the Price Loss Coverage (PLC) program, the Agriculture Risk Coverage (ARC) program, and the seed cotton PLC program, which will suit the needs of the research in analyzing the effects of alternative payment limitations.

The current study will use the FLIPSIM firm level simulation model to analyze the effect of nine different payment limitation scenarios described in the Introduction chapter. By determining the change in government payments, net cash farm income, and ending cash from the base scenario to each of the different alternative scenarios, we can determine which scenarios have the greatest impact on moderate and large size farms in various regions of the country. From this determination, we will be able to estimate the likelihood that a farm will reorganize to avoid payment limitations and observe the effect that reorganization will have on the economic efficiency of the farm.

CHAPTER III

METHODOLOGY

Limitations of the Research

The objective of the proposed study is to quantify the economic effects of alternative farm program payment limits on farm efficiency and viability for representative crop farms. The purpose of conducting this study is to inform the debate over farm program payment limitations for future Farm Bills. This study is not meant to determine what level of limit should be imposed or to take a stance on payment limitations as a whole. It is intended that the results of this research provide policymakers with a clearer picture of how farmers may react to payment limitations, and how those reactions would affect the structure and efficiency on representative farms.

Previous research has been conducted regarding the equitability of farm program payments, as well as the effect that payment limitations have on acreage planted in the United States. This study does not attempt to address the equitability of farm program payments, nor does it address the effect of payment limitations on acreage planted in the United States. The Review of Literature includes several references to studies that have addressed the issue of handling long run average cost (LRAC) curve construction and the presence of economies of scale on farms. The current study will employ the results of these studies to determine possible outcomes of reduced government payments, rather than attempt to construct a LRAC curve for any of the farms used in the research.

Assumptions

Before defining the model used to analyze the effects of farm program payment limits in this research, it is important to establish the overarching assumptions that have been made.

Additional assumptions will arise within the construction of the model, but it is worth noting these initial assumptions first.

Definition of Efficiency

Efficiency will be measured by the relative unit cost ratio (cost of production per dollar of revenue) of one farm compared to another. By this definition, if Farm A were to have a unit cost ratio of 0.7, while Farm B had a unit cost ratio of 0.8, we would say that Farm A was *more efficient* than Farm B because Farm A has the lower unit cost ratio. Using this definition of efficiency, the changes in efficiency that would result if a farm were to reduce acres planted to avoid payment limits will be identified.

Economic Viability

For farms to be economically viable, they must maintain positive cash flows (liquidity) and maintain or increase net worth (equity). Net cash is used to estimate liquidity, and ending cash reserves are used to estimate equity.

Definition of "Person"

As is defined in 7 U.S.C. 1308(a), "the term 'person' means a natural person, and does not include a legal entity." This is the definition used in the Agricultural Act of 2014, and is most applicable to the research.

Number of Persons per Farm

The current research does not address the issue of the Actively Engaged in Farming condition for a farmer to receive farm program payments, nor the issue of the number of people who can claim a separate limit on a given farm. It is possible that some farms operate with only one farm owner who claims a farm program payment, and thus will only have one limit, and it is possible that some farms operate with several farm owners who claim several limits, allowing the whole farm to increase the value of payments it is eligible to receive. Given the nature of the data collected, it is unclear how many persons are considered actively engaged on the representative farms, so the number of persons is assumed to be two. In describing a payment limit scenario, we would say that we have imposed a $50,000 per person payment limit on the farm being analyzed, which would indicate that the farm could receive a total of $100,000 in program payments ($50,000 times two persons equals $100,000). This is a very limiting assumption, but it was necessary to make due to lack of data, as well as to maintain simplicity.

Adjusted Gross Income Limits

As of the 2014 farm bill, any person with an average adjusted gross income of more than $900,000 is not eligible to receive farm program payments. Given this, the FLIPSIM model is set to attribute zero government payments to a person when their AGI is greater than the given AGI limit for the scenario. The AGI eligibility limit scenarios in the FLIPSIM model also include a $125,000 per person payment limit.

Simulating the Effects of Alternative Payment Limits on Farm Viability

Since the effects of payment limits on farm viability give farms an incentive to reorganize, which can potentially cause loss of efficiency of farm operations, the first step taken in analyzing the effects of payment limits on U.S. farms was to determine the effects of payment limits on farm viability. Effects of alternative payment limits on farm economic viability are estimated by simulating representative farms with FLIPSIM for ten payment limits.

Representative Farms

The farm input data used to simulate the effects of alternative payment limits was obtained from the Agricultural and Food Policy Center at Texas A&M University, which "develops and maintains data to simulate 94 representative crop, dairy, and livestock operations in major production areas in 29 states" (Richardson et al. 2017). The Agricultural and Food Policy Center (AFPC) updates its database of representative farm data every two years, and data is compiled using face-to-face panel interviews with farmers operating in particular crop production regions (Agricultural and Food Policy Center). As the compiled data is frequently used by the AFPC to simulate economic activity of the representative farm operations and project future viability of the farms, the AFPC's data is well suited to the current research. The use of actual farm data allows this research to utilize the composite approach to constructing farm budgets and calculating average costs.

Because the payment limits only affect crop producers, only representative crop farms from the AFPC database were selected. Where possible, AFPC develops data for both a moderate and a large farm in a study area. To incorporate farm structure in the analysis, the farms selected for analysis were the moderate and large farms in fourteen regions. These farms cover ten different states, of which Texas, Kansas, and California include multiple crop-producing regions. Furthermore, the representative farms simulated represent three categories of crop production: grain-producing farms (which produce primarily corn, soybeans, and wheat); cotton farms; and rice farms. The following are detailed descriptions of the representative farms which were simulated, grouped by crop production category. These descriptions are direct quotations from the Richardson et al. 2017 working paper, with adjustments for changes in acres planted, changes in acreage distribution among crop enterprises, and exclusion of unrelated enterprises.

Grain Farms

<u>IAG1350</u> IAG 1350 is a 1,350-acre northwestern Iowa (Webster County) grain farm. The farm is moderate-sized for the region and plants 880 acres of corn and 470 acres of soybeans annually.

<u>IAG3400</u> This 3,400-acre large-sized grain farm is located in northwestern Iowa (Webster County). It plants 1,870 acres of corn and 1,530 acres of soybeans each year.

<u>NEG2400</u> South-central Nebraska (Dawson County) is home to this 2,400-acre grain farm. This farm plants sixty-seven percent of cultivated acres to corn and thirty-three percent to soybeans.

<u>NEG4300</u> This is a 4,300-acre grain farm located in south-central Nebraska (Dawson County). This operation plants 3,000 acres of corn and 1,000 of soybeans each year. Remaining acres are planted to alfalfa.

<u>MOCG2300</u> MOCG2300 is a 2,300-acre grain farm located in central Missouri (Carroll County) and plants 1,150 acres of corn and 1,150 acres of soybeans annually.

<u>MOCG4200</u> This is a 4,200-acre central Missouri (Carroll County) grain farm with 2,310 acres of corn and 1,890 acres of soybeans.

<u>TXNP3450</u> This is a 3,450-acre diversified grain farm located on the northern High Plains of Texas (Moore County). This farm plants 160 acres of cotton, 1,430 acres of irrigated corn, 345 acres of irrigated sorghum for seed production, and 1,170 acres of irrigated wheat annually.

<u>TXNP8000</u> TXNP8000 is a large-sized diversified grain farm located in the Texas Panhandle (Moore County). This farm annually plants 3,113 acres of cotton, 4,000 acres of irrigated corn, and 713 acres of winter wheat.

<u>ING1000</u> Shelby County, Indiana, is home to this 1,000-acre moderate-sized feedgrain farm. This farm annually plants corn and soybeans in a 50/50 rotation.

<u>ING3250</u> ING3250 is a large-sized grain farm located in east central Indiana (Shelby County). This farm plants 1,625 acres to corn and 1,625 acres to soybeans each year.

<u>WAW2000</u> This is a 2,000-acre moderate-sized grain farm in the Palouse of southeastern Washington (Whitman County). It plants 1,320 acres of wheat, 140 acres of barley, and 540 acres of dry peas.

<u>WAW8000</u> A 8,000-acre, large-sized grain farm in the Palouse of southeastern Washington (Whitman County). Annually, this farm allocates 4,950 acres to wheat and 2,400 acres to dry peas. [This farm also allocates 250 acres to the Conservation Reserve Program]

<u>NDG3000</u> NDG3000 is a 3,000-acre, moderate-sized, south central North Dakota (Barnes County) grain farm that plants 500 acres of wheat, 1,000 acres of corn, and 1,500 acres of soybeans.

<u>NDG8000</u> This is an 8,000-acre, large-sized grain farm in south central North Dakota (Barnes County) that grows 3,000 acres of soybeans, 3,000 acres of corn, 1,500 acres of wheat, and 250 acres of barley annually. The remaining acreage is enrolled in the Conservation Reserve Program.

<u>KSCW2000</u> South central Kansas (Sumner County) is home to this 2,000-acre, moderate-sized grain farm. KSCW2000 plants 1,000 acres of winter wheat, 333 acres of soybeans, 333 acres of sorghum, and 334 acres of corn each year.

<u>KSCW5300</u> A 5,300-acre, large-sized grain farm in south central Kansas (Sumner County) that plants 3,445 acres of winter wheat, 795 acres of corn, 795 acres of soybeans, and 265 acres of sorghum.

KSNW4000 This is a 4,000-acre, moderate-sized northwest Kansas (Thomas County) grain farm. This farm plants 1,500 acres of winter wheat (wheat-fallow rotation), 1,000 acres of corn, and 500 acres of sorghum.

KSNW7000 KSNW7000 is a 7,000-acre, large-sized Northwest Kansas (Thomas County) grain farm that annually plants 1,700 acres of winter wheat, 3,770 acres of corn, 700 acres of sorghum, and 130 acres of soybeans.

COW3000 A 3,000-acre northeast Colorado (Washington County), moderate-sized farm that plants 1,012 acres of winter wheat and 675 acres of corn each year. [This farm also allocates 300 acres to the Conservation Reserve Program]

COW6000 A 6,000-acre, large-sized northeast Colorado (Washington County) wheat farm. It plants 2,000 acres of wheat, 1,000 acres of millet, and 1,000 acres of corn.

Cotton Farms

TXSP2500 A 2,500-acre Texas South Plains (Dawson County) cotton farm that is moderate-sized for the area. TXSP2500 plants 1,297 acres of cotton (1,012 dryland, 285 irrigated), 500 acres of grain sorghum (405 dryland, 95 irrigated), and 702 acres of peanuts (607 dryland, 95 irrigated).

TXSP4500 The Texas South Plains (Dawson County) is home to this 4,500-acre, large-sized cotton farm that grows 4,047 acres of cotton (2,667 dryland, 1,380 irrigated), 225 irrigated peanuts, and 120 acres of wheat.

TXCB3000 A 3,000-acre cotton farm located on the Texas Coastal Bend (San Patricito County) that farms 1,350 acres of cotton, 1,500 acres of sorghum, and 150 acres of corn annually.

TXCB9200 Nueces County, Texas is home to this 9,200-acre farm. Annually, 3,680 acres are planted to cotton, 3,680 acres to sorghum, and 1,840 acres of corn.

Rice Farms

TXR1500 This 1,500-acre rice farm located west of Houston, Texas (Colorado County) is moderate-sized for the region. TXR1500 harvests 600 acres of rice.

TXR3000 TXR3000 is a 3,000-acre, large-sized rice farm located west of Houston, Texas (Colorado County). This farm harvests 1,500 acres of rice annually.

CAR1200 CAR1200 is a 1,200-acre moderate-sized rice farm in the Sacramento Valley of California (Sutter and Yuba Counties) that plants 1,200 acres of rice annually.

CAR3000 This is a 3,000-acre rice farm located in the Sacramento Valley of California (Sutter and Yuba Counties) that is large-sized for the region. CAR3000 plants 3,000 acres of rice annually.

CABR1000 The Sacramento Valley (Butte County) is home to CABR1000, a 1,000-acre rice farm. CABR1000 harvests 1,000 acres of rice annually.

CACR800 CACR800 is an 800-acre rice farm located in the Sacramento Valley of California (Colusa County). This farm harvests 800 acres of rice each year.

The naming convention used by the AFPC for its representative farms takes the following form: two letters indicate the state; one or two letters indicate either the crop the farm produces, the county it is located in, or both; and the number is the cropland acres the farm owns and/or rents. The crop acreage may not add up to the total number of acres the farm owns and/or rents, due to Conservation Reserve Program (CRP) acres or acres dedicated to non-program crops, or acres left fallow.

FLIPSIM

The financial data for the representative crop farms was used as inputs for FLIPSIM to simulate the changes in various output variables given different levels of payment limits. This subsection describes: the inputs used in FLIPSIM; the payment limit scenarios simulated by the model; and the outputs to be obtained from simulating the scenarios. Each representative farm was simulated under each scenario five hundred times using the same stochastic prices and yields. The model was simulated for 2016-2025.

Inputs

Distribution The FLIPSIM model is capable of simulating scenarios deterministically or stochastically. Deterministic simulation uses projected prices, yields, and other input variables that are either assumed to be the same for all years simulated, or change based on a set formula. Stochastic simulation uses the same projected variables, but includes random yields and prices based on the distribution of past yields. Stochastic national prices in the August 2018 FAPRI Baseline are used in the model. National prices are localized to each farm using historical average basis values.

Crop Mix The crop mixes for each farm in the model were based on the descriptions of the farms as listed in the previous section. The crop mixes are held constant.

Variable Costs Many variable costs are included in the model depending on the farm type and relevant production practices, such as seed, fertilizer, herbicide, irrigation fuel, machinery repairs, harvesting costs, and other production costs. Costs of production are different across sizes of farms, crops, and regions.

Fixed Costs Fixed costs include property taxes, accountant and legal fees, insurance, and other fixed costs. Costs differ by farm and farm type.

Loans Three loans are included in the non-cash expenses of the representative farms: a long-term loan; an intermediate term loan; and an operating loan. The long-term and intermediate term loans are included in the initial data input. Each year ending cash reserves are negative, a second operating loan is established to cover the negative cash reserves.

Government Programs The current government programs offered to farms are the Agriculture Risk Coverage (ARC) program and the Price Loss Coverage (PLC) program. The ARC program makes payments based on a moving average of farm revenue, while the PLC program makes payments based on the difference between a reference price and the actual market price. It is assumed soybeans are enrolled in ARC for all years. Corn, wheat, sorghum, barley, and seed cotton are enrolled in PLC for 2019-2025. For 2016-2018, the grain farms are enrolled in PLC or ARC based on the information from the farmers' interviews. Cotton had no PLC or ARC payments prior to 2018.

Receipts Cash receipts calculated in the model includes receipts from sale of crops, other farm income, indemnity payments, and government program payments received for the year, which could include LDP and ARC or PLC.

Scenarios

Ten different scenarios were simulated for each AFPC representative farm. The first scenario is a control or base scenario; the second through seventh scenarios are alternative per person payment limits; and the eighth through tenth scenarios use adjusted gross income (AGI) limits.

