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THE BUCK STOPS WHERE? THE DISTRIBUTION OF AGRICULTURAL SUBSIDIES

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ABSTRACT

The U.S. has a long history of providing generous support for the agricultural sector. A recent omnibus package of farm legislation, the 2008 Farm Bill (P.L. 110-246) will provide in excess of $284 billion in financial support to U.S. agriculture over the 2008-2012 period. Commodity program payments account for $43.3 billion of this total. Our paper is concerned with the distribution of these benefits. Farm subsidies make agricultural production more profitable by increasing and stabilizing farm prices and incomes. If these benefits are expected to persist, farm land values should capture the subsidy benefits. We use a large sample of individual farm land values to investigate the extent of this capitalization of benefits. Our results confirm that subsidies have a very significant impact on farm land values and thus suggest that landowners are the real benefactors of farm programs. As land is exchanged, new owners will pay prices that reflect these benefits, leaving the benefits of farm programs in the hands of former owners that may be exiting production. Approximately 45% of U.S. farmland is operated by someone other than the owner. We report evidence that owners benefit not only from capital gains but also from lease rates which incorporate a significant portion of agricultural payments even if the farm legislation mandates that benefits must be allocated to producers. Finally, we examine rental agreements for farmers that rent land on both a cash and share basis. We find evidence that farm programs that are meant to stabilize farm prices provide a valuable insurance benefit.

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1 Introduction

A 2002 news report posed the following question. What do former basketball star Scottie Pippen, publisher Larry Flynt, and stockbroker Charles Schwab all have in common? The surprising answer is that all are recipients of farm program subsidies.[1] Other notable payment recipients include nine U.S. Members of Congress; David Rockefeller, former chairman of Chase Manhattan and grandson of oil tycoon John D. Rockefeller, who received 99 times more in subsidies than the median farmer; Ted Turner, the 25th wealthiest man in America, who received 38 times more subsidies than the median farmer; and the late Kenneth Lay, the ousted Enron CEO and multi-millionaire. (Reidl, 2004). Several *Fortune-500* companies have also received substantial farm program payments, including John Hancock Mutual Insurance ($2.5 million in 2002), the Chevron corporation, and the Caterpillar corporation.

In arguing for program reforms, U.S. Senator Amy Klobuchar (D-MN) stated that "$3.1 million in farm payments went to the District of Columbia, $4.2 million has gone to people living in Manhattan, and $1 billion of taxpayer money for farm payments has gone to Beverly Hills 90210."[2] The fact that support for U.S. "farmers" is often directed to individuals and corporations that seem to be some distance from the farm has been the topic of considerable debate in recent years, in particular since congressional support for U.S. agriculture continues to expand. The 2008 Farm Bill (P.L. 110-246) will provide in excess of $284 billion in financial support to U.S. agriculture over the 2008-2012 period. Commodity program payments account for $43.3 billion of this total.

To the extent that eligibility for government benefits is tied to the ownership or operation of certain assets, the market values of these assets will reflect expected future benefits.

[1] "Farm Subsidies Help Those Who Help Themselves," a Fox News report by William LaJeunesse, July 15, 2002. This article is available from `http://www.foxnews.com/story/0,2933,57602,00.html`. These statistics are all drawn from the Environmental Working Group's farm subsidy database (`www.ewg.org`).

[2] December 12, 2007 Senate floor statement of Senator Amy Klobuchar.

Such is the case with farmland. Considerable variation exists in agricultural land values across the U.S. (see Figure 1). USDA statistics indicate that 45.3% of U.S. farmland is operated by someone other than the owner (USDA-NASS, 1999). Mishra et al. (2002) report that, contrary to conventional wisdom, most agricultural landlords (57%) are non-farm corporations or individuals that work in or are retired from nonfarm-related activities. In light of these facts, a fundamental question arises regarding the distribution of farm support programs and the extent to which those who operate the farms actually receive the benefits. This is a critical issue, not only for policymakers but also for farm operators who should understand the extent of their gain from the various programs they tend to support.

The relevant question is, of course, who are the policies intended to benefit? The capture of agricultural benefits by farmland values is problematic if the policies aim to support farmers and these farmers do not own their land when the policies are announced. To the extent that (young) expanding farmers are paying for the expected policy benefits in the farm assets they acquire, the present value of future benefits is captured by the (old) sellers. New owners only benefit from surprise increases in public transfers. Given the large share of U.S. farm land that is operated by tenant farmers, the extent to which lease rates capture program benefits is also important to the distribution of these benefits.

The concern with the capture of agricultural policy benefits by the initial land owners is not new. A number of papers have attempted to estimate the capitalization of aggregate agricultural transfers into farmland values.[3] These papers suffer from a number of shortcomings which we are able to address here through an empirical analysis of a unique set of farm-level data. We contribute to the understanding of the distribution of farm subsidies in several ways. First, we are able to investigate the differential impact of the principal farm programs because we are able to observe the breakdown of government payments at both the farm and the county level. Second, because we know the location of each farm, we are able

[3]See Barnard et al. (1997), Goodwin and Ortalo-Magné (1992), Ryan et al. (2001), Shertz and Johnston (1997), Shoemaker et al. (1990), and Weersink et al. (1999). These papers only examine aggregate policy effects on land values, thus ignoring the myriad effects of different programs. In addition, the extraction of policy benefits through lease arrangements has not been widely investigated. Important exceptions exist in the recent studies of Kirwan (2009) and Patton et al. (2008), which we discuss below.

to control for non-agricultural pressures on the land and determine how they affect its value. Third, we observe not only land values but also the terms of lease arrangements and rates. This puts us in a unique position to be able to assess directly the extent to which owners and farmer operators share the benefits of various agricultural programs, a useful complement to the indirect assessment we obtain from investigating land values. Finally, variations in the difference between cash lease rates and share lease rates enables us to investigate the extent to which the market values the insurance features built into some farm programs, a feature ignored by the literature.

Our analysis makes use of a data set drawn from an annual survey of approximately 10,000 farms per year over the 1998-2005 period. This period was characterized by a variety of different farm programs, including some which were not connected in any way to market conditions or production, at least in theory. At the other extreme are output price-support payments which are intimately tied to contemporaneous market conditions. We find that payments that are decoupled from output and are supposed to be transitory yield the smallest effects on land values. Payments that may signal future benefits, even in cases where they are not a permanent part of farm legislation, have stronger effects. Price-support payments have the strongest effects.

U.S. farm legislation typically intends benefits to be "shared" between the owner and operator of a farm. Under cash lease arrangements, the entire subsidy is sent to the operator. However, the law does not regulate lease rates; they are set by the market. Our empirical analysis indicates that owners extract a large proportion of farm benefits from tenants through the lease rates. From the study of lease rates, we also find that programs with strong insurance objectives, such as output-price support payments, significantly affect the gap between cash and share lease rates. In particular, the share rate premium is significantly diminished by programs that serve to lower the risk associated with uncertain farm earnings. This finding provides direct evidence of the land market pricing the insurance component of agricultural policy.

Accounting for the benefits of decreased earnings volatility raises two issues with the traditional approach to the assessment of the contribution of agricultural policy to farm land values. First, the insurance feature of several governmental programs raises questions about the traditional implicit assumption that a dollar of transfer today conveys the same information about future transfers, regardless of market conditions and local agricultural output characteristics. Instead, a low price support payment this year may be due to high market prices and thus in no way indicates a decrease in the expected stream of long run benefits from the price support program. Second, those government transfers whose level are negatively correlated with farm earnings from the market decrease the volatility of farm land returns. They must therefore decrease the discount rate required to hold farm land and thus the discount rate applied to earnings from the market. Hence, regression estimates of the contribution of market earnings to the value of land depend on the policy environment. In particular, it is wrong to assume that such estimates would not change to reflect a more volatile environment if price support programs were to be dismantled.

We have noted that the empirical literature has largely been focused on policy effects on land values and the incidence of policy benefits in rental arrangements—which is an increasingly prominent feature of US agriculture—has not received the same level of scrutiny. Two important exceptions lie in the recent analysis of Kirwan (2009) and Patton et al. (2008), who both evaluated the effects of policy benefits on land rental rates. Kirwan (2009) used farm-level panel data taken from the 1992 and 1997 Agricultural Censuses to evaluate the incidence of policy benefits in farmland rental arrangements. However, the census data only included rents for land leased on a cash or free basis and he therefore largely ignored the potentially important role of share lease contracts. In the sample of farms evaluated in this analysis, 63.6% of the farms reported renting land and, of those that rented land, 36.3% reported leasing land on a share basis. As Kirwan points out, to the extent that a significant share of rented land is leased under share arrangements, this may raise an errors-in-variables problem that results in biases if the measurement error is correlated with policy benefits. Kirwan undertook an analysis intended to demonstrate that the biases raised by ignoring share lease arrangements were modest. To do so, he used a single year of data from a related survey, the Agricultural Economics Land Owners Survey (AELOS) in 1999, to investigate the extent to which the measurement error in rental rates arising from the omission of share rents resulted in biases in his estimates of benefit incidence. On the basis of results for this single year, he concluded that the biases were small and generally positive. While these arguments are persuasive, the reliance upon a single year of data in a case where policy benefits are very dependent upon market conditions in any given year may make it hard to generalize his results. Further, as we argue below, it may be important to segregate benefits across different policy types since the effects on land values and rents may vary substantially for different types of policies—a point demonstrated by Goodwin, Mishra, and Ortalo-Magné (2003b).

