PERCEPTION OF FIXED DIRECT PAYMENTS:

EVIDENCE FROM A NATIONAL SURVEY

by

FARIZ AKIF AHMADOV

(Under the Direction of Barry J. Barnett)

ABSTRACT

The 1996 Federal Agriculture Improvement and Reform (FAIR) Act introduced fixed payments which unlike previous payment programs are designed to be "decoupled" from production decisions. In general, economists believe that fixed payments, which account for one-third of total United States government payments to farmers, are an efficient way to transfer income to targeted recipients. Further, fixed payments are believed to generate only minimal distortions in resource allocation decisions. This study, based on data from a national survey of farm households, examines how farm households allocate the proceeds from a fixed payment. In addition, the research examines what factors best explain how farm households indicate that they would allocate the hypothetical payment. Results indicate that the extent to which fixed payments can be considered "decoupled" depends on a variety of factors that describe the farm business, operator, and household.

INDEX WORDS: Decoupled Payments, Fixed Direct Payments, Trade Distortions, WTO Disputes, Allocation of Farm Payments

PERCEPTION OF FIXED DIRECT PAYMENTS:

EVIDENCE FROM A NATIONAL SURVEY

by

FARIZ AKIF AHMADOV

B.Sc. Engineering Economics, Azerbaijan Agricultural Academy, Azerbaijan, 2002

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2006

PERCEPTION OF FIXED DIRECT PAYMENTS:

EVIDENCE FROM A NATIONAL SURVEY

by

FARIZ AKIF AHMADOV

Major Professor: Barry J. Barnett

Committee: Michael E. Wetzstein
Glenn C.W. Ames

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
May 2006

ACKNOWLEDGEMENTS

I would like to express sincere gratitude to my major professor, Dr. Barry J. Barnett, for an excellent guidance throughout my research process and thesis preparation. I believe I could not have an academic advisor who would be better than you. I would also like to thank Dr. Michael E. Wetzstein for always being there when I needed help. It has been an amazing experience to both work with you and learn from you.

It is not possible to overestimate the strong support and wise guidance I received from Dr. Glenn C.W. Ames starting from my first days in Athens. I thank you for all your efforts you put in to see me graduate. I thank Dr. Ashok Mishra from ERS/USDA for assisting and guiding me throughout the empirical analysis. Likewise, I want to thank Dr. Hisham El-Osta, Dr. Kenneth Ericsson, and Dr. Mary Clare Ahearn for the great ideas that contributed into my understanding of concepts and techniques used in my thesis. I am deeply indebted to Erdal Kara, a Ph.D. student from the University of Wyoming for assistance in designing my SAS codes.

There is no way I can ever overemphasize all the support I received from Tatiana Gubanova. I am also grateful to Carrie Neely, Katia Romero Leon, Ozgur Kaya, Julia Beckhusen, Yongchong Mao, and Joseph Goodenbery for their friendship and hospitality. Finally, none of my achievements would be possible without support and blessings from my family that I have not seen for the last two years. Though you were so far away from me, I constantly felt your love, patience and understanding.

I am deeply grateful to the Muskie Fellowship Program by the Bureau of Educational and Cultural Affairs, U.S. Department of State, for the financial support of my graduate study.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

Federal government policies to subsidize farmers were initiated in the United States more than sixty years ago during the Great Depression when world agricultural markets had collapsed and farmers were numerous and impoverished. Current government programs continue making various types of payments to farmers with the objective of supporting their incomes. The fixed direct payments or Production Flexibility Contract (PFC) payments introduced with the Federal Agriculture Improvement and Reform (FAIR) Act in 1996 help maintain farm income in a manner that proponents argue does not distort farm-level production decisions and encourage overproduction. They believe that these payments generate only minimal distortions in resource allocation decisions. They are also believed to be an efficient way to transfer income to targeted recipients.

From the New Deal Programs to Market Transition

Though the origin of U.S. governmental intervention in agriculture goes back to the foundation of the country, commodity farm programs did not originate until the Great Depression. The main efforts to get the U.S. government directly involved in protecting farmers started in the early 1920s and culminated in the New Deal programs in the 1930s. The policies were aimed at stabilizing and supporting farm incomes and agricultural markets. They have survived to the present day.

The Agricultural Adjustment Act of 1933 intended to control production as a way to keep supply from increasing and to control prices for major crops. The Act was ruled unconstitutional by the Supreme Court because it was paid for by a tax on processors. The 1938 Agricultural Adjustment Act introduced price supports for major crops. The costs were paid with general tax revenue. The price support programs continued until 1985 for most crops (until 2002 for peanuts), and were carried out through the nonrecourse loan program, where the loan rate was a price floor. The major negative consequence of these price support programs was the creation of a surplus of farm commodities (Gardner, 2002).

The deficiency payment program was introduced during the 1970s. This program provided farmers with direct payments with a requirement to keep producing the same crop in order to stay eligible for program participation. They were designed to make up the difference between the market price and a target price legislated by Congress for major field crops. Therefore, these payments were tied to production and varied with market price. In the Food Security Act of 1985 the Marketing Loan Program replaced price supports for major crops. While the Marketing Loan Program supported the prices received by farmers the loan rate was no longer a price floor and the government did not take possession of surplus commodities.

The Movement to Direct Payments

The FAIR Act of 1996 broadly introduced decoupling and flexibility features under the PFC payments (see Figure 1-1) and replaced deficiency payments. These payments were continued through the Farm Security and Rural Investment (FSRI) Act of 2002 under the name of fixed direct payments. The policy objective behind these payments was to compensate producers for the elimination of deficiency payments and initiate a transition to a free market.

Initially direct payments were designed to decrease over time and eventually completely phase out, however due to low prices during the 2000-2002 period, the FSRI Act of 2002 increased spending on the program. Unlike the deficiency payment program, the fixed direct payments do not require that the farmer produce a specified crop nor do they vary with market prices.

Another advantage of fixed direct payments is that they also provide flexibility of planting to the farmers. The farmers receiving these payments do not have to produce the specified crop on base acres. In fact they are not even required to produce anything during the year in which they receive payment. This allowed farmers to rotate crops. However, there were some crops which were excluded from being planted on base acres. They mainly include fruits and vegetables. The FSRI Act also introduced payment limitations of $40,000 per recipient.

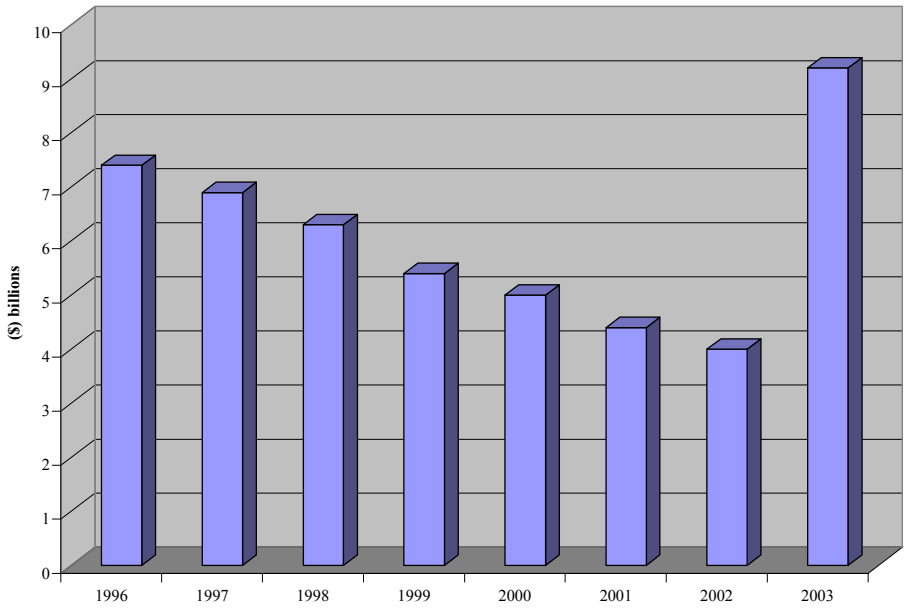

Figure 1-1: U.S. fixed direct payments (Source: ERS/USDA)

The calculation of direct payments is provided using a cotton example. It is based on payment base acres, which were used as a base to receive deficiency payments prior to 1996, payment yield, and direct payment rate. In addition, payments are made on 85% of base acres. So, if a farm business used base acres to grow cotton prior to 1996 and received deficiency payments in the past, then based on the values of base acres and payment yield shown below the amount of direct payment is calculated in the following way:

Base acres = 500 acres;

Payment yield = 750 lbs/acre;

Direct payment rate for cotton: 6.7¢ per pound (specified in the 2002 FSRI Act);

Payment = 500 acres x 750 lbs/acre x 6.7¢ per pound x 0.85 = $21,356.25 per year.

Decoupling issue and WTO implications

The distortionary effects of domestic farm support programs became an important issue during the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) and World Trade Organization (WTO) negotiations in the 1980s and 1990s. Domestic farm programs were treated as trade-distortionary and thus were targeted for eventual reduction just like any export subsidies. This created the need to establish a classification scheme which divides domestic policies based on the extent to which they were considered to be trade-distorting (see Figure 1-2). Those programs that supposedly cause only minimal trade distortions, such as conservation programs, food aid, spending on research and extension services would fall under the “green box” policies and were not subject to the limits on overall domestic support.

The blue box was originally designed to exempt the U.S. and European Union's agricultural subsidy programs from the Amber Box. While it is no longer used by the U.S. it is still somewhat used by the European Union.

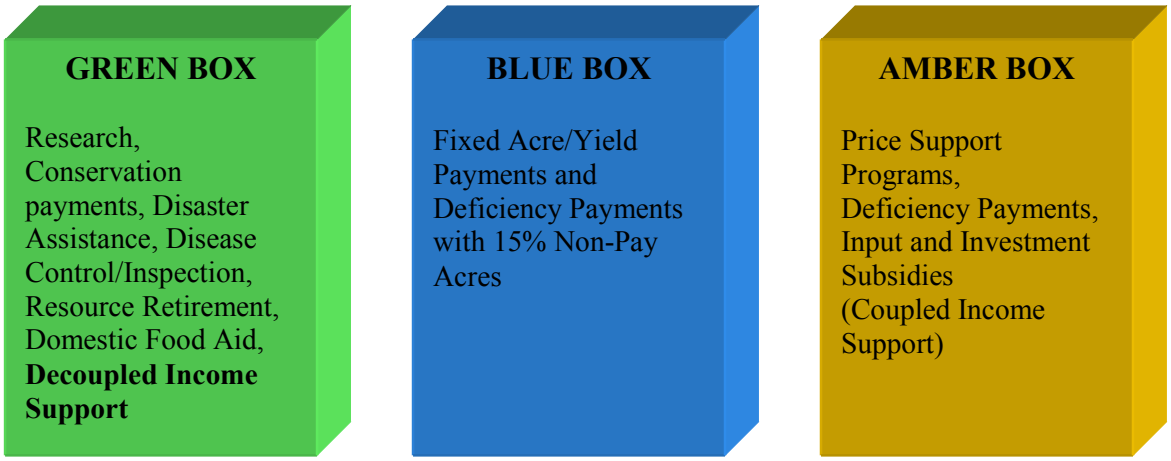

Figure 1-2: WTO Boxes for classification of domestic agricultural policies and programs

Any government support that does not qualify to be in the green or blue box falls by definition under Amber box, also called Aggregate Measure of Support (AMS). The current U.S. Marketing Loan Program as well as sugar and dairy price support programs fall under this category. All amber box policies and programs are subject to limitations. The figure 1-3 demonstrates the U.S. support and WTO amber box limits.

Decoupling involves the separation of fixed income support payments to farmers from agricultural market prices and production decisions. Theoretically farmers are expected to make all of their production decisions based on market prices while the amount of fixed payments they receive from government is independent of current (as well as future) production and market decisions.

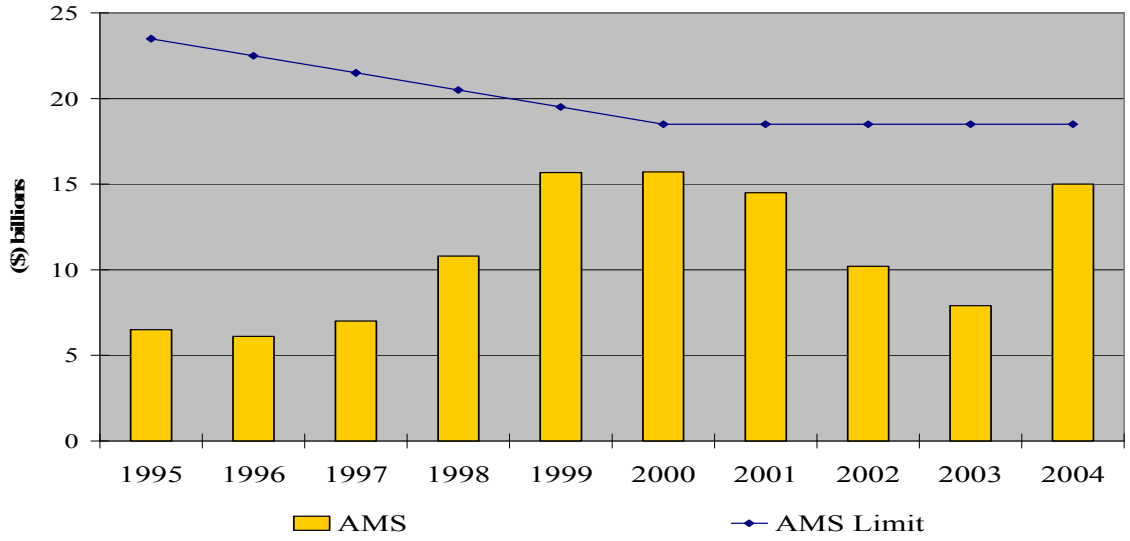

Figure 1-3. U.S. Amber Box limits and actual support.

Historically the payments were proposed by the Reagan administration during the Uruguay Round of GATT as a means to allow trade patterns to be more influenced by market forces and at the same time to provide income support to farmers. They have also been supported as a means to allow agricultural exports to be more competitive in international markets without price and production support programs and to reduce or eliminate the need to control production and supply.

According to WTO guidelines the following conditions are necessary for a payment to be considered decoupled and not to affect production:

- Payments must not be tied to planting decisions and should only be tied to a fixed base acreage and yield so as not to stimulate additional acreage of crop;

- Payments must not be tied to current quantity of crop planted so that planting decisions are made based on market prices;

- The amount of the fixed payment must be known in advance and completely separated from fluctuations in market prices or in yields.

The U.S. considered fixed direct payments under the FSRI Act of 2002 just like the PFC payments to be a "green box" policy because there were presumed to be decoupled from production. Due to such classification of direct payments, they were not considered during the negotiations for reduction in support until recently when Brazil started a dispute with the U.S. in the WTO. Part of that dispute involved a claim that the fixed payments were not decoupled because of the fruit and vegetable exclusion. The U.S. fixed payments do not allow farmers to grow vegetables so they are not totally decoupled. This issue has already been discussed in the WTO and the final judgment was that the U.S. needs to get rid of the exclusion on planting fruits and vegetables.

Cotton case in WTO disputes and U.S. position

The fixed payments have been the focus of significant attention during the recent World Trade Organization (WTO) round of negotiations. The debate centered on the extent to which the U.S. fixed payments (and similar payments in the European Union) are really decoupled from farm-level production decisions.

The extent to which U.S. fixed payments can still be considered truly decoupled, even after fruit and vegetable exclusion will be removed, still remains under question. Some critics have claimed that even fixed direct payments spur agricultural production and drive down prices. Specifically, the opponents argue that income support provided to U.S. cotton farmers through fixed direct payments creates incentives to produce more cotton and thus suppresses world cotton prices. They discussed various mechanisms by which fixed payments may affect

production decisions. Some pointed out that agents with risk-averse preferences would be willing to assume more risk as wealth increases from fixed payments since such an increase lowers their aversion to risk. Others argued that fixed payments may allow producers to cover production costs and thus may allow marginal farmers that would otherwise be forced to shut down to remain in production. Meanwhile, others pointed out that fixed payments may improve producers' access to credit by raising wealth directly and through increases in land values.

The WTO panel rejected the arguments of critics, essentially siding with the overwhelming body of agricultural economics literature showing that these payments have no more than minimal effects, which distort production and trade. Though current WTO global rules do not restrict fixed payments since they are treated under the "green box" which exempts them from the requirement for reduction in total farm support for the implementation period, the potential for placing restrictions on such payments could be discussed during the negotiations among member-countries and decoupling issue could certainly be used as an argument in a future case.