Base The first scenario is designated as the "base" scenario, which acts as a control against which to compare all other scenarios. In the base scenario, no payment limits are imposed.

2 x $50K The second scenario simulated imposes a $50,000 per person limit on farm program payments. Given the assumption that each farm in the study consists of two owners (represented here by “2x”), each actively engaged in farming, each representative farm would be eligible for a total of $100,000 in payment limits. No AGI limit is imposed.

2 x $75K The third scenario simulated imposes a $75,000 per person limit on farm program payments, resulting in a total farm payment limit of $150,000. No AGI limit is imposed.

2 x $100K The fourth scenario simulated imposes a $100,000 per person limit on farm program payments, resulting in a total farm payment limit of $200,000. No AGI limit is imposed.

2 x $125K The fifth scenario simulated imposes a $125,000 per person limit on farm program payments, resulting in a total farm payment limit of $250,000. No AGI limit is imposed.

2 x $150K The sixth scenario simulated imposes a $150,000 per person limit on farm program payments, resulting in a total farm payment limit of $300,000. No AGI limit is imposed.

2 x $250K The seventh scenario simulated imposes a $250,000 per person limit on farm program payments, resulting in a total farm payment limit of $500,000. No AGI limit is imposed.

2 x $250K The eighth scenario simulated imposes a $250,000 per person eligibility limit on AGI, resulting in a total farm program payment eligibility limit of $500,000 in AGI. The eighth scenario also imposes a $125,000 per person payment limit, resulting in a total farm payment limit of $250,000.

2 x $500K The ninth scenario simulated imposes a $500,000 per person eligibility limit on AGI, resulting in a total farm program payment eligibility limit of $1,000,000 in AGI. The ninth scenario also imposes a $125,000 per person payment limit, resulting in a total farm payment limit of $250,000.

2 x $900K The tenth scenario simulated imposes a $900,000 per person eligibility limit on AGI, resulting in a total farm program payment eligibility limit of $1,800,000 in AGI. The tenth scenario also imposes a $125,000 per person payment limit, resulting in a total farm payment limit of $250,000.

The scenarios listed above are applied to each representative farm for the years 2019 through 2025, assuming continuation of the 2014 farm bill. The output values reported are averages of the years simulated for each representative farm. Because averages are used, the government payments observed in the results chapter will not be equal to the maximum payment limits imposed for a given scenario. Some years, government payments are zero, and only a small percent are at the maximum.

Outputs

Four output variables were calculated as the average annual values for 2019-2025: average probability of exceeding payment limits; average annual government payments; average annual net cash farm income; and average annual ending cash reserves. These variables are used to determine at which point payment limits become binding for each of the representative farms, as well as the effects of payment limits on the viability of the farms. Net cash farm income and ending cash reserves are used because they are most indicative of farm viability.

Average Probability of Exceeding Government Payment Limits

The first output variable shows how likely it is on average that a farm's government payments would exceed the payment limit for the years 2018-2025. The probability for each year was calculated in the simulation by diving the number of times that government payments exceeded the payment limit by five hundred, the number of iterations. This results in the probability that, over five hundred iterations of simulating government payments, the government payments for the farm will be greater than the limit. For example, the probability that the government payments to the 1,350-acre Iowa grain farm will exceed the $50,000 payment limit in 2016 is 6.8 percent. The average probability reported in the results is a simple average of the annual probabilities for 2018-2025 and is useful to compare across alternative payment limits.

Average Annual Government Payments

Average annual PLC, ARC and LDP payments are reported for 2019-2025 for each payment limitation scenario. Payments are calculated for each farm using the farm's base acres, payment yields, and national prices in the program payment formulas. In the case of ARC, stochastic county yields are also generated and used in the analysis.

Average Annual Net Cash Farm Income

Net cash farm income is used in the model as a measure of farm viability. Net cash farm income equals total receipts minus total cash receipts.

Average Annual Ending Cash Reserves

Ending cash reserves are also used as a measure of viability for farm operations. Ending cash equals net cash income plus interest earned minus non-cash expenses, such as principal payments, family living expenses, and taxes.

Estimating the Effects of Alternative Payment Limits on Farm Efficiency

After estimating the effects of payment limits on viability and determining the payment limits which incentive given farms to restructure, it is important to determine whether reorganization will cause farms to become less efficient. The Review of Literature noted the opposing results that have been obtained by studies addressing the economies of scale that are typically attributed to larger farms. While no attempt is made here to differentiate between technical and pecuniary economies of scale, it is the intent that the efficiency of various sizes of farms be determined so that estimates for loss in efficiency can be made when analyzing the reorganization of a farm from one size to another. Unit cost ratios will be calculated to determine the efficiency of the AFPC representative farms.

Agricultural Resource Management Survey Data Sample Farms

The USDA Agricultural Resource Management Survey (ARMS) is a survey of about 35,000 farms from across the United States. One of the key uses of the data collected from the survey is "to develop and report estimates of commodity costs and returns for selected commodities" (Kuethe and Morehart 2012). The ARMS data used for this study consists of farm financial statements from sample farms in ten different states. The ARMS data was stratified by farm size for states where AFPC representative farms are located. The data was condensed into tables of total cash costs, total cash receipts, and acres harvested, and used to calculate the unit cost ratios described below.

Unit Cost Ratios

From the tables of total cash costs, total cash receipts, and acres harvested, unit cost ratios (costs divided by receipts) and costs per acre were calculated as estimates of farm efficiency. The same calculations were made for the AFPC representative farms, and the unit cost ratios, costs per acre, and average sample sizes of all of the farms were compiled into tables for each crop production region. For states in which the AFPC had multiple crop production regions, such as Texas and California, the same ARMS variables for the entire state were used. Many of the unit cost ratios of the ARMS sample farms were significantly different from one or for both of the representative farms in the same region. To improve comparability, it was necessary to scale the ARMS unit cost ratios to the AFPC representative farms' unit cost ratios for ease of comparison. To scale the ARMS unit cost ratios, the difference in the unit cost ratios of the AFPC representative farm and the ARMS sample farm that were closest in acreage to each other was added to each of the unit cost ratios of the ARMS sample farms for the region. For example, the unit cost ratio of the 3,400-acre representative Iowa grain farm was 0.88. The closest ARMS sample farm in size was a 3,076-acre sample farm with a unit cost ratio of 0.76. To scale the ARMS sample farms to the representative farms, the difference in the unit cost ratios of the 3,400-acre representative farm and the 3,076-acre sample farm, which was 0.12, was added to the unit cost ratios of all of the Iowa ARMS sample farms. The same process was repeated for each of the crop production regions.

Loss of Efficiency

Unit cost ratios indicate the efficiency with which a farm is able to operate; a farm with a relatively high unit cost ratio is able to produce less revenue for every dollar of costs than a farm with a relatively low unit cost ratio, which indicates inefficiency. Additionally, one can use the unit cost ratio to infer the farm's profit margin, as a ratio of 0.85 implies the farm's profit margin is fifteen percent for every dollar of receipts. By using the unit cost ratio as a measure of efficiency, we can determine what the effect of different levels of payment limits will be on the economic efficiency of representative farms. If a representative farm is faced with binding payment limits, it will most likely reorganize. By observing the efficiencies of different sizes of farms, we can determine what would happen to the efficiency of the representative farms if they restructured into smaller sizes to avoid payment limits.

CHAPTER IV

RESULTS

The results are presented in two parts. The first part used data from AFPC representative farms as inputs for simulation of farm economic activity given ten different payment limit scenarios. The second part used data from the same AFPC representative farms as well as Agricultural Resource Management Survey (ARMS) sample farms to calculate output ratios. From the simulations conducted, two sets of results were obtained: output variables indicative of the viability of the AFPC representative farms given the different payment limit scenarios; and output variables indicative of the efficiency of the AFPC representative farms and the sample of farms obtained from the ARMS data.

Effects of Payment Limitations on Viability of Representative Farms

The results obtained from simulating the representative farms includes four output variables: probability of exceeding the payment limit; government payments; net cash farm income; and ending cash. Each of these variables indicates, in part, the effects of payment limits on the viability of the AFPC representative farms. Ten payment limit scenarios were simulated to obtain these output variables. The first seven payment limit scenarios constitute limits imposed on the value of government payments that can be received by each person or entity who is "actively engaged in farming." The payment limitations assume that the owners of the representative farms are considered to be "actively engaged in farming," and that each representative farm has two persons actively engaged. The seven payment limit scenarios simulated were: $0 per person, or no payment limit (base scenario); $50,000 per person; $75,000 per person; $100,000 per person; $125,000 per person; $150,000 per person; and $250,000 per person. In addition to these scenarios, three scenarios were simulated to analyze the effects of adjusted gross income (AGI) eligibility requirements on farm viability. These three scenarios were: $250,000 per person; $500,000 per person; and $900,000 per person. The results of the simulation of the output variables for each of these payment limits and AGI eligibility requirement scenarios are described in this section.

Probability of Exceeding Payment Limit

The first output variable obtained from the simulation of the representative farms was the average probability of exceeding the payment limit. This output variable indicates, on average, how likely each farm is to receive annual government payments that would exceed the payment limit for each scenario. Table 1 shows the probability of each farm exceeding the payment limit for each of the ten scenarios, and the patterns observed in it indicate which representative farms are most affected by payment limits.

Grain Farms

Of all the grain farms, the large Nebraska, Texas, Washington, and North Dakota farms have the greatest chances of exceeding payment limits, even at the least restrictive limits. The Nebraska and North Dakota farms are less likely to exceed payment limits than the other large farms overall, as the probability of the Nebraska farm exceeding payment limits is only one percent at the highest limit, and the North Dakota farm has no chance of exceeding payment limits at the highest limit. Additionally, the Nebraska and North Dakota farms have a twenty-seven and twenty-eight percent chance of exceeding payment limits at the $50,000 per person payment limit, respectively, whereas the large Texas and Washington farms have a seventy-seven and forty-seven percent chance, respectively. These are the largest grain farms, indicating, as expected, that larger farms will be the most likely to be affected by payment limits. The moderate-sized Nebraska and Texas farms are the only moderate-sized grain farms that have a chance of exceeding the current payment limit of $125,000 per person.

The large Texas grain farm also has the highest probability of exceeding the AGI limits. This is to be expected as large farms will naturally have larger receipts and, consequently, larger income. However, the large Washington farm has a much lower probability of exceeding the AGI limits than the large Texas farm, indicating that the Washington farm likely has more costs that offset some of the increased income from being a large farm. We also see that the large Missouri and south-central Kansas farms have a significant chance of exceeding the $250,000 per person AGI limit. The probabilities of these two farms exceeding the AGI limits are actually higher than the Washington farm, suggesting that they have income comparable to the Washington farm. The moderate-sized Texas grain farm is the only moderate-sized grain farm that is significantly affected by the $250,000 per person AGI limit, as the probability of it exceeding payment limits is forty-seven percent at the $250,000 per person limit.

Cotton Farms

All four cotton farms have at least some chance of exceeding the payment limit at most all of the payment limits. The 2,500-acre South Plains farm, which is the smallest, is less likely to exceed larger payment limits. The 9,200-acre Coastal Bend farm is most likely to exceed all of the payment limits, with an eighty-three percent chance if the $50,000 per person limit is in place. The 9,200-acre and the 4,500-acre cotton farms have the highest probability of exceeding the AGI limits, which is expected given that they are the largest. Additionally, the 9,200-acre farm has much higher chances of exceeding the AGI limit than the 4,500-acre farm, which is also consistent with the understanding that larger farms generally generate higher taxable incomes.

Table 1. Average Probability of Exceeding Payment Limits, 2018-2025

Farm Name	Acres Farmed	**Base NO LIMIT**	Per Person Payment Limits (No AGI Limit)						AGI Limit With $125,000 per Person Payment Limit		
			2 x $50K	2 x $75K	2 x $100K	2 x $125K	2 x $150K	2 x $250K	2 x $250K	2 x $500K	2 x $900K
Feed Grain Farms											
IAG1350	1350	**0%**	7%	1%	0%	0%	0%	0%	0%	0%	0%
IAG3400	3400	**0%**	20%	12%	6%	3%	1%	0%	3%	3%	3%
MOCG2300	2300	**0%**	7%	1%	0%	0%	0%	0%	7%	0%	0%
MOCG4200	4200	**0%**	16%	8%	3%	1%	0%	0%	48%	15%	1%
ING1000	1000	**0%**	0%	0%	0%	0%	0%	0%	0%	0%	0%
ING3250	3250	**0%**	18%	10%	5%	1%	0%	0%	3%	1%	1%
KSCW2000	2000	**0%**	4%	0%	0%	0%	0%	0%	1%	0%	0%
KSCW5300	5300	**0%**	25%	14%	6%	2%	0%	0%	34%	6%	2%
KSNW4000	4000	**0%**	17%	5%	1%	0%	0%	0%	0%	0%	0%
KSNW7000	7000	**0%**	26%	15%	7%	3%	0%	0%	3%	3%	3%
NEG2400	2400	**0%**	22%	15%	9%	5%	2%	0%	5%	5%	5%
NEG4300	4300	**0%**	27%	22%	17%	12%	8%	1%	12%	12%	12%
TXNP3450	3450	**0%**	40%	27%	19%	13%	8%	0%	47%	15%	13%
TXNP8000	8000	**0%**	77%	72%	59%	54%	49%	35%	70%	63%	54%
WAW2000	2000	**0%**	22%	11%	4%	0%	0%	0%	0%	0%	0%
WAW8000	8000	**0%**	47%	38%	33%	29%	25%	11%	29%	29%	29%
NDG3000	3000	**0%**	4%	0%	0%	0%	0%	0%	0%	0%	0%
NDG8000	8000	**0%**	28%	19%	11%	6%	3%	0%	8%	7%	6%
COW3000	3000	**0%**	0%	0%	0%	0%	0%	0%	0%	0%	0%
COW6000	6000	**0%**	18%	6%	1%	0%	0%	0%	0%	0%	0%
Cotton Farms											
TXSP2500	2500	**0%**	33%	19%	8%	3%	1%	0%	3%	3%	3%
TXSP4500	4500	**0%**	63%	48%	40%	34%	27%	10%	34%	34%	34%
TXCB3000	3000	**0%**	58%	37%	24%	15%	8%	1%	15%	15%	15%
TXCB9200	9200	**0%**	83%	78%	73%	68%	63%	37%	68%	68%	68%
Rice Farms											
TXR1500	1500	**0%**	33%	21%	13%	9%	5%	0%	9%	9%	9%
TXR3000	3000	**0%**	58%	35%	27%	20%	15%	4%	20%	20%	20%
CAR1200	1200	**0%**	40%	29%	20%	14%	10%	0%	14%	14%	14%
CAR3000	3000	**0%**	70%	66%	62%	58%	41%	27%	58%	58%	58%
CABR1000	1000	**0%**	35%	24%	15%	10%	6%	0%	10%	10%	10%
CACR800	800	**0%**	30%	17%	11%	6%	2%	0%	6%	6%	6%

Rice Farms

Rice farms also have very high probabilities of exceeding payment limits. The California 3,000-acre rice farm has a 27 percent chance of exceeding the $250,000 per person payment limit. All of the rice farms have a non-zero chance to exceed the $150,000 per person payment limit. The Sacramento Valley, California farms also have a higher chance of exceeding payment limits than the Texas rice farms. Overall, CAR1200 and CAR3000 are the most likely to exceed payment limits among the rice farms. Additionally, CAR3000 has nearly a sixty percent chance of exceeding the AGI limits. TXR1500 and CACR800 have very little chance of exceeding the AGI limits, and the probabilities of the remaining rice farms exceeding the AGI limit are moderate.