An important point of relevance is the significant variety of agricultural programs used by policymakers to convey support to the farm sector (see Appendix Table 1 below). Kirwan (2009) argues that policy benefits after the 1996 Farm Bill were exogenously determined by underlying program parameters. As we discuss in greater detail below, this is not entirely the case since a wide range of policies are used to convey benefits to agricultural producers. Although certain payments were exogenously determined by Congressional mandate and were known with certainty over the life of the legislation, other significant benefits, including price supports, disaster payments, and market loss payments were not exogenously known prior to the year in which they were received.

Patton et al. (2008) draw a careful distinction between payments that are "coupled" and "decoupled." Although disagreement exists over what constitutes coupling of payments, a formal definition is afforded by Annex 5 of the 1996 WTO Uruguay Agreement on Agriculture (URAA), which defines a decoupled payment as one that is not dependent upon production or price in the year in which it is made. Patton et al. (2008) adopt an instrumental variables approach to recognize the fact that payments are not known with certainty at the time rental contracts are determined and thereby represent expected values of policy benefits by using instruments. We follow a similar approach in certain portions of our analysis.

Their results indicate that different types of agricultural policy benefits have different effects on rental rates, thereby confirming the earlier assertions of Goodwin, Mishra, and Ortalo-Magné (2003a) that predicted such differential effects. Patton et al.'s (2008) results also raise important questions regarding the validity of the assumed operation of agricultural programs and modeling of benefit incidence presented by Kirwan (2009).

The remainder of our paper is organized as follows. The next section gives a brief overview of the history and nature of U.S. farm programs. We are particularly concerned with providing a careful description of the different mechanisms commonly used to convey policy benefits to U.S. agricultural producers. Section three discusses issues pertaining to model specification, estimation, and measurement of the relevant variables. The fourth section presents the results of our empirical analysis and discusses their implication for the distribution of agricultural policy benefits. The final section offers some concluding remarks.

2 A Brief Overview of U.S. Farm Policy

Most U.S. farm programs have their origins in the New Deal legislation of the Great Depression. A variety of price and income support programs have been used over time to increase and stabilize farm earnings. These programs are revised approximately every 5 years by an omnibus "Farm Bill" package of legislation. In addition to this major package of farm programs, support is provided through a number of other legislative channels. This is the case with farm programs such as crop insurance and conservation measures. On a regular basis, agriculture also benefits from ad hoc support (though emergency bills) that is not a part of any budgeted legislation.

Over most of its history, U.S. agricultural policy has used price supports coupled with production controls, with the declared objective to provide income support to the farm sector. Some support was made on the basis of a need for "parity" with the high relative agricultural prices of 1910.[4] In more recent times, support was provided only to program

[4]Though any link with market and production conditions in 1910 would seem difficult to make, arguments in favor of such "parity" pricing are still heard on occasion in farm policy debates.

crops (corn, wheat, cotton, rice, grain sorghum, rye, barley, and oats). Deficiency payments, determined by the difference between market and target prices, were paid to producers on the basis of their "base" acreage and yields. This base reflected historical production (in most cases, acreage and yields during the 1980s). The fact that price supports were tied to historical production patterns implied a lack of planting flexibility for producers. In addition, soybeans, a major U.S. crop, was largely omitted in provisions for support due to the fact that it was not an important crop when most farm programs began.

In 1996, Congress agreed to what was intended to be a major overhaul of U.S. farm policy—the Farm and Agricultural Improvement and Reform (FAIR) Act. This Act is also known as the "Agricultural Market Transition Act" or AMTA. The nomenclature "Reform" and "Market Transition" was meant to indicate a major shift in policy away from government involvement and toward market oriented policies. Eligibility for price support was no longer based upon historical production—producers were free to plant whatever crops they desired and prices were supported at a legislatively-determined loan rate. Soybeans were made eligible for price supports, which were now provided through the "Loan Deficiency Payment" (LDP) program. LDP payments were made on the basis of the difference between market and support prices (the loan rates). The rhetoric accompanying the Act implied, in principle at least, that the legislation signaled a transition to an environment with limited government support. A program of direct payments to those producers with base acreage (historical rights to program benefits) was instituted to compensate producers over this transition, at least in theory. These payments were known as AMTA or Production Flexibility Contract (PFC) payments. By design, AMTA payments were completely decoupled from the market—the only requirement for receiving AMTA payments was that the producer (or landowner) had to have base acreage. Eligibility for such payments in no way depended upon current production patterns. In some cases, payments were made on land no longer in production. The AMTA payments were set to decline each year until the FAIR Act expired in 2002. Of course, the extent to which such payments were perceived to be temporary is a subject of debate, especially since the payments were continued (and even increased) in the 2002 and 2008 Farm Bills. Further, the 2002 Farm Bill allowed landowners the option to update their base acreage using production and yields over the 1998-2001 period. Many critics of U.S. farm programs have argued that this updating made it much harder to characterize the payments as decoupled, since farmers and landowners may factor such updating possibilities into their future production decisions.

Over its history, U.S. farm policy has provided benefits through three general channels—price supports (sometimes tied to acreage restrictions) that are tied to production (i.e., benefits are provided on a per-unit basis), decoupled income support, which has no production requirements, and disaster or market assistance payments, which provide benefits intended to offset poor production or bad market conditions. Since the 1996 Farm Bill, U.S. agricultural policy has been characterized by three specific program mechanisms, together with a large collection of various minor programs. These mechanisms include the aforementioned direct payments (PFC and fixed, direct payments), market loss assistance and counter-cyclical payments (payments that are triggered by low prices but are not tied to current production), and loan deficiency payments and marketing loans, which use loan rates to support market prices. Each of these policies functions in unique ways to provide support.

Direct payments were introduced in 1996 and were specified for the subsequent 7 years. Payment recipients knew in advance exactly what their payments would be since they were determined exogenously. However, other major components of farm program benefits are not known in advance. Market loss assistance and its successor—counter-cyclical payments—are triggered by low market prices. The market loss assistance program which was introduced in 1999 was entirely ad-hoc and was determined outside of the farm bills. Its successor, counter-cyclical payments, formally brought these price supporting payments into the farm legislation. In both cases, these programs are triggered by market prices falling beneath a legislatively defined target price. Because market prices are not realized until after harvest, agents do not know what payments will be in advance.

Figure 2 illustrates the evolution of these three types of payment programs over the last 20 years. Note that coupled price supports and counter-cyclical payments are very volatile from year to year. This is because they are based on market prices.[5] The fixed, decoupled payments, which were known in advance over the life of the legislation, began in 1996 and are much less variable by design.

The important point regarding these payment programs is that, contrary to arguments advanced in the literature (e.g., Kirwan 2009), the bulk of farm program payment benefits is not predetermined by legislation and payments are not known in advance because they are triggered by market conditions. Such arguments simply mischaracterize the basic operation of farm programs. Agents' actions and the effects of policy on asset values and rental agreements will therefore be based upon *expectations* of such payments—a point well noted by Goodwin, Mishra, and Ortalo-Magné (2003b) and Patton et al. (2009). Further, the level of support varies substantially from year to year and thus any analysis that focuses on one or two years (e.g., the 1992 and 1997 Census years or the 1999 AELOS survey year) is faulty since benefits will most certainly reflect market conditions in those two years, which are volatile over time but highly systemic in nature, and therefore highly correlated in the cross-section.

Ad hoc disaster assistance has been a fixture in U.S. agricultural policy for many years. Periods of drought or poor market conditions frequently trigger ad hoc assistance labeled as disaster payments. Under provisions of other farm legislation (the Crop Insurance Reform Act of 1994), Congress stated an intention to make subsidized insurance the only mechanism for providing disaster relief.[6] However, localized droughts and low market prices led Congress to rapidly retreat from this position and conclude that the support provided to farmers under the FAIR Act was not sufficient. Ad hoc assistance, in the form of yield compensations and the aforementioned payments for low market prices (market loss assistance), were then

[5] This degree of volatility increases substantially when one considers individual commodities and support at lower levels of aggregation (i.e., the state or county).

[6] As an aside, an interesting policy situation exists for crop insurance, which recently has returned about $2.00 in indemnity payments for every dollar of premiums paid by farmers. This program, also in existence since the 1930s, runs hand-in-hand with ad hoc disaster assistance—a form of free insurance. Note that disaster assistance is an obvious impediment to a well-functioning insurance program.

instituted. Again, such support cannot be perfectly anticipated since it is based upon random production and market conditions.

A number of other programs have been important to agricultural policy. For example, a considerable amount of farm land (approximately 35 million acres) has been removed from production through the Conservation Reserve Program (CRP). The CRP pays producers annual rents to place their land in reserve under a ten-year lease agreement. In order to be eligible for the CRP program, land must be “erodible” and environmentally fragile. Such land is typically of a lower value in terms of crop production.