Problem statement and objectives

This thesis, based on data from a national survey of farm households, investigates further how farm households perceive the fixed payments and thus, has an objective to enrich the existing literature on the efficiency and rationality of fixed payments as a means of income transfer. This is accomplished via two specific objectives. The first is to examine what factors explain differences in how farm households indicate that they would allocate a hypothetical fixed payment between generalized farm and household categories. The second objective is to examine what factors explain differences in the specific farm (household) uses to which the funds would

be allocated. Better understanding the factors that explain how households choose to allocate fixed payments provides insights into the extent to which these payments can be considered decoupled. The specific objectives of the thesis are:

1. Use the national survey data to determine the factors that would explain the allocation behavior of participants in fixed payment government program as well as the hypothetical allocation behavior of non-participants and compare the results;
2. Determine the factors that explain farm households' allocation to specific farm and household uses.

Organization of the thesis

This thesis is organized into six chapters. The literature review covers the most recent theoretical and empirical work on the decoupling issue, especially the effect of decoupling on production decisions. In addition, it includes some body of economics literature devoted to farm households' allocation and investment decisions, since the study uses the approach of farm-level allocation decisions to investigate farm households' perception of direct payments. Chapter three introduces and discusses the conceptual framework used for the study and explains major assumptions made for the analysis. Chapter four provides a detailed description of the econometric methods and data, while chapter six presents and discusses the empirical results of the analysis. Chapter six closes the thesis with conclusions and its broader implications.

CHAPTER 2

LITERATURE REVIEW

The purpose of this chapter is to provide a survey of previous literature on the decoupling issue and household allocations of fixed direct payments. The chapter begins with early studies which were based on general static models. Next is a discussion of recent contributions to the literature on decoupled payments. It specifically covers the frameworks which were used to investigate possible scenarios for distortions caused by direct payments. A special discussion is devoted to recent studies conducted by Goodwin and Mishra which introduced an alternative approach based on perception of direct payments by farmers. The final section discusses general literature as well as specific findings of research in the field of farm household allocations and investments.

Early studies

The issues of decoupling and the effect of decoupled payments on production decisions and supply have been analyzed using various approaches and frameworks. A great majority of empirical studies (OECD, 2005) focused on the analysis of the acreage and/or production response to the direct payments made to US farmers of wheat, feed grains, cotton, and rice under the FAIR Act of 1996. These studies are based on the general theory that the impact on production of any type of government financial support for agriculture depends on the exact nature of the program through which the support is being provided as well as on the incentives that the program creates and the behavior of producers in response to those incentives. These

studies are based on the idea that farmers respond to changes in relative prices and returns created by government programs.

The general literature supports the several mechanisms through which fixed payments might potentially impact production decisions (OECD, 2001). Most studies assume the existence of market imperfections including constrained capital markets and uncertainty. Some consider a dynamic framework to introduce intertemporal links into the producers' decisions. However, it is still useful to look at the effects of decoupled subsidies in the deterministic and static world.

The majority of early studies focused on the static effects of agricultural income support in the absence of uncertainty. They considered various cases under which the overall effect of decoupled income support is either ambiguous or such that it leads to an increase in production. However, this is too simplified a world and assumes non-increasing returns to scale and perfect markets with no constraints. Rude (2000) assumed increasing returns to scale and farm debt constraints and came to the conclusion that under such an assumption government payments may affect total production. Benjamin (1992) utilizes the farm household model to explain farmers' production decisions and concludes that if the labor market is perfect, production decisions would be separated from consumption decisions, so that lump sum income transfers would have no production effect. However, if the labor market is imperfect, production and consumption decisions would be made simultaneously. In this case, lump sum payments will affect production decisions made by farmers. Using the same type of model OECD (1999) estimated that lump sum income transfers will have a negative effect on farm labor supply and production.

Wealth and risk effects

Farmers, just like any other economic agents, face some degree of uncertainty (at least from price) in their decision making process. Hennessy (1998) developed a neo-classical framework for the analysis of income support policies under uncertainty which was used by Mullen et al (2001) in their study. He assumes that a farm business maximizes the expected utility of profits. He finds two kinds of effects under uncertainty that cause the farmer to be risk averse – wealth and insurance effects. However lump sum payments only cause wealth effects but no insurance effect. The government payment affects the total wealth of the farmer and this change in wealth can affect farmers' risk attitude. Hennessy argues that if absolute risk aversion is reduced by the wealth effect (declining absolute risk aversion), farmers who receive government payments will be willing to face more risk and therefore will produce more. In addition, OECD (2001) shows that payments may make producers less risk averse than otherwise, causing them to expand production by planting crops on land that would otherwise be viewed as too risky.

Makki, Somwaru, and Vandeveer (2004) review the empirical studies of risk aversion of U.S. farmers. These studies generally found evidence of risk aversion for most U.S. farmers but with a wide range of risk attitudes. Thus, although farmers who receive fixed payments likely display varying attitudes toward risk, it is certainly possible that fixed payments cause some farmers to assume more risk. Yet, Makki et al. conclude that the resulting effects on production are likely to be small for several reasons. Payments are on the average low (less than 3 percent) relative to the net worth of participants. They fully agree that fixed payments might influence production through "risk effects" in a way that such payments increase farmers' income and wealth and they become less risk averse. However, this change in attitude could then be

manifested through changes in input use, a new output mix, and changes in overall production. Farm production is only one of many outlets farm households use to take on additional risk. Surveys find that producers use various tools – such as insurance, hedging, and management strategies – to reduce risk. Farm households can respond to changes in their risk attitudes with adjustments throughout their portfolio, such as off-farm employment and investing in non-farm real estate or financial assets. Finally, they review the small empirical literature on risk-related production effects of fixed payments, which finds minimal production impacts.

Another part of the literature is based on the Newbery-Stiglitz model (Newbery and Stiglitz, 1981) which allows labor supply decisions by the farmer to affect production decisions. This is a risk version of the farm household model discussed above (OECD, 1999). The Newbery-Stiglitz model assumes not only labor market imperfections, leisure as a normal good, and uncertainty, but also that farmers cannot separate production and consumption (as well as labor supply) decisions. The results of the model show payments that are fully decoupled under certainty will have production effects under uncertainty.

Mullen et al (2001) use a similar approach to examine risk reduction effects of fixed payments as well as other government payments. Producers are assumed to face output price uncertainty and to maximize the expected utility of initial wealth and profit under decreasing absolute risk aversion. The fixed payments are assumed to have an effect on production decisions only through the wealth effect. The results obtained suggest that the fixed payments had only a minor effect on production in the year examined (1998).

Even if producers are not risk averse, expectations about the conditions attached to the future payments might influence production decisions. The most relevant case provided by OECD (2001) is the one in which producers have reason to believe that there might be future

updating of the area upon which payments are based. In such a case, producers might be reluctant to reallocate acreage from program crops to other crops or to idle marginal land in order to protect their future eligibility for payments. For there to be a link between current payments and these production decisions, producers would have to believe that the existence of payments today is a predictor of payments in the future, or that current levels of payments provide an indication of what future payment levels might be. Goodwin and Mishra (2006) evaluated the effect of base updating on acreage. Their results do not exhibit a statistically significant effect on acreage allocations.

Intertemporal choice and imperfect capital markets

Farmers also need to take into account the impact of current decisions on future profits. Then, a dynamic model would assume that farmers make an intertemporal choice involving current and future profits (OECD, 2001; Roe et al., 2004). Such choice would involve investment decisions and would have different effects depending on whether capital markets are perfectly competitive or not. Capital goods can be used at least partially in future production years. This means that production should be a function of several inputs including the current level of capital, which depends on past investment decisions. The farmer must decide each year how much to produce and how much to invest in the farm, taking into account that any additional capital will affect both current and future production.

Roe et al (2004) use an intertemporal multi-sector model to examine the market effects of fixed payments. Their economywide analysis finds that if agricultural markets are perfectly integrated with capital markets in the rest of economy and if those who are taxed and those who receive payments hold identical preferences for goods and services, then the key effects of

payments over time are to increase land values, the wealth of program recipients, and their expenditures on final goods. Over the long run, recipient households respond to declining rates of return to agricultural capital by increasing their consumption and lowering their savings rate until the rates of return between farm and non-farm assets are "re-equilibrated". As a result, the small production increases in the short-run, less than 0.2 percent, become negligible in the long run.

If capital markets are perfectly competitive, the production and investment decisions will be independent of consumption decisions. The level of optimal investment will be based on the rate of the return from the farm investment compared to the market interest rates. Farmers are going to adjust their pattern of consumption and investment decisions across time, using capital markets to borrow or lend freely. Then, statically fully decoupled payments will not affect investment decisions. They will also be fully decoupled in a dynamic sense.

However, if capital markets are imperfect, then any agricultural program, no matter whether it is coupled or decoupled, will affect farmers' investment decisions (OECD, 2001). In fact, no agricultural policy affecting farmer's income will be fully decoupled in a dynamic sense. When producers face a capital constraint, they are limited in their ability to secure capital from traditional lenders, and then the additional income generated from payments may allow them to relax that constraint by investing more heavily in farm operations out of earnings generated by the farm business. OECD (2005) suggests that producers will use the funds provided by payments for production-enhancing investments, rather than for any other purposes.

Based on this theory, Young and Westcott (2000) argue that greater cash flow provided by decoupled payments and higher wealth may facilitate more production through increases in agricultural investment if farmers otherwise face credit constraints or limited liquidity. Some of

the payments are likely to go to consumption, savings, and non-farm investments, with the largest share typically going to consumption. But, farm investment could also rise. The reasoning behind this conceptual argument is based on the idea that for credit-constrained farmers, lenders may be more willing to provide loans to farmers with higher incomes, higher farm equity, and lower risk. This may allow more farmers to increase their farm investments.

Collender and Morehart (2004) examine empirical evidence of the extent to which capital imperfections may affect farm investment and production. According to them, imperfections in capital markets do exist but they do not appear to influence aggregate investment. Some farmers may face a credit constraint (for liquidity or for capital) and thus the receipt of decoupled payments would allow them to continue or expand production. In addition, in a capital-rich economy where few farmers are likely to be capital constrained, any impact of decoupled payments would be transitory. Farmers that cannot afford efficient levels of investment in productive capital would soon be induced by competitive forces to relinquish control of their assets to unconstrained farm owners or managers.

Discouragement of farm exit decisions

Chau and de Gorter (2000) looked at one more effect – the existence of payments may prompt some producers to remain in agriculture rather than exiting the industry. In their model fixed payments have an impact on production only when the possibility of farm exit is included. If exit would result in land abandonment or the conversion of land to other crops, the provision of payments would result in the production of supported crops being maintained at a higher level than would otherwise be the case. In contrast, the exit of less efficient farmers may result in the land being acquired by more efficient farmers – those with superior managerial skills – who are

able to produce profitably at existing market prices. The merger of land parcels may cause an increase in economies of scale, leading to increased production efficiency and lower average costs of production. Larger scale farms may be in a better position to obtain financing from lenders to fund purchases of variable inputs or to make investments which would increase output. Any of these effects related to the exit from farming and resulting structural changes might lead to an increase in production in the presence of payments.

Chau and de Gorter estimated that the removal of fixed payments in 1998 would have resulted in an exit of 3.4% of wheat farms and a decline in wheat production of 3.4%. However, they also concluded that though removal of fixed payments can have a relatively large impact on the exit decision of low-profit farm units, the impact on its aggregate output can remain quite modest as long as the output level of the marginal farm is relatively small. They note that their results are sensitive to the distribution of payments across farm size and they did not consider the possibility that land and machinery owned by exiting farmers could be rented or sold to other farmers, which would diminish the impact of the payments on production.

Acreage response models

A significant body of literature covers econometric studies of land allocation and acreage response. Adams et al (2001) used a variety of econometric models to analyze the relationship between a state's total crop area and the sum of fixed payments. All of their models show that the fixed payment variable is statistically insignificant. Key et al. (2004) used farm-level panel data and found that growth rate of program crop acreage among participants was greater than that of non-participants. The authors suggest two possible explanations for their results. One is that program participation rules associated with pre-1996 programs effectively acted to limit

program acreage in 1992. When these rules were relaxed under the FAIR Act, acreage in program crops increased. An alternative explanation is that payments under the FAIR Act were distortionary, and led farmers to produce more than they would have without the payments. The authors note that additional research would be needed to examine these two explanations.

Goodwin and Mishra (2005) estimated acreage models which incorporate market prices, fixed payments per acre, and variables that attempt to capture the indirect effects of fixed payments on area response through farmers' aversion to risk and capital constraints. They estimated their models not only at the farm level but also on the county level mainly because in the farm-level data individual farms are not observed over time.

They found that the direct effect of fixed payments on acreage decisions is very small, though in some cases statistically significant for corn and soybeans. Though the exact mechanism by which fixed payments affect acreage response – wealth effects, changes in risk preferences, capital constraints, or changes related to the anticipation of future benefits – is not identified in the analysis, it is clear that allegations regarding the substantial production effects are not supported, at least for these data. This does not mean that there is not at least a limited potential for distortions to arise as a result of the provisions of fixed payments. These results are similar to those obtained from the aggregate model by Burfisher and Hopkins (2003).

Goodwin and Mishra also found that acreage is not affected by wealth, thus perhaps implying that any risk preference shifts caused by different levels of wealth do not appear to affect crop acreage. This is in contrast to the findings from other work (e.g. Hennessy, Chavas and Pope, Pope and Just) that suggested important wealth effects on risk preferences and production.

Goodwin and Mishra evaluated the effects of fixed payments on alternative production practices, like conservation reserves, pasture, forest, set-asides, fallow, and other idling practices. Their results suggest that higher fixed payments tend to be associated with more intensive use of land. These results indicate that fixed direct payments are correlated with lower amounts of land being put in fallow or set-aside, though the extent to which this reflects the fact that farms with more crop land naturally are those that have higher historical base and thus higher fixed payments is unclear. In general, the models used for land idling suggest that the provision of direct government payments, even in cases where the payments are not tied to production of a particular crop, may lead to less idling of land and thus may result in more land being in production. This may reflect either the wealth or risk effects noted above. Alternatively, these results may provide evidence consistent with these policies easing capital constraints on agents and thus permitting greater use of land resources.

Goodwin and Mishra also considered the acquisition of new owned land resources by farms. An interesting result is that the direct effect of fixed payments on the decision to purchase land is not statistically significant. Though estimates suggest that the provision of payments may lead to more land ownership transactions, the effect is not significant for the average farm in their sample and is very small even for farms that have no insurance or debts. This may reflect a general lack of capital constraints that could inhibit the acquisition of land. Even if a larger effect were indicated, one could not necessarily conclude that this would involve the introduction of new land into production, since this may merely involve the exchange of ownership of land that was already in production.

Estimates from the county-level data show that fixed payments again appear to have a positive relationship with crop acreages at the county level, though once again the effect is very small. The effects on acreage are only statistically significant for soybeans.

Resource allocation and off-farm investment decisions

Burfisher and Hopkins (2003) suggest that decoupled payments might impact upon the farm household's labor-leisure choice. Ahearn et al. (2002) analyze the impact of government payments on off-farm labor force participation decisions and hours worked off the farm by farm operators. Their results indicated that government payments reduced the probability of working off the farm. However, these estimates were relatively small. For example, for 1999 the authors estimated the elasticity of hours worked off the farm by the farm operator with respect to fixed payments at the level of about -0.01.

El-Osta et al. (2004) used 2001 farm household data from Agricultural Resource Management Survey (ARMS) to analyze the impacts of government payments on on-farm, off-farm work hours, and total work hours among farm operators. They found that the impact of fixed payments on on-farm work hours was statistically significant but small in magnitude. Their results indicate that the elasticity of on-farm work hours by the farm operator with respect to fixed payments was about 0.02. They also found a statistically significant and negative impact of fixed payments on off-farm work hours by the farm operator, with an elasticity of -0.05, while their impact on total work hours were statistically insignificant.

Dewbre and Mishra (2002) used 1998-2000 ARMS data to analyze the impacts of government payments on leisure hours and on-farm work hours by farm operators and their spouses. The impacts of fixed payments on on-farm work hours were statistically insignificant

for farm operators or spouses. The impacts of fixed payments on leisure hours were statistically significant and positive but very small in magnitude, with an elasticity of approximately zero for both farm operators and spouses. Unlike Ahearn et al. (2002) and El-Osta et al. (2004), Dewbre and Mishra (2002) focus not only on commercial farms, but also on retirement and leisure/lifestyle (hobby) farms.

Goodwin and Mishra (2005) use 2001 farm household data from ARMS to analyze the impacts of fixed payments and other variables on off-farm work by farm operators. They find that fixed payments have a negative and statistically significant impact on off-farm work hours. Among farm operators working off the farm, their results imply an elasticity of off-farm work hours with respect to fixed payments of approximately -0.51. This elasticity seems quite large, and it is possible that the fixed payments variable was serving as a proxy for other government payments or the scale of the farming operation.

Previous studies looked at the general allocation of resources or funds towards farm and off-farm uses. Their findings contribute a useful perspective to understanding the response of U.S. farm households to decoupled income transfers. This views holds that the allocation of received payments can be traced through the flow of household's income and expenditure (see Figure 2-1). Government transfers contribute to total household income along with other income sources. A household makes decisions about the expenditure of government benefits on consumption or savings while taking into account tax liabilities. There is a tradeoff between these two main choices and it is influenced by the characteristics of the households including age, risk attitudes, expected yield on investments and many others. This approach was specifically used by Goodwin and Mishra (2006).