The size of the farms is the primary factor that contributes to high probabilities of exceeding payment limits for all farm types, but overall, the cotton and rice farms are much more likely to exceed payment limits than the grain farms. Only five of the grain farms have a probability of more than five percent of exceeding the $125,000 per person payment limit, while three of the four cotton farms and all of the rice farms have a probability greater than five percent of exceeding this limit. Therefore, cotton and rice farms, along with the Texas grain farms and the large Washington, Nebraska, and North Dakota grain farms, are the most likely to exceed payment limits, and consequently experience reduced government payments which could encourage farm reorganization.

The AGI limits mostly affect farms that are large in their region, except the moderate-sized Texas grain farm, the 3,000-acre Coastal Bend cotton farm, and the moderate-sized rice farms. This is expected, as larger farms have higher receipts, which leads to higher adjusted gross income, causing the larger farms to have a relatively high probability of exceeding the current AGI limit. The moderate-sized Texas grain farm also has a fifteen percent probability of exceeding the $500,000 per person AGI limit, indicating that its receipts and cost ratios are more comparable to the larger farms than the moderate-sized farms.

Government Payments

The second output variable from the representative farm simulation was government payments. Table 2 identifies the dollar value of average annual government payments received by each representative farm for each of the nine alternative levels of payment limits, as well as the base scenario at which no payment limits are imposed. The base scenario acts as a control against which all other scenarios can be compared. Because the base scenario does not include a payment limit, it yields the highest average annual government payments for each farm. It should also be the case that out of all of the payment limit levels (aside from the base scenario), the $250,000 per person payment limit should yield the highest average annual government payments, and the $900,000 per person AGI eligibility limit should yield the highest amount of average annual government payments. The next step in analyzing the effects of the various limit levels on farm viability is to compare the average annual government payments at each of the payment limit levels and AGI eligibility limit levels to the base scenario to determine how much payments are reduced.

Table 2. Average Annual Government Payments to Representative Farms Assuming Alternative Payment Limits, 2019-2025 ($1,000's)

Farm Name	Acres Farmed	**Base NO LIMIT**	Per Person Payment Limits (No AGI Limit) 2 x $50K	2 x $75K	2 x $100K	2 x $125K	2 x $150K	2 x $250K	AGI Limit With $125,000 per Person Payment Limit 2 x $250K	2 x $500K	2 x $900K
Feed Grain Farms											
IAG1350	1350	**26**	24	26	26	26	26	26	26	26	26
IAG3400	3400	**51**	33	42	47	50	51	51	50	50	50
MOCG2300	2300	**30**	28	30	30	30	30	30	30	30	30
MOCG4200	4200	**40**	30	37	39	40	40	40	21	38	40
ING1000	1000	**16**	16	16	16	16	16	16	16	16	16
ING3250	3250	**46**	32	40	44	46	46	46	46	46	46
KSCW2000	2000	**34**	33	34	34	34	34	34	34	34	34
KSCW5300	5300	**68**	49	60	65	68	68	68	53	67	68
KSNW4000	4000	**52**	45	51	52	52	52	52	52	52	52
KSNW7000	7000	**70**	49	60	66	69	69	70	69	69	69
NEG2400	2400	**59**	34	45	52	56	58	59	56	56	56
NEG4300	4300	**84**	37	51	62	70	76	84	70	70	70
TXNP3450	3450	**116**	62	80	93	102	108	116	76	102	102
TXNP8000	8000	**403**	78	111	141	168	193	272	119	148	168
WAW2000	2000	**56**	42	51	55	56	56	56	56	56	56
WAW8000	8000	**199**	66	91	111	129	144	184	129	129	129
NDG3000	3000	**29**	28	29	29	29	29	29	29	29	29
NDG8000	8000	**80**	49	62	71	76	78	80	75	76	76
COW3000	3000	**24**	24	24	24	24	24	24	24	24	24
COW6000	6000	**52**	44	50	52	52	52	52	52	52	52
Cotton Farms											
TXSP2500	2500	**80**	56	69	76	79	80	80	79	79	79
TXSP4500	4500	**204**	68	95	117	137	153	187	137	137	137
TXCB3000	3000	**133**	71	94	109	120	125	132	120	120	120
TXCB9200	9200	**449**	85	124	160	194	224	319	193	193	194
Rice Farms											
TXR1500	1500	**92**	56	71	81	87	90	92	87	87	87
TXR3000	3000	**151**	63	86	104	117	127	148	117	117	117
CAR1200	1200	**121**	60	80	94	104	110	121	104	104	104
CAR3000	3000	**371**	69	101	131	158	182	258	158	158	158
CABR1000	1000	**101**	58	74	85	92	97	101	92	92	92
CACR800	800	**82**	54	67	75	80	82	82	80	80	80

To determine the levels at which limits become binding for the representative farms, it is helpful to utilize the data in Table 2 to create a second table: the percentage changes in government payments relative to the base scenario (no payment limit). By calculating the percentage changes in Table 2, Table 3 was constructed. The average government payments under the AGI scenarios were compared to the $125,000 per person payment limit to isolate the effect of the AGI eligibility limits on average government payments.

Table 3. Percentage Change in Average Annual Government Payments for Alternative Payment Limits Assuming Two Persons per Farm, 2019-2025

Farm Name	Acres Farmed	Per Person Payment Limits (No AGI Limit) 2 x $50K	2 x $75K	2 x $100K	2 x $125K	2 x $150K	2 x $250K	AGI Limit With $125,000 per Person Payment Limit 2 x $250K	2 x $500K	2 x $900K
Feed Grain Farms										
IAG1350	1350	-8.01%	-0.80%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
IAG3400	3400	-35.59%	-17.60%	-7.14%	-2.29%	-0.59%	0.00%	-0.22%	0.00%	0.00%
MOCG2300	2300	-6.43%	-0.40%	0.00%	0.00%	0.00%	0.00%	-2.18%	0.00%	0.00%
MOCG4200	4200	-24.64%	-8.48%	-2.02%	-0.30%	0.00%	0.00%	-47.20%	-5.83%	0.00%
ING1000	1000	-0.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ING3250	3250	-31.13%	-13.60%	-4.62%	-1.17%	-0.17%	0.00%	-0.42%	0.00%	0.00%
KSCW2000	2000	-2.17%	-0.06%	0.00%	0.00%	0.00%	0.00%	-0.30%	0.00%	0.00%
KSCW5300	5300	-28.22%	-11.97%	-3.82%	-0.57%	0.00%	0.00%	-21.40%	-0.81%	0.00%
KSNW4000	4000	-14.58%	-3.14%	-0.19%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
KSNW7000	7000	-29.92%	-13.53%	-4.89%	-1.18%	-0.09%	0.00%	-0.04%	0.00%	0.00%
NEG2400	2400	-41.60%	-23.46%	-11.62%	-4.90%	-1.71%	0.00%	0.00%	0.00%	0.00%
NEG4300	4300	-56.30%	-39.76%	-26.85%	-17.12%	-10.10%	-0.53%	-0.10%	0.00%	0.00%
TXNP3450	3450	-46.55%	-30.68%	-19.36%	-11.47%	-6.34%	-0.12%	-25.32%	-0.58%	0.00%
TXNP8000	8000	-80.74%	-72.49%	-65.03%	-58.19%	-52.02%	-32.33%	-29.04%	-12.22%	0.00%
WAW2000	2000	-25.37%	-8.94%	-1.96%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
WAW8000	8000	-66.65%	-54.39%	-44.08%	-35.15%	-27.46%	-7.74%	0.00%	0.00%	0.00%
NDG3000	3000	-3.15%	-0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NDG8000	8000	-38.65%	-22.22%	-11.42%	-5.10%	-1.90%	0.00%	-0.55%	-0.09%	0.00%
COW3000	3000	-0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
COW6000	6000	-16.09%	-3.54%	-0.17%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cotton Farms										
TXSP2500	2500	-30.73%	-13.78%	-5.46%	-2.01%	-0.64%	0.00%	0.00%	0.00%	0.00%
TXSP4500	4500	-66.89%	-53.71%	-42.48%	-33.05%	-25.29%	-8.27%	-0.10%	0.00%	0.00%
TXCB3000	3000	-46.28%	-29.37%	-17.52%	-9.78%	-5.34%	-0.24%	0.00%	0.00%	0.00%
TXCB9200	9200	-81.02%	-72.34%	-64.31%	-56.94%	-50.19%	-28.98%	-0.26%	-0.03%	0.00%
Rice Farms										
TXR1500	1500	-39.28%	-22.80%	-12.58%	-5.98%	-1.99%	0.00%	0.00%	0.00%	0.00%
TXR3000	3000	-58.02%	-42.79%	-31.02%	-22.09%	-15.50%	-1.69%	0.00%	0.00%	0.00%
CAR1200	1200	-49.88%	-33.65%	-22.07%	-14.07%	-8.36%	0.00%	0.00%	0.00%	0.00%
CAR3000	3000	-81.30%	-72.75%	-64.76%	-57.43%	-50.81%	-30.31%	0.00%	0.00%	0.00%
CABR1000	1000	-42.79%	-26.20%	-15.50%	-8.38%	-3.66%	0.00%	0.00%	0.00%	0.00%
CACR800	800	-34.68%	-18.63%	-9.11%	-3.32%	-0.52%	0.00%	0.00%	0.00%	0.00%

Table 3 provides a clear picture of the magnitude of the change in government payments received by representative farms when alternative payment limitations are imposed. For example, the moderate-sized Iowa farm receives about eight percent less in government payments if the $50,000 per person payment limit is imposed than it would have received if no payment limit had been imposed. However, IAG1350 experiences no change in government payments regardless of which AGI limit is imposed. These observations indicate that the $50,000 per person payment limit is binding on the IAG1350 farm, while none of the AGI limits are binding on the moderate-sized Iowa farm. “Binding” payment limits are those at which a representative farm receives less government payments than it would have if there had been no effective payment limit.

Some farms observe small reductions in government payments at several limit levels; however, there would be some room for disagreement over whether a limit is binding or not in cases where the percentage change is relatively small. Therefore, “binding” payment limits will be defined as those which cause the level of government payments to be reduced by more than five percent from the base scenario. Payment reductions of less than five percent may constitute a significant change in dollar value for average government payments, but to ensure significance and maintain consistency, and provide a basis for analysis, this assumption is applied.

Using the measure of a five percent reduction in government payments, Table 4 shows a clearer picture of the levels at which payment limits become binding for the representative farms. The table was constructed using the word “BINDING” for payment limit levels at which farms experienced a reduction in government payments of five percent or more. Table 4 can be used to more easily observe patterns of binding conditions, and easily identify which payment limits are binding for each individual representative farm.

Table 4. Identification of Binding Payment Limits on Representative Farms Assuming Binding Condition of Five Percent Loss in Government Payments

		Per Person Payment Limits (No AGI Limit)						AGI Limit With $125,000 per Person Payment Limit		
Farm Name	Acres Farmed	2 x $50K	2 x $75K	2 x $100K	2 x $125K	2 x $150K	2 x $250K	2 x $250K	2 x $500K	2 x $900K
Feed Grain Farms										
IAG1350	1350	BINDING								
IAG3400	3400	BINDING	BINDING	BINDING						
MOCG2300	2300	BINDING								
MOCG4200	4200	BINDING	BINDING					BINDING	BINDING	
ING1000	1000									
ING3250	3250	BINDING	BINDING							
KSCW2000	2000									
KSCW5300	5300	BINDING	BINDING					BINDING		
KSNW4000	4000	BINDING								
KSNW7000	7000	BINDING	BINDING							
NEG2400	2400	BINDING	BINDING	BINDING						
NEG4300	4300	BINDING	BINDING	BINDING	BINDING	BINDING				
TXNP3450	3450	BINDING	BINDING	BINDING	BINDING	BINDING		BINDING		
TXNP8000	8000	BINDING	BINDING	BINDING	BINDING	BINDING	BINDING	BINDING	BINDING	
WAW2000	2000	BINDING	BINDING							
WAW8000	8000	BINDING	BINDING	BINDING	BINDING	BINDING	BINDING			
NDG3000	3000									
NDG8000	8000	BINDING	BINDING	BINDING	BINDING					
COW3000	3000									
COW6000	6000	BINDING								
Cotton Farms										
TXSP2500	2500	BINDING	BINDING	BINDING						
TXSP4500	4500	BINDING	BINDING	BINDING	BINDING	BINDING	BINDING			
TXCB3000	3000	BINDING	BINDING	BINDING	BINDING	BINDING				
TXCB9200	9200	BINDING	BINDING	BINDING	BINDING	BINDING	BINDING			
Rice Farms										
TXR1500	1500	BINDING	BINDING	BINDING	BINDING					
TXR3000	3000	BINDING	BINDING	BINDING	BINDING	BINDING				
CAR1200	1200	BINDING	BINDING	BINDING	BINDING	BINDING				
CAR3000	3000	BINDING	BINDING	BINDING	BINDING	BINDING	BINDING			
CABR1000	1000	BINDING	BINDING	BINDING	BINDING					
CACR800	800	BINDING	BINDING	BINDING						

Grain Farms

Twenty of the thirty representative farms simulated are grain farms. The large number of grain farms results in a wide variety of patterns of binding payment limits. Thirteen of the twenty grain farms simulated are bound at limit levels of $75,000 per person or less, and only two of the twenty grain farms are bound at the $250,000 per person limit level.

The Iowa, Missouri, and Northwest Kansas grain farms all have very similar patterns of binding limits for both large and moderate-sized farms. None of these farms are bound at the current payment limit ($125,000 per person), and the moderate-sized Iowa, Missouri, and Northwest Kansas farms are only bound at the $50,000 per person payment limit. The largest impact for the Midwest grain farms is felt by the large farms, especially the 4,300-acre Nebraska farm, which loses seventeen percent of its average government payments at the $125,000 per person payment limit. The 4,300-acre Nebraska farm is the only Midwest farm that is bound at the $125,000 per person payment limit. Based on government payments lost, it is safe to say that the Midwest farms begin to feel the effects of payment limits at the $75,000 per person payment limit, but the Nebraska farms are affected more than the other Midwest farms by government payment limits.