In spite of rhetoric to the contrary, congressional support for U.S. agriculture continues to expand. President Bush signed an omnibus package of farm program support on May 13, 2002 that was scored at $190 billion. The Food, Conservation, and Energy Act of 2008 (P.L. 110-246) was enacted into law on June 18, 2008. These two packages of farm programs did not make substantial changes to farm policy. Notable is the fact that direct, decoupled payments were maintained in both farm bills, thereby eliminating any doubt regarding the extent to which these payments were transitory. One important exception to this general lack of change in programs occurred in the introduction of “counter-cyclical payments” (CCPs) in the 2002 Farm Bill. These payments formally brought the ad-hoc market loss assistance support that characterized the late 1990s into farm legislation. The CCP program established target prices for program commodities. If market prices fall beneath a target, payments are made on the basis of the price deficiency and the base yield and acreage. The CCP program was continued with little modification in the 2008 Farm Bill.[7]

Congressional debate over the 2008 farm legislation and the generous level of support that emerged from these deliberations have made clear Congress’s intent to continue taxpayer support for agriculture. The most recent policy debate centered on means-testing for payment eligibility and limits on the amount of payments any individual could receive. Under the 2002 Farm Bill, individuals with an adjusted gross income over $2.5 million were

[7] The 2008 Farm Bill did introduce an optional alternative to the CCP program—the Average Crop Revenue Election (ACRE) program. Enrolling farmers agreed to cuts in some program benefits and the elimination of CCP payments in order to obtain a crop revenue guarantee. Only about 12.8% of eligible acreage was enrolled in the ACRE program.

ineligible for payments unless more than 75% of this total came from agriculture. Payments to an individual farm were limited to $360,000, although price support payments made on actual production were essentially unlimited due to program loopholes. The 2008 Farm Bill essentially removed payment limits on coupled support and provided limited income limitations on some payments.[8]

In all, support for agriculture remains strong in the U.S. Congress. A wide variety of programs are used to convey significant benefits to the farm sector. The latest omnibus farm bill is projected to cost U.S. taxpayers nearly $300 billion to provide agricultural and nutritional support.

3 Modeling Framework

3.1 The Income Approach to Farm Land Valuation

All government transfers help the farmers in at least one of two ways: by raising the returns to farming and by decreasing the volatility of these returns. The LDP and DP programs have major insurance components. The $AMTA$ payments are lump sum transfers determined by farmers' activities prior to their implementation. The same is true with CRP payments; they are lump sum additions to the return of farming that are uncorrelated with present or future earnings from the market. In addition to all these transfers, farm land also gives the farmer the opportunity to generate non-agricultural earnings. The jackpot is to own land in an area under strong urban pressure with friendly zoning authorities, hence providing the opportunity to realize substantial capital gains by converting the land to residential or commercial use.

The value of a parcel of land is the present discounted value of expected cash flows from agricultural activities plus the value of the option to convert the land to non-agricultural

[8]In particular, a person or legal entity with adjusted farm gross income of over $750,000 is not eligible for direct (decoupled) payments. A person or entity with average adjusted gross non-farm income in excess of $500,000 is not eligible for any program payments. However, the legislation allowed a husband and wife to allocate income as if they had filed separate returns, essentially doubling these limits.

use.

$$V_0 = \mathrm{E}_0 \left[\sum_{t=1}^{\infty} \frac{MKT_t + \mathrm{LDP}_t + DP_t + \mathrm{AMTA}_t + \mathrm{CRP}_t}{(1+r)^t} \right] + CONV_0, \tag{1}$$

where MKT and DP denote earnings from the market and from disaster payments, $CONV$ is the value of the conversion option, and r is the discount factor. The discount factor reflects the risk of the overall portfolio of individual streams of cash flow. This risk is not simply the sum of the individual risks because of the non-zero covariance, by design, between MKT payments, LDP and DP.

As mentioned earlier, AMTA and CRP are, for the most part, lump sum transfers whose levels are independent of current and future earnings from MKT, LDP and DP, and from each other. We can therefore rewrite equation (1) as

$$V_0 = \mathrm{E}_0 \left[\sum_{t=1}^{\infty} \frac{MKT_t + \mathrm{LDP}_t + DP_t}{(1+r_1)^t} + \frac{\mathrm{AMTA}_t}{(1+r_2)^t} + \frac{\mathrm{CRP}_t}{(1+r_3)^t} \right] + CONV_0, \tag{2}$$

where r_1, r_2 and r_3 denotes the discount factors for output related earnings, AMTA payments, and CRP payments, respectively.

Implicit in equation (2) is the assumption of a constant discount rate. If we are willing to assume that farm land buyers and sellers expect the various earnings to grow at a constant rate, then the regression coefficients we will obtain will be the inverse of the capitalization rates, or cap rates. The valuation formula can indeed be re-arranged as

$$V_0 = \mathrm{E}_0 \left[\frac{MKT_1}{\kappa_1} + \frac{\mathrm{LDP}_1}{\kappa_2} + \frac{DP_1}{\kappa_3} + \frac{\mathrm{AMTA}_1}{\kappa_4} + \frac{\mathrm{CRP}_1}{\kappa_5} \right] + CONV_0 \tag{3}$$

where the cap rates are denoted by $\kappa_{\cdot}$. It is easy to check that if a stream of cash flows is expected to grow at the constant rate g and is discounted at the constant rate r, then the cap rate κ satisfies $\kappa = r - g$.

To estimate the contribution of each source of value in equation (3), we need estimates of expected next period cash flows for each source of agricultural earnings. This raises a serious measurement issue. As mentioned above, it has been largely ignored in the literature which tends to rely on current payments as an indicator of future payments. This is the issue to which we now turn.

3.2 Measuring Expected Cash Flows

Let us suppose that agents correctly assess the true determinants of land values but the econometrician, working with actual realizations of policy outcomes from year to year, is unable to observe these determinants. Instead the econometrician relates the observable annual realizations of market and policy outcomes to land prices. In this case, the econometrician is confronted with the classical errors in the explanatory variables problem. Errors-in-variables results in an attenuation bias that forces coefficients toward zero and thus yields inconsistent estimates.[9] This problem is compounded by the fact that the government operates more than one program of payments, hence suggesting that traditional empirical approaches suffer from multiple explanatory variables observed with error.

A complicating factor arises in that the errors applying to observed policy benefits may be correlated in a typical sample. This correlation may assume two different forms—correlation of the errors across different programs (for a given farm) and correlation of errors across different farms in a sample. Both circumstances are likely to exist when one considers a pooled cross-section of farms (as is the case in our empirical analysis). Consider a case of two programs—price supports and market loss assistance payments. The extent of support provided from the government is likely to vary considerably from year to year according to market conditions. Low price years realize larger payments for both programs. Thus, the errors associated with using realized benefits are likely to be highly correlated across the programs. The correlation could also be negative. Consider the case of yield disaster relief and price supports. In low yield years, market prices are likely to be high and thus price support payments will be low, though disaster benefits will be higher to compensate for the production shortfalls.

Another form of correlation is likely to be relevant when a pooled sample of individual farms is considered. Since realized program benefits are dependent upon aggregate market conditions, the errors are likely to be highly correlated across observational units (farms) in

[9]This problem is analogous to the standard omitted variable problem, where the omitted factor is the difference between what is observed and the true, latent value.

a given year. In a sample consisting of only a few years of data, the correlation across farms increases the estimation error and may further exaggerate the bias; year-to-year shocks may not average out when only a few years are observed.

Furthermore, if realizations are highly correlated across units within a year, parameter estimates may shift considerably from year to year. If only a few years are observed, the estimates from a pooled sample may be sensitive to events in the years observed and thus may vary substantially across years and be more variable in a pooled analysis.[10]

The standard approach to addressing this problem is to obtain instruments or proxy variables for those latent variables that are measured with error. An instrument should be correlated with the variable of interest but uncorrelated with the error pertaining to the observation. We represent the expected payment benefits by constructing average values of each relevant policy variable over the preceding four years. This approach raises one complicating factor. As we discuss in detail below, our data set is not a true panel in that a different set of farms is sampled each year—meaning that repeated observations for an individual farm are not available.

To represent expected payment benefits, we utilize the four-year average value of real payments per farm acre *in the county* where the individual farm is located.[11] We argue that this is a superior measure of long-run expected benefits as compared to realized payments because values in the county more closely represent the long-run potential benefits associated with agricultural policy. Payments on an individual farm, in contrast, may reflect individual policy choices and characteristics of the farm operation. Transfer of the land to a new operator may result in different subsidy realizations (for example, because of a different crop mix) which are better represented using county-level averages.[12]

[10]See Goodwin, Mishra, and Ortalo-Magné (2003b) for a quantitative assessment of this issue in the farm land valuation context.

[11]A standard instrumental variables estimation approach is also feasible, though the fact that payment realizations in any given year may be very weakly tied to long run expected benefits makes the utility of such an approach limited. This problem is exacerbated in a short sample when realizations are highly correlated in the cross section, as is true in our application.

[12]Observations for an individual farmer in a particular year might reflect crop rotation patterns. We expect county level acreage to be more reflective of the expected crop mix.

We adopt a number of different historical averages to represent expected policy benefits. We use a four year average of county level total payments in our aggregate policy models. In contrast, because LDPs were not the main instrument for providing price support prior to the 1996 Farm Bill, we use a two-year average for LDP payments at the county level. We should note that this errors-in-variables problem does not apply to all sources of government subsidies. Subsidies provided through AMTA payments and rents earned on land enrolled in the CRP program are known with certainty a priori. It is only those payments that are triggered by market and production events (price supports and disaster payments) that must be proxied.