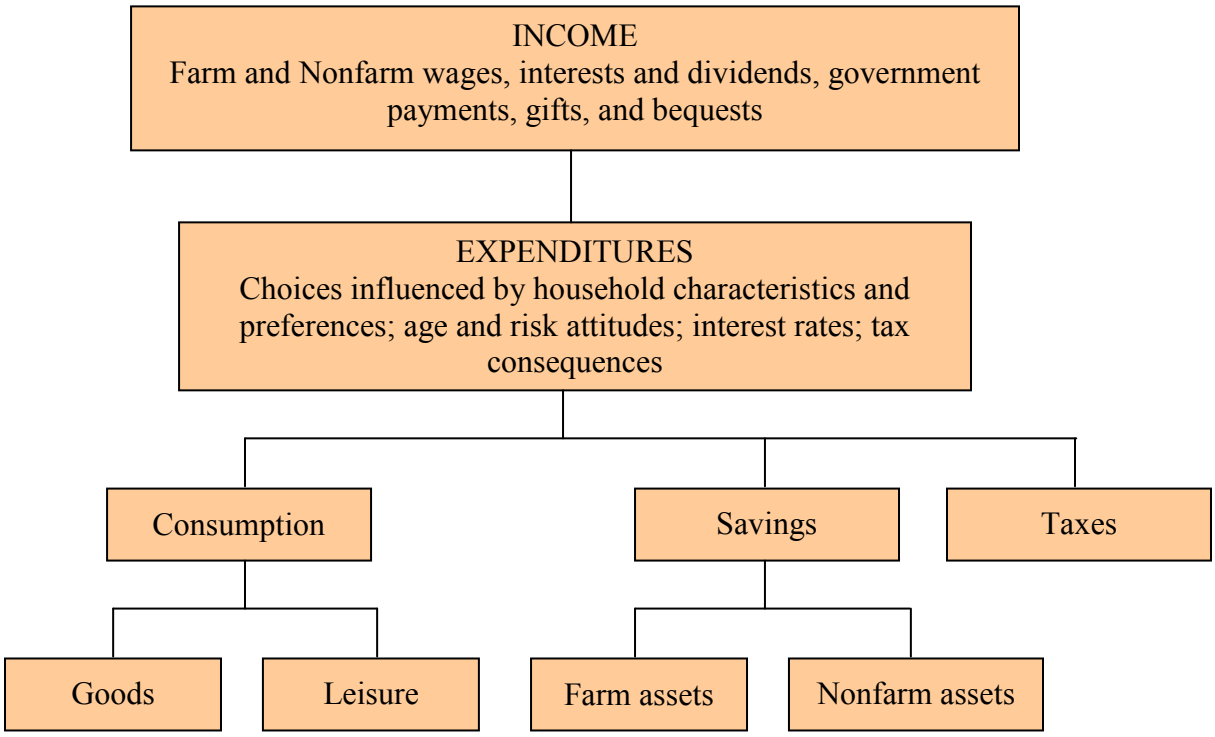

Figure 2-1: The flow of household income and expenditure

The decision by a farm operator to allocate part of the household income to non-farm use may be both rational and consistent with the goals of maximizing family well-being. This theoretical foundation was first suggested by Lee (1965) in his paper on allocating farm resources. Though his analysis was restricted to resource allocation at the farm level and dealt chiefly with farm labor, he stated that the same principles can be applied to any other resources. This was the first step to include non-farm use of farm resources in models of response to changes in economic stimuli and structural adjustment. Lee proposed that the farm operator can maximize household economic well-being ("satisfaction") by partially allocating available resources into non-farm uses. He justifies that by assuming that operator makes his investment

decisions based on expected returns to investment and thus it may be more optimal to allocate resources both to farm and non-farm uses rather than solely to either one of them.

Ahearn et al. (1993) determined that an increase in farm household's income will cause a rise in consumption and living expenditures. In addition, those households that operate larger farms are expected to have higher living expenses than do other households. Farm-level data from 2002 show that total consumption expenditures are higher than expenditures in the absence of payments from government. When comparing across most income distributions, those farm households that received payments consumed more than the ones with similar incomes but who did not receive payments.

Mishra and Moreheart (2001) investigated factors that affect off-farm investment by farm households. They used a logit analysis to analyze the effect of various farm, operator, and regional characteristics on off-farm investment decisions by farm households. The operator's level of education and age had positive signs and were significant in explaining off-farm investment decisions. Household net worth, farm size, and off-farm involvement had positive effects on off-farm investment. In the case of farm size, results suggest that large farms are more likely to be financially diversified than small farms. Increased farm diversification and higher debt reduced the likelihood of off-farm investment by farm households. Higher educated managers are more likely to invest off the farm.

Goodwin and Mishra (2006) updated and expanded their previous study using a modified approach. They evaluate farmers' reported allocations of fixed direct payment receipts among farm and non-farm uses. In addition, they presented an updated version of the acreage-response equations used in their previous study by adding a base updating variable (the results were discussed above). Their results indicate that operators of larger farms are more likely to report

significant on-farm usage of the funds received as direct payments. Operators that are highly leveraged are much more likely to allocate funds toward on-farm uses. This is consistent with the argument that direct payments may affect production through their effect on credit-constrained producers. Older farmers and farmers expecting to retire in the near future are much less likely to allocate direct payment receipts to on-farm uses. Wealthy farm operators are more likely to use direct payment receipts for on-farm purposes while high risk-averse operators are less likely to allocate direct payments to the farm. These results support the theory that if farming currently generates a high proportion of household income, then a risk-averse decision-maker might want to invest direct income payments off-farm for diversification purposes.

These results may have implications for the non-neutrality of direct payments. Farm operators report that a substantial proportion of direct payments are directed toward farm operating costs and other on-farm uses. However, the authors pointed out that many questions remain and, in some cases, the results reflect inconsistencies that merit further investigation. The results are also subject to caveats regarding the fungibility of funds across alternative uses.

CHAPTER 3

CONCEPTUAL FRAMEWORK

In this chapter a theoretical framework explains the decisions of individual farm households on the allocation of government payments. The main assumptions underlying the model are also presented.

Individual decision-making

Assume each individual household has three general choices to allocate the fixed direct payment: farm, household, or some combination of both. All three alternatives are assumed to be mutually exclusive for developing a model of individual decision-making behavior. Individual choice is based on household's preferences for increasing farm income and household utility. However, each individual is also constrained with a utility possibilities frontier (transformation function between farm income and household utility). Then, the decision to allocate the payment will correspond to the optimal solution where the slope of the utility possibilities frontier is equal to the slope of an indifference curve (see figure 3-1). Then three possible solutions to this problem are the points A, B, and C, which are mutually exclusive choices. Point B represents any combination of allocation to both farm and household.

The slope of utility possibilities frontier represents the opportunity cost of choosing to allocate more of the payment to the household use in terms of allocating less to the farm and is measured by marginal rate of product transformation ($dF/dH = MRPT$). The slope of the indifference curve implies household's willingness to substitute farm income for the utility of the

whole household (marginal rate of substitution, *MRS*). Thus, the optimal choice is where the opportunity cost is equal to the rate of substitution of farm income for household utility.

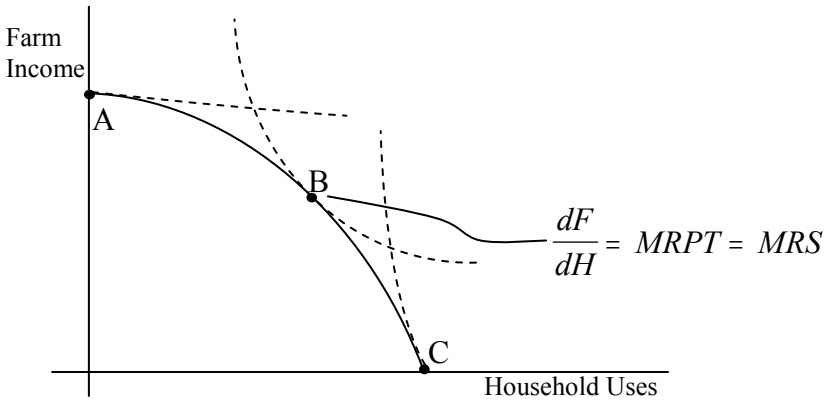

Figure 3-1. Three alternative choices for allocation of the government payment

The decision to allocate to the farm is based on profit maximization. This assumes that farm households perceive the farm payments as decoupled lump sum payments and all farm investment and planting decisions are made based on market prices. Farm income is a function of farm characteristics, farm tenure, type of commodity produced, and market strategies; while household utility is the utility the household derives from further education, better living, more leisure.

It is considered that the decision by a farm operator to allocate part of the farm payments to the household may be both rational and consistent with the goals of maximizing household's well-being and making efficient use of the payment. This theoretical foundation was used by Lee (1965) in his analysis of allocating farm resources between farm and nonfarm uses. Though his analysis was restricted to resource allocation at the farm level and dealt chiefly with farm labor, he stated that the same principles can be applied to any other resources. This was one of the first attempts to include nonfarm use of farm resources in the models that would explain a household's response to changes in economic stimuli and structural adjustment. Based on this

theoretical foundation one can propose that a farm operator can maximize the household's overall well-being ("satisfaction") by partially allocating available resources into nonfarm uses. This can be justified by assuming that that the operator makes investment decisions based on expected returns to investments and thus it may be more optimal to allocate resources both to the farm and nonfarm uses rather than to either one of them. This can also be supported by assuming that most farm operators are rational decision-makers and they know what they are doing with the money they have. If this is true then, farm households truly are able to make optimal allocations of farm payment toward available alternative uses.

Decisions under uncertainty

A household's decision on how to allocate farm payments is made under uncertainty. The household does not know for certain the risks and effectiveness of the allocation. The decision can be thought as discrete choice in which the expected net welfare from allocating all farm payments to the farm is compared with the expected net welfare of allocating all farm payments to the household or some combination.

Given this choice there is a probability associated with a household's allocation dependent on the returns from farming, π, household utility, U, and risk preferences, r. The household will then make a choice y (i = 1 all farming, 2 all household, or 3 combination) if it yields the highest expected utility

$$EU[y_i| \pi, U, r] > EU [y_j| \pi, U, r], \qquad \text{for all } i, j; \qquad i \neq j$$

where E is the expectations operator. The risk is a consequence of environmental and market uncertainty, since we assume that all production and planting decisions are made solely based on

the market prices. There is an uncertainty associated with allocating money towards non-farm assets as well. Then, the analysis can be cast in a discrete choice econometric model by appending additive stochastic elements to the expected utility function. This is discussed more in detail in chapter 4.

Wealth effect and investment portfolio decisions

As it has been discussed in the review of previous literature, theory explains that the only way for lump-sum payments to create incentive for increased farm investments and production is through the wealth effect. It is based on the idea that wealthier people are willing to take more risk than poorer people. Although this might be due to differences in utility functions across people, it is more likely that the source of the difference lies in the possibility that richer people can afford to take the chance (Mas-Colell et al, 1995). Therefore, assuming that farm households have a decreasing absolute risk aversion (DARA), farm operators are more likely to use the payment for risky investments rather than for the household uses. This happens because the receipt of the payment from the government increases household's wealth. This effect may not be significant, particularly because the amount of payment received in most cases is likely to be less than the overall wealth or income of the farm household.

To understand households' decisions of allocating the payment across specific farm and household uses, a slightly different approach for the analysis can be chosen. It considers that farm households might view the decisions of how to allocate the farm payment as part of investment portfolio decisions. According to ARMS data, most farm households manage a diversified investment portfolio (see Figure 3-2) and they can be assumed to maximize expected returns on their investments. Farm operators, just like any other investors, can make optimal

investment decisions by balancing the risk and tax-adjusted rates of return into non-farm assets instead of investing into farm assets only. Then, risk averse investors would be expected to invest more towards non-farm assets if they believe the latter ones bear less financial risk and/or greater expected returns. At the same time, an operator might choose to use some or all of the payment to cover living expenses, to build a cash reserve, and/or to pay down farm and non-farm debt to maximize expected utility.

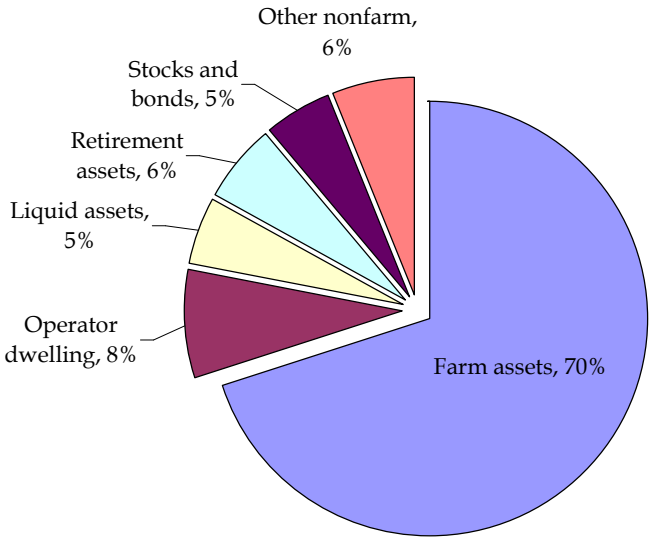

Figure 3-2. Farm households' investment portfolio. (source: ARMS, 1999)

Major assumptions

Major assumptions used for the analysis are the following:

1) farm production is subject to diminishing physical and economic returns;
2) all farm decisions are made by the operator based on current market prices and other market information;

3) the farm under analysis starts with a given stock of capital, labor, and land;
4) households' indifference curves between farm income and utility are identical;
5) farm payment is divisible as a monetary amount and is not subject to institutional and other constraints;
6) farm households have decreasing absolute risk aversion;

The model presented is static. It may be extended to the dynamic framework but available data for the analysis is taken from the specific survey questions that were only asked in the year of 2003. The model also ignores capacity constraints, as well as the fact that capital markets can be imperfect. However, the analysis relies on the finding by Collender and Morehart (2004) that imperfections in capital markets do not appear to influence aggregate investment. The empirical studies also indicate that any increased investment enabled under these circumstances would move the sector toward greater rather than less efficiency. In addition, in a capital-rich economy where few farmers are likely to be capital constrained, any impact of decoupled payments would be transitory. Farmers that cannot afford efficient levels of investment in productive capital would soon be induced by competitive forces to relinquish control of their assets to unconstrained farm owners or managers.

CHAPTER 4

DATA AND METHODS

ARMS Survey Data

The analysis is conducted using individual farm data collected under the ARMS project by the National Agricultural Statistics Service (NASS) of the USDA. These data are collected annually by means of a survey of individual farmers. The ARMS data represent the USDA's primary source of information about U.S. agricultural production conditions, marketing practices, resource use, and the economic well-being of farm households. It provides valuable information that describes the financial situation and characteristics of farm households and farm operators.

This thesis is focused on the data taken from the 2003 ARMS survey which includes several questions where farm operators who received fixed payments were asked to identify the allocation of funds received as fixed direct payments within their farm and household. An additional question in the survey asks those who did not receive fixed payments in 2003 to indicate where the money would be allocated if an unexpected payment of $10,000 were received every year for 6 years. The respondents reported the allocations among three available choices: 1) farm, 2) household, or 3) both farm and household. Survey respondents were also asked to report the shares (in percentages) of farm and household allocations that went to specific uses (see figure 4-1). These questions were asked only in the 2003 survey and thus, the analysis has a limitation of looking at a single-period model.

The results of preliminary analysis of responses are provided in table 4.1. and figures 4-2 and 4-3.