The 8,000 acre farms in Texas and Washington are bound by the $250,000 per person payment limit. WAW8000 loses eight percent of its government payments at the $250,000 per person payment limit, and TXNP8000 loses almost thirty-three percent of its government payments at the $250,000 per person payment limit. TXNP3450 is restricted at the $150,000 per person payment limit, and loses six percent of its government payments. None of the other regions have moderate-sized farms that are affected this quickly, and none of the other large farms see as much of a loss due to payment limits as the large Texas grain farm. The 3,450-acre Texas grain farm is larger than the other moderate-sized grain farms, resulting in it being affected by the $125,000 and $150,000 per person payment limits.

The 3,000-acre North Dakota grain farm and the 3,000-acre Colorado grain farm are not bound by any payment limits, and the 6,000-acre Colorado farm is only bound at the $50,000 per person payment limit. The 8,000-acre North Dakota farm is bound for limits at or below

$125,000 per person. The large North Dakota grain farm responds more slowly to payment limits than the other 8,000-acre farms; it loses about forty percent of its government payments at the $50,000 per person limit, while the 8,000-acre Washington farm loses almost the same percentage at the $125,000 per person payment limit.

The large Missouri farm, the large south-central Kansas farm, and the Northern Plains Texas farms are the only grain farms that are bound by any of the AGI eligibility limits. The large Missouri grain farm loses forty-seven percent of its average government payments at the $250,000 per person AGI limit. The large south-central Kansas farm and the Texas farms lose between twenty and thirty percent of their average government payments at the $250,000 per person AGI limit. None of the grain farms are affected at all by the $900,000 per person AGI limit, and only the Large Missouri and Texas grain farms are affected at the $500,000 per person AGI limit. It should be noted that the AGI computed in the simulations does not include off-farm income, so it is possible that some of the other farms obtain income by other means that would contribute to triggering the AGI limit.

Cotton Farms

The four cotton farms simulated are located in Texas, and are heavily affected by payment limits. All but the 2,500-acre South Plains farm are bound at the $150,000 per person payment limit level, and the two large farms are bound at the $250,000 per person payment limit. At the $125,000 per person payment limit, TXSP4500 loses a third of its government payments, TXCB3000 loses about ten percent of its payments, and TXCB9200 loses fifty-seven percent of its payments. All of the cotton farms are bound at the $100,000 per person payment limit. The AGI eligibility limits do not have any significant effect on the average government payments of any of the representative cotton farms.

Rice Farms

Rice farms are impacted almost as much by high levels of payment limits as the cotton farms, with every rice farm being bound by the $100,000 per person payment limit, and all but one being bound by the $125,000 per person payment limit. The 3,000-acre California farm is most impacted by the limits, losing thirty percent of its payments at the $250,000 per person payment limit. This farm loses eighty percent of its payments at the $50,000 per person payment limit, which is the most that any farm loses. The high level at which rice farms are affected by payment limits and the large percentage of payments that are lost for the farms is likely an indication of volatile prices and frequent triggering of PLC payments for rice. The AGI eligibility limits do not have any effect on the average government payments of any of the representative rice farms.

As expected, the large representative farms experience the largest reductions in government payments. The cotton farms and rice farms tend to lose more payments than the grain farms, although at the currently enforced $125,000 per person payment limit, TXNP8000 loses the largest percentage of government payments. At the currently enforced payment limit, the moderate-sized cotton and rice farms are also more heavily impacted in general than the moderate-sized grain farms. The current $125,000 per person payment limit on government payments has the largest effect on cotton and rice farms and the large Texas and Washington grain farms. The moderate-sized Texas grain farm and the large Nebraska and North Dakota grain farms are bound by this payment limit, but are not affected to the extent of the large Texas and Washington farms. The current AGI limit of $900,000 per person only significantly affects MOCG4200, KSCW5300, TXNP3450, and TXNP8000. The Texas grain farms are also bound by the $125,000 per person payment limit, indicating that they take additional losses from the lowest AGI limit, while the Missouri and Kansas farms are only affected by the AGI limit. None of the representative farms are affected by the current AGI limit, which is set at $900,000 per person.

Net Cash Farm Income

The third output variable obtained from the simulation of the AFPC representative farm data was net cash farm income. Net cash farm income is a measure of farm viability given that it is calculated as total receipts, including government payments, minus cash expenses. Net cash farm income is used to cover reasonable family living expenses, replace machinery, pay taxes, and retire debt. Therefore, if net cash farm income is reduced by a sufficient amount, it could jeopardize the viability of the farm operation. Table 5 identifies the simulated 2019-2025 average annual net cash farm income for each representative farm at each of the ten alternative payment limit scenarios. This makes it possible to see how profitable each farm is without payment limits, and what effect, if any, the limits have on the operation's ability to cover non-cash expenses and provide for the operator's family living expenses. Table 6 indicates the percentage changes in average net cash farm income from the base scenario for each of the payment limit scenarios, making it easier to observe the effects of each scenario.

Table 5. Average Annual Net Cash Farm Income, 2019-2025 ($1,000's)

Farm Name	Acres Farmed	**Base NO LIMIT**	Per Person Payment Limits (No AGI Limit) 2 x $50K	2 x $75K	2 x $100K	2 x $125K	2 x $150K	2 x $250K	AGI Limit With $125,000 per Person Payment Limit 2 x $250K	2 x $500K	2 x $900K
Feed Grain Farms											
IAG1350	1350	**(85)**	(88)	(86)	(85)	(85)	(85)	(85)	(85)	(85)	(85)
IAG3400	3400	**354**	334	344	350	353	354	354	353	353	353
MOCG2300	2300	**656**	654	656	656	656	656	656	655	656	656
MOCG4200	4200	**1,331**	1,321	1,327	1,330	1,330	1,331	1,331	1,312	1,328	1,330
ING1000	1000	**210**	210	210	210	210	210	210	210	210	210
ING3250	3250	**497**	482	490	495	496	497	497	496	496	496
KSCW2000	2000	**342**	341	342	342	342	342	342	341	342	342
KSCW5300	5300	**900**	881	892	897	899	900	900	885	899	899
KSNW4000	4000	**103**	94	101	103	103	103	103	103	103	103
KSNW7000	7000	**249**	225	238	245	248	249	249	248	248	248
NEG2400	2400	**230**	201	214	222	226	228	230	226	226	226
NEG4300	4300	**360**	305	321	334	343	350	359	343	343	343
TXNP3450	3450	**873**	819	838	851	860	866	873	834	859	860
TXNP8000	8000	**1,956**	1,616	1,652	1,684	1,713	1,740	1,822	1,664	1,693	1,713
WAW2000	2000	**329**	314	324	328	329	329	329	329	329	329
WAW8000	8000	**625**	475	503	526	546	563	608	546	546	546
NDG3000	3000	**154**	153	154	154	154	154	154	154	154	154
NDG8000	8000	**978**	943	958	967	973	976	978	973	973	973
COW3000	3000	**89**	89	89	89	89	89	89	89	89	89
COW6000	6000	**(146)**	(157)	(148)	(146)	(146)	(146)	(146)	(146)	(146)	(146)
Cotton Farms											
TXSP2500	2500	**154**	129	143	150	153	154	154	153	153	153
TXSP4500	4500	**590**	446	474	498	519	536	573	519	519	519
TXCB3000	3000	**205**	143	165	181	192	198	205	192	192	192
TXCB9200	9200	**479**	114	153	189	222	253	349	222	222	222
Rice Farms											
TXR1500	1500	**236**	191	211	223	230	234	236	230	230	230
TXR3000	3000	**318**	195	229	254	274	289	314	274	274	274
CAR1200	1200	**227**	153	178	196	208	216	227	208	208	208
CAR3000	3000	**(75)**	(507)	(460)	(416)	(375)	(337)	(228)	(375)	(375)	(375)
CABR1000	1000	**127**	63	89	107	116	122	127	116	116	116
CACR800	800	**(191)**	(231)	(211)	(200)	(195)	(192)	(191)	(195)	(195)	(195)

Table 6. Percent Changes in Average Annual Net Cash Income from Base Scenario, 2019-2025

Farm Name	Acres Farmed	Per Person Payment Limits (No AGI Limit) 2 x $50K	2 x $75K	2 x $100K	2 x $125K	2 x $150K	2 x $250K	AGI Limit With $125,000 per Person Payment Limit 2 x $250K	2 x $500K	2 x $900K
Feed Grain Farms										
IAG1350	1350	-2.85%	-0.26%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
IAG3400	3400	-5.90%	-2.91%	-1.18%	-0.38%	-0.10%	0.00%	-0.03%	0.00%	0.00%
MOCG2300	2300	-0.30%	-0.02%	0.00%	0.00%	0.00%	0.00%	-0.10%	0.00%	0.00%
MOCG4200	4200	-0.74%	-0.26%	-0.06%	-0.01%	0.00%	0.00%	-1.42%	-0.18%	0.00%
ING1000	1000	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ING3250	3250	-3.07%	-1.35%	-0.46%	-0.12%	-0.02%	0.00%	-0.04%	0.00%	0.00%
KSCW2000	2000	-0.21%	-0.01%	0.00%	0.00%	0.00%	0.00%	-0.03%	0.00%	0.00%
KSCW5300	5300	-2.14%	-0.91%	-0.29%	-0.04%	0.00%	0.00%	-1.61%	-0.06%	0.00%
KSNW4000	4000	-8.68%	-1.84%	-0.11%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
KSNW7000	7000	-9.62%	-4.34%	-1.56%	-0.37%	-0.03%	0.00%	-0.01%	0.00%	0.00%
NEG2400	2400	-12.31%	-6.92%	-3.42%	-1.43%	-0.49%	0.00%	0.00%	0.00%	0.00%
NEG4300	4300	-15.32%	-10.80%	-7.28%	-4.63%	-2.73%	-0.14%	-0.02%	0.00%	0.00%
TXNP3450	3450	-6.22%	-4.08%	-2.57%	-1.52%	-0.84%	-0.01%	-3.02%	-0.07%	0.00%
TXNP8000	8000	-17.37%	-15.54%	-13.89%	-12.39%	-11.03%	-6.81%	-2.86%	-1.20%	0.00%
WAW2000	2000	-4.41%	-1.55%	-0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
WAW8000	8000	-24.01%	-19.56%	-15.85%	-12.63%	-9.86%	-2.78%	0.00%	0.00%	0.00%
NDG3000	3000	-0.66%	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NDG8000	8000	-3.51%	-2.02%	-1.04%	-0.46%	-0.17%	0.00%	-0.04%	-0.01%	0.00%
COW3000	3000	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
COW6000	6000	-7.93%	-1.50%	-0.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cotton Farms										
TXSP2500	2500	-16.47%	-7.43%	-2.96%	-1.09%	-0.35%	0.00%	0.00%	0.00%	0.00%
TXSP4500	4500	-24.52%	-19.68%	-15.57%	-12.11%	-9.26%	-3.01%	-0.03%	0.00%	0.00%
TXCB3000	3000	-30.31%	-19.27%	-11.52%	-6.45%	-3.54%	-0.17%	0.00%	0.00%	0.00%
TXCB9200	9200	-76.27%	-68.10%	-60.55%	-53.61%	-47.25%	-27.30%	-0.23%	-0.03%	0.00%
Rice Farms										
TXR1500	1500	-19.01%	-10.56%	-5.56%	-2.62%	-0.86%	0.00%	0.00%	0.00%	0.00%
TXR3000	3000	-38.56%	-27.93%	-19.92%	-13.65%	-9.04%	-0.98%	0.00%	0.00%	0.00%
CAR1200	1200	-32.81%	-21.73%	-13.78%	-8.50%	-5.03%	0.00%	0.00%	0.00%	0.00%
CAR3000	3000	-580.02%	-517.39%	-458.20%	-402.92%	-352.48%	-206.10%	0.00%	0.00%	0.00%
CABR1000	1000	-50.48%	-29.72%	-15.61%	-8.42%	-3.68%	0.00%	0.00%	0.00%	0.00%
CACR800	800	-20.68%	-10.11%	-4.77%	-1.74%	-0.27%	0.00%	0.00%	0.00%	0.00%

Grain Farms

The 8,000-acre Texas and Washington grain farms are the only two grain farms significantly affected by the $125,000 per person payment limit. Both farms lose about twelve percent of their net cash farm income at the $125,000 per person payment limit, while none of the other farms lose more than five percent. The large Nebraska farm loses seven percent of its net cash income at the $100,000 per person payment limit, but these three farms (TXNP8000, WAW8000, and

NEG4300) are the only grain farms that take significant losses in net cash farm income at any limit higher than $75,000 per person. The AGI eligibility limits do not have any significant effect on the average net cash farm income of any of the representative grain farms. The 3,450-acre Texas grain farm loses the most average net cash income at the $250,000 per person AGI limit, and it only loses three percent of its average net cash income.

Cotton Farms

The representative cotton farms are affected more than the grain farms. The 9,200-acre Coastal Bend farm takes large losses in net cash farm income for all payment limits due to its size and the large amount of government payments it received under the base scenario. The large percentage loss in net cash farm income that TXCB9200 experiences also indicates its reliance on government payments for viability. At the $250,000 per person payment limit, TXCB9200 loses twenty-seven percent of its net cash farm income, and at the $50,000 per person payment limit it loses seventy-six percent. The 2,500-acre South Plains cotton farm is the least affected, losing only one percent of its net cash income at the $125,000 per person payment limit. The other two cotton farms lose less net cash income than the large Coastal Bend farm, but they still lose more than five percent of their net cash income at the $125,000 per person payment limit. The AGI eligibility limits do not have any significant effect on the average net cash farm income of any of the representative cotton farms.

Rice Farms

In terms of net cash farm income, rice farms are the most negatively affected of the farms. All but the two smallest California rice farms experience net cash losses even at the $250,000 per person payment limit. The 3,000-acre California farm takes the most notable losses; it loses two hundred percent of its net cash income at the $250,000 per person payment limit and it loses four hundred percent of its net cash income at the current payment limit ($125,000 per person). This farm had negative net cash income under the base scenario, so taking a hit this large would likely put the future of the farm in serious jeopardy. CACR800 also has negative net cash income under all payment limit scenarios, and takes a twenty percent loss in net cash under the $50,000 per person payment limit. The other four rice farms maintain positive net cash income, but take significant reductions in net cash income at payment limits even as high as $150,000 per person. The AGI eligibility limits do not have any significant effect on the average net cash farm income of any of the representative rice farms.

At the current $125,000 per person payment limit, the representative rice and cotton farms, as well as the Nebraska grain farms and the large Texas and Washington grain farms are adversely affected in terms of net cash farm income. The 3,000-acre Texas and California rice farms and the 9,200-acre Texas cotton farm lose more net cash farm income than any other farm, and the Nebraska, Texas, and Washington farms lose more net cash farm income than the other grain farms. The AGI eligibility limits do not have any significant effect on the average net cash farm income of any of the representative farms.