3.3 Data

The primary source of our farm-level data is a data set collected from a large sample of farms through the USDA's National Agricultural Statistics Service (NASS) Agricultural Resource Management Survey (ARMS) project. The ARMS survey is a large probability-weighted, stratified sample of about 8,000-20,000 U.S. farms each year. The survey collects detailed government payments information for individual farm program benefits as well as extensive farm and operator characteristics. We focus on data collected over the years 1998-2005. Thus, our empirical analysis focuses on these years. All monetary values in our sample were adjusted to 2005 equivalent real values by deflating by the consumer price index. Given the relatively short nature of our sample, such deflation had only minor effects on the results.

Besides detailed farm earnings, the survey also reports farm land value. Farm operators are asked to estimate the market value as of December 31 of the preceding year of their land, dwellings, and other farm buildings and structures. We restrict our attention to the value of land only (excluding trees and orchards).[13]

In order to eliminate hobby and retirement type farms and to focus on commercial agricultural operations, we eliminated any farm of less than 50 total acres. We also excluded

[13]Confidentiality of responses is maintained and farmers do not have any incentive to distort their response to the survey.

farms located in counties with less than 100 total farm acres, thereby excluding urban counties that have no production agriculture. We excluded farms for which incomplete data were available. This left us with a small number of extreme outlier observations (land values less than $200 per acre or those exceeding $20,000 per acre). Such extreme observations represent non-typical agricultural properties, such as vineyards and properties with characteristics (e.g., river-side properties) not recorded in the survey. Only a very small number of observations (less than 1%) were excluded on this basis. In the portion of our analysis that addresses rental markets, we excluded any observation for which a share or cash lease rate in excess of $1,000 per acre was reported. Again, such outliers occurred in only a very small number of cases.

A variety of sources were used to collect county-level observations on crop acreage and state level prices (unpublished USDA-NASS statistics) and data relevant to county population and trends (unpublished U.S. Census data). Aggregate (county-level) agricultural market performance (total sales and production costs) and population statistics were taken from the Bureau of Labor Statistics' (BLS) "Regional Economic Information System" (REIS). Total farm acres for each county were taken from the 1997, 2002, and 2007 Agricultural Censuses. We used linear splines to interpolate between census years. In that these values evolve slowly over time but vary significantly in the cross-section, such interpolation should provide valid estimates in non-census years. Unpublished data on calendar-year total program payments at the county level for individual farm programs were collected from the Farm Service Agency (FSA) of the USDA.

Our empirical approach involves consideration of farm-level observations of land values, cash rental rates, and share rental rates. We use explanatory variables that are measured at the farm level as well as at a more aggregate county level. It is important to note that this is not analogous to analysis at the county level as the left-hand-side variables in our empirical models are measured at the farm-level. Further, in our models of actual realized payment benefits, the right-hand-side explanatory factors are also measured at the farm level. In the case of models that utilize aggregate averages of payment benefits, right-hand-side explanatory factors are constant across all farms within a county while the dependent variables of interest vary within and across counties. It is relevant to note that, because the ARMS is a national survey, it is uncommon for a large number of farms to be sampled in a single county. In our estimation sample, each county had an average of 1.15 farms each year and the number of farms sampled per county ranged from 1 to 7.

Summary statistics and definitions for the key variables of our analysis are presented in Table 1. To the variables aimed at capturing expected cash flows from farming, we added three factors intended to represent the additional value of land in areas facing non-agricultural pressures. First, to represent non-agricultural demand pressures, we included the population growth rate in each county. We also include a series of discrete indicator variables (obtained from the USDA) that represent the extent of urbanization for each county. The ordinal ranking ranges from 1=rural to 4=urban. Finally, we considered the ratio of total population to total farm acres to again capture the effects of residential and non-agricultural commercial demands for farm land.

We are interested in evaluating the differential effects of benefits provided by the government versus those returns generated by the market. Of course, a risk-neutral farmer will not care where a dollar comes from, though alternative sources of revenue may have different levels of risk, thus affecting the preferences of a risk-averse farmer. We acknowledge at the outset that any representation of market earnings should not be interpreted as a measure of the market returns that would be generated in the *absence* of farm policy. Returns in such a situation are difficult to assess, especially in light of the long history of government involvement in U.S. agriculture. Likewise, the relevance of such a consideration is limited—it is unlikely, to the authors at least, that the U.S. government will completely remove policies that currently support agriculture. Having acknowledged these limitations, we construct a measure of net returns from the market using county-level averages of the difference in total agricultural sales receipts (exclusive of government payments) and total production costs (dollars per acre of farm land). We considered using measures of market returns from individual farm records. However, farm-level financial records are highly volatile across individual years and individual farms due to any number of idiosyncratic factors and therefore we use the county-wide average to represent market returns.

A few final aspects of the construction of our sample merit discussion. The ARMS survey is conducted annually from a stratified random sample of farms. Strata are defined by farm size, sales class, and area. While it is possible that individual farms may be sampled in multiple years, the identity of any individual farm is unknown (at least to the researcher), though we do know the county in which the farm was located. Thus, it is impossible to track an individual farm across time and, ever if such identification were possible, it is likely that farms would be sampled infrequently and without regularity. This fact complicates inferences in that unobserved heterogeneity concerns and endogeneity of key variables may be difficult to address using standard econometric practices. Our use of county-level aggregates, which should be exogenous to individual farm observations, alleviates these concerns in many cases.[14]

A second point of relevance pertains to the timing of production decisions, including rental agreements, and the administration of the survey. In most cases, rental agreements are set prior to planting and in some cases may be long-term agreements that extend across multiple years. Such agreements are therefore clearly based upon expected values of returns and policy benefits. A subtle difference exists in the case of land values. Farm operators are asked to assess the value of their land holding as of December 31 of the previous year. Such an assessment would be made with full knowledge of realized returns and policy benefits. However, in that returns and program payments are very time-dependent, observed returns and payments may not accurately reflect the long-run expected values that influence land values and rental rates—a point demonstrated by Goodwin, Mishra, and Ortalo-Magné (2003a). We therefore use an average of the preceding five years for individual program payments and county-level market returns. The extent to which a five-year historical average accurately represents long-run expected values is debatable but such a measure should control

[14]Approaches to directly addressing endogeneity and unobserved heterogeneity remain important topics for future research.

for year-specific effects that may move realized benefits in any given year far from expected values.[15]

4 Empirical Results

Our empirical analysis utilizes three distinct approaches to modeling policy effects on land values and rental rates. The first simply considers the effect of farm-level, realized payments on farm-level land values and rental rates. This approach is analogous to that adopted in many studies (see, for example, Kirwan(2009)) and ignores the fact that payment benefits are largely unknown at the time asset values and rental arrangements are determined. A second approach constructs explicit measures of expected policy benefits by considering an average of historical county-level aggregates. A third approach adopts an instrumental variables model in which the aggregate measures of policy benefits are used to form instruments that represent expected payments in a generalized method of moments (GMM) context. In the case of standard regression models, we also considered clustered and robust standard error estimation techniques. We allowed for clustering among regions, states, counties, and population weights. Controlling for clustering generally produced larger standard errors but did not alter the overall conclusions of the analysis. We present conventional standard errors in the results contained below.

We first consider the relationship between land values and agricultural policy benefits. As we have noted, our individual farm-level data are collected using a complex survey design. The individual strata used in collecting the data are not identifiable, again reflecting confidentiality considerations. This precludes efficiency gains that could be achieved from incorporating information about the construction of strata. However, we can observe population weights for each farm and thus have pursued both weighted and unweighted regression methods. In every case, the weighted and unweighted results were quite similar and thus we

[15]Consider, for example, basic price supports. These programs (e.g., deficiency payments) support prices by making a payment any time market prices fall beneath a target support level. In a year of strong prices, no payments may be made. However, in light of the considerable volatility of basic commodity prices, a subsequent year may realize substantial payments due to low prices.

only present unweighted results.[16] However, the unweighted results which follow should be interpreted as applying to this sample of farms only and should not be directly extended to the entire population.

Our analysis of the determinants of land values is conducted in three segments. In the first, we consider models that aggregate all program payments into a single category. Such a model is useful in that it provides a summary of the impacts of additional federal subsidy dollars on land values at the margin. This analysis also permits a straightforward comparison to the large literature on this topic. Two versions of this model are considered. The first uses actual, observed payments for each farm. The second uses county-level historical averages to assess the total, expected per-acre receipts from farm program payments. Note again that expected payments are represented using the county average over the preceding five year period. The results are presented in Table 2.

The model using actual observed farm-level payments (Model 1) indicates that $1 of farm payments tends to add $2.93 per-acre to the value of farm land. The effect, though highly statistically significant, is unreasonably low and suggests a very high rate of discounting payment benefits (approximately a 30% rate of discounting). Such a high rate of discounting would necessarily imply that land market agents either anticipate the elimination of such benefits or that considerable uncertainty exists regarding the future of agricultural programs. Neither explanation seems persuasive in light of the previous 70 years of generous support for U.S. agriculture.

It is interesting to compare the effects of government payments on land values to the effects of market returns. The results indicate that an additional $1 obtained from the market would raise land values by $3.14, a figure very similar to what is implied for subsidy payments. The results reflect the expected influences of urban pressures on land values, with more highly populated and less rural areas having higher land values. Although these urban effects are interesting in their own right, it is important that they be accounted for (a step

[16] Because strata are defined using size and sales class, dropping very small farms from our sample mitigates bias concerns resulting from the non-random sampling, at least to a degree. Weighted regression results are available from the authors on request.

that has generally been neglected in previous analyses) in order to obtain accurate measures of the policy effects on land values.[17] Land in the most rural areas tends to be values at $1,395 per acre less than that in the most urban areas, other things constant. Population growth and a greater population relative to agricultural land in a county also both positively contribute to land values.