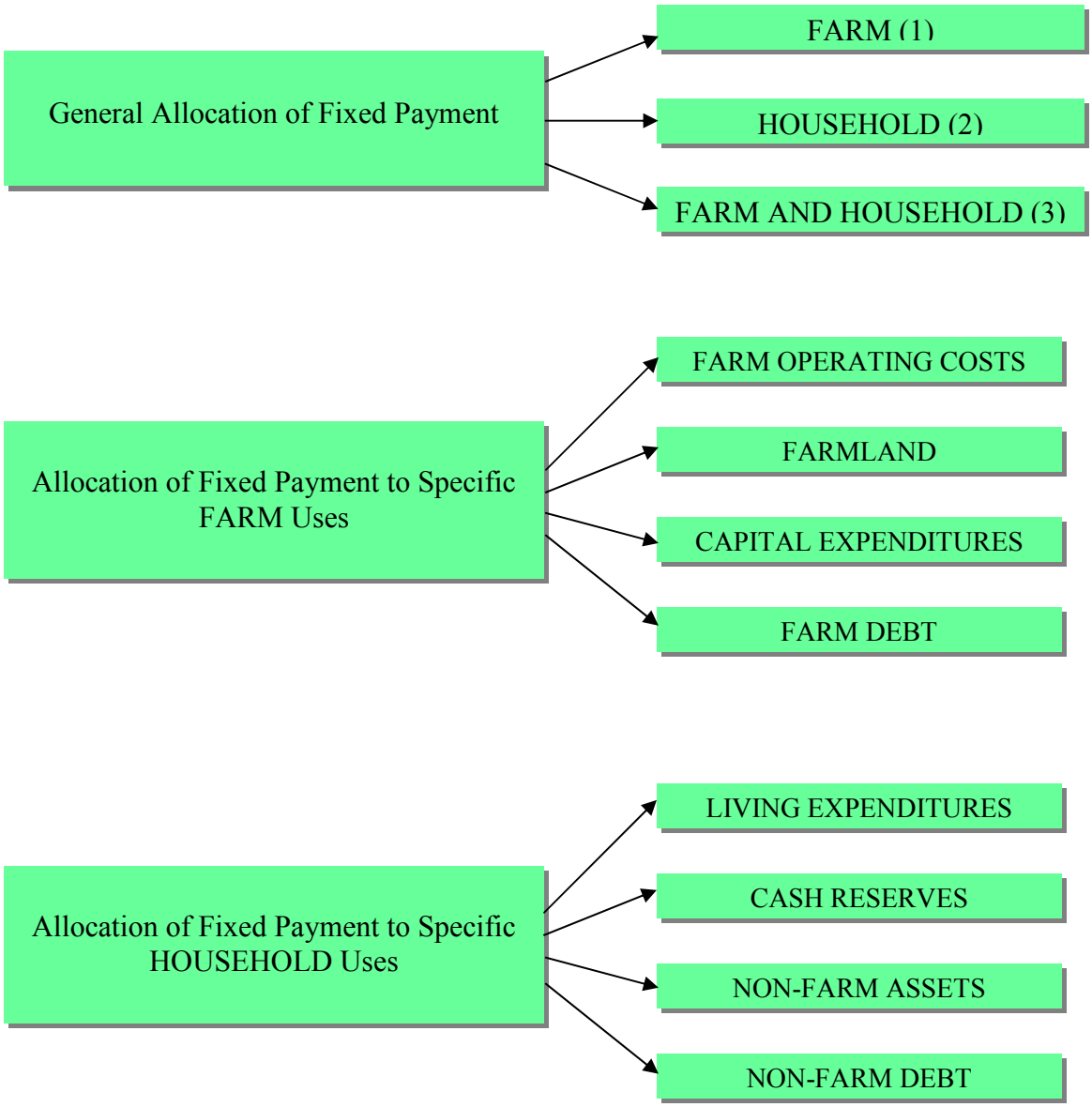

Figure 4-1. Framework of ARMS Survey questions on the allocation choices of fixed payments.

Table 4.1. Stated Uses of Fixed Payments in 2003

Use of Payments	Weighted Average
Entire Sample (n = 5,596)	
Used on Farm	65.11
Used on Household	34.89
Used on Farm Operating Costs	32.56
Used on Farmland Rental and Purchase	9.13
Used on Farm Capital Expenditures	12.18
Used to Pay Down Farm Debt	11.24
Used on Living Expenditures	16.24
Used to Build Household Cash Reserves	7.12
Used in Non-farm Assets	7.66
Used to Pay Down Non-farm Debt	3.87
Sub-Sample (1) that Received Payments in 2003 (n = 2,017)	
Used on Farm	74.67
Used on Household	25.33
Used on Farm Operating Costs	43.31
Used on Farmland Rental and Purchase	11.35
Used on Farm Capital Expenditures	6.68
Used to Pay Down Farm Debt	13.33
Used on Living Expenditures	15.48
Used to Build Household Cash Reserves	3.62
Used in Non-farm Assets	3.96
Used to Pay Down Non-farm Debt	2.12
Sub-Sample (2) that Did Not Receive Payments in 2003 (n = 3,579)	
Used on Farm	48.10
Used on Household	51.90
Used on Farm Operating Costs	24.16
Used on Farmland Rental and Purchase	7.87
Used on Farm Capital Expenditures	14.42
Used to Pay Down Farm Debt	10.65
Used on Living Expenditures	21.36
Used to Build Household Cash Reserves	12.09
Used in Non-farm Assets	13.57
Used to Pay Down Non-farm Debt	4.88

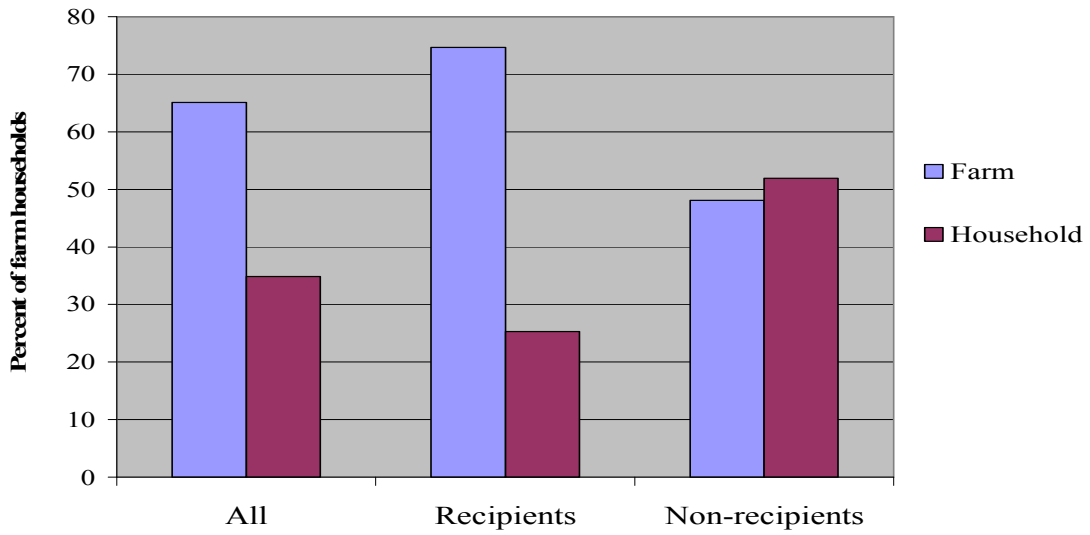

Figure 4-2. Reported general allocation of fixed payments by actual recipient and non-recipient farm households (Source: ARMS 2003)

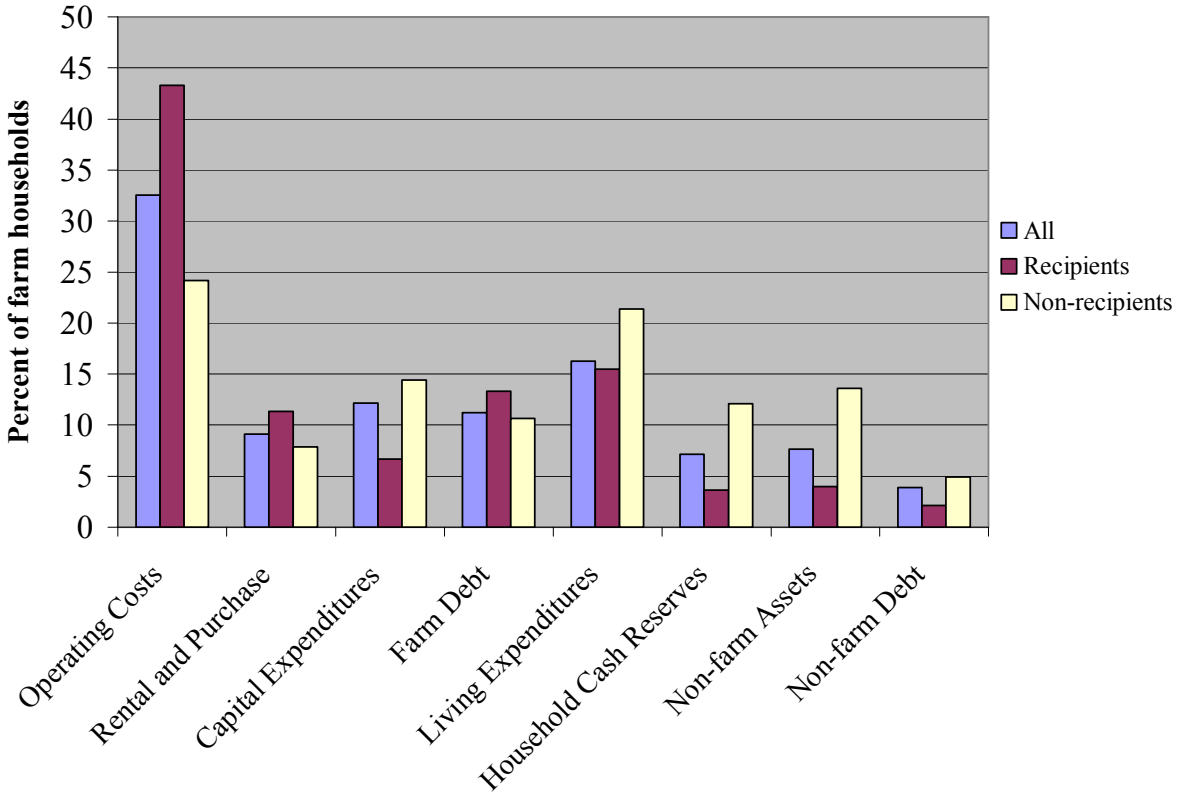

Figure 4-3. Allocation of fixed payments to specific farm and household uses (Source: ARMS, 2003)

Estimation techniques

The estimation of the underlying model was implemented in two segments. The first segment utilizes multinomial logit procedures and examines factors that explain how households indicated they allocate actual fixed payments or how they would allocate a hypothetical fixed payment between general farm and household uses. Goodwin and Mishra (2006) did similar empirical analysis, however they only included the responses of actual recipients of payments (those who received payments in 2003). The analysis in this thesis includes both recipients and non-recipients, while the entire sample of 5596 observations was divided into two subsamples and the same model was estimated using each subsample separately.

Multinomial logit regression is widely used to estimate discrete choice models. The multinomial logit model used here was suggested by Maddala (1999) and was derived from random utility models. Let x_{ij} denote the vector of explanatory variables where i indicated the household and j is the allocation choice. The household i will get an expected utility EU_{ij} for each allocation choice that is a function of farm and household characteristics. The household will choose the allocation alternative that maximizes its expected utility. The probability that household i chooses to allocate fixed payment to alternative j is

$$P_{ij} = \frac{\exp(\beta' x_{ij})}{\sum_{k=1}^{3} \exp(\beta' x_{ik})}, \quad j = 1, 2, 3 \qquad (2.1)$$

where there are only 3 possible choices for the allocation of the fixed payment. The estimated coefficients can be used to predict the probability that the household with a specified set of characteristics will choose any particular allocation choice j. Then, given a new farm household

with specified characteristics, we can predict the probability that the household will choose one of the *j* allocations for the fixed direct government payment.

In the second part, a censored two-limit tobit model is employed to examine factors that explain allocations across specific farm and household uses. The tobit model is a model of censored normal regression when values of the dependant variable for many observations are centered around zero. This model was first studied by Tobin (1958). Maddala (1999) recommends the use of a two-limit tobit model, when the dependent variable is truncated at both high and low values. The percentages of the shares of farm and household allocations that went to specific uses are bound by fixed upper (100%) and lower (0%) limits. However, the process of maximum-likelihood estimation is very similar to that of the simple tobit model. The computer program designed to estimate the two-limit tobit model for the analysis of specific uses of fixed payments uses the Newton-Raphson method of iteration (Maddala, 1999).

The ARMS survey used 5 specific allocations for farm use – farm operating costs (excluding the rental of farmland), farmland rental, farm capital expenditures (excluding the purchase of farmland), farmland purchases, and farm debt payments. For allocations to the households, the survey asked for the share that went to: family living expenditures (food, clothing, appliances, medical care, education, vacations, etc.), maintain a cash reserve for the household, non-farm financial assets (e.g. stocks, bonds, or other investments), non-farm real assets (e.g. non-farm real estate or home improvements), and non-farm debt payments. To simplify the analysis the shares allocated to farmland rental and purchase were summed, since both would indicate acreage expansion. Also, the shares allocated to non-farm financial and real assets were summed since together they represent the allocation to all non-farm assets of any

kind. Thus, eight separate equations for each specific use of the fixed payment were estimated using two-limit censored tobit regression.

Selection of explanatory variables

In both segments of the empirical analysis the focus is on family farms only, so any farm that is classified as a non-family farm has been eliminated from the sample. Family farms would still include those that are classified as commercial, limited-resource, retirement, or residential and lifestyle farms. Thus, the sample would include only farms that are closely held or controlled by farm operator and household. To control for geographic location, a dummy variable for regions used by the Economic Research Service (ERS) of USDA was included. ERS distributes all 49 states among 9 resource regions (see figure 4-4) which are based on characteristics of the land and the commodities produced. They are more homogeneous with respect to resources or production than regions based on combinations of states. In addition, a variable to describe farm typology based on the major commodity produced was included in the analysis. Though ERS uses 19 types to classify farms based on the major commodity produced, some of these are combined and 8 types are used in this analysis (see table 4-2).

Other variables included in the empirical models are the farm size (measured by total value of production), wealth (measured by net worth), financial leverage (measured by debt-to-asset ratio), rate of return on assets, dependency on farm income measured as the ratio of farm income over the total household income, farm tenure, and marketing strategy. In addition, household characteristics were included as well as characteristics of farm operator. These variables are household size, operator gender, operator age, operator's education level, retirement plans, operator's off-farm employment, and operator's marital status.

To consider operator's risk and diversification attitudes two dummy variables were included. Specifically the data is obtained from two survey questions: respondents were supposed to answer whether they agree or disagree that non-farm investments offer higher return than farm investments and that non-farm investments reduce the family's overall financial risk. In addition, to measure risk preferences a proxy variable was constructed which is a ratio of total expenditures on insurance over total farm expenses. It is expected that more risk averse farms will tend to devote more of their total production expenditures to insurance. The proxy variable could also be measuring risk exposure. Definitions for the variables used in both segments of the empirical analysis are presented in Table 4-2. Table 4.3 present the expected signs for the variables used in the first part of the empirical analysis (multinomial logit) based on previous literature.

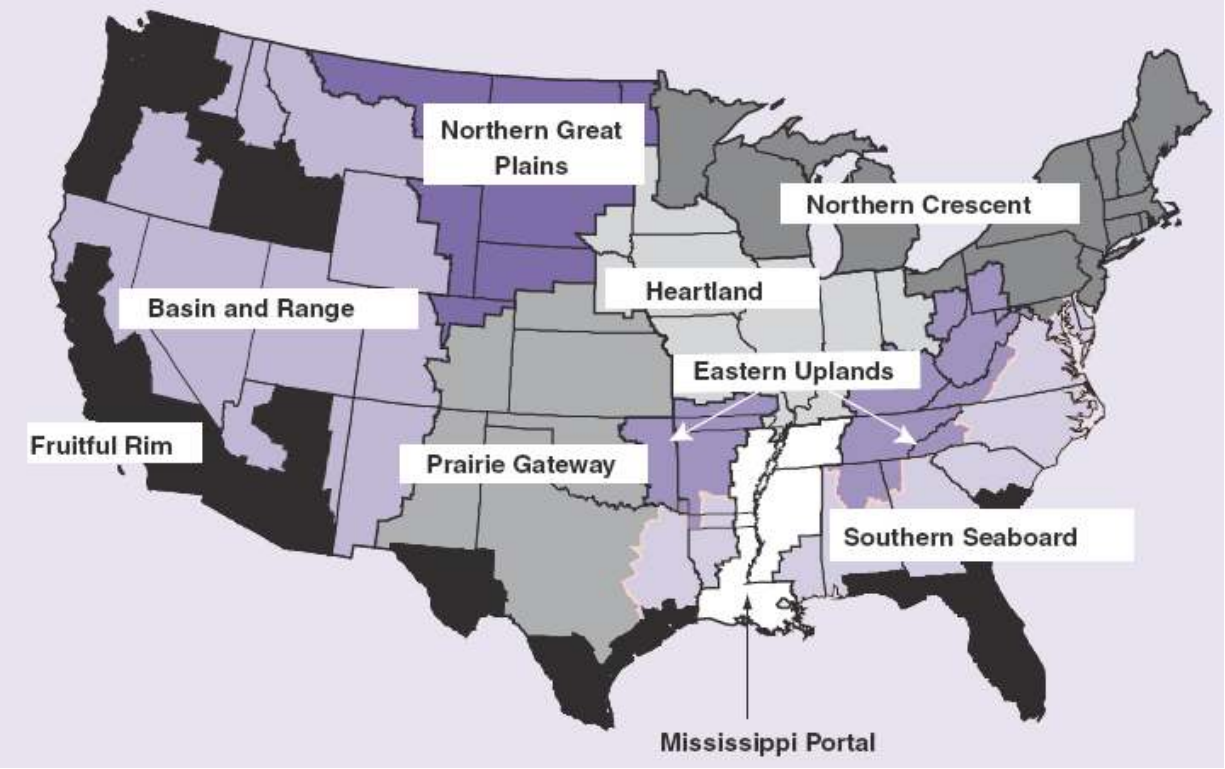

Figure 4-4. ERS resource regions (Source: ERS 2002)