Ending Cash Reserves

The effects of the binding payment limit levels are not isolated to net cash farm income. The reduction in government payments observed at binding payment limit levels also affects the ending cash reserves for the representative farms. Because ending cash reserves are typically used to help service debt and finance new equipment and machinery in the following year, it is important for farmers to try to maintain these reserves. Negative ending cash reserves must be compensated for through additional debt, which can cause problems in subsequent years as negative ending cash increases interest costs in the next year, and the deficit loan has to be paid.

Table 7 identifies the simulated average ending cash reserves for the years 2019-2025.

Table 7. Average Annual Ending Cash Reserves, 2019-2025 ($1,000's)

			Per Person Payment Limits (No AGI Limit)						AGI Limit With $125,000 per Person Payment Limit		
Farm Name	Acres Farmed	**Base NO LIMIT**	2 x $50K	2 x $75K	2 x $100K	2 x $125K	2 x $150K	2 x $250K	2 x $250K	2 x $500K	2 x $900K
Feed Grain Farms											
IAG1350	1350	**(1,604)**	(1,611)	(1,605)	(1,604)	(1,604)	(1,604)	(1,604)	(1,604)	(1,604)	(1,604)
IAG3400	3400	**(496)**	(561)	(528)	(509)	(500)	(497)	(496)	(500)	(500)	(500)
MOCG2300	2300	**1,628**	1,622	1,628	1,628	1,628	1,628	1,628	1,627	1,628	1,628
MOCG4200	4200	**4,016**	3,994	4,008	4,014	4,015	4,016	4,016	3,982	4,011	4,015
ING1000	1000	**128**	128	128	128	128	128	128	128	128	128
ING3250	3250	**853**	809	834	846	851	853	853	851	851	851
KSCW2000	2000	**1,118**	1,117	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118
KSCW5300	5300	**2,998**	2,952	2,979	2,992	2,998	2,998	2,998	2,973	2,997	2,998
KSNW4000	4000	**(551)**	(578)	(557)	(551)	(551)	(551)	(551)	(551)	(551)	(551)
KSNW7000	7000	**(297)**	(371)	(329)	(308)	(299)	(297)	(297)	(299)	(299)	(299)
NEG2400	2400	**(737)**	(825)	(786)	(761)	(747)	(740)	(737)	(747)	(747)	(747)
NEG4300	4300	**(1,769)**	(1,943)	(1,890)	(1,850)	(1,820)	(1,799)	(1,770)	(1,820)	(1,820)	(1,820)
TXNP3450	3450	**2,734**	2,563	2,650	2,682	2,704	2,718	2,734	2,643	2,702	2,704
TXNP8000	8000	**7,286**	5,917	6,112	6,288	6,437	6,575	6,880	6,313	6,385	6,437
WAW2000	2000	**673**	639	661	671	673	673	673	673	673	673
WAW8000	8000	**437**	(60)	38	116	183	240	384	183	183	183
NDG3000	3000	**(619)**	(622)	(619)	(619)	(619)	(619)	(619)	(619)	(619)	(619)
NDG8000	8000	**887**	780	827	858	874	883	887	874	874	874
COW3000	3000	**(250)**	(250)	(250)	(250)	(250)	(250)	(250)	(250)	(250)	(250)
COW6000	6000	**(2,117)**	(2,175)	(2,124)	(2,118)	(2,117)	(2,117)	(2,117)	(2,117)	(2,117)	(2,117)
Cotton Farms											
TXSP2500	2500	**167**	105	136	153	162	165	167	162	162	162
TXSP4500	4500	**1,828**	1,251	1,362	1,451	1,530	1,599	1,752	1,530	1,530	1,530
TXCB3000	3000	**107**	6	39	64	80	91	106	80	80	80
TXCB9200	9200	**(51)**	(550)	(497)	(448)	(402)	(360)	(234)	(404)	(402)	(402)
Rice Farms											
TXR1500	1500	**238**	(12)	115	188	214	230	238	214	214	214
TXR3000	3000	**358**	(312)	(113)	33	159	252	347	159	159	159
CAR1200	1200	**119**	(239)	(109)	(6)	57	82	119	57	57	57
CAR3000	3000	**(2,988)**	(5,429)	(5,153)	(4,886)	(4,630)	(4,391)	(3,774)	(4,630)	(4,630)	(4,630)
CABR1000	1000	**(647)**	(978)	(829)	(719)	(685)	(664)	(647)	(685)	(685)	(685)
CACR800	800	**(1,735)**	(1,941)	(1,814)	(1,768)	(1,747)	(1,736)	(1,735)	(1,747)	(1,747)	(1,747)

Table 8. Percent Changes in Average Annual Ending Cash Reserves, 2019-2025

Farm Name	Acres Farmed	Per Person Payment Limits (No AGI Limit) 2 x $50K	2 x $75K	2 x $100K	2 x $125K	2 x $150K	2 x $250K	AGI Limit With $125,000 per Person Payment Limit 2 x $250K	2 x $500K	2 x $900K
Feed Grain Farms										
IAG1350	1350	-0.46%	-0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
IAG3400	3400	-13.01%	-6.32%	-2.51%	-0.77%	-0.18%	0.00%	-0.04%	0.00%	0.00%
MOCG2300	2300	-0.36%	-0.01%	0.00%	0.00%	0.00%	0.00%	-0.05%	0.00%	0.00%
MOCG4200	4200	-0.53%	-0.19%	-0.04%	-0.01%	0.00%	0.00%	-0.83%	-0.10%	0.00%
ING1000	1000	-0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ING3250	3250	-5.15%	-2.23%	-0.79%	-0.18%	-0.02%	0.00%	-0.06%	0.00%	0.00%
KSCW2000	2000	-0.11%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.02%	0.00%	0.00%
KSCW5300	5300	-1.55%	-0.64%	-0.21%	-0.03%	0.00%	0.00%	-0.83%	-0.03%	0.00%
KSNW4000	4000	-4.94%	-0.99%	-0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
KSNW7000	7000	-25.00%	-10.91%	-3.73%	-0.86%	-0.05%	0.00%	-0.01%	0.00%	0.00%
NEG2400	2400	-11.94%	-6.61%	-3.22%	-1.32%	-0.43%	0.00%	0.00%	0.00%	0.00%
NEG4300	4300	-9.83%	-6.85%	-4.57%	-2.87%	-1.68%	-0.07%	-0.01%	0.00%	0.00%
TXNP3450	3450	-6.24%	-3.07%	-1.90%	-1.12%	-0.60%	-0.01%	-2.25%	-0.06%	0.00%
TXNP8000	8000	-18.78%	-16.11%	-13.69%	-11.65%	-9.75%	-5.57%	-1.92%	-0.80%	0.00%
WAW2000	2000	-5.06%	-1.87%	-0.35%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
WAW8000	8000	-113.64%	-91.30%	-73.39%	-58.14%	-45.01%	-12.07%	-0.01%	0.00%	0.00%
NDG3000	3000	-0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NDG8000	8000	-12.09%	-6.78%	-3.37%	-1.45%	-0.52%	0.00%	-0.08%	-0.01%	0.00%
COW3000	3000	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
COW6000	6000	-2.72%	-0.33%	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cotton Farms										
TXSP2500	2500	-37.42%	-18.72%	-8.41%	-3.44%	-1.20%	0.00%	0.00%	0.00%	0.00%
TXSP4500	4500	-31.57%	-25.50%	-20.60%	-16.28%	-12.52%	-4.15%	-0.03%	0.00%	0.00%
TXCB3000	3000	-94.14%	-63.12%	-40.22%	-24.62%	-14.88%	-0.80%	0.00%	0.00%	0.00%
TXCB9200	9200	-977.95%	-874.99%	-777.80%	-688.90%	-606.51%	-359.55%	-0.39%	-0.04%	0.00%
Rice Farms										
TXR1500	1500	-105.10%	-51.42%	-21.00%	-9.87%	-3.21%	0.00%	0.00%	0.00%	0.00%
TXR3000	3000	-187.15%	-131.63%	-90.81%	-55.60%	-29.45%	-3.10%	0.00%	0.00%	0.00%
CAR1200	1200	-300.74%	-191.46%	-105.11%	-51.74%	-30.65%	0.00%	0.00%	0.00%	0.00%
CAR3000	3000	-81.66%	-72.42%	-63.50%	-54.92%	-46.94%	-26.29%	0.00%	0.00%	0.00%
CABR1000	1000	-51.21%	-28.10%	-11.12%	-5.95%	-2.60%	0.00%	0.00%	0.00%	0.00%
CACR800	800	-11.90%	-4.56%	-1.92%	-0.70%	-0.10%	0.00%	0.00%	0.00%	0.00%

Grain Farms

Table 8 shows that while most of the previous patterns observed for grain farms continue to hold, one major difference stands out when analyzing the changes in ending cash. The effect of payment limits on the 8,000-acre Washington farm is staggering; the $250,000 per person payment limit causes a twelve percent reduction in ending cash, and the $125,000 per person payment limit reduces the farm’s average ending cash by almost sixty percent. Additionally, the initial sixty-six percent reduction in government payments at the $50,000 per person payment limit induced a twenty-four percent drop in net cash farm income for the WAW8000 farm, which caused ending cash to decrease by 113 percent. The large Texas grain farm (TXNP8000) loses less ending cash than the large Washington grain farm. TXNP8000 loses more than five percent of its ending cash for all payment limits, and the large Texas, Washington, and Nebraska farms lose the most ending cash at the current ($125,000 per person) payment limit. The AGI eligibility limits do not have any significant effect on the average ending cash reserves of any of the representative grain farms. The Texas grain farms lose the most average ending cash reserves under the AGI limits, and they only lose about two percent of their ending cash reserves.

Cotton Farms

The moderate-size South Plains Texas cotton farm is the only cotton farm that does not lose more than five percent of its ending cash reserves at the $125,000 per person payment limit. The 9,200-acre Coastal Bend cotton farm takes the largest losses of the cotton farms, losing almost 690 percent of its ending cash reserves at the $125,000 per person payment limit. At the $100,000 per person payment limit, the ending cash reserves of all of the representative cotton farms are significantly reduced. This indicates again that the viability of the representative cotton farms will be adversely affected if payment limits are set lower than the current $125,000 per person payment limit, and that all but one of the representative cotton farms will be adversely affected even if the current payment limit is maintained. The AGI eligibility limits do not have any significant effect on the average ending cash reserves of the representative cotton farms.

Rice Farms

Once again, rice farms are heavily affected by payment limits. Though the smallest farm, CACR800, only loses more than five percent of its ending cash at the $50,000 per person payment limit, the 1,000-acre farm loses six percent of its ending cash reserves at the $125,000 per person payment limit and fifty percent of its ending cash reserves at the $50,000 per person payment limit, which is consistent with its reductions in net cash. Each of the remaining farms are drastically affected at the $125,000 per person payment limit and below, with TXR3000, CAR 1200, and CAR3000 losing more than fifty percent of their ending cash reserves at the $125,000 per person payment limit. The AGI eligibility limits do not have any significant effect on the average ending cash reserves of any of the representative rice farms.

Again, the rice and cotton farms are most affected by the current $125,000 per person payment limit. The three largest rice farms (TXR3000, CAR1200, and CAR3000) all lose more than fifty percent of their ending cash reserves at the $125,000 per person payment limit, and the 3,000-acre California rice farm has negative ending cash at all payment limits. The 9,200-acre Texas cotton farm loses an average of nearly seven hundred percent of its ending cash, which, given that the farm's ending cash is negative, would continually force the farm to take on more debt to finance their operations. The large Washington grain farm is also heavily affected as it was in regard to government payments and net cash farm income, and is affected more than TXNP8000 in regards to ending cash reserves. The AGI eligibility limits do not have any significant effect on the average ending cash reserves of any of the representative farms.

Effects of Payment Limits on Viability

Based on the effects of the payment limit scenarios on the government payments, net cash farm income, and ending cash reserves of the thirty representative farms, it is clear that farm program payment limitations have the most adverse effect on cotton and rice farms, and on farms that are large for their region, especially those that have 8,000 acres or more. At the current payment limit of $125,000 per person, the 8,000-acre Texas and Washington grain farms, as well as the large cotton farms (TXSP4500 and TXCB9200) and rice farms (TXR3000 and CAR3000), all had a high probability of exceeding the payment limit. This probability translated to large reductions in average government payments from the base scenario to the $125,000 per person payment limit scenario for these farms. These farms were similarly affected in regard to net cash farm income. The 3,000-acre California rice farm lost 400 percent of its net cash farm income, and the 9,200-acre Texas cotton farm lost fifty-four percent. None of the other farms lost anywhere close to those percentages in terms of net cash farm income, but all of the farms that were most affected by government payments were also some of the most affected in terms of net cash farm income. The reductions in net cash farm income facing the large cotton and rice farms and the large Texas and Washington grain farms resulted in serious losses in ending cash reserves. The 9,200-acre Texas cotton farm's near-700 percent loss in ending cash reserves could seriously jeopardize the farm's future; CAR3000 might also face solvency issues given its fifty-four percent loss in ending cash that resulted in it having average annual ending cash reserves of negative $4.6 million. While these problems will likely occur under the $125,000 per person payment limit that is currently enforced, reducing the payment limit would cause these farms to undertake even more debt, and TXR3000 and CAR1200, which have positive ending cash under the current payment limit, would end up with negative ending cash, forcing them to take on debt. The results indicate that other than reducing average government payments, AGI eligibility limits do not have any significant effect on the viability of the representative farms, especially at the current AGI limit.

In terms of viability, since the largest grain farms and most of the cotton and rice farms experience the greatest effects in terms of government payments, net cash farm income, and ending cash (with a few exceptions), these farms will be most at risk for losing economic viability. The analysis examined the effects of the current payment limit on the representative farms, but reducing the payment limit would exacerbate these losses. Implications would include reductions in net cash farm income, which would further reduce the viability of the farms, and incentivize the farms to restructure to avoid lower payment limits. This would result in many new farms being created, which may lead to potential losses in efficiency for these farms. This does not include costs of reorganizing the farm, which include legal fees that can easily become burdensome for a farm operation.

Effects of Possible Farm Reorganization on Farm Economic Efficiency

After establishing the levels at which payment limits are binding for the representative farms and the effects that those limits have on the measures of viability, the next step in analyzing the effects of the limits is to determine their possible effects on efficiency. Based on the study conducted by Collins et al. (2003), it is assumed that the representative farms will seek to avoid payment limits that are binding on their operation. Four options are available when a farm is faced with a binding payment limit: 1) continue current operations and receive the reduced payment; 2) reduce acreage to reduce costs and avoid reaching the limit; 3) exit farm operation; or 4) restructure by adding “persons” to be eligible for additional payment limits. The output variables in Tables 5-8 demonstrated that when payment limits are binding, the viability of the farm is at risk to varying degrees, depending on the farm. It is not likely that farm owners would continue normal operations if they faced a significantly binding payment limit. Additionally, taking acres out of production would leave assets idle and not likely reduce costs enough to compensate for the loss in revenue, and exiting farm operations would likely only be a last resort. Therefore, in determining the effects of the payment limitations on efficiency, it is assumed that at the binding payment limit level, a given representative farm will restructure its operation such that the operators will be able to receive additional payment limits. This means that the farm will have to be divided, either by selling a portion of the farm, or making a family member the owner of the new portion and establishing it as a new and separate farm. Adding additional "persons" has a hidden effect of increasing family living withdrawals to support the added "persons actively engaged" in farming. The added cash outflows could further reduce a farm's economic viability in the current farm economic downturn.