We have argued that the use of observed payments may result in an attenuation bias that forces the implied capitalization rates toward zero. As an alternative, we have argued that a measure of expected payments may be preferred. Model 2 replaces the total realized payment measure with the five-year average measure noted above. As expected, the results suggest much larger and more reasonable effects of agricultural policy benefits on agricultural land values. An additional $1 of government payments raises land values by $13.13 per acre. Such a finding implies a much more reasonable capitalization rate of policy benefits into agricultural land values. The effect of historical average market returns is quite similar across the alternative models, with an additional $1 of net market returns corresponding to an increase of $3.45 in land values. The fact that market returns appear to be much more heavily discounted than is the case for government payments may seem puzzling at first glance. However, an examination of the historical patterns of returns and payments may help to explain this finding. Figure 3 below illustrates the patterns of net returns (given by total marketings less total production costs) and total government payments over the 1970-2006 period. Three different levels of aggregation are presented—the entire U.S., Iowa (a major agricultural state), and Kossuth County Iowa (a major agricultural county in Iowa). In each case, the diagram illustrates the fact that real net farm market returns have been falling over time and that market returns are much more volatile than government payments. In many cases, net returns from the market are actually negative. Aggregation conceals much of the volatility in returns that is actually present at the farm level. This is demonstrated by the increased level of volatility across the successively less aggregated statistics. At the individual farm level, at least to the extent that individual risks are not

[17] Hardie et al. (2001) estimate the effects of urban pressure on agricultural land. They are not concerned, however, with the contribution of agricultural policy to the returns from land.

perfectly correlated across farms, one would expect an even higher level of variation in net market returns.

In light of the observed behavior of market returns over time, a high degree of discounting by risk averse agents is not unexpected. Of course, one cannot fully decouple market returns from government payments, since most agricultural programs are intended to provide counter-cyclical benefits intended to offset decreases in market earnings. Such counter-cyclical behavior is evident in the diagrams in that benefits are higher when market returns fall. It is important to again emphasize that it is not our intention to interpret the full or average impact of payments and thereby to make inferences about the total impact of payments on land values. Such inferences may be impossible given the fact that payments are so deeply embedded in asset markets and are so closely tied to market swings. Rather, our intent is to examine marginal impacts of changes in payments and market returns on land values—the effects that are represented by our model coefficients.

A second segment of the analysis breaks out the overall government payments into their individual components, generated from different programs. We have argued that it is likely that different policies, which operate through widely varied support mechanisms, may have different effects on land values. Models 3 and 4 use actual payment receipts and our measure of expected payments (historical averages), respectively. We segment payments into four different components. The first consist of LDP payments, which includes marketing loan gains and deficiency payments in years prior to 1996. These payments are directly tied to production and are intended to support the price of actual production of commodities. A second component of payments is direct payments. This is comprised of payments that are not tied to production but rather are based upon historical "base" acreage and yield, which was largely established in the early 1980s.[18] These payments include direct, decoupled payments, market loss assistance, and counter-cyclical payments. Although these payments are all based upon historical base production and are not tied to current production and acreage, the market loss and counter-cyclical payments are triggered by market prices and

[18] The 2002 Farm Bill gave landowners the option of updating their base using 1998-2001 production and acreage records.

thus may not be known in advance.[19] Ad-hoc disaster payments are also identified separately and are included in the disaggregated regression. A distinction between the aggregate and disaggregate segmentation of payment data should be noted at this point. The ARMS survey collected market loss assistance data jointly with disaster payments whereas the aggregate FSA data groups counter-cyclical payments (the successor to the market loss assistance program) together with fixed, direct payments. In light of this fact, we group together direct and counter-cyclical payments for the disaggregated data and direct payments, market loss assistance, and counter-cyclical payments for the aggregate data. Finally, we have a category of all other payments which consists of conservation payments, state and local government benefits, and any other miscellaneous government subsidies.

The model of observed payments suggests that an additional dollar of LDP payments (direct price supports) will increase land values by only \$2.38 per acre. When realized payments are replaced by the five year average at the county level, the LDP effect rises to \$21.07, again perhaps reflecting the attenuation biases inherent in using observed payments in any given year on an individual farm. The significantly higher value of an additional dollar of price support is consistent with expectations and suggests a reasonable discounting rate close to 5%.

Disaster payments tend to exhibit a large effect on agricultural land values, especially in the model using aggregate data. These payments are largely ad hoc by design and encompass a wide range of Congressional objectives. Expectations regarding the impacts of aggregated disaster payments are unclear since so many different programs are of such an ad hoc nature and are included in this category (see Appendix Table 1). However, direct monetary subsidies may certainly be expected to raise the returns to ownership of an asset and thus should increase land values. On the other hand, disaster relief is often targeted to higher risk, marginal areas. Thus, it would not be unexpected to see disaster payments being correlated with lower land values. Our results suggest that additional support in the form of disaster payments does indeed increase asset values in agriculture. An additional \$1 of disaster relief

[19]This particular grouping of payments was dictated by the available FSA data.

raises land values by $5.02 in the case of the realized payments model (Model 3) and by $31.10 in the model based upon long-run average values of disaster payments. The 1990s were a period that experienced significant ad hoc disaster relief and thus may certainly have had significant impacts on farmland values.[20]

Direct payments also exert a significant effect on agricultural land values. An additional dollar in payments raises land values by $2.00 per acre in the model using realized payments and $5.35 per acre in the model based upon long-run average values. If land market agents truly believed that these payments were transitory, as the 1996 legislation seemed to imply, these impacts would seem to be larger than expected.[21] It is likely that these payments were a signal of future benefits to be paid on a decoupled basis. Indeed, in its generosity, Congress not only continued these payments under the 2002 and 2008 farm legislation, but also expanded and enhanced the benefits. More importantly, the new Farm Bill made soybean acreage eligible for direct payments in 2002. Thus, our results suggest that agents anticipated such legislative actions— any implicit threats to terminate this avenue of support with the expiration of the 1996 legislation were heavily discounted.

Similar values of the impacts of market returns and non-agricultural demands for farmland are revealed in the disaggregate policy models. A larger impact of market returns is exhibited in the model using the long-run average value of historical returns than occurs in the case of realized returns in the year of the survey. Urban pressures again play an important role in determining agricultural land values. In every case, the effects are statistically significant.

In all, the results confirm that government payments exert a significant effect on land values. The (marginal) rates of capitalization suggest that in the current policy context, a dollar in benefits typically raises land values by $13-$30 per acre, with the response differing substantially across different types of policies. This response certainly suggest that agents

[20] A 2006 report from the Environmental Working Group (EWG, 2006) reports that U.S. taxpayers provided nearly $26 billion in emergency agricultural disaster aid to more than two million farm and ranch operations over the 1985-2005 period, with payouts exceeding one billion dollars in 11 of the 21 years.

[21] Cynics often note that, beyond naïve academics, few farm policy observers believed these so-called transition payments were temporary. The empirical evidence has confirmed such suspicions.

expect these benefits to be sustained for some time. In terms of the implications for the distribution of farm program benefits, our results confirm that a substantial share of the benefits is captured by landowners. Recall that, in many cases, landowners may be a very different entity than farmers. Farmers wishing to expand or enter production will realize much smaller benefits than the policy rhetoric tries to substantiate. An important finding is that market returns, which are much more volatile than government payment benefits, tend to have a much lower influence on land values. Such returns have often been negative over the last several years and the degree of volatility increases at less aggregate levels of measurement.

The results on farm land values provide evidence that land captures policy benefits as land values are enhanced by the subsidies. When the farm operator owns the land, the transfers go to him. Likewise in the absence of effective limits on payments (there are none) the larger a farm is the greater will be total payment benefits.[22] However, as we have noted above, about 45% of U.S. farmland is operated by someone other than the owner.

This raises the important question—how do the generous provisions for support of agriculture affect the significant share of farmers that rent the land used in production? Likewise, how much of the support goes to landowners? Again, the stated intent of the legislation is a "fair and equitable" sharing of program payments, with an owner that shares no risk (i.e., rents under cash lease arrangements) receiving none of the benefits. The real answer to this question lies in an evaluation of the terms of lease arrangements—do lease rates reflect policy benefits? If, as we have demonstrated, the value of land is increased by policy transfers, given that value of land is a present discounted value of expected cash flows plus an option to convert, one would expect that lease rates reflect payments from the government. Lease rates provide direct evidence on the proportion of farm payments passed on to landlords, something much more difficult to assess from land values.

[22] The extent to which farm program payments should be limited was an important point of considerable debate in recent farm bill deliberations. Any support based on production (such as LDP payments) will naturally favor larger producers. In the end, any limits on benefits tied directly to production were eliminated in 2008 and very loose income "means-tests" were imposed. Goodwin (2008) investigated the likely impacts of binding payment limits and found that, for the vast majority of producers, limits have no impact on production.