Table 4.2. Description of the explanatory variables

Variable	Description
Farm Characteristics:	
FARMSIZE	total value of production in thousands U.S. dollars
WEALTH	net worth in thousands U.S. dollars
DEBTASSET	debt-to-asset ratio
RROA	rate of return on assets (from farming)
INS	proxy variable, the ratio of total expenditures on insurance over total farm expenses
SHARE	ratio of income from farming over the overall household income
Farm Tenure (base=full tenant)	
FOWNER	=1 if full owner, 0 otherwise
POWNER	=1 is partial owner, 0 otherwise
Farm Type based on major commodity produced (base=OLIVE, other livestock)	
CG	=1 if cash grains (including wheat, corn, soybean, grain sorghum, and rice), 0 otherwise
OFC	=1 if other field crops (tobacco, cotton, peanut), 0 otherwise
HVC	=1 if high-value crops (fruits, tree nuts, vegetables, nursery and greenhouses), 0 otherwise
BEEF	=1 if beef cattle, 0 otherwise
HOGS	=1 if hogs, 0 otherwise
POULT	=1 if poultry, 0 otherwise
DAIRY	=1 if dairy, 0 otherwise
Market Strategy (Contract is the base)	
PRODUCT	=1 if product contract
MARKET	=1 if market contract
CONTRACT	=1 if any contract, either market or product
Farm Operator/Spouse Characteristics	
HH_SIZE	number of persons in the household
HH_SIZE18	number of persons who are 18 or younger
HH_SIZE65	number of persons who are 65 or older
OP_GEN	operator's gender, =1 if male, 0 otherwise
OP_AGE	operator's age
RETIRE	retirement plans, =1 if operator plans to retire during the next 5 years, 0 otherwise
OP_OFF	=1 if operator is off-farm employed, 0 otherwise
EDUC	operator's education level, =10 if some high school or less, 12 if completed high school, 14 if some college, 16 if completed college, 18 if graduate school
MARRIED	operator's marital status, =1 if married, 0 otherwise
NFRET	=1 if strongly agree or agree that non-farm investments offer a higher return than farm investments, 0 otherwise
NFRISK	=1 if strongly agree or agree that non-farm investments reduce my family's overall financial risk, 0 otherwise
ERS Regions (Mississippi Portal region is used as a base)	
HEART	=1 if the farm is located in the Heartland region, 0 otherwise
NORTHC	=1 if the farm is located in the Northern Crescent region, 0 otherwise
NORTHGP	=1 if the farm is located in the Northern Great Plains region, 0 otherwise
PGATE	=1 if the farm is located in the Prairie Gateway region, 0 otherwise
EUPLAND	=1 if the farm is located in the Eastern Upland region, 0 otherwise
SSBOARD	=1 if the farm is located in the Southern Seabord region, 0 otherwise
FRIM	=1 if the farm is located in the Fruitful Rim region, 0 otherwise
BASINR	=1 if the farm is located in the Basin and Range region, 0 otherwise

Table 4.3. Expected signs of explanatory variables for multinomial logit model.

Variable	Expected sign for FARM allocation
FARMSIZE	+
WEALTH	+
DEBTASSET	+
RROA	+
INS	–
SHARE	+
FOWNER	–
POWNER	–/+
RETIRE	–
OP_OFF	–
EDUC	–
NFRET	–
NFRISK	–

Empirical issues

Due to an important characteristic of the ARMS data relating to the stratified nature of sampling used to collect the data, a serious econometric issue must be addressed in the empirical analysis. The ARMS survey applies complex stratified, multi-frame, probability-weighted, and sometimes multiple-phase sampling methods to provide financial measures of the agricultural sector. These sampling methods lead to complications in estimating the efficiency of summary statistics. Statistical estimates derived from the ARMS data should follow basic weighting rules (Dubman, 2000). ARMS weights are based on value of sales. Since the purpose of this thesis is to describe characteristics of the population, official estimates from the surveys must be

weighted. For example, a regression with both small and large farms would be dominated by the high weights of small farms and distort conclusions for large farms.

To avoid problems in complex sample design, a delete-a-group jackknife procedure should be used as proposed by Dubman (2000). This procedure is easy to apply to any weighted estimates, regardless of their complexity or statistical properties. This study uses the NASS version of the delete-a-group jackknife, where the sample is divided into 15 nearly equal and mutually exclusive different parts. Fifteen estimates of the statistic, called "replicates", are created. One of the 15 parts is eliminated in turn for each replicate estimate with replacement. Then the replicate and full sample estimates are placed into the following basic jacknife variance formula:

$$Variance(\beta) = {}^{14}\!/_{15} \sum_{k=1}^{15} (\beta_{(k)} - \beta)^2 \qquad (2.2)$$

where β is the full sample estimate and $\beta_{(k)}$ is a replicate estimate with part k removed.

In a simple jackknife, each replicate weight is defined by setting the full sample weight of every 15th observation to zero. The remaining weights in each replicate are then adjusted so that their sum approximates the sum of the full sample weights. Replicate weights are adjusted in a complex manner to assure the near unbiasedness of the jackknife variance estimator.

Alternatively, to solve this issue a bootstrapping method could be used. However, this method would rely on random number generation and random resampling that may not be duplicable. In this case, two researchers may calculate different variances and different hypothesis test results for the same official estimate. The jackknife estimator avoids this and it is relatively effortless to administer.

According to Maddala (1999), a direct R^2 cannot be used for any of the econometric models used in the analysis. For the maximum likelihood estimation of a model, the goodness-of-fit measure would be:

$$R^2 = 1 - \left(\frac{L_\omega}{L_\Omega} \right)^{2/n} \tag{2.3}$$

where L_ω is the maximum of the full likelihood function when maximized with respect to all the parameters β_j, L_Ω is the maximum of the restricted model when maximized with respect to the intercept only, and n is the sample size.

However, even if the model fits perfectly, the resulting R^2 will be much less than 1. Instead a better measure is the pseudo-R^2 (also called McFadden's R^2) defined as:

$$pseudo - R^2 = \frac{L_\Omega^{2/n} - L_\omega^{2/n}}{1 - L_\omega^{2/n}} \tag{2.3}$$

Another pseudo-R^2 measure suggested by McFadden (1974) is

$$pseudo - R^2 = 1 - \frac{(\log L_\omega)}{(\log L_\Omega)} \tag{2.4}$$

Amemiya (1981) concluded that it is normal to have a very low value for R^2 for qualitative-response models.

CHAPTER 5

EMPIRICAL RESULTS

The multinomial logit analysis of payment allocation was based upon 5,596 farms across the U.S. The model was run separately on two sub-samples – those who received payments in 2003 (a sample of 2.017 farms), and those were non-recipients in 2003 but answered the question on how they would allocate a hypothetical payment of $10,000 (a sample of 3,579 farms). The objective is to examine what factors explain differences in how farm households actually allocated and how they indicate that they would allocate a hypothetical fixed payment between generalized farm and household categories. The discrete dependent variable is the farm household's allocation choice. The base for the dependent variable is allocation to both farm and household. The results of estimations are provided in Tables 5.1-5.2.

General uses of fixed payments

Empirical findings show that farm characteristics such as net worth, rate of return on assets, and financial leverage explain why farm operators are more likely to allocate payments to agricultural production and less likely to allocate toward household use rather than to both farm and household. These results were expected. However, one interesting result is that farm size does not seem to explain the decision to allocate the payment to the farm. In fact, larger farmers are more likely to allocate the payment on the household only than to both farm and household. This estimate was significant for the sample of non-recipients. Farm households that are more dependent on income from farming are more likely to use the payment to the household only.

Another interesting empirical result is that estimates for farm tenure show that if the farm operator is either a full or partial owner, he/she is less likely to invest to farm only and more likely to use the payment for the household. There are possibly many factors that can weaken incentive to allocate the payment to farm only for an operator who owns all or at least part of his/her farmland. Full and partial owners might choose to conserve their farmland while full tenants would not engage in land conservation. Then, the opposite would be true for a full tenant.

The base variable for the farm specialization dummies is other livestock. For farms that specialize in poultry the payment is less likely to be allocated towards farm only than for farms specializing in other livestock. Interesting behavior can be observed for those who specialize in hog production. The actual recipients specializing in this field are less likely to allocate the payment to the farm only than actual recipients specializing in other livestock, while non-recipient hog-producers are less likely to allocate the payment to the household. However, dairy farmers tend to allocate less towards household only rather than to both farm and household compare with other livestock farmers. Possible explanation could be the fact that most dairy farms produce corn to use it as feed for cattle. Those who produce high-value crops like fruits and vegetables are likely to allocate the payment to the household only rather than to both farm and household compared with other livestock farmers.

The estimates that describe household and operator characteristics as well as those of the operator's spouse exhibit the expected signs. For example, those that have children (18 years and younger) are less likely to allocate the payment to the household. It might be that the operator prefers to invest more towards farm only to build more wealth for growing children. This can be easily supported by intertemporal behavior of the household. At the same time, households with

persons who are 65 years old or older prefer to allocate less towards both farm and households rather to either farm only or household only.

Those farm operators that plan to retire during the next 5 years prefer to allocate less to farm. They also prefer to make off-farm investments. This estimate was significant for the sample of non-recipients. Non-recipient farm operators employed off-farm are less likely to use the money for the household only.

The results for the households that prefer to diversify their investments are unexpected. In fact they are contradictory to the idea that if an operator prefers to invest off-farm due to higher returns, then one will diversify and invest into non-farm assets. However, expected results were obtained for the households that believe there is less risk associated with non-farm assets. Specifically, non-recipient farm households that believe there is less risk associated with non-farm assets prefer not to spend all of the payment to the farm only. In other words, these households prefer to diversify their investments.

The base case for the regional dummy variables is the Mississippi Portal. Farm households located in Heartland, Northern Crescent, Northern Great Plains, Prairie Gateway, Southern Seaboard, and Fruitful Rim are more likely to make farm investments than the ones located in Mississippi Portal.

Specific farm uses

In the tobit analysis the same tobit model was run for each specific allocation individually and therefore, there are 8 two-limit tobit models. Since it can be very overwhelming to show the large volume of significant results it was decided to discuss only those that are particularly important to understand the behavior of farm households (see Tables 5.3 – 5.10).

Wealthy farm households who were not recipients in 2003 are more likely to allocate some money to farm operating costs. Larger household are less likely to use the payment for farm operating costs. Households with children or people who are 65 and older are more likely to allocate the payment to farm operating costs. Those farm operators who are employed off the farm are less likely to use the payment to cover farm operating costs. This estimate is significant for both samples. Educated non-recipient households would not use the payment for this purpose either. Those who perceive investments into non-farm assets to be less risky than farming would still prefer spending the money for the farm operating costs. Farm operators from most regions are less likely to use the payment for this specific farm use.

Full and partial owners are less likely to use the payment to purchase or rent more farmland. However, farms specializing in high-value crops would tend to purchase or rent more land. Farm households that had market contracts are less likely to use the payment for this purpose, while production contract-holders would behave in the opposite way. Large households tend not to purchase or rent more land, while households with children would be more likely to use the payments for either one of those transactions. Households with people who are 65 or older are less likely to allocate the payment for this specific use. Likewise older farm operators are less likely to use the payment to purchase or rent more land. The estimates for those operators who planned to retire by the year 2007 have opposite signs for each sample. Households located in Southern Seaboard and Fruitful Rim are less likely to purchase or rent more land.

Large farm households tend to use the payment for farm capital expenditures, while those with children and older people would not use the money for this use. Older farm operators as well as those who are employed off the farm or educated would be more willing to use the

payment to increase farm capital expenditures. Retiring farm households would be less likely to allocate the payment in this manner. It would be interesting to note those households that expect higher returns from off-farm investments would still use the payments for farm capital.

Household with higher debt-to-asset ratio and with greater rate of return on farm assets are more likely to use the payment to pay down the farm debt. Risk-averse households who did not receive payments in 2003 would prefer not to use the payment for this use. Both full owners and partial owners are more likely to use the money for farm capital investments. The same is true for large households and those farm operators who were employed off-farm. Households located in Fruitful Rim and Basin and Range regions are more likely to do the same compared with Mississippi Portal households.

In general, most of the results discussed above are either expected or can find possible explanation in practice. However, there are some opposite signs between the estimates of two different samples. These differences are less likely due to the descriptive characteristics of the samples, provided in the appendix tables.

Specific household uses

The results for the last four tobit models used to estimate the allocations toward specific household uses provide better insights to understand farm household behavior.

Households that operated highly leveraged and profitable farms will prefer not to use the money for living expenses. Full owners would be more likely to use the payment for living expenses. This model also predicts that households producing other field crops like cotton, tobacco and rice are very likely to use the payment to cover family living expenses. The expected results for bigger households were obtained – they need to cover higher education,

medical care and transportation expenses as well as food and clothing purchases. Older farm operators are less likely to use the payment for family expenses, which is not true for retiring operators. Operators that prefer to diversify and invest into non-farm assets are likely to use the payments to cover family living expenses. Households located in all 8 ERS regions prefer not to allocate the payment to family living compared with Mississippi Portal households.

Highly-leveraged farms are less likely to increase cash reserve using the money from government, while bigger households are likely to act in the opposite manner. Retiring operators also prefer to use this money for cash reserve. Operators believing that there is lower risk associated with non-farm assets will use the money to build cash reserve.

Again highly-leveraged farmers will tend not to use the payments to invest into non-farm assets, while retiring operators are more likely to do that. Partial owners who were not recipients would use the payment for investments into non-farm assets. An interesting result is that farms specializing in other field crops (cotton, tobacco, and peanuts) would prefer to use the payment for investments into non-farm assets. Those who believe that there is lower risk from diversification are likely to invest into non-farm assets as well. In addition, farm households located in the Northern Crescent, Northern Great Plains, Southern Seaboard, Fruitful Rim, and Basin and Range regions are more likely to invest into non-farm assets using the payment than those located in the Mississippi Portal region.

Highly-leveraged farmers will likely use the money to pay down non-farm debt. Those households which are dependent on income from farming would be more likely to use the payment to pay down non-farm debt. Full and partial owners are likely to do the same. However this is true for the sample of non-recipients, while for the actual recipients, the sign of likelihood estimate is negative. Farmers who grow cotton, tobacco, or peanuts would use the payment to

pay down the farm debt as well. Larger households and the ones with higher number of children are likely to pay down the non-farm debt. This is also true for operators who are employed off-farm. Higher educated farm operators would behave in the similar manner. Those households which are located in Heartland, Northern Crescent, and Fruitful Rim regions are more likely to pay down the non-farm debt using the payments than those located in Mississippi Portal region.

Major findings

Most of the estimates presented explain the behavior of farm households in allocating government payments which supports findings of previous literature. Though some of them cannot be based on strong theoretical ground, the implications of the results can still be discussed with a goal to derive certain conclusions. The results showed various effects and possible explanations behind the revealed preferences and behavior; however some of them provide interesting insights to the issue studied in this thesis.

First, the analysis determined that larger farmers are more likely to allocate direct payments towards household only rather than to both farm and household, which is different from the likely behavior of wealthier farmers. The financial leverage of farms plays a significant role in explaining the preference of households to allocate more on farm. The results also show that highly-leveraged farms are less likely to use this money for family living, to build cash reserve and invest into non-farm assets. At the same time such farmers tend to use this money to pay down both farm and non-farm debt.

Second, those households which are dependent on farm income are more likely to allocate payment to the household only rather than to both farm and household. These households would also use payments to pay down non-farm debt.

Third, full and partial owners of farmland are less likely to use direct government payments on farm, including on expanding farmland. When allocated towards farm, they will probably use this money to pay down farm and non-farm debt. Such households will also be more likely to use the payments to increase family living expenditures and investments into non-farm assets.

Fourth, farmers growing cotton, tobacco, and peanuts tend to use the payment for family living expenses, investments into non-farm assets, and to pay down non-farm debt. Those who specialize in high-value crops (fruits and vegetables) will tend to allocate less to the household. Specifically they would be more likely to use the payment to purchase or rent more land. They are also less likely to use the payment to pay down farm debt and to cover family living expenses.

Fifth, bigger farm households are less likely to allocate the payments to cover farm operating costs, purchase or rent farmland, and are more likely to use it for farm capital investments and to pay down farm debt. Likewise, these households tend to increase their family living expenses and cash reserve using fixed payments. They are also highly likely to use this money to pay down non-farm debt.

Sixth, older and retiring farm operators are less likely to use payments for expansion of farmland. Retiring operators are more likely to use it for family expenses, cash reserve, and investments into non-farm assets. They also tend not to use the payment for farm capital investments.