Unit cost ratios were used to measure farm efficiency. Unit cost ratios are calculated by dividing total cash costs by total cash receipts. Unit cost ratios were calculated for the AFPC representative farms as well as the sample farms obtained from the ARMS database. The ratios for the ARMS sample farms were scaled to the AFPC farm ratios to allow for better comparison.

The results of the unit cost ratio calculations are presented by crop and grouped according to the discussion in the previous sections. The AFPC farm ratios and the ARMS sample farm ratios have been combined into tables by region to show the approximate cost ratio that would likely be experienced if the representative farms were reorganized into one or more smaller farms.

Grain Farms

Table 9 exhibits the scaled unit cost ratios and costs per acre for the AFPC representative farms and ARMS sample farms for Iowa, Missouri, Indiana, Kansas, and Nebraska, most of which have similar patterns of unit cost ratios, and all of which are located in the Midwest. The Iowa table shows that if the 3,400-acre AFPC farm were to reorganize to avoid payment limits, it could reduce its unit cost ratio from 0.88 to 0.84, given the most efficient size is around 2,000 acres. However, Table 9 also shows that the 1,350-acre representative farm in Iowa has a unit cost ratio of 1.11, which would suggest a large reduction in efficiency if the 3,400-acre farm were to restructure into two farms around 1,500 acres in size. This ratio is much larger than the ratios of the farm sizes smaller and larger than the 1,350-acre farm, and it is unclear whether this farm is an anomaly, or if 1,300-acre farms in Iowa are typically less efficient.

The Missouri AFPC farms in Table 9 seem to be much different from the Iowa farms. If the MOCG4200 farm were to reorganize, it appears that it would lose efficiency by moving to a smaller farm size. All of the ARMS sample farm sizes with fewer than 4,200 acres have higher cost/receipt ratios (0.81, 0.83, and 0.70) than the large Missouri farm (0.64), and even the costs per acre are higher. The same is true for the 2,300-acre Missouri farm (0.70).

Table 9 indicates that the 1,000-acre Indiana grain farm is about as efficient (0.71) as the ARMS sample farms (0.71 to 0.77) and more efficient than the large Indiana farm (0.82). Additionally, this farm has no incentive to restructure as it does not experience binding payment limits at any level. However, the estimated efficiency results of the larger farms in Indiana are mixed. The 3,250-acre representative farm has a unit cost ratio of 0.82, while the largest sample farm from the ARMS data, which is 4,196 acres in size, has a unit cost ratio of 0.74, making it more efficient than ING3250, as well as the smallest sample farm. This still leaves the moderate-sized representative farm as the most efficient, but makes it difficult to estimate the effect of farm size on the efficiency of grain farms in Indiana.

Table 9. Midwest Grain Farms Scaled Long Run Average Cost Tables (2016-2017)

Iowa Grain

	Size Category (Acre Range)	0-500	500-1500	1500-2500	2500+	Rep Farms	
Scaling Factor	Average Number of Farms	22,105	8,937	1,124	387	IAG1350	IAG3400
	Average Sample Size	250	154	46	28	1	1
	Acres	161	884	1,932	3,076	1350	3400
	Costs/Acre	551	496	516	478	645	451
0.12	Costs/Receipts	0.84	0.84	0.81	0.88	1.11	0.88

Missouri Grain

	Size Category (Acre Range)	0-1000	1000-2000	2000-3000	3000+	Rep Farms	
Scaling Factor	Average Number of Farms	21,558	938	416	406	MOCG2300	MOCG4200
	Average Sample Size	148	45	26	29	1	1
	Acres	123	1,442	2,515	5,578	2300	4200
	Costs/Acre	360	331	356	355	326	291
0.04	Costs/Receipts	0.81	0.83	0.70	0.76	0.70	0.64

Indiana Grain

	Size Category (Acre Range)	0-500	500-1500	1500-2500	2500+	Rep Farms	
Scaling Factor	Average Number of Farms	30,388	3,223	718	543	ING1000	ING3250
	Average Sample Size	259	152	59	53	1	1
	Acres	68	902	1,894	4,196	1000	3250
	Costs/Acre	562	453	478	551	398	500
(0.01)	Costs/Receipts	0.77	0.71	0.72	0.74	0.71	0.82

South Central Kansas Grain

	Size Category (Acre Range)	0-1000	1000-2000	2000-4000	4000+	Rep Farms	
Scaling Factor	Average Number of Farms	25,914	1,971	1,149	277	KSCW2000	KSCW5300
	Average Sample Size	253	72	42	17	1	1
	Acres	120	1,450	2,789	7,512	2000	5300
	Costs/Acre	323	255	250	316	280.41	266.86
(0.03)	Costs/Receipts	0.67	0.62	0.63	0.73	0.62	0.69

Northwest Kansas Grain

	Size Category (Acre Range)	0-1000	1000-2000	2000-4000	4000+	Rep Farms	
Scaling Factor	Average Number of Farms	25,914	1,971	1,149	277	KSNW4000	KSNW7000
	Average Sample Size	253	72	42	17	1	1
	Acres	120	1,450	2,789	7,512	4000	7000
	Costs/Acre	323	255	250	316	160.00	204.44
0.10	Costs/Receipts	0.79	0.74	0.75	0.85	0.88	0.85

Nebraska Grain

	Size Category (Acre Range)	0-1000	1000-2000	2000+	Rep Farms	
Scaling Factor	Average Number of Farms	14,615	2,823	701	NEG2400	NEG4300
	Average Sample Size	257	84	43	1	1
	Acres	283	1,414	3,050	2400	4300
	Costs/Acre	484	495	465	685	685
0.13	Costs/Receipts	0.86	0.84	0.92	0.92	0.94

The representative Kansas grain farms are located in two different regions, and are separated into two tables. The south central Kansas grain farms are consistent with the pattern for the Kansas ARMS sample farms; the moderate-sized representative farm is the most efficient farm, along with the 1,450-acre sample farm, and the large representative farm (0.69) is the second-to-least efficient, being only more efficient than the 7,500-acre sample farm. The 2,000-acre representative farm is not bound by payment limits at any level, so it would not have a reason to reorganize, and would not be in danger of losing efficiency. On the other hand, the large farm may gain efficiency by reducing its farm size.

The northwest Kansas farms have much higher unit cost ratios than the south central Kanas farms. The 7,000-acre representative farm is closest in size to the 7,500-acre ARMS sample farm, so they both show a scaled unit cost ratio of 0.85. The 4,000-acre farm, however, is less efficient than both the smaller ARMS sample farms and the larger ARMS sample farms. The 2,700-acre sample farm has a unit cost ratio of 0.75, while the 4,000-acre representative farm has a unit cost ratio of 0.88. The higher unit cost ratio (0.88) for the moderate-sized representative farm might be due to the fixity of costs when expanding farm size; the large representative farm might have overcome the fixity of costs with its larger acreage.

The pattern of unit costs for the Nebraska grain farms resemble that of the south central Kansas grain farm. The two representative farms have the highest unit cost ratios in the sample, so neither would be negatively affected in terms of efficiency if they were to reorganize to avoid payment limits. The most efficient farm size in the ARMS sample is about 1,400 acres, while the 2,000-acre and greater range is the least efficient.

As payment limits are currently set at $125,000 per person, the Nebraska representative farms are the most likely out of all the Midwest grain farms to be forced to reorganize. However, according to Table 9, neither of the Nebraska farms would be faced with reduced efficiency if they were forced to reorganize. The large Iowa grain farm would be forced to reorganize if payment limits were reduced to $100,000 per person, but it is difficult to determine what effect this would have on the efficiency of the farm. Assuming a reduction would cause the 3,400-acre farm to restructure into two farms, each between 1,350 and 1,900 acres, taking an average of the two ratios would suggest that the new farms would experience a unit cost ratio of 0.96 and a loss of efficiency. The Missouri farms would also lose efficiency, but only at lower payments limits.

Table 10. Texas, Washington, North Dakota, and Colorado Grain Farms Scaled Long Run Average Cost Tables (2016-2017)

Texas Grain

	Size Category (Acre Range)	0-1000	1000-2000	2000-4000	4000+	Rep Farms	
Scaling Factor	Average Number of Farms	80,097	1,529	809	368	TXNP3450	TXNP8000
	Average Sample Size	301	60	38	22	1	1
	Acres	29	1,449	2,714	6,593	3450	8000
	Costs/Acre	1,004	344	297	333	399	597
0.11	Costs/Receipts	0.94	0.73	0.73	0.85	0.73	0.77

Washington Grain

	Size Category (Acre Range)	0-1000	1000-2000	2000-4000	Rep Farms	
Scaling Factor	Average Number of Farms	18,873	544	314	WAW2000	WAW8000
	Average Sample Size	482	76	44	1	1
	Acres	44	1,442	2,949	2000	8000
	Costs/Acre	3,097	1,050	545	237	332
(0.09)	Costs/Receipts	0.66	0.56	0.72	0.72	0.92

North Dakota Grain

	Size Category (Acre Range)	0-1000	1000-2000	2000-4000	4000+	Rep Farms	
Scaling Factor	Average Number of Farms	14,502	3,299	2,789	861	NDG3000	NDG8000
	Average Sample Size	62	43	45	34	1	1
	Acres	192	1,423	2,714	5,243	3000	8000
	Costs/Acre	247	296	273	292	315	313
0.15	Costs/Receipts	0.78	0.88	0.94	0.86	0.94	0.85

Colorado Grain

	Size Category (Acre Range)	0-1000	1000-2000	2000-4000	4000+	Rep Farms	
Scaling Factor	Average Number of Farms	18,248	421	156	154	COW3000	COW6000
	Average Sample Size	45	14	10	16	1	1
	Acres	33	1,375	2,670	8,799	3000	6000
	Costs/Acre	1,452	432	528	188	86.28	129.36
(0.15)	Costs/Receipts	0.73	0.65	0.83	0.60	0.83	0.93

Table 10 includes scaled unit cost ratios for the Texas, Washington, North Dakota, and Colorado ARMS sample and representative grain farms. The Texas 3,450-acre grain farm is the most efficient of the farms in the sample, with a unit cost ratio of 0.73. This farm is bound by payment limits at all but the highest level, meaning that it is highly at risk of facing binding payment limits, which would encourage reorganization and result in the loss of economic efficiency. The large representative farm, though less efficient than the moderate-sized farm, has a lower unit cost ratio (0.77) than the sample farm at the 6,500-acre size (0.85). This could be another situation in which fixity of costs may cause the efficiency of a farm to fall when expanding to a larger size.

The change in the unit cost ratio as farm size increases for the Washington grain farms creates a pattern similar to that of the south central Kansas and Nebraska grain farms. The moderate-sized Washington sample farms (0.56) are more efficient than both the small (0.66) and large sample farms (0.72). Additionally, the 8,000-acre Washington representative farm has a very high unit cost ratio (0.92), indicating that it is inefficient compared to the other farms, in particular the 2,000-acre representative farm (0.72). It is highly likely that the large Washington representative farm will be affected by payment limits, as it is bound by the $250,000 per person payment limit. However, Table 10 suggests that reorganizing to avoid payment limits should positively affect the efficiency of the large Washington representative farm.

The pattern of change in efficiency given increasing farm size for the North Dakota farms is unlike any pattern observed so far. Table 10 indicates that the smallest North Dakota farm, which consists of only about 200 acres, is the most efficient (0.78). Additionally, the unit cost ratios peak at 0.94 for the 2,700-acre sample farm, the same ratio as for the 3,000-acre representative farm. The representative farms are about as efficient as their near size ARMS sample farms, with unit cost ratios of 0.94 and 0.85. Though the moderate-sized representative farm is not affected by payment limits, and will therefore have no reason to restructure the farm, the large North Dakota grain farm may face a severe loss in efficiency (0.85 to 0.94) if payment limits are implemented at or below the $125,000 per person payment limit.

The efficiency of the Colorado grain farms behaves similarly to the Indiana, Northwest Kansas, and Texas grain farms. The efficiency of the representative Colorado grain farms is not in jeopardy, as the 6,000-acre Colorado grain farm would reduce its unit cost ratio from 0.93 to 0.83 if it reduced its acreage, and the 3,000-acre Colorado grain farm would reduce its unit cost ratio from 0.83 to 0.65. The 3,000-acre representative farm is not bound by payment limits, and the 6,000-acre representative farm is only bound at the $50,000 per person payment limit, so it is unlikely that either of these farms would be forced to reorganize.

Overall, these results indicate that if the large representative farms do not reduce their acreage by more than a few thousand acres when faced with binding payment limits, they will likely experience reduced efficiency. It is even possible that this would be the case for the 8,000-acre Washington representative farm, since the next largest farm size included in the Washington sample was only about 3,000 acres. Again, this also indicates the fixity of costs when expanding farm size, and the need to spread those costs over more acres to increase efficiency.

The moderate-sized Texas representative grain farm is most at risk of experiencing reduced economic efficiency should it be forced to reorganize to avoid payment limits. The Missouri representative farms would face lost efficiency, but they are only bound by payment limits at the $50,000 and $75,000 per person payment limits, so, given that the current payment limit is $125,000 per person, it is unlikely that these two farms would be forced to reorganize. The moderate-sized Texas farm, however, is bound by the $150,000 per person payment limit level. If the payment limit level stays at $125,000 per person, the moderate-sized Texas farm will be forced to reorganize to form a potentially less efficient farm structure. The 8,000-acre Texas and North Dakota farms would be at risk of losing efficiency if reorganizing their farm structures would result in farm sizes in the 7,000-acre range for Texas or the 3,000-5,000 acre range for North Dakota. Thus, these farms would have to sell or restructure a large portion of their farm to avoid loss of efficiency. Either way, these farms will likely experience large cost increases if forced to restructure. The implications of binding payment limits are more difficult to determine for the Washington farm, as there is a 5,000-acre difference between farm sizes in the sample. Based on our results, it appears that the 8,000-acre Washington farm's efficiency would be unaffected by binding payment limits. Only the large Colorado farm experiences binding payment limits, and only at the $50,000 per person payment limit, so it is unlikely that the Colorado farms' efficiency will be affected by payment limits. Overall, the Midwest farms are less likely to experience reduced efficiency due to farm reorganization, and of the other five farms, the Texas farms and the large North Dakota farm are the most likely farms to be forced to reorganize and lose efficiency.

Cotton Farms

Table 11 indicates the scaled unit cost ratios of the four Texas representative cotton farms, compared to the ratios of the ARMS sample farms. The Texas cotton farms are located in two regions, the South Plains of Texas and the Coastal Bend area. The only difference between the patterns of the unit cost ratios for the two regions is that the unit cost ratio in the Coastal Bend area increases slightly at the larger farm size. This is likely another instance of fixity of costs, causing the unit cost ratio of the 6,645-acre sample farm to be higher than that of the 9,200-acre Coastal Bend farm.