For those farmers in our sample that were engaged in renting land, we were able to obtain the rental rates paid per acre for land rented under both share and cash arrangements. This is an important distinction since both types of rental arrangements are common. In our sample, 65.6% of farm operators reported renting some land and of those that rented, 84.6% used cash leases, 37.8% used share leases, and 22.4% used both cash and share leases. Previous research (e.g., Kirwan 2009) has focused on analysis of cash rental agreements in evaluating the incidence of benefits among tenants and landlords.

It is likely that some frictions exist in lease arrangements for farm land, since these arrangements may not be negotiated every year. In this light, it may take some time for lease markets to respond to increases or decreases in the level of support provided to producers, in particular for cash leases. On the other hand, we should expect share lease payments to reflect the ex-post contribution of every single source of agricultural earnings. Share rents are indeed paid at the end of the season, once all uncertainty has been realized. Share lease payments are supposed to reflect the agreed proportion of cash flows from all sources of earnings related to the farming of the land, including government payments, though again share arrangements may be subject to the terms set through individual negotiations. In both share and cash leases, the terms of the lease are set in advance of the realization of farm earnings and program benefits, at least in most cases. Thus, it is again the case that rental rates will be based upon expectations of returns and further that the terms of the lease are set prior to the realization of these returns.

A subtle distinction exists in the role of expectations in our analysis of land values and rental rates. The data are collected early in the year following the survey year. At this point, survey respondents have full knowledge regarding realized payment benefits and market returns and are free to factor such knowledge into their assessment of land values. However, as we have noted, it is not realized payments in the preceding year but rather long-run payment expectations that will influence land values. In the case of rental rates, realized returns and policy benefits are not known at the time lease terms are determined. In the end, the distinction does not alter the fundamental analysis in that a measure of expectations of payments and market returns is necessary. To this end, we again utilize the historical five-year average value of the payment variables and of market returns. In addition, we adopt an approach similar to that used by Patton et al. (2008) and utilize the generalized method of moments approach of Hansen and Singleton (1982) and utilize instrumental variables to model expectations. We choose instruments available in agents' information sets at the time rental terms are defined.

We considered regressions of cash and share rents, respectively, against the factors expected to be relevant to land values and rents, including the indicators of expected payments. The results are presented in Tables 4-7. We consider both aggregate policy benefits (for all programs at the farm level) and the alternative specification which distinguishes benefits from different types of policies. Table 4 presents estimates from a regression of farm-level cash rental rates on aggregated, historical payment benefits (Model 5) and the GMM estimates that are based upon instruments that include lagged payment variables, pre-planting futures prices, annual fixed effects, and lagged county-level market returns (Model 6).

The key question is the extent to which higher government payments are reflected in higher cash rental rates. Kirwan (2009) found that the incidence of subsidy benefits fell mainly upon tenants, who received about \$0.79 of each \$1 of total payments. Put differently, cash rents tended to increase by \$0.21 for each \$1 of payments. However, as we have noted above, these estimates may be subject to measurement error biases due to the ignorance of share leases and the assumption that payment benefits are pre-determined by exogenous policy parameters. It is again important to note that payments are delivered to farmers through many different mechanisms and in most cases are unknown until after harvest.

Our analysis reveals a substantially higher share of payments being distributed to landlords engaged in cash rental arrangements with farmer tenants. For each \$1 of aggregated payments (across all program types), landlords claim \$0.32 in benefits, other things constant. When actual payment receipts are used within an IV-GMM context (Model 6), this amount rises to \$1. This does seem unreasonably high but both results are indicative of a situation somewhat counter to the results of Kirwan (2009) in which landlords are effective at extracting payment benefits through higher cash leases. Table 5 presents results for disaggregated programs. The results again indicate that landlords are effective in extracting a large share of payment benefits through higher cash rental rates. In the model using historical average payments (Model 7), cash rents rise anywhere from \$0.73-\$1.64 for each \$1 of payments received, depending on the program mechanism used to deliver these payments. Direct payments, which are not tied to production and which, at least in part, were known with certainty over the period of study, raise rents by \$0.73 for each additional \$1 of payments. Disaster payments are actually correlated with lower cash rents, a result that is not consistent with our earlier findings regarding land values. However, disaster payments are, by definition, directed toward more marginal areas of production and therefore may be correlated with lower productivity and lower rents. The results again indicate a relatively low incidence of market returns on cash rental rates. The GMM estimates (Model 8) imply even larger impacts of payments on cash rents, though the general implications of the analysis are the same—landlords are effective at extracting policy benefits through higher cash rental rates.

Table 6 repeats the analysis for share rental rates. An important point regarding the construction of share rental rates should be noted. These rental rates include payments going directly to the landlord. This allows a direct comparison with cash rental rates. If the landlord's direct share of payments were removed from the calculation of rental rates, one would expect coefficients to be zero if the landlords were unable to extract additional benefits through higher share rates. The results are largely similar to those for cash rental rates, with an additional \$1 of total payments raising share rental rates by \$0.50-\$1.16 per acre. This again indicates that landlords are likely able to extract additional policy benefits beyond those received directly, though if the rental agreements are on a 50-50 share basis, the lower estimate would suggest no additional benefits for landlords over those that they receive directly.[23] Again, significant differences in rental impacts of policies are apparent across different policy types. Disaster payments tend to lower share rental rates, though the

[23]Legislation mandates a "fair and equitable" allocation of policy benefits, which in share leases typically corresponds to the overall terms of the share lease.

effect is statistically significant only in the case of the GMM estimates (Model 12). This is consistent with expectations in that share lease rates are usually considered to carry a risk premium over cash rental arrangements. To the extent that disaster payments lower risk as they are designed to do, they should lower share rental rates. Each additional \$1 in direct payments raise share rental rates by \$0.33-\$0.70, again indicating a significant benefit for landlords.

The typical approach to the assessment of the total contribution of agricultural policy to land values relies on the coefficient from the land value regressions. This is problematic for two reasons. The first one, usually mentioned in the literature, is due to the fact that regressions yield the effects of the marginal dollar for each type of policy. The literature has however overlooked the second reason. If we think about land as a portfolio of securities each delivering its stream of cash flow, it is obvious that the risk of the portfolio depends on the covariance of the various underlying securities. Therefore, eliminating one or more of the underlying securities will affect the risk of the portfolio. In terms of the analysis of the policy contribution, this implies that eliminating a policy which provides an insurance benefit will not only decrease expected returns, it will also increase the volatility of the remaining (market) returns. In other words, we should expect the coefficient on market earnings to decrease in response to an increase in uncertainty. The capitalization rate of earnings will be lower reflecting the higher opportunity cost of capital for an asset with more volatile earnings.

This raises the following question: if there is a theoretical argument in favor of an insurance component to the contribution of agricultural policy to land, can we find evidence from the market that it matters quantitatively? Unfortunately, there are no counties targeted by the ARMS survey that exempt all farmers from the benefits of agricultural policy. However, as we have noted above, farm land is rented under both cash lease and share lease arrangement. Cash lease rate are set ex-ante while the share payment depends upon the actual earning of the parcel, thus implying a risk sharing arrangement.

The main programs designed to reduce the variability of farm earnings and insure the cash flow to farmers are price supports and disaster payment programs. If the insurance component matters, we should find that higher payments should be correlated with a lower risk premium on rental arrangements. By committing to an ex-ante fixed payment, the farmer provides insurance to his landlord for which we should expect him to be rewarded (unless we observe cash rents only when the farmer is not risk averse).

To evaluate this risk premium, for the subset of 11,227 farms that have both cash and share rental agreements in place, we consider the impact of different policies on the share-cash rental rate differential. These results are presented in Table 8. We find that disaster payments do indeed tend to exhibit an insurance benefit effect in that they lower the share-cash rental rate differential. In contrast, LDP payments tend to increase the differential. The insurance properties of disaster payments are obvious but reason for the positive relationship between LDP payments and the risk premia is less clear. Because LDP payments tend to be higher for crops and regions that experience more price volatility, this may reflect the greater price risk associated with such crops and regions. The category of "other payments" appears to lower the share-cash differential, likely reflecting the insurance benefits provided by this large grouping of payments, which includes conservation program payments.

5 Concluding Remarks

Policy rhetoric often justifies Farm Bill expenditures with the argument that impoverished farmers are in need of governmental support to remain in business. This view is pervasive outside of Washington. For example, consider the annual "Farm Aid" events intended to draw attention to the plight of the American farmer. Our analysis challenges this view. We demonstrate that land owners capture substantial benefits from agricultural policy. This is particularly problematic given that in many cases land owners are distinct from the farmers whose plight we are told we should be concerned with.

Of course, many farmers are also landowners and thus have an important stake in maintaining agricultural policy benefits. A farmer that purchased land which reflected the value of anticipated benefits would certainly suffer a damaging capital loss if such support were to be withdrawn. Furthermore, all farmers have a strong interest in congressional surprises whereby more transfers are allocated than anticipated by the land market. As owners they benefit from the unexpected capital gains. The 2002 and 2008 Farm Bills, with their large increases in support expenditures, may have been such nice surprises.

Tenants also gain from positive surprises as long as lease rates do not adjust instantaneously. However, the 2002 Farm Bill seems to have shut down this avenue for a temporary increase in the share of transfers captured by farm operators. One valuable provision of the bill is that it offers to farmers the opportunity to update the factors which determine the level of some of the payments they receive. The power to decide whether or not to update has been given to the owners of the land, not the operator. Not surprisingly, tenant farmers complained that land owners used this opportunity to impose a renegotiation of the existing leases that did not foresee the generosity of the 2002 Farm Bill. No base updating provisions were included in the 2008 legislation. However, the precedent for such updating has been established and agents most certainly have some expectation, however much it is discounted, that such future opportunities will again be presented.