Finally, those who revealed during the survey that they would prefer to invest into non-farm assets due to associated lower financial risk, are more likely to use payments towards cash reserve and investments into non-farm assets.

To check for statistical significance of obtained estimates marginal effects for each variable estimate were alternatively computed (see tables A.1 – A.9). The difference in the magnitude of likelihood estimates and their significance for each parameter between actual recipients and non-recipients can be explained by the difference of farm, operator and household characteristics for each sample. The descriptive summary statistics of main parameters are provided in the Appendix (see tables A.10 – A.20).

Table 5.1. Parameter Estimates for Multinomial Logit Model: Actual Recipients.

Variable	FARM[b)]		HOUSEHOLD[b)]	
	Parameter Estimate[a)]	Standard Error	Parameter Estimate[a)]	Standard Error
Intercept	0.5148	1.358	-4.872	5.622
Farm Size	0.000474	0.00052	0.000062	0.00013
Wealth	0.000062	0.00013	-0.000292	0.000942
Debt-to-Asset Ratio	2.15905**	0.93178	-3.48323	4.61497
RROA	0.000046	0.00613	-0.003507	0.011745
Risk Aversion	-1.5877	3.0855	-7.9399	8.3619
Farm Dependency	0.00424	0.00983	-0.00486	0.0615
Full Owner[b)]	0.0867	0.6429	1.3908*	1.0592
Partial Owner	0.4919	0.5033	0.7695	0.9329
Cash Grains[b)]	-0.4702	0.7309	0.2679	2.1427
Other Field Crops	-0.9665	0.7781	-0.0771	2.2893
High-value Crops	0.3981	1.7837	-10.6874***	3.4244
Beef Cattle	-1.0924	0.6024	-0.3344	1.7198
Hogs	-0.7435	0.8889	-10.897***	2.9094
Poultry	-3.2681**	1.6346	1.7999	6.2899
Dairy	0.2379	0.6054	-2.4085	9.6027
Product[b)]	0.6621*	0.5039	-1.6266	4.7075
Market	-0.3764	0.3738	0.6679	1.7273
Household size	-0.1265	0.1559	0.1485	0.4246
HH size (18 and younger)	0.103	0.2595	-1.1679*	0.7509
HH size (65 or older)	0.9648	2.2483	-0.9297	12.264
Operator's age	-0.0117	0.0102	-0.0004	0.0299
Retirement plans	0.2836	0.3821	0.0262	1.0113
Off-farm employment	-0.0093	0.3103	0.6642	0.9826
Education level	0.0496	0.0594	0.0815	0.2387
NFRET	0.3286	0.3593	-0.7002	0.9118
NFRISK	-0.107	0.3359	-0.2134	0.6364
Heartland[b)]	0.8554**	0.4293	1.9972*	1.3578
Northern Crescent	0.6947**	0.4014	0.6557	2.6728
Northern Great Plains	0.6325***	0.2471	-0.0291	2.3983
Prairie Gateway	0.5618	0.5011	1.7476*	1.1528
Eastern Uplands	1.2608*	0.8197	1.9772	3.0749
Southern Seaboard	0.3656	0.7018	1.7332	2.5334
Fruitful Rim	0.8442	0.7527	2.6346*	1.8683
Basin and Range	1.4616**	0.6476	0.9034	1.1728
N	2017			
R^2	0.2178			

Notes: a) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels of significance, respectively; b) the base variables for dependent variable (allocation choice), farm tenure, farm specialization, market strategy, and regional variables are "both farm and household", "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table 5.2. Parameter Estimates for Multinomial Logit Model: Non-Recipients

Variable	FARM[b)]		HOUSEHOLD[b)]	
	Parameter Estimate[a)]	Standard Error	Parameter Estimate[a)]	Standard Error
Intercept	0.4136	0.955	-0.3529	0.9192
Farm Size	0.000142	0.00037	0.00071***	0.00173
Wealth	0.00031***	0.00011	-0.00088***	0.000304
Debt-to-Asset Ratio	1.4651***	0.4097	-1.8595***	0.7386
RROA	0.00337***	0.00097	-0.00219	0.00678
Risk Aversion	-0.2272	1.00538	1.0422	1.7053
Farm Dependency	-0.0041	0.01786	0.0501***	0.02
Full Owner[b)]	-1.0943***	0.423	-0.2018	0.711
Partial Owner	-1.011**	0.482	-0.997*	0.694
Cash Grains[b)]	0.0575	0.5981	-0.2372	0.7937
Other Field Crops	-0.2955	0.2456	-0.3576	0.2998
High-value Crops	0.4633	0.4628	-0.0548	0.4689
Beef Cattle	0.1987	0.2212	0.0316	0.3771
Hogs	-1.6741***	0.6693	-0.5883	3.3421
Poultry	-1.3061**	0.7723	0.5491	1.2584
Dairy	0.1052	0.5375	-1.0431*	0.7379
Product[b)]	0.8705	0.8669	-2.1523**	1.2409
Market	0.1247	0.2599	0.2535	0.3739
Household size	-0.0609	0.0796	0.0764	0.0692
HH size (18 and younger)	-0.1398	0.1174	-0.4235**	0.2138
HH size (65 or older)	-0.8171***	0.3433	-1.3981***	0.4204
Operator's age	-0.0065	0.0056	-0.0048	0.0118
Retirement plans	-0.5508***	0.1863	0.5185***	0.2151
Off-farm employment	-0.2161	0.2294	-0.6795**	0.3339
Education level	0.0404	0.0442	0.0494	0.0574
NFRET	-0.1931	0.2197	-0.4562*	0.2784
NFRISK	-0.3432*	0.2217	-0.0166	0.2662
Heartland[b)]	1.0679***	0.2381	0.2891	0.4803
Northern Crescent	0.4502*	0.2993	0.0297	0.4722
Northern Great Plains	0.5651	0.5392	-0.5111	0.5738
Prairie Gateway	0.4315*	0.2719	-0.2992	0.6345
Eastern Uplands	0.1271	0.2802	-0.4757*	0.3586
Southern Seaboard	0.9619***	0.2688	0.5926	0.5569
Fruitful Rim	0.4825*	0.3323	-0.4165	0.4585
Basin and Range	0.1397	0.3364	-0.1581	0.4582
N	3579			
R^2	0.2532			

Notes: a) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels of significance, respectively; b) the base variables for dependent variable (allocation choice), farm tenure, farm specialization, market strategy, and regional variables are "both farm and household", "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table 5.3. Parameter Estimates for Two-Limit Tobit Model: Farm Operating Cost Equation

Variable	Actual Recipients		Non-Recipients	
	Parameter Estimate[a)]	Standard Error	Parameter Estimate[a)]	Standard Error
Intercept	99.769	88.558	156.66*	99.847
Farm Size	0.0039	0.0061	-0.0042	0.0059
Wealth	0.0001	0.0019	0.0116***	0.0039
Debt-to-Asset Ratio	-13.217	30.263	-12.466	45.546
RROA	-0.0235	0.1479	-0.0284	0.1894
Risk Aversion	13.217	172.82	-21.249	65.289
Farm Dependency	-0.0729	0.9969	-1.9136	1.0601
Full Owner[b)]	-5.7611	19.634	10.689	33.527
Partial Owner	-15.841	15.245	39.555	37.402
Cash Grains[b)]	49.867	75.681	1.2634	39.237
Other Field Crops	29.474	68.662	-26.078	28.854
High-value Crops	39.762	82.125	19.461	36.161
Beef Cattle	35.742	77.468	-7.9545	22.875
Hogs	47.859	86.363	63.409	108.79
Poultry	-19.365	85.674	33.946	79.756
Dairy	71.537	68.246	42.709*	29.907
Product[b)]	4.3615	18.779	-50.972	69.042
Market	-6.5548	16.304	16.283	23.337
Household size	-8.4246*	6.3555	-5.9349	5.8041
HH size (18 and younger)	21.351*	14.142	-3.7259	15.391
HH size (65 or older)	79.397***	24.208	26.411*	16.986
Operator's age	0.5716	0.5352	-0.4842	1.1285
Retirement plans	-11.864	20.459	1.8221	21.639
Off-farm employment	-29.475**	14.129	-20.263*	15.669
Education level	-3.2893	3.1224	-8.4895**	4.0731
NFRET	2.8856	15.642	-11.748	19.562
NFRISK	17.762	17.701	38.472***	14.756
Heartland[b)]	-21.793	26.309	-84.649**	47.311
Northern Crescent	14.219	26.416	-65.843***	26.816
Northern Great Plains	-5.2725	32.009	-36.626	50.911
Prairie Gateway	-5.7131	24.267	11.581	33.643
Eastern Uplands	-19.828	51.453	-25.772	20.988
Southern Seaboard	22.236	33.865	-56.194*	35.561
Fruitful Rim	-20.394	34.288	-2.1324	33.569
Basin and Range	20.033	39.462	-57.598**	27.381
Σ	109.49***	9.5918	165.76***	14.364
R^2	0.2101		0.2351	

Notes: a) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels of significance, respectively; b) the base variables for farm tenure, farm specialization, market strategy, and regional variables are "both farm and household", "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table 5.4. Parameter Estimates for Two-Limit Tobit Model: Land Purchase and Rental Equation

Variable	Actual Recipients		Non-Recipients	
	Parameter Estimate[a)]	Standard Error	Parameter Estimate[a)]	Standard Error
Intercept	82.631	84.973	-7.3811	134.14
Farm Size	0.0101	0.0231	-0.0169	0.0209
Wealth	-0.0047	0.0046	-0.0063	0.0067
Debt-to-Asset Ratio	-20.326	26.653	-114.94	94.288
RROA	0.0491	0.0983	-0.2614	0.2158
Risk Aversion	-41.757	107.83	76.573	99.134
Full Owner[b)]	-60.618***	21.003	-92.414***	38.531
Partial Owner	-24.438***	10.016	-48.838	39.769
Cash Grains[b)]	-81.066	79.038	59.235	47.592
Other Field Crops	-92.818	86.281	33.107	32.145
High-value Crops	-99.569	80.275	69.824**	34.966
Beef Cattle	-97.514	81.166	58.589**	33.662
Hogs	-77.557	89.374	-294.14***	70.914
Poultry	-143.06**	64.305	-69.495	94.864
Dairy	-118.52*	76.981	31.751	61.581
Productb)	-6.5414	9.6808	133.98*	99.858
Market	4.1926	9.1074	-29.464*	21.583
Household size	-8.8707**	4.8343	-9.3641*	5.9535
HH size (18 and younger)	22.571*	14.131	34.265***	13.295
HH size (65 or older)	-15.864	13.129	-53.551**	24.703
Operator's age	-0.7079	0.5681	-1.6659*	1.1754
Retirement plans	33.714*	26.087	-55.646**	25.649
Off-farm employment	22.474*	14.176	36.416**	17.389
Education level	0.9833	2.8107	0.9559	5.3196
NFRET	1.8609	17.681	-2.7986	17.881
NFRISK	-3.7702	14.557	-19.642	19.127
Heartland[b)]	11.082	22.507	2.3323	29.692
Northern Crescent	15.816	16.529	-21.765	28.742
Northern Great Plains	12.354	26.376	46.502	55.549
Prairie Gateway	26.193	22.541	15.826	26.606
Eastern Uplands	4.3271	42.739	-5.8756	24.126
Southern Seaboard	30.043	45.234	-44.026**	23.533
Fruitful Rim	-0.4921	32.491	-44.629*	34.578
Basin and Range	7.8616	57.371	-22.561	31.798
Σ	75.151***	9.0854	172.11***	17.517
R^2	0.2181		0.2452	

Notes: a) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels of significance, respectively; b) the base variables for farm tenure, farm specialization, market strategy, and regional variables are "both farm and household", "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table 5.5. Parameter Estimates for Two-Limit Tobit Model: Capital Expenditures Equation

Variable	Actual Recipients		Non-Recipients	
	Parameter Estimate[a)]	Standard Error	Parameter Estimate[a)]	Standard Error
Intercept	-251.33**	118.93	-384.19***	65.699
Farm Size	0.0021	0.0098	0.0044	0.0109
Wealth	-0.0009	0.0025	-0.0023	0.0065
Debt-to-Asset Ratio	-44.236	39.893	-172.24	49.388
RROA	-0.0468	0.1288	-0.2397	0.2924
Risk Aversion	-15.211	129.881	56.926	123.99
Farm Dependency	-0.2332	1.9159	-0.0033	1.3684
Full Owner[b)]	13.372	26.793	-8.3594	48.375
Partial Owner	14.665	14.722	-15.879	45.085
Cash Grains[b)]	18.671	29.059	30.522	76.297
Other Field Crops	32.258	29.952	-32.254	30.864
High-value Crops	24.198	51.183	-12.686	23.785
Beef Cattle	34.314	27.899	-2.6218	23.477
Hogs	16.151	46.092	-47.135	214.15
Poultry	29.845	57.771	-56.227	63.965
Dairy	39.114	34.678	29.369	26.922
Product[b)]	-1.4822	25.019	83.371	70.029
Market	2.3538	15.078	-36.429	24.373
Household size	10.301**	5.9927	5.8637	5.8675
HH size (18 and younger)	-14.152*	9.9889	-5.8465	12.028
HH size (65 or older)	-63.195**	33.569	-4.4059	31.536
Operator's age	0.5527	0.8265	1.4566**	0.6685
Retirement plans	-8.5171	19.639	-35.039*	21.407
Off-farm employment	-10.199	16.968	35.911**	19.521
Education level	8.1442**	4.2273	12.525***	4.7828
NFRET	29.092	23.506	39.746**	21.444
NFRISK	-16.134	14.796	0.0775	20.603
Heartland[b)]	-7.8136	34.524	38.764	38.776
Northern Crescent	-57.834**	31.914	78.574***	32.984
Northern Great Plains	-15.381	31.667	-43.766*	29.871
Prairie Gateway	-38.683	33.456	-66.797**	37.736
Eastern Uplands	-58.343	49.863	40.741	36.002
Southern Seaboard	-79.679	32.002	40.821	32.191
Fruitful Rim	-0.7154	41.569	36.453*	25.664
Basin and Range	-58.493*	40.186	39.085	36.598
Σ	96.845***	8.6201	166.85***	17.654
R^2	0.2295		0.2361	

Notes: a) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels of significance, respectively; b) the base variables for farm tenure, farm specialization, market strategy, and regional variables are "both farm and household", "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table 5.6. Parameter Estimates for Two-Limit Tobit Model: Farm Debt Equation

Variable	Actual Recipients		Non-Recipients	
	Parameter Estimate[a)]	Standard Error	Parameter Estimate[a)]	Standard Error
Intercept	-124.84**	64.731	-349.24***	73.632
Farm Size	-0.0007	0.0089	-0.0474*	0.0349
Wealth	0.0014	0.0018	0.0041	0.0087
Debt-to-Asset Ratio	152.21***	26.661	327.91***	43.524
RROA	0.2611***	0.0722	0.7352	0.6762
Risk Aversion	30.496	319.97	-216.43**	102.75
Full Owner[b)]	-2.0035	15.245	88.677**	55.163
Partial Owner	39.511***	14.032	123.97**	65.136
Cash Grains[b)]	9.7557	21.287	41.825	39.782
Other Field Crops	21.661	31.297	-1.9204	21.611
High-value Crops	28.321	47.851	-51.752*	38.263
Beef Cattle	19.243	28.489	5.9708	20.731
Hogs	27.606	37.051	-18.495	135.98
Poultry	114.33*	79.571	-6.2365	57.515
Dairy	-5.6707	30.285	94.329***	35.919
Product[b)]	-10.347	17.785	129.07***	45.799
Market	7.5877	15.401	45.427**	25.264
Household size	10.035**	5.9381	9.7634**	4.7799
HH size (18 and younger)	-19.721**	11.695	15.622	12.572
HH size (65 or older)	-52.324**	24.551	55.639***	22.818
Operator's age	-0.7258**	0.3881	-0.3049	0.4448
Retirement plans	-11.965	15.831	3.9608	20.529
Off-farm employment	0.2809	9.8717	49.815***	18.092
Education level	0.2529	4.0815	1.5576	3.5215
NFRET	-13.396**	7.4146	-3.2746	19.834
NFRISK	4.7209	13.825	3.3201	16.095
Heartland[b)]	22.383	27.537	-22.324	38.905
Northern Crescent	8.0315	28.913	4.5008	35.608
Northern Great Plains	18.584	35.451	-37.418	44.493
Prairie Gateway	18.953	27.279	33.196	30.913
Eastern Uplands	20.597	29.671	-9.6061	35.648
Southern Seaboard	-20.762	29.587	27.817	36.495
Fruitful Rim	27.949	45.008	50.603*	35.533
Basin and Range	10.712	43.415	64.482*	42.673
Σ	99.067***	11.069	147.81***	11.586
R^2	0.2309		0.2533	