The 4,500-acre South Plains cotton farm is the most efficient in the region, with a unit cost ratio of .73. However, the 4,500-acre cotton farm experiences binding payment limits at $250,000 per person, indicating that it is very likely that the farm will either be forced to accept lower government payments, or restructure the farm and lose efficiency if payment limits become more restrictive. At best, the farm might be able to restructure into a 1,500-acre farm and a 2,500-acre farm, allowing the two resulting farms to operate at less efficient unit costs ratios of .80 and .77, respectively.

The 3,000-acre Coastal Bend cotton farm is the most efficient in its area, and is also highly at risk to be forced to reorganize. However, it is more difficult to discern the effects on efficiency, as two of the smaller ARMS farm sizes have similar to slightly higher unit cost ratios, and the smallest farm is only 513 acres. It would make sense for the farm to split into two 1,500-acre farms, which should allow it to maintain a 0.90 efficiency ratio (Table 11). The 9,200-acre Coastal Bend farm would also reduce its efficiency if it reduced acreage to the level of the 6,500-acre sample farm. The large Coastal Bend is also highly at risk of being forced to reorganize, as it faces binding payment limits at $250,000 per person. However, if it were able to form three 3,000-acre farms, it appears that its efficiency would improve.

Table 11. Texas Cotton Farms Scaled Long Run Average Cost Tables (2016-2017)

Texas Southern Plains Cotton

	Size Category (Acre Range)	0-1000	1000-2000	2000-4000	4000+	Rep Farms	
Scaling Factor	Average Number of Farms	1,572	1,254	688	314	TXSP2500	TXSP4500
	Average Sample Size	37	45	30	19	1	1
	Acres	513	1,445	2,737	6,645	2500	4500
	Costs/Acre	375	327	302	349	246	311
0.16	Costs/Receipts	0.84	0.80	0.77	0.95	0.77	0.73

Texas Coastal Bend Cotton

	Size Category (Acre Range)	0-1000	1000-2000	2000-4000	4000+	Rep Farms	
Scaling Factor	Average Number of Farms	1,572	1,254	688	314	TXCB3000	TXCB9200
	Average Sample Size	37	45	30	19	1	1
	Acres	513	1,445	2,737	6,645	3000	9200
	Costs/Acre	375	327	302	349	300	367
0.26	Costs/Receipts	0.94	0.90	0.87	1.05	0.87	0.94

Based on the results, the 4,500-acre South Plains cotton farm is most at risk of being forced to reorganize and face reduced efficiency. Though at higher levels of payment limit the farm should be able to reorganize in such a way that would increase its unit cost ratio by about

0.04, if the payment limit is set at $100,000 per person or lower (the limit at which the 2,500-acre farm is bound), the farm would be forced to reorganize into structures that would likely cause more reduced efficiency. The large Coastal Bend farm is also very likely to be forced to reorganize, though if it were able to divide into much smaller farms, it would be able to increase its efficiency. The 9,200-acre Coastal Bend farm would only face reduced efficiency if it were to reduce its farm size to around 6,500 acres.

Rice Farms

Table 12 indicates the scaled unit cost ratios of the Texas and California representative and sample rice farms. The rice results are problematic as only one farm size was obtainable from the ARMS database, the 0-1,000-acre farm size in both states, due to limited sampling. When scaled, the unit cost ratios for the sample farms are identical to at least one of the representative farms. The following discussion of the efficiency of the available rice farms attempts to take the incompleteness of the data into account.

Based on Table 12, the 1,500-acre representative Texas rice farm and the 500-acre sample Texas rice farm are more efficient than the 3,000-acre representative Texas rice farm. The 3,000-acre farm is bound by payment limits at the $150,000 per person payment limit, so it is likely that the 3,000-acre farm would be forced to reorganize, but it should not lose efficiency. The 1,500-acre representative farm is bound by the $125,000 per person payment limit, so it is also possible that this farm will face reorganization, but according to Table 12, its efficiency should not be affected. It is also useful to note that the unscaled version of Table 12 (see Table 12b. Appendix B) lists the unit cost ratio of the 500-acre farm as .59, further indicating that the 1,500-acre representative farm should not lose efficiency if forced to reorganize.

The pattern of unit cost ratios for the Sutter and Yuba County California rice farms is the same as for the Texas rice farms. The sample farm and the moderate-sized representative farm have the same unit cost ratio when scaled, and the 3,000-acre representative farm is much less efficient than either of these farms. Both of the representative farms are bound by high payment limits, so it is likely that they will be forced to reorganize; however, neither of the farms' efficiency should be negatively impacted.

Table 12. Texas and California Rice Farms Scaled Long Run Average Cost Tables (2016-2017)

Texas Rice

	Size Category (Acre Range)	0-1000	Rep Farms	
Scaling Factor	Average Number of Farms	174	TXR1500	TXR3000
	Average Sample Size	5	1	1
	Acres	525	1500	3000
	Costs/Acre	576	385	431
0.15	Costs/Receipts	0.73	0.73	0.82

California Rice

	Size Category (Acre Range)	0-1000	Rep Farms	
Scaling Factor	Average Number of Farms	1,020	CAR1200	CAR3000
	Average Sample Size	35	1	1
	Acres	407	1200	3000
	Costs/Acre	1,060	1,071	1,367
0.17	Costs/Receipts	0.86	0.86	0.98

California Rice

	Size Category (Acre Range)	0-1000	Rep Farm	Rep Farm
Scaling Factor	Average Number of Farms	1,020	CABR1000	CACR800
	Average Sample Size	35	1	1
	Acres	407	1000	800
	Costs/Acre	1,060	1,168	1,389
	Costs/Receipts	0.86	0.86	1.08

Given that the Butte County and Colusa County California rice farms are the only representative farms in their region, it is difficult to make any observations about their relation to the scaled sample farm. Note that the unscaled version of Table 12 (see Table 12b. Appendix B) indicates that the unit cost ratio of the California sample farm is .70. This would indicate that the representative farms for Butte County and Colusa County, California, are less efficient than the sample farm, and would not be impacted negatively in regards to efficiency if forced to reorganize. Again, this is not a strong indication given that only one size of ARMS sample farm is available, and that the sample size for all California rice farms is only thirty-five.

Overall, the pattern that can be discerned from the rice farm tables is that the unit cost ratio of the farms increases as the farms increase in size. Table 12 is unclear due to limited ARMS sample size, but it suggests that none of the rice farms would experience reduced efficiency were they to reorganize to avoid payment limits. It should also be noted that it is very likely that the rice farms will have an incentive to reorganize, as all but the 800-acre California farm experience binding payment limits at the $125,000 per person level, and three of the farms are bound by higher levels.

Effects of Payment Limits on Efficiency

Among the representative farms that would experience reduced efficiency when faced with payment limits, two situations are typically observed. Either the farm is moderate- or large-sized with a low unit cost ratio that would lose efficiency if it were to reorganize; or, the farm is a large-sized farm in the 7,000-acre and greater range that would lose efficiency if it were to reduce its acreage by a moderate amount, but would increase its efficiency if it were to reorganize into farms of substantially smaller size. Four exceptions exist: the Iowa grain farms; the Indiana grain farms; the Washington grain farms; and the Colorado grain farms. These regions are described in more detail in the preceding sections. None of the rice farms appear to experience reduced efficiency when reorganized, so they are not mentioned in this section.

The Missouri representative farms, the 3,450-acre Texas grain farm, and the 4,500-acre Texas South Plains cotton farm would all lose efficiency if they were to face reorganization. The Missouri farms are only bound by the two lowest payment limits ($50,000 and $75,000 per person), so it is not likely that these farms will need to resort to restructuring. The moderate-sized Texas grain farm is bound by all but the highest payment limit ($250,000 per person), but the sample farm that indicates it would lose efficiency due to restructuring is only twenty-nine acres. The farm would likely split into two farms around 1,500 acres in size, which Table 10 indicates would have the same unit cost ratio as the 3,450-acre farm. Therefore, it is not likely that the 3,450-acre Texas farm will lose efficiency. However, the 4,500-acre Texas South Plains cotton farm is bound by all payment limits, so it is highly likely that the farm would be forced to reorganize, and would lose efficiency in the process. The 4,500-acre Texas South Plains cotton farm would lose twenty-five percent of its government payments at the $150,000 per person payment limit, resulting in a loss of nine percent of its net cash farm income and thirteen percent of its ending cash, on top of increased costs per dollar of production.

All of the 8,000-acre and larger farms are bound by the $250,000 per person payment limit except for the North Dakota grain farm. This puts these farms at the greatest risk of facing farm reorganization. Assuming that it would be preferable to reorganize into as few farms as possible, and to keep as many of the farm's acres in one farm as possible, the 8,000-acre Texas grain farm and the 9,200-acre Texas cotton farm would experience an increase in unit cost ratios of .08 and .11, respectively. This loss of efficiency, on top of the net cash farm income these two farms would lose, would negatively affect the farms' ability to cover family living expenses and operator labor. It is possible that efficiency loss could be avoided if the farms were able to restructure to form several 2,000- or 3,000-acre farms, but this would incur more legal fees, which could outweigh the potential gain in efficiency. The 8,000-acre North Dakota grain farm faces the same problems at the $125,000 per person payment limit, and essentially cannot avoid losing efficiency.

CHAPTER V

SUMMARY AND CONCLUSIONS

As of the Agricultural Act of 2014, farm program payment limitations are set at $125,000 per person for the combination of all crop programs, with one separate $125,000 per person payment limit for peanuts. During the process of writing the 2018 Farm Bill, Congress has debated whether to make the current payment limit more restrictive by reducing the level of payments farmers are eligible to receive. Based on the literature reviewed (Farm Reorganization 1987; Collins et al. 2003; Knutson et al. 1987), if payment limitations are made more restrictive, it is likely that farmers who typically receive government payments in excess of the proposed payment limit will reorganize their farm structure to prevent loss of farm program payments. The research conducted by Knutson et al. (1987) suggested many farms that restructure when faced with tighter payment limits also face losses in efficiency. Given this information, the objective of this study is to quantify the economic effects of alternative farm program payment limitations on farm efficiency and viability for representative farms. The purpose of the study is to inform the debate over farm program payment limitations for future Farm Bills.

Methodology

To determine the effects of alternative levels of payment limits on the efficiency of representative farms, we needed to know which farms would experience reduced viability and therefore have an incentive to restructure their farm to avoid payment limits. The FLIPSIM simulation model was used to estimate the effects of different levels of payment limits on four output variables. The net cash farm income and ending cash reserves output variables were used as measures of farm viability. The results of the simulation of these output variables were used to determine which representative farms would have an incentive to reorganize their farm structure, and at what level of payment limit they would reorganize.

The assumption was made that there are two persons actively engaged in farming on each representative farm. This is not usually the case, so the assumption limits application to real world situations. However, this assumption maintains simplicity in the analysis, and allows for a demonstration of an extremely restrictive payment limit. Examining a farm that included many persons actively engaged in farming would likely yield uninteresting results.

Data

The farm financial data for the representative farms came from the Agricultural and Food Policy Center (AFPC) at Texas A&M University. The AFPC maintains a database of financial information and production practices of farmers in major crop production areas of the United States that is updated every two years. Data was obtained for representative farms producing feed grains, cotton, and rice. Two farms were selected from each of fifteen production regions, one large and one moderate-size; thirty representative farms were simulated.

Additionally, financial data was obtained from the Agricultural Resource Management Survey (ARMS) database. The ARMS data included financial statements for different size sample farms, and the costs and receipts from these statements were used to calculate unit cost ratios for the sample farms. The sample sizes for the larger sample farms were smaller than the sample sizes for the moderate-sized and smaller sample farms due to a limited number of large farms being surveyed by USDA.

The lack of sufficient data from the ARM survey is problematic. There are too few respondents and a lot of room for bias based on who has time on the farm to complete the surveys. The farm operators who know the operation best may not have adequate time to complete the surveys, so it is likely that the tasks falls to someone less familiar with the operation. Additionally, some farmers may skew their responses based on some perceived benefit of giving the impression that they are better or worse off than they actually are. These factors have the potential to skew the results and cause difficulty in drawing conclusions.

The August 2018 FAPRI baseline was used in the estimation of farm costs and revenues. The baseline projected low cotton and grain prices through 2025, which may have skewed the probability of receiving a payment and, therefore, of exceeding the payment limit.

Scenarios

Ten different payment limit scenarios were simulated for each representative farm. A base scenario with no payment limit was simulated, along with six different per person payment limits, and three different adjusted gross income (AGI) limits. The per person payment limits simulated were $50,000 per person, $75,000 per person, $100,000 per person, $125,000 per person, $150,000 per person, and $250,000 per person. The AGI eligibility limits simulated were $250,000 per person, $500,000 per person, and $900,000 per person. The AGI payment limits assumed the current ($125,000 per person) limit was in place as the base from which AGI limits could be analyzed. It was assumed that each representative farm has two persons actively engaged in farming.

Results

The simulation results for the representative crop farms indicated that instituting payment limits that are more restrictive than the current payment limit ($125,000 per person) would have the greatest impact on the economic viability of the representative cotton and rice farms and the large Texas and Washington representative grain farms. The 800-acre Colusa County, California rice farm is the only representative rice farm that did not lose more than five percent of its net cash farm income and ending cash reserves at the $100,000 per person payment limit. The results also indicate that the AGI limits reduced the government payments of MOCG4200, KSCW5300, and the two representative Texas grain farms. The reduction in government payments under the $250,000 per person AGI payment limit led to no more than a three percent reduction in net cash farm income and ending cash reserves for each of the farms affected by the AGI limits. The minor loss in net cash farm income and ending cash reserves indicates that the reduction in government payments caused by the AGI limit had virtually no additional effect on the viability of these farms.

At the $125,000 per person payment limit, TXNP8000, TXCB9200, and CAR3000 have the highest probabilities of having payments that exceeded the payment limit (54 percent, 68 percent, and 58 percent, respectively). These probabilities increase to 77 percent, 83 percent, and 70 percent, respectively, at the $50,000 per person payment limit. All but two of the cotton and rice farms have more than a ten percent probability of exceeding the payment limit at the $125,000 per person payment limit. These high probabilities of exceeding the payment limit translate to reduced average government payments, average net cash farm income, and average ending cash reserves. Most of the moderate-sized cotton and rice farms and the large Texas and Washington grain farms lose 6-12 percent of average net cash farm income at the $125,000 per person payment limit; this range increases to 11-20 percent at the $100,000 per person payment limit, and to 15-30 percent at the $75,000 per person payment limit. The effects on average ending cash reserves are more drastic. While the large Texas grain farm only loses about twelve percent of its average ending cash at the $125,000 per person payment limit, the large Washington grain farm loses almost sixty percent, TXCB3000 loses twenty-five percent, and CAR1200 loses fifty-two percent.