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Table 1. Variable Definitions and Summary Statistics

Variable	Definition	Mean	Std. Dev.
Total Payments	Total government payments operator and landlord ($/farm acre)	29.4142	49.1946
Average Total Payments	County average payments over previous 5 years ($/farm acre)	23.1093	20.6402
Land Value	Land value for owned land ($/acre)	2,258.4700	2,485.6500
Cash Rent	Cash rental rate ($/acre)	76.7523	89.1673
Share Rent	Share rental rate, including payments to landlords ($/acre)	99.8997	109.1717
Share-Cash Difference	Share-cash differential ($/acre) on farms with both lease types	11.8615	41.5512
LDP Payments	Loan deficiency payments ($/acre)	6.5507	17.8325
Direct Payments	Direct payments (including countercyclical payments) ($/acre)	10.9385	22.8224
Disaster Payments	Diaster payments (including market loss assistance) ($/acre)	5.0161	25.7740
Other Payments	All other federal and state government payments ($/acre)	11.0282	29.1607
Average LDP Payments	County average loan deficiency payments ($/acre)	7.1304	8.4403
Average Direct Payments	County average direct payments (includes countercyclical and market loss payments) ($/acre)	13.6405	14.0972
Average Disaster Payments	County average disaster payments ($/acre)	2.3527	2.8248
Average Other Payments	County average of all other payments ($/acre)	3.4808	4.4062
Average Market Returns	County average cash crop and livestock sales less costs ($/acre)	36.3074	145.0764
Aggregate Market Returns	Current year county average sales less costs ($/acre)	37.6490	168.9909
Population Growth	Annual population growth rate (percentage change year $t-1$ to t)	0.4069	1.5293
$Urban_1$	Urban indicator variable 1 (most rural counties)	0.6660	0.4717
$Urban_2$	Urban indicator variable 2	0.1043	0.3057
$Urban_3$	Urban indicator variable 3	0.0902	0.2865
$Urban_4$	Urban indicator variable 4 (most urban counties)	0.1395	0.3465
Population / Farm Acres	Ratio of county population to farm acres	0.6648	13.3475

Table 2. Aggregated Policy Models of Land Value Determinants:
Parameter Estimates and Summary Statistics [a]

	Model 1		Model 2	
Variable	Estimate	t-Ratio	Estimate	t-Ratio
Intercept	2995.9138	131.69	2679.4802	107.68
	(22.7502)		(24.8831)	
Total Payments	2.9304	17.62	13.1309	32.19
	(0.1664)		(0.4080)	
Market Returns	3.1442	64.00	3.4549	58.92
	(0.0491)		(0.0586)	
Population Growth	385.1069	70.40	408.7445	73.49
	(5.4701)		(5.5623)	
$Urban_1$	−1395.2725	−58.38	−1290.0735	−53.57
	(23.8995)		(24.0821)	
$Urban_2$	−931.7608	−28.70	−879.6743	−27.00
	(32.4653)		(32.5752)	
$Urban_3$	−667.5923	−19.97	−626.3230	−18.69
	(33.4375)		(33.5112)	
Population / Farm Acres	0.4298	0.76	15.9674	11.62
	(0.5657)		(1.3747)	
Observations Used	83,936		83,790	
R^2	0.1766		0.1758	

[a] Numbers in parentheses are standard errors. Model 1 uses current year realized values for payments and market returns. Model 2 uses the historical average values of payments and market returns over the preceding 5-year period to represent expected values.

Table 3. Disaggregate Policy Models of Land Value Determinants: Parameter Estimates and Summary Statistics

	Model 3		Model 4	
Variable	Estimate	t-Ratio	Estimate	t-Ratio
Intercept	2911.0958	106.31	2649.6005	104.40
	(27.3840)		(25.3794)	
Other Payments	3.1634	8.44	−0.9048	−0.49
	(0.3747)		(1.8495)	
LDP Payments	2.3818	3.96	21.0658	11.58
	(0.6015)		(1.8189)	
Direct Payments	2.0045	3.96	5.3529	4.71
	(0.5056)		(1.1370)	
Disaster Payments	5.0215	13.94	31.1035	10.36
	(0.3602)		(3.0022)	
Market Returns	2.7420	42.88	3.3864	56.48
	(0.0639)		(0.0600)	
Population Growth	350.4934	53.12	403.5037	72.22
	(6.5988)		(5.5875)	
$Urban_1$	−1414.6055	−49.38	−1242.8038	−50.91
	(28.6454)		(24.4121)	
$Urban_2$	−936.4743	−24.04	−849.7788	−26.01
	(38.9550)		(32.6728)	
$Urban_3$	−631.2550	−15.84	−607.3020	−18.07
			(33.6108)	
Population / Farm Acres	−0.2463(0.5744)	−0.43	36.9117	20.16
	(0.4041)		(1.8312)	
Observations Used	53,542		83,135	
R^2	0.1645		0.1786	

[a] Numbers in parentheses are standard errors. Model 3 uses current year realized values for payments and market returns. Model 4 uses the historical average values of payments and market returns over the preceding 5-year period to represent expected values.

Table 4. Aggregate Models of Cash Rental Rate Determinants:
Parameter Estimates and Summary Statistics

	Model 5		Model 6	
Variable	Estimate	t-Ratio	Estimate	t-Ratio
Intercept	74.7981	68.02	56.4471	47.51
	(1.0997)		(1.1882)	
Total Payments	0.3207	39.76	1.0137	52.89
	(0.0081)		(0.0192)	
Aggregate Market Returns	0.0785	30.98	0.1159	38.42
	(0.0025)		(0.0030)	
Population Growth	3.6276	13.31	5.5842	20.31
	(0.2726)		(0.2750)	
Urban_1	−15.3141	−13.22	−12.9287	−11.28
	(1.1581)		(1.1460)	
Urban_2	−14.7203	−9.4	−13.3325	−8.61
	(1.5652)		(1.5482)	
Urban_3	−17.2977	−10.78	−15.6342	−9.85
	(1.6046)		(1.5869)	
Population / Farm Acres	0.7389	8.96	0.8131	8.87
	(0.0825)		(0.0917)	
Observations Used	50,611		50,571	
R^2	0.0601		0.0806	

[a] Numbers in parentheses are standard errors. Model 5 uses current year realized values for payments and market returns. Model 6 uses the historical average values of payments and market returns over the preceding 5-year period to represent expected values.

Table 5. Disaggregate Models of Cash Rental Rate Determinants:
Parameter Estimates and Summary Statistics

Variable	Model 7 Estimate	Model 7 t-Ratio	Model 8 Estimate	Model 8 t-Ratio
Intercept	58.4650	48.8	54.9059	17.21
	(1.1981)		(3.1901)	
Other Payments	0.9007	10.72	2.2508	7.27
	(0.0840)		(0.3098)	
LDP Payments	1.6367	20.93	2.9856	8.84
	(0.0782)		(0.3379)	
Direct Payments	0.7295	14.73	0.6020	3.22
	(0.0495)		(0.1867)	
Disaster Payments	−2.1341	−15.28	−4.2835	−8.74
	(0.1397)		(0.4904)	
Market Returns	0.1287	42.17	0.1574	21.53
	(0.0031)		(0.0073)	
Population Growth	6.0780	22.14	4.3409	7.22
	(0.2745)		(0.6013)	
$Urban_1$	−12.2037	−10.6	−12.9420	−5.1
	(1.1510)		(2.5388)	
$Urban_2$	−13.0745	−8.48	−12.1397	−3.58
	(1.5424)		(3.3888)	
$Urban_3$	−15.9286	−10.07	−18.5700	−5.52
	(1.5814)		(3.3651)	
Population / Farm Acres	0.9721	11.99	1.2248	6.87
	(0.0811)		(0.1783)	
Observations Used	50,115		32,526	
R^2	0.0962		0.0336	

[a] Numbers in parentheses are standard errors. Model 7 uses the historical average values of payments and market returns over the preceding 5-year period to represent expected values. Model 8 uses GMM-IV estimation methods to incorporate expectations of current period values.

Table 6. Aggregate Models of Share Rental Rate Determinants:
Parameter Estimates and Summary Statistics

	Model 9		Model 10	
Variable	Estimate	t-Ratio	Estimate	t-Ratio
Intercept	98.0877	48.34	81.5600	37.65
	(2.0291)		(2.1665)	
Total Payments	0.4978	31.64	1.1635	35.94
	(0.0157)		(0.0324)	
Aggregate Market Returns	0.0527	7.25	0.1421	16.26
	(0.0073)		(0.0087)	
Population Growth	5.4354	11.14	−22.6754	−10.66
	(0.4878)		(2.1265)	
Urban_1	−23.7259	−11.09	−8.5924	−3.07
	(2.1400)		(2.8032)	
Urban_2	−7.8767	−2.79	−11.2415	−3.81
	(2.8187)		(2.9505)	
Urban_3	−12.9986	−4.38	7.0523	14.44
	(2.9671)		(0.4884)	
Population / Farm Acres	−0.3355	−1.53	−0.2611	−1.20
	(0.2189)		(0.2177)	
Observations Used	23,627		23,601	
R^2	0.0594		0.0716	

[a] Numbers in parentheses are standard errors. Model 9 uses current year realized values for payments and market returns. Model 10 uses the historical average values of payments and market returns over the preceding 5-year period to represent expected values.