Notes: a) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels of significance, respectively; b) the base variables for farm tenure, farm specialization, market strategy, and regional variables are "both farm and household", "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table 5.7. Parameter Estimates for Two-Limit Tobit Model: Family Living Expenses Equation

Variable	Actual Recipients		Non-Recipients	
	Parameter Estimate[a)]	Standard Error	Parameter Estimate[a)]	Standard Error
Intercept	-125.17	221.76	93.765*	69.391
Farm Size	-0.0271	0.0444	-0.0112	0.0118
Debt-to-Asset Ratio	-303.44***	116.59	-103.04***	41.361
RROA	-0.0853	0.3584	-0.2649***	0.0859
Risk Aversion	-41.523	333.75	79.017	70.171
Farm Dependency	-0.4439	0.6161	-0.0124	0.8852
Full Owner[b)]	23.219	51.576	42.718*	26.781
Partial Owner	-45.409	40.826	27.681	29.565
Cash Grains[b)]	82.119	74.246	-23.193	26.752
Other Field Crops	125.41**	75.937	-14.046	25.324
High-value Crops	-3.6842	187.49	-58.644***	22.115
Beef Cattle	128.73**	75.371	-31.693*	19.508
Hogs	10.484	81.911	-36.955	66.512
Poultry	329.79***	126.25	85.397*	57.204
Dairy	-30.197	81.285	-1.4761	29.675
Product[b)]	-109.34**	59.061	-48.352	48.281
Market	27.355	33.473	7.5943	1.974
Household size	31.931**	19.116	-5.7263	6.1751
HH size (18 and younger)	-31.373	35.989	7.1408	8.7374
HH size (65 or older)	-86.832	139.59	12.653	23.351
Operator's age	1.5643	1.4289	-0.5505*	0.4209
Retirement plans	-52.984	43.381	16.006*	12.336
Off-farm employment	-1.3552	38.922	-13.004	12.664
Education level	-9.7116	8.1825	-3.2817	3.3539
NFRET	-0.9921	45.628	30.912**	16.638
NFRISK	20.935	41.935	-5.7091	17.473
Heartland[b)]	-81.192	66.323	-97.061***	30.365
Northern Crescent	-106.82**	53.042	-77.556***	23.396
Northern Great Plains	-63.053	55.657	-79.849**	47.705
Prairie Gateway	-40.957	48.726	-27.046	26.831
Eastern Uplands	-193.58**	110.84	-39.589**	18.403
Southern Seaboard	-6.7957	97.637	-90.883***	26.042
Fruitful Rim	-79.998	84.827	-60.346**	27.351
Basin and Range	-307.91***	123.71	-65.627***	23.964
Σ	214.28***	25.999	141.23***	11.859
R^2	0.2240		0.2492	

Notes: a) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels of significance, respectively; b) the base variables for farm tenure, farm specialization, market strategy, and regional variables are "both farm and household", "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table 5.8. Parameter Estimates for Two-Limit Tobit Model: Cash Reserve Equation

Variable	Actual Recipients		Non-Recipients	
	Parameter Estimate[a)]	Standard Error	Parameter Estimate[a)]	Standard Error
Intercept	-81.992	95.889	-40.535	44.236
Farm Size	-0.0137	0.0371	-0.0229*	0.0169
Debt-to-Asset Ratio	-205.59***	62.501	-77.284***	29.403
RROA	0.1842	0.4399	0.1716	0.2409
Risk Aversion	68.876	85.650	37.933	70.984
Farm Dependency	-0.0392	0.2463	0.7281	1.2507
Full Owner[b)]	30.059	30.437	-24.098	25.649
Partial Owner	7.6443	24.505	-28.409	27.328
Cash Grains[b)]	15.904	36.697	-28.927	31.987
Other Field Crops	4.7127	42.246	5.5996	12.419
High-value Crops	-13.156	70.639	-17.272	17.102
Beef Cattle	37.334	44.042	-5.9917	13.719
Hogs	35.122	57.451	-36.973	58.146
Poultry	227.64**	122.92	-6.0062	85.876
Dairy	-15.895	36.509	21.811	37.627
Product[b)]	-64.706*	43.522	1.8242	67.732
Market	32.186	32.134	-10.268	20.964
Household size	-7.7545	11.291	5.4872**	2.5079
HH size (18 and younger)	3.3021	12.381	-4.8365	6.9313
HH size (65 or older)	-556.43***	127.79	4.3867	16.271
Operator's age	-0.0381	0.6824	0.1918	0.3965
Retirement plans	-2.2525	18.235	48.555***	8.8898
Off-farm employment	-11.881	16.113	3.5454	13.458
Education level	1.3598	3.7409	-2.8631	2.2785
NFRET	-12.303	30.278	7.1769	8.1458
NFRISK	30.545*	18.842	36.345***	7.6174
Heartland[b)]	-54.652*	38.871	-45.591***	14.697
Northern Crescent	-60.232*	37.946	-35.321**	15.929
Northern Great Plains	-72.979**	32.452	-63.869**	27.776
Prairie Gateway	-93.231**	46.135	-28.298**	13.582
Eastern Uplands	-52.564	62.612	-9.4297	13.447
Southern Seaboard	-43.913	45.622	-29.964*	18.338
Fruitful Rim	-51.952	50.031	4.7137	18.028
Basin and Range	-34.985	54.421	-36.946**	19.339
Σ	93.429***	18.509	111.29***	7.3297
R^2	0.2189		0.2387	

Notes: a) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels of significance, respectively; b) the base variables for farm tenure, farm specialization, market strategy, and regional variables are "both farm and household", "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table 5.9. Parameter Estimates for Two-Limit Tobit Model: Non-Farm Assets Equation

Variable	Actual Recipients		Non-Recipients	
	Parameter Estimate[a)]	Standard Error	Parameter Estimate[a)]	Standard Error
Intercept	-203.01**	102.34	-314.65***	100.49
Farm Size	-0.0501*	0.0345	-0.0221	0.0279
Debt-to-Asset Ratio	-121.26*	82.944	-174.36***	55.814
RROA	-0.1414	0.4802	0.29987	0.2867
Risk Aversion	12.192	217.71	49.128	105.83
Farm Dependency	1.4739	1.7871	-0.0072	1.4404
Full Owner[b)]	-63.312**	34.474	39.484	38.767
Partial Owner	-31.665	39.832	56.527*	37.085
Cash Grains[b)]	-28.617	57.544	-22.178	40.831
Other Field Crops	-48.205	68.534	46.116*	28.983
High-value Crops	-34.925	95.339	19.537	30.864
Beef Cattle	-24.971	53.392	20.267	22.669
Hogs	69.027	82.499	222.49**	111.56
Poultry	13.805	58.151	36.074	112.93
Dairy	-63.331*	45.296	39.253	44.225
Product[b)]	-31.868	43.878	-32.019	75.538
Market	51.909**	29.807	-32.046	33.779
Household size	-12.963	12.237	1.4682	4.3825
HH size (18 and younger)	11.868	17.723	15.531	12.471
HH size (65 or older)	-613.92***	59.638	-10.264	24.259
Operator's age	1.1824*	0.7981	0.2685	0.6858
Retirement plans	-29.461	31.769	36.769**	20.424
Off-farm employment	4.3835	19.168	13.528	15.351
Education level	0.3401	4.5203	4.7398	4.6467
NFRET	-14.696	27.531	-15.053	25.759
NFRISK	57.255**	26.555	-1.5098	27.723
Heartland[b)]	38.711	42.175	-9.0267	35.452
Northern Crescent	36.582	54.041	63.116**	35.706
Northern Great Plains	57.282*	43.001	-9.5298	55.582
Prairie Gateway	51.552	44.679	-34.416	31.412
Eastern Uplands	71.141	69.007	22.582	41.887
Southern Seaboard	44.575	73.309	49.214*	38.049
Fruitful Rim	115.89**	63.028	28.059	42.754
Basin and Range	42.782	72.564	62.997**	33.805
Σ	124.21***	13.405	172.99***	18.746
R^2	0.2224		0.2116	

Notes: a) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels of significance, respectively; b) the base variables for farm tenure, farm specialization, market strategy, and regional variables are "both farm and household", "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table 5-10. Parameter Estimates for Two-Limit Tobit Model: Non-Farm Debt Equation

Variable	Actual Recipients		Non-Recipients	
	Parameter Estimate[a)]	Standard Error	Parameter Estimate[a)]	Standard Error
Intercept	-393.79***	160.08	-374.58***	133.07
Farm Size	0.0025	0.0176	-0.0378	0.0324
Debt-to-Asset Ratio	18.345	36.714	135.49**	65.198
RROA	-0.1503	0.2144	0.2845	0.2555
Risk Aversion	-274.61	214.63	-97.381	130.81
Farm Dependency	-0.2985	0.5747	4.1125**	2.4412
Full Owner[b)]	-30.777	41.399	87.524**	41.801
Partial Owner	-39.487*	30.376	102.84***	41.405
Cash Grains[b)]	63.276	74.555	69.765	130.06
Other Field Crops	135.57**	80.921	16.525	33.512
High-value Crops	72.275	517.57	2.5857	75.798
Beef Cattle	117.87*	86.009	-13.258	29.118
Hogs	68.869	88.933	18.398	343.19
Poultry	201.92*	124.78	-88.633*	60.051
Dairy	72.195	78.865	-22.676	55.075
Product[b)]	-92.404**	43.431	82.906	65.329
Market	-22.147	27.844	-77.912*	50.906
Household size	7.7929	8.6437	10.976**	4.7766
HH size (18 and younger)	6.6373	19.276	29.772***	11.756
HH size (65 or older)	-575.85***	163.61	52.777	43.569
Operator's age	-0.5758	0.7159	-0.0092	1.0081
Retirement plans	-27.387	26.657	4.8888	20.147
Off-farm employment	-9.8184	26.165	86.609***	23.828
Education level	8.1435*	5.7576	-1.3689	4.6656
NFRET	16.042	25.665	-64.531**	31.118
NFRISK	28.024	27.024	41.931	37.363
Heartland[b)]	68.099*	45.221	-30.914	66.786
Northern Crescent	86.493**	46.651	35.759	39.785
Northern Great Plains	56.099	45.661	-21.602	46.471
Prairie Gateway	37.432	34.509	6.6177	37.354
Eastern Uplands	64.249	73.364	-3.1732	35.919
Southern Seaboard	15.859	47.611	10.027	41.889
Fruitful Rim	95.293**	53.285	36.933	53.688
Basin and Range	26.738	41.807	23.368	43.767
Σ	109.14***	22.132	161.76***	17.729
R^2	0.2136		0.2178	

Notes: a) ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels of significance, respectively; b) the base variables for farm tenure, farm specialization, market strategy, and regional variables are "both farm and household", "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

CHAPTER 6

DISCUSSION AND CONCLUSIONS

Summary

The general objective of the analysis was to determine how farm households perceive the fixed payments and to determine the factors which possibly explain such behavior. This thesis extended the analysis and research done by Goodwin and Mishra (2006) and used the same approach. Unlike Goodwin and Mishra, it used the data for both recipients and non-recipients and estimated the allocation of payments on specific uses. It is important to note that most estimates provided very similar signs and behavior both for actual recipients and non-recipients of fixed payments.

Based on the available data from the ARMS survey of 2003 significant empirical results were obtained which can be utilized to consider the extent to which U.S. fixed direct payments may cause distortions in production. Though they are not directly linked to current production level and prices, critics argued that these payments could still alter production decisions because payments increase farm operators' income, and the expectation of fixed, future payments increases their wealth. Previous research concluded that though "decoupled" payments can provide an incentive to increase farm production, they are expected to have minimal links to actual farm production levels.

The general conceptual model was based on the main assumption that if farm households perceive fixed payments as predetermined lump-sum income transfers, then these payments are truly decoupled and may cause only minimal distortions. Then it is important to consider where

this additional income to the farm household is allocated or would be allocated if one receives a fixed amount each year for a certain period of time (e.g. 6 years). The main concern here is whether these payments enable increased farm investment and lead to higher production level.

Both recipients and non-recipients of fixed payments have a wide choice for the investment decisions. Rational agents likely seek to equalize expected asset returns, adjusted for risk and taxes. This leads us to the point made earlier – risk-averse households will invest to non-farm assets to diversify their investment portfolio and thus, reduce financial risk. Surveys show that farm operators use many market mechanisms, such as hedges and forward contracts, to reduce their risk exposure in their farm operation. Households with diversified investment portfolios are also likely to adjust to changes in risk tolerance through reallocations of their whole portfolio. If they use these strategies to manage risk, then the extent to which changes in risk attitude due to payments, if any, lead to increased production levels is minimized.

Conclusions and implications

The empirical results support the theory discussed above as well as other theories and previous empirical and theoretical findings. The research also found many new results which provide a better explanation to farm household behavior than previous work and thus, enrich the findings of previous literature. The logit and tobit analysis and available data were used to investigated the allocation of payments on specific uses and found the explanatory variables that affect these allocation decisions most significantly. The findings also include very interesting results that bring some light into the degree to which fixed payments can be allocate towards farm uses rather than off-farm or household. One interesting empirical result was that the larger farmers are more likely to allocate direct payments towards household uses rather than both farm

and household uses. Another finding is for those farm operators who are full or partial owners it is less likely that payments would be allocated towards the farm.

In general, estimates explain that farm households would probably allocate more of the fixed payment towards household (non-farm) uses rather than to the farm business. Particularly, the estimates suggest that farm households are not likely to allocate fixed payments to farm land purchase or rental or to other farm uses that would be expected to expand production. Even if the household indicated that it would allocate the fixed payment to the farm business, the majority of the payment would be typically allocated to either farm operating cost and/or paying down the farm debt. This behavior is explained by land tenure, financial leverage, rate of return on assets, risk aversion, and other parameters of farm business as well as characteristics of farm operators and the household. Most of the estimates largely confirm the findings of earlier research in that they generally suggest that the effect of direct payments on acreage increase are likely to be very small.

In addition to all these, it is important to point again some other specific findings. The estimates show, at least for the sample of data used, that farmers specializing in tobacco, cotton, and peanut production are more likely to allocate on household only and less likely to invest to farm business. Specifically, out of general allocation to non-farm uses, these farmers are more likely to use payment on investments into non-farm assets.

A specific analysis of the factors that explain farm household behavior allowed to conclude that the direct payments are allocated (or would be allocated) in such way that does not increase farm investments and have minimal production or acreage effects. The findings support the notion that fixed payments are not trade distorting and thus fit appropriately into the WTO "green" box classification of agricultural programs and policies. Therefore current fixed direct

payments are perceived to be just like any other lump-sum payments received from the government. This might lead one to the conclusion that these payments have the least chance to have an unfair impact on other exporters of agricultural commodities.

Limitations and future research

This study was only based on the single-period data since specific questions used for the analysis were only asked in the ARMS survey of 2003. If the data for more than one year were available a dynamic model could be used to determine the long-term effect of factors analyzed in this study. A recommendation for designers of AMRS survey questions would be to continue asking the question on where the households choose to allocate the fixed direct payment for each year independently from other years of participation in the government program. This would allow future research to study whether allocation behavior of farm households is consistent over time. This particularly relates to specific allocation of the payments on production-enhancing activities like land purchase or rental and farm capital investments which have long-term effects on agricultural production than other farm investments.

In addition, future studies could focus on separate analyses of specific groups of farm households that have common characteristics and compare them with each other. Such methodology would allow researchers to get empirical results based on relatively homogeneous sample. It would be useful for the analysis to be conducted separately for each geographical region.

REFERENCES

Adams, G., P.Westhoff, B.Willott, and R.E.Young II, 2001. "Direct Payment, Safety Nets and Supply Response: Do 'Decoupled Payments Affect U.S. Crop Area? Preliminary Evidence from 1997-2000." *American Journal of Agricultural Economics*, Volume 83, pp. 1190-1995

Ahearn, M., Hisham S. El-Osta, and Joe Dewbre, 2002. "The Impact of Government Subsidies on the Off-farm Labor Supply of Farm Operators." Selected paper at the 2002 AAEA Annual Meeting, Long Beach, CA July 28-31, 2002. http://agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=45879type=.pdf

Benjamin, D., 1992. "Household Consumption, Labor Markets and Labor Demand: Testing for Separation ion Agricultural Farm-Household Models." *Econometrica*, Vol. 60(2), p.287-322.

Burfisher, M.E. and J.Hopkins, 2003. "Decoupled Payments: Household Income Transfers in Contemporary U.S. Agriculture." Agricultural Economic Report No. 822, ERS, USDA, Washington, DC.

Chau, N. and H.de Gorter, 2000. "Disentangling the Production and Export Consequences of Direct Farm Income Payments." Paper presented at the 2000 AAEA Annual Meeting, Tampa, FL August 2000. http://agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=2082&type=.pdf

Chavas, J.P. and R.D.Pope, 1985. "Price Uncertainty and Competitive Firm Behavior: Testable Hypotheses from Expected Utility," *Journal of Economics and Business*, vol. 37, pp. 223-35.