The largest effects are on the large cotton and rice farms. TXCB9200 loses about fifty percent of its net cash farm income and 688 percent of its ending cash reserves at the $125,000 per person payment limit. This farm has negative average ending cash reserves of $402,000 at the $125,000 per person payment limit; this means that this farm has to pay off on average over $400,000 in debt, while still covering family living expenses, using only an average of $222,000 in net cash farm income. This is not sustainable, and the situation is similar for the 3,000-acre California rice farm, which has negative $4,630,000 in average ending cash at the $125,000 per person payment limit and negative $375,000 in average net cash farm income.

A farm that loses fifty percent of its average ending cash reserves is at serious risk of insolvency and inability to cover costs of family living. Farms that face such adverse effects on farm viability when faced with payment limits have the greatest incentive to reduce acreage or restructure their farm to avoid payment limits. In some cases, these changes in farm structure will reduce the efficiency of the farm, causing more of the farm's receipts to go to covering costs. The results of the study indicate that the two large Texas cotton farms are at risk of losing efficiency if they restructure their farms to avoid payment limits. The 4500-acre Southern Plains cotton farm has a unit cost ratio of 0.73; assuming it restructured to form two 2,250-acre farms, the unit cost ratio of each farm would be roughly 0.77, causing both farms to be less efficient than the original. The 9,200-acre Coastal Bend cotton farm would also be very likely to lose efficiency. If TXCB9200 split into one farm of about 6,000 acres and one farm of about 3,000 acres, the farms would have unit cost ratios of about 1.05 and 0.87, respectively. Though the 3,000-acre farm would be more efficient than the original 9,200-acre farm, the two farms together would be less efficient than the original. The best way for TXCB9200 to avoid efficiency loss would be to organize three farms of about 3,000 acres. However, this would introduce more new farm owner/operators, which would increase family living expenses.

Conclusions

The results of this study indicate that if future Farm Bills set farm program payment limitations lower than the current $125,000 per person payment limit, cotton and rice farms will suffer a loss of economic viability. Grain farms go largely untouched by the effects of more restrictive payment limits, however, those that are affected are large farms and will suffer losses of economic viability. Though the affected grain farms are not impacted as drastically as the cotton and rice farms, the losses they take are significant, and detrimental to their ability to provide for the family operating the farm. Payment limits below the $125,000 per person payment limit will push many farmers to restructure their farms to avoid the payment limit in an attempt to maintain their current viability. When farms reorganize for this reason, there are no savings in government costs for program payments.

Based on the results obtained from the available ARMS data, the only farms that would suffer losses in efficiency from restructuring their farms appear to be the Texas representative cotton farms. Below the $125,000 per person payment limit, all four of the Texas representative cotton farms have a strong incentive to restructure to avoid payment limits. If any of these farms were to restructure, they would face higher unit cost ratios on top of the additional legal and administrative fees they would incur to restructure. Additionally, establishing a new farm would involve bringing more family members into the business structure, which would put stress on the newly formed farms to pay for increased family living expenses. For the farms that would not lose efficiency when reorganizing, legal and administrative fees would still increase, and they would still be faced with additional family living expenses.

Additional Research

The data for the estimation of unit cost ratios for the ARMS sample farms was incomplete, as many of the larger size categories had very small sample sizes. Estimating these unit costs ratios with the data available is a good first step toward discerning the efficiency of farms in major crop production regions of the country, but additional research should be conducted to obtain better estimates of farm efficiency when more accurate data can be obtained. Additionally, it would be useful to estimate the dollar value of efficiency lost or gained from farm reorganization, and to compare it to the dollar value increase in legal and administrative fees and family living expenses for representative farms. Knutson et al. (1987) estimated the dollar value increase in production costs from farm reorganization, and a new estimate of this figure would provide more insight for policymakers debating the merits of more restrictive payment limits.

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APPENDIX A

DETAILED SUMMARY OF PAYMENT LIMITATIONS HISTORY

Farm Bill Name and Year	**Payment Limits**	**Definitions and Changes**
Agricultural Act of 1970	Limited total government payments to $55,000 per crop	No clear definition of “person”
Agricultural and Consumer Protection Act of 1973	Limited total government payments to $20,000 for the combination of all crop payments	Same as 1970
Rice Production Act of 1975	Set payment limit of $55,000 for rice when deficiency payments became available	Same as 1973
Food and Agriculture Act of 1977	1978 $40,000 combined limit for wheat, feed grains, and cotton $52,250 limit for rice 1979 $45,000 combined limit for wheat, feed grains, and cotton $50,000 limit for rice 1980-1981 $50,000 combined total limit for all crops, including rice	“Persons” same as preceding bills; limit did not apply to disaster payments

<u>Farm Bill Name and Year</u>	**<u>Payment Limits</u>**	**<u>Definitions and Changes</u>**
<u>Agriculture and Food Act of 1981</u>	$50,000 total combined payment limit for all crop programs from 1982-1985 Separate $100,000 limit for combination of all disaster payments from 1982-1985	"Persons" same as preceding bills
<u>Food Security Act of 1985</u>	$50,000 total combined payment limit for all crop programs except disaster $100,000 limit for combination of all disaster payments	Required "attribution" of payments to individuals and entities (not Direct Attribution); Determination of whether a corporation is a separate person depends on percentage ownership of corporation by stockholders, but percentage is not defined in the Food Security Act

Farm Bill Name and Year	**Payment Limits**	**Definitions and Changes**
Omnibus Budget Reconciliation Act of 1987	Payment limits did not change	Introduction of the "three-entity rule;" Introduction of "actively engaged in farming" (AEF) requirement for payment recipients; First bill to explicitly define "person;" defined as: o An individual o A corporation (or other business entity) o A State or political subdivision o Does not include cooperatives o Husband and wife defined as one person except in specific circumstances

Farm Bill Name and Year	Payment Limits	Definitions and Changes
Omnibus Budget Reconciliation Act of 1987 (continued)		No limit on marketing assistance loan benefits from commodity certificate exchanges or from crop forfeitures
Food, Agriculture, Conservation, and Trade Act of 1990	$75,000 total combined payment limits for all covered crops (added oilseeds) for 1991-1995 crop years; Separate limits for honey: ○ $200,000 in 1991 ○ $175,000 in 1992 ○ $150,000 in 1993 ○ $125,000 in 1994 and subsequent years Same scheme for wool and mohair	USDA authorized to implement rule allowing spouses to be separate under certain conditions; No limit on marketing assistance loan benefits from commodity certificate exchanges or from crop forfeitures

Farm Bill Name and Year	**Payment Limits**	**Definitions and Changes**
Federal Agriculture Improvement and Reform Act of 1996	$40,000 limit on production flexibility contracts; $75,000 total combined payment limit for marketing loans gains and loan deficiency payments	No limit on marketing assistance loan benefits from commodity certificate exchanges or from crop forfeitures
Agriculture Appropriations Act for FY 2000	Increased marketing loan gain and loan deficiency payment limit to $150,000; $40,000 limit on production flexibility contracts	

Farm Bill Name and Year	**Payment Limits**	**Definitions and Changes**
Farm Security and Rural Investment Act of 2002	$40,000 total combined direct payment limit for all covered commodities; $40,000 separate direct payment limit for peanuts $65,000 total combined counter-cyclical payment limit for all covered commodities; $65,000 separate counter-cyclical payment limit for peanuts; $75,000 total limit for marketing loan gains and loan deficiency payments for covered commodities; $75,000 separate total limit for marketing loan gains and loan deficiency payments for peanuts, wool, mohair, and honey	No limit on marketing assistance loan benefits from commodity certificate exchanges or from crop forfeitures; Introduction of Adjusted Gross Income limit; Producer ineligible to receive benefits if AGI is greater than $2,500,000, unless greater than 75% of the producer's AGI derives from farming

Farm Bill Name and Year	Payment Limits	Definitions and Changes
Food, Conservation, and Energy Act of 2008	$40,000 total combined direct payment limit for all covered commodities, with a separate $40,000 direct payment limit for peanuts; $65,000 total combined counter-cyclical payment limit for all covered commodities, with a separate $65,000 counter-cyclical payment limit for peanuts; $65,000 total combined ACRE payment limit for all covered commodities, with a separate $65,000 ACRE payment limit for peanuts; Disaster payment limit of $125,000 for ELAP, LFP, and LIP combined	Separate disaster payment limit for TAP; Separate disaster payment limit for NAP; Commodity certificate exchanges eliminated; No limit for marketing assistance loan benefits or loan deficiency payments, regardless of whether they used commodity certificate exchanges or crop forfeitures; Change in definition of "person" o Defined as "a natural person," and DOES NOT include a legal entity;

Farm Bill Name and Year	**Payment Limits**	**Definitions and Changes**
Food, Conservation, and Energy Act of 2008 (continued)		Eliminated the three-entity rule; Established requirement of "Direct Attribution" ○ States that a payment cannot be made to a legal entity, but must be made to "persons" with interest in the legal entity ○ Attribution is made to the fourth level of ownership; Same AGI requirement as 2002 bill

Farm Bill Name and Year	**Payment Limits**	**Definitions and Changes**
Agricultural Act of 2014	$125,000 total combined payment limit for all covered commodities and crop programs; Separate $125,000 limit for peanuts; $40,000 limit for cotton transition payments for 2014-2015	Return to no limit on marketing assistance loan benefits if crop is forfeited; AGI limit set to $900,000
Consolidated Appropriations Act of FY 2016	No change	Reinstated commodity certificate exchanges; No limit on marketing assistance loan benefits under CCE's or if crop is forfeited

APPENDIX B

TABLE 12B, UNSCALED TEXAS AND CALIFORNIA RICE FARMS LONG RUN AVERAGE COST TABLES (2016-2017)

Table 12b. Unscaled Texas and California Rice Farms Long Run Average Cost Tables (2016-2017)

Texas Rice	Size Category (Acre Range)	0-1000	Rep Farms	
	Average Number of Farms	174	TXR	TXR
	Average Sample Size	5	1	1
	Acres	525	1500	3000
	Costs/Acre	576	385	431
	Costs/Receipts	0.59	0.73	0.82
California Rice	Size Category (Acre Range)	0-1000	Rep Farms	
	Average Number of Farms	1,020	CAR	CAR
	Average Sample Size	35	1	1
	Acres	407	1200	3000
	Costs/Acre	1,060	1,071	1,367
	Costs/Receipts	0.70	0.86	0.98
California Rice	Size Category (Acre Range)	0-1000	Rep Farm	Rep Farm
	Average Number of Farms	1,020	CABR	CACR
	Average Sample Size	35	1	1
	Acres	407	1000	800
	Costs/Acre	1,060	1,168	1,389
	Costs/Receipts	0.70	0.86	1.08

APPENDIX C

FAPRI BASELINE PROJECTIONS

Table 13. FAPRI August 2018 Baseline Projections of Crop Prices, 2016-2025.

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Corn ($/bu.)										
August 2018 Base	3.36	3.4	3.62	3.83	3.85	3.87	3.85	3.79	3.76	3.75
Wheat ($/bu.)										
August 2018 Base	3.89	4.73	5.12	5.11	5.16	5.21	5.16	5.16	5.05	5.03
Cotton ($/lb.)										
August 2018 Base	0.68	0.68	0.7516	0.712	0.7104	0.6983	0.7019	0.6998	0.7071	0.7058
Sorghum ($/bu)										
August 2018 Base	2.79	3.2	3.34	3.68	3.6	3.58	3.55	3.51	3.49	3.48
Soybeans ($/bu.)										
August 2018 Base	9.47	9.35	8.73	8.95	9.29	9.39	9.23	9.14	9.09	9.06
Barley ($/bu.)										
August 2018 Base	4.96	4.47	4.61	4.75	4.8	4.79	4.76	4.7	4.64	4.63
Oats ($/bu.)										
August 2018 Base	2.06	2.58	2.82	2.58	2.67	2.67	2.67	2.65	2.63	2.62
Rice ($/cwt.)										
August 2018 Base	10.4	12.5	12.25	12.64	12.55	12.32	12.36	12.34	12.38	12.56
Soybean Meal ($/ton)										
August 2018 Base	302.24	333.83	299.92	304.81	312.34	315.2	311.36	308.8	307.26	304.04

Source: Food and Agricultural Policy Research Institute (FAPRI) at the University of Missouri-Columbia.

Table 14. FAPRI August 2018 Baseline Assumed Rates of Change in Input Prices and Annual Interest Rates, 2017-2025

	2017	2018	2019	2020	2021	2022	2023	2024	2025
Annual Rate of Change for Input Prices Paid									
Seed Prices (%)									
August 2018 Base	-0.91	-1.25	2.17	1.93	2.03	1.85	1.54	1.28	1.19
Fertilizer Prices (%)									
August 2018 Base	-7.12	-0.34	2.38	-3.97	1.67	1.5	1.19	2.04	2.4
Herbicides Prices (%)									
August 2018 Base	-3.74	0.48	2.9	2.3	2.59	2.24	1.97	1.87	1.91
Insecticide Prices (%)									
August 2018 Base	-5.01	0.23	2.72	2.45	2.52	2.27	2.09	2	2
Fuel and Lube Prices (%)									
August 2018 Base	13.67	10.14	-0.49	-2.45	-1.01	1.51	2.4	3.05	4.13
Machinery Prices (%)									
August 2018 Base	1.99	0.48	3.04	1.62	1.75	1.66	1.69	1.57	1.56
Wages (%)									
August 2018 Base	2.76	3.36	3.51	3.69	3.97	4.06	4.02	3.93	3.82
Supplies (%)									
August 2018 Base	1.22	2.9	2.16	2.31	2.04	1.88	1.93	1.88	1.8
Repairs (%)									
August 2018 Base	1.98	2.43	2.83	2.87	2.68	2.85	3.05	2.99	2.86
Services (%)									
August 2018 Base	-2.77	1.58	3.1	2.71	3.05	2.82	2.63	2.54	2.54
Taxes (%)									
August 2018 Base	1.39	1	4.27	4.05	2.23	2.78	2.73	2.69	2.67
PPI Items (%)									
August 2018 Base	-0.19	1.62	1.5	1.09	1.77	1.81	1.74	1.62	1.5
PPI Total (%)									
August 2018 Base	0.38	2.03	1.91	1.55	2.02	2.08	2.01	1.9	1.8
Annual Change in Consumer Price Index (%)									
August 2018 Base	2.14	2.58	2.09	2.3	2.2	2.33	2.44	2.48	2.45
Annual Interest Rates									
Long-Term (%)									
August 2018 Base	8.97	9.47	9.93	10.3	10.53	10.75	10.93	11.09	11.27
Intermediate-Term (%)									
August 2018 Base	7.26	7.67	8.04	8.33	8.53	8.7	8.85	8.97	9.12
Savings Account (%)									
August 2018 Base	2.49	2.63	2.75	2.85	2.92	2.98	3.03	3.07	3.13

Source: Food and Agricultural Policy Research Institute (FAPRI) at the University of Missouri-Columbia.