Collender, R.N. and M.Morehart, 2004. "Decoupled Payments to Farmers, Capital Markets, and Supply Effects," Agricultural Economic Report No. 838, November 2004, U.S. Department of Agriculture Economic Research Service, Washington, DC

Dewbre, J. and A. Mishra, 2002. "Farm Household Incomes and U.S. Government Program Payments," Selected paper for presentation at the 2002 AEAA Annual Meeting, Long Beach, CA, July 28-31, 2002. http://agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=4517&ftype=.pdf

Dubman, R.W., 2000. "Variance Estimation with USDA's Farm Costs and Returns Surveys and Agriculture Resource Management Study Surveys," ERS Staff Paper, U.S. Department of Agriculture, Economic Research Service, Washington, DC

El-Osta, H., A.Mishra, and M.C. Ahearn, 2004. "Labor Supply by Farm Operators Under 'Decoupled' Farm Program Payments," *Review of Economics of the Household*, vol.5, September 2004.

Gardner, B.L., 2002. American Agriculture in the Twentieth Century: How It Flourished and What It Cost. Harvard University Press. Cambridge, MA

Goodwin, B.K. and A. Mishra, 2006. "Are 'Decoupled' Farm Program Payments Really Decoupled? An Empirical Evaluation," *American Journal of Agricultural Economics,* vol. 88(1), pp. 73-89.

Harvey, D.R., 2004. "Policy Dependency and Reform: Economic Gains Versus Political Gains," *Journal of Agricultural Economics*, vol. 31, pp. 265-275.

Hennessy, D.A., 1998. 'The Production Effects of Agricultural Income Support Policies Under Uncertainty," *American Journal of Agricultural Economics*, vol. 80: 46-57.

Key, N., R. Lubowski, and M.J. Roberts, 2004. "The 1996 Federal Agricultural Improvement and Reform Act: Correcting a Distortion?" Paper presented at the AAEA Annual Meeting, Denver CO http://agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=1459&type=.pdf

Knutson, R.D., Penn, J.B., and Boehm, W.T., 1995. Agricultural and Food Policy. Third Edition, Prentice Hall. Englewood Cliffs, NJ.

Lee, J.E., Jr., 1965. "Allocating Farm Resources Between Farm and Nonfarm Uses," *Journal of Farm Economics*, vol. 47, no.1, pp. 83-92

Maddala, G.S., 1999. Limited-Dependent and Qualitative Variables in Econometrics. Cambridge University Press. New York.

Makki, S.S., A.Somwaru, and M.Vandeveer, 2004. "Decoupled Payments and Farmers' Production Decisions Under Risk," Agricultural Economic Report No. 838, November 2004, U.S. Department of Agriculture Economic Research Service, Washington, DC

Mas-Colell, A., Winston, M.D., and Green, J.R., 1995. Microeconomic Theory. Oxford University Press, New York.

Mishra, A.K. and M.J. Morehart, 2001. "Off-farm Investment of Farm Households: A Logit Analysis," *Agricultural Finance Review*, 61, pp.87-101. http://afr.aem.cornell.edu/61/Pdfspring/V61_1SP6.pdf

Mullen, K., N.Chau, H. de Gorter, and B.Glog, 2001. "The Risk Reduction Effects of Direct Payments on U.S. Wheat Production," Paper presented at the International Agricultural Trade Research Consortium Symposium, Washington, DC.

Newberg, D. and J. Stiglitz , 1981. "The theory of Commodity Price Stabilization: A Study in the Economics of Risk." Oxford University Press. Oxford

OECD, 1999. "A Matrix Approach to Evaluating Policy: Preliminary Findings from PEM Pilot Studies of Crop Policy in the EU, US, Canada and Mexico," Paris, OECD, COM/AGR/CA/TD.TC(99)117/FINAL

OECD, 2001. "Decoupling: A Conceptual Overview", Paris, OECD http://www.oecd.org/dataoecd/23/51/25481500.pdf

OECD, 2005. "A Review of Empirical Studies of the Acreage and Production Response to U.S. Production Flexibility Contract Payments Under the FAIR Act and Related Payments Under Supplementary Legislation," Paris, OECD, AGR/CA/APM(2004)21/FINAL

Pope, R.D. and R.E. Just, 1991. "On Testing the Structure of Risk Preferences in Agricultural Supply Analysis," *American Journal of Agricultural Economics*, vol. 73: 743-748.

Roe, T., A. Somwaru, and X.Diao, 2004. "Decoupled Payments: A Dynamic, Economywide Perspective," Agricultural Economic Report No. 838, November 2004, U.S. Department of Agriculture Economic Research Service, Washington, DC.

Rude, J.I., 2000. "An Examination of Nearly Green Programs: Case Study for Canada," *American Journal of Agricultural Economics*, no.82, p.755-761.

Swinbank, A. and S. Tangermann, 2001. "The Future of Direct Payments Under the CAP: A Proposal," *Eurochoices*, Premier Issue 28-29, 32-34.

Tobin, J., 1958. "Estimation of Relationships for Limited Dependent Variables." *Econometrica* 26:24-26.

Wetzstein, M., 2005. Microeconomic Theory: Concepts and Connections. Thomson South-Western.

Young, C.E. and P.C. Westcott, 2000. "How Decoupled is U.S. Agricultural Support for Major Crops?" *American Journal of Agricultural Economics*, vol. 82: 762-767.

APPENDIX

Table A.1. Marginal Effects of Variables for Multinomial Logit Model.

Variable	Actual recipients		Non-recipients	
	Farm	Household	Farm	Household
Farm Size				0.0631
Wealth			0.0032	- 0.0429
Debt-to-Asset Ratio	1.2915		0.5212	-0.2126
RROA			0.0062	
Farm Dependency				0.0744
Full Owner		0.0365	-0.3666	-0.0376
Partial Owner			-0.3287	-0.0902
High-value Crops		-2.7403		
Hogs		-1.7612	-0.6077	
Poultry	-2.0847		-0.4153	
Dairy				-0.1113
Product				-1.5973
HH size (18 and younger)		-0.0426		-0.0001
HH size (65 or older)			-0.2706	-0.1773
Retirement plans			-0.1807	0.1459
Off-farm employment				-0.0153
NFRET				-0.0094
NFRISK			-0.1147	
Heartland	0.5205	0.0485	0.3313	
Northern Crescent	0.4383		0.1479	
Northern Great Plains	0.3899			
Prairie Gateway		0.0505	0.1408	
Eastern Uplands	0.7896			-0.0012
Southern Seaboard			0.3064	
Fruitful Rim		0.0825	0.1702	
Basin and Range	0.7829			

Note: the base variables for dependent variable (allocation choice), farm tenure, farm specialization, market strategy, and regional variables are “both farm and household”, “full tenant”, “other livestock”, “contract”, and “Mississippi Portal” respectively.

Table A.2. Marginal Effects of Variables for Two-Limit Tobit Model: Farm Operating Cost Equation.

Variable	Actual Recipients	Non-recipients
Wealth		0.0312
Dairy		3.8099
Household Size	-0.7833	
HH size (18 and younger)	8.6721	
HH size (65 or older)	12.605	11.082
Off-farm employment	-4.8089	-3.1617
Education level		-1.7706
NFRISK		8.3559
Heartland		-17.706
Northern Crescent		-14.095
Southern Seaboard		-14.052
Basin and Range		-14.111

Notes: the base variables for farm specialization and regional variables are “other livestock” and “Mississippi Portal” respectively.

Table A.3. Marginal Effects of Variables for Two-Limit Tobit Model: Land Purchase and Rental Equation.

Variable	Actual Recipients	Non-recipients
Full Owner	-6.1934	-7.3813
Partial Owner	-2.8126	
High-value crops		6.2689
Beef cattle		6.1863
Hogs		-28.122
Poultry	-5.9084	
Dairy	-4.7413	
Product		13.6514
Market		-3.1902
Household Size	-0.6604	-0.6985
HH size (18 and younger)	2.6135	3.0527
HH size (65 or older)		-6.0384
Operator's age		-0.1224
Retirement plans	3.1933	-5.7472
Off-farm employment	1.7885	1.9504
Southern Seaboard		-5.6113
Fruitful Rim		-3.5744

Notes: the base variables for farm tenure, farm specialization, market strategy, and regional variables are "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table A.4. Marginal Effects of Variables for Two-Limit Tobit Model: Capital Expenditures Equation.

Variable	Actual Recipients	Non-recipients
Household Size	0.6237	
HH size (18 and younger)	-0.8089	
HH size (65 or older)	-11.385	
Operator's age		0.2134
Retirement plans		-7.9492
Off-farm employment		4.2194
Education level	1.0479	1.4275
NFRET		4.3844
Northern Crescent	-7.3492	10.347
Northern Great Plains		-5.2663
Prairie Gateway		-7.6378
Fruitful Rim		5.9472
Basin and Range	-7.3747	

Notes: the base for regional variables is "Mississippi Portal" region.

Table A.5. Marginal Effects of Variables for Two-Limit Tobit Model: Farm Debt Equation.

Variable	Actual Recipients	Non-recipients
Farm size		-0.0012
Debt-to-asset ratio	29.189	42.857
RROA	0.0955	
Risk aversion		-25.092
Full owner		13.437
Partial owner	5.7015	18.138
High-value crops		-3.8493
Poultry	17.596	
Dairy		9.5974
Product		13.129
Market		7.3329
Household Size	2.1896	1.8275
HH size (18 and younger)	-2.9649	
HH size (65 or older)	-4.4727	5.2164
Operator's age	-0.0596	
Off-farm employment		6.9431
NFRET	-0.5491	
Fruitful Rim		6.7285
Basin and Range		8.4674

Notes: the base variables for farm tenure, farm specialization, market strategy, and regional variables are "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table A.6. Marginal Effects of Variables for Two-Limit Tobit Model: Family Living Expenses Equation.

Variable	Actual Recipients	Non-recipients
Debt-to-asset ratio	-34.528	-20.784
RROA	-0.0128	-0.0529
Full owner	6.6754	10.819
Other field crops	24.181	
High-value crops	-0.7229	-12.957
Beef cattle	21.176	-5.0824
Poultry	32.118	19.234
Product	-21.278	
Household Size	5.9627	
Operator's age	0.3047	-0.1058
Retirement plans	-10.051	3.9628
NFRET	-0.2809	7.1821
Heartland	-20.145	-23.315
Northern Crescent	-24.402	-17.608
Northern Great Plains	-16.523	-20.192
Eastern Uplands	-29.118	-7.9212
Southern Seaboard	-1.1033	-20.187
Fruitful Rim	-15.838	-14.479
Basin and Range	-32.156	-15.258

Notes: the base variables for farm tenure, farm specialization, market strategy, and regional variables are "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table A.7. Marginal Effects of Variables for Two-Limit Tobit Model: Cash Reserve Equation.

Variable	Actual Recipients	Non-recipients
Farm size	-0.0045	-0.0092
Debt-to-asset ratio	-25.134	-12.097
Poultry	27.391	
Product	-11.368	
Household Size	-0.8556	0.7615
HH size (65 or older)	-47.127	
Retirement plans	-0.2078	8.053
NFRISK	5.4735	6.7158
Heartland	-8.3764	-7.2144
Northern Crescent	-9.3221	-4.4967
Northern Great Plains	-10.492	-9.8932
Prairie Gateway	-13.677	-3.9217
Southern Seaboard	-7.3538	-4.5112
Basin and Range	-6.2777	-6.6444

Notes: the base variables for farm specialization, market strategy, and regional variables are “other livestock”, “contract”, and “Mississippi Portal” respectively.

Table A.8. Marginal Effects of Variables for Two-Limit Tobit Model: Non-Farm Assets Equation.

Variable	Actual Recipients	Non-recipients
Farm size	-0.0039	
Debt-to-asset ratio	-23.338	-24.813
Full owner	-13.839	
Partial owner	-5.9629	11.132
Other field crops	-8.8837	8.6718
Hogs	14.153	26.659
Dairy	-14.256	
Market	-20.996	
HH size (65 or older)	-48.275	
Operator's age	0.0383	
Retirement plans	-4.5692	5.2013
NFRISK	18.262	
Northern Crescent	7.3461	12.278
Northern Great Plains	17.676	
Southern Seaboard	6.7851	7.6788
Fruitful Rim	22.883	
Basin and Range	8.7575	12.785

Notes: the base variables for farm tenure, farm specialization, market strategy, and regional variables are "full tenant", "other livestock", "contract", and "Mississippi Portal" respectively.

Table A.9. Marginal Effects of Variables for Two-Limit Tobit Model: Non-Farm Debt Equation.

Variable	Actual Recipients	Non-recipients
Debt-to-asset ratio		20.252
Farm dependency		0.2263
Full owner		16.834
Partial owner	-8.2981	18.809
Other field crops	22.193	
Beef cattle	19.419	
Poultry	31.495	-17.415
Product	-18.712	
Market		-13.044
Household Size		0.9215
HH size (18 and younger)		2.0182
HH size (65 or older)	-46.678	
Off-farm employment		-16.977
Education level	0.6522	
NFRET		-10.779
Heartland	11.013	
Northern Crescent	15.683	
Fruitful Rim	18.984	

Notes: the base variables for farm tenure, farm specialization, market strategy, and regional variables are “full tenant”, “other livestock”, “contract”, and “Mississippi Portal” respectively.

Table A.10. Descriptive Statistics of the Continuous Variables for Payment Recipients

Variable name	Units	Mean	Standard Deviation
FARMSIZE	1000 Dollars	446.5	1000.06
WEALTH	1000 Dollars	1468.17	2963.72
DEBTASSET	Ratio	0.1815	0.23461
RROA	Ratio	2.9472	49.3503
INS	Ratio	0.0439	0.0389
SHARE	Ratio	0.0774	12.4391
OP_AGE	Numbers of years	52	12.25

Table A.11. Descriptive Statistics of the Continuous Variables for Non-Recipients

Variable name	Units	Mean	Standard Deviation
FARMSIZE	1000 Dollars	395.658	1322.99
WEALTH	1000 Dollars	1144.54	2714.13
DEBTASSET	Ratio	0.1368	0.44038
RROA	Ratio	– 4.1238	161.377
INS	Ratio	0.0496	0.0639
SHARE	Ratio	–1.913	132.417
OP_AGE	Numbers of years	55	13.113

Table A.12. Farm Tenure of Survey Respondents (in percentages)

	Actual recipients	Non-recipients
Full owner	17.01%	56.27%
Partial owner	68.17%	36.41%
Full tenant	14.82%	7.32%

Table A.13. Farm Type by Major Commodity Produced

	Actual Recipients	Non-Recipients
Cash Grains	47.65%	3.44%
Other Field Crops	12.54%	14.25%
High-value Crops	3.67%	15.42%
Beef livestock	15.62%	30.82%
Hogs	2.38%	1.17%
Poultry	2.08%	12.27%
Dairy	13.34%	11.2%
Other Livestock	2.72%	11.43

Table A.14. Household size (excluding operator)

Number of people	Actual Recipients	Non-Recipients
1	8.28%	9.08%
2	42.98%	48.06%
3	17.45%	15.73%
4	16.31%	14.92%
5	9.57%	6.76%
more than five	5.41%	5.45%

Table A.15. Number of people in the household at 18 and younger

Number of people	Actual Recipients	Non-Recipients
0	75.46%	81.67%
1	15.42%	11.51%
2	8.08%	5.64%
3	0.94%	1.03%
4	0.1%	0.14%

Table A.16. Number of people in the household at 65 and older

Number of people	Actual Recipients	Non-Recipients
0	97.42%	96.03%
1	1.93%	3.38%
2	0.59%	0.56%
3	0.05%	0%
4	0%	0.03%

Table A.17. Age distribution

Age range	Actual Recipients	Non-Recipients
34 and younger	5.5%	4.92%
35-49	36.29%	29.11%
50-64	40.16%	40.07%
65 and older	18.05%	25.9%

Table A.18. Operator's characteristics

	Actual Recipients	Non-Recipients
Male operator	97.77%	91.53%
Retirement plans	16.96%	19.73%
Married	70.65%	64.4%
Off-farm employed	23.85%	38.06%

Table A.19. Operator's education level

Education level	Actual Recipients	Non-Recipients
Some high school or less	6.94%	11.99%
Completed high school	40.31%	38.89%
Some college	28.36%	25.62%
Completed college	20.72%	16.96%
Graduate school	3.67%	6.54%

Table A.20. Geographic location of farm households across ERS regions

	Actual Recipients	Non-Recipients
Heartland	5.11%	26.67%
Northern Crescent	15.98%	18.39%
Northern Great Plains	2.65%	9.47%
Prairie Gateway	8.75%	13.83%
Eastern Uplands	15.65%	4.56%
Southern Seaboard	18.47%	7.68%
Fruitful Rim	19.2%	7.14%
Basin and Range	7.77%	3.47%
Mississippi Portal	6.42%	8.79%