Table 7. Disaggregate Models of Share Rental Rate Determinants:
Parameter Estimates and Summary Statistics

	Model 11		Model 12	
Variable	Estimate	t-Ratio	Estimate	t-Ratio
Intercept	84.3849	37.18	65.8711	9.77
	(2.2697)		(6.7400)	
Other Payments	−0.2209	−1.04	6.8322	6.35
	(0.2124)		(1.0758)	
LDP Payments	2.4906	21.08	0.0008	0.00
	(0.1182)		(0.6939)	
Direct Payments	0.3302	4.45	0.6957	2.57
	(0.0741)		(0.2703)	
Disaster Payments	−0.2583	−0.85	−4.5738	−5.55
	(0.3030)		(0.8248)	
Market Returns	0.1390	15.88	0.1772	7.48
	(0.0088)		(0.0237)	
Population Growth	6.6198	13.58	3.4059	3.41
	(0.4876)		(0.9993)	
$Urban_1$	−21.6807	−10.14	−26.8882	−6.51
	(2.1379)		(4.1282)	
$Urban_2$	−8.5882	−3.08	−10.1961	−1.87
	(2.7916)		(5.4412)	
$Urban_3$	−11.7639	−4.00	−13.5427	−2.32
	(2.9416)		(5.8366)	
Population / Farm Acres	−0.2124	−0.98	−0.0287	−0.05
	(0.2167)		(0.6288)	
Observations Used	23,466		15,143	
R^2	0.0852		0.0352	

[a] Numbers in parentheses are standard errors. Model 11 uses the historical average values of payments and market returns over the preceding 5-year period to represent expected values. Model 12 uses GMM-IV estimation methods to incorporate expectations of current period values.

Table 8. Analysis of Share-Cash Rental Rate Differentials:
Parameter Estimates and Summary Statistics

	Model 13		Model 14	
Variable	Estimate	t-Ratio	Estimate	t-Ratio
Intercept	13.5978	10.38	26.9354	4.50
	(1.3106)		(5.9900)	
Other Payments	−0.1328	−1.04	−2.7560	−2.29
	(0.1282)		(1.2040)	
LDP Payments	0.0966	1.36	2.1743	3.00
	(0.0713)		(0.7236)	
Direct Payments	0.0660	1.40	−0.1708	−0.94
	(0.0471)		(0.1827)	
Disaster Payments	−0.7841	−3.95	−2.1911	−2.85
	(0.1985)		(0.7698)	
Market Returns	−0.0214	−3.39	0.0184	0.93
	(0.0063)		(0.0197)	
Population Growth	0.2551	0.88	0.0415	0.07
	(0.2908)		(0.6037)	
$Urban_1$	−2.9239	−2.35	−0.8763	−0.34
	(1.2449)		(2.5514)	
$Urban_2$	−3.4084	−2.12	−1.4991	−0.45
	(1.6064)		(3.3340)	
$Urban_3$	1.8332	1.11	1.4492	0.42
	(1.6534)		(3.4305)	
Population / Farm Acres	0.0189	0.20	−0.5210	−1.21
	(0.0960)		(0.4293)	
Observations Used	11,227	7,514		
R_2	0.0069	0.0021		

[a] Numbers in parentheses are standard errors. Model 13 uses the historical average values of payments and market returns over the preceding 5-year period to represent expected values. Model 14 uses GMM-IV estimation methods to incorporate expectations of current period values.

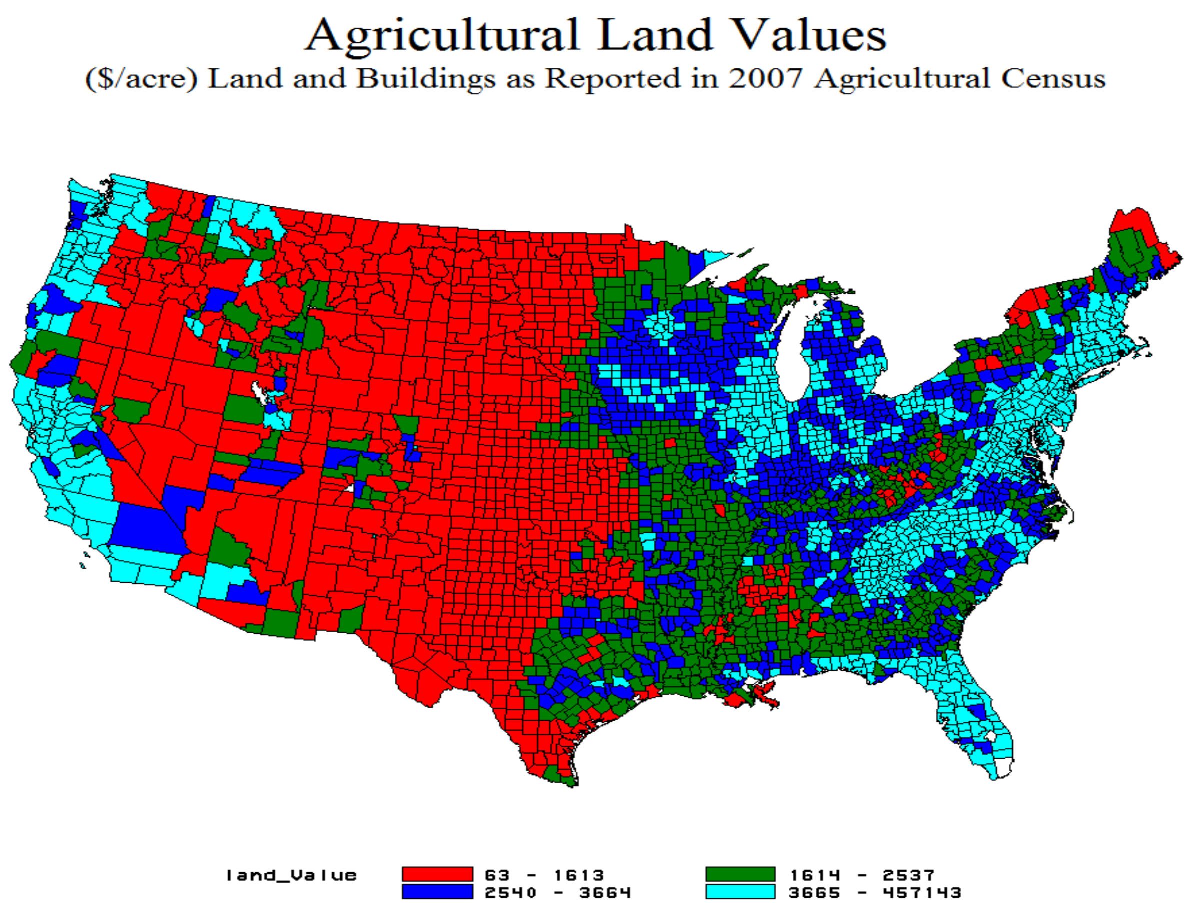

Figure 1: US Agricultural Land Values

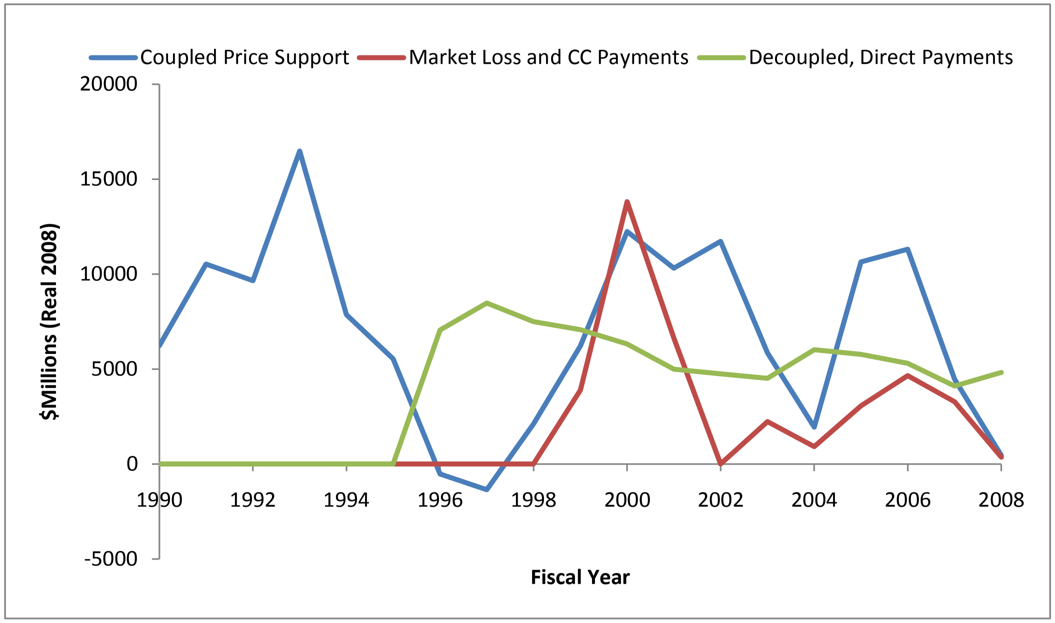

Figure 2: US Farm Program Payments by Category (Real $2008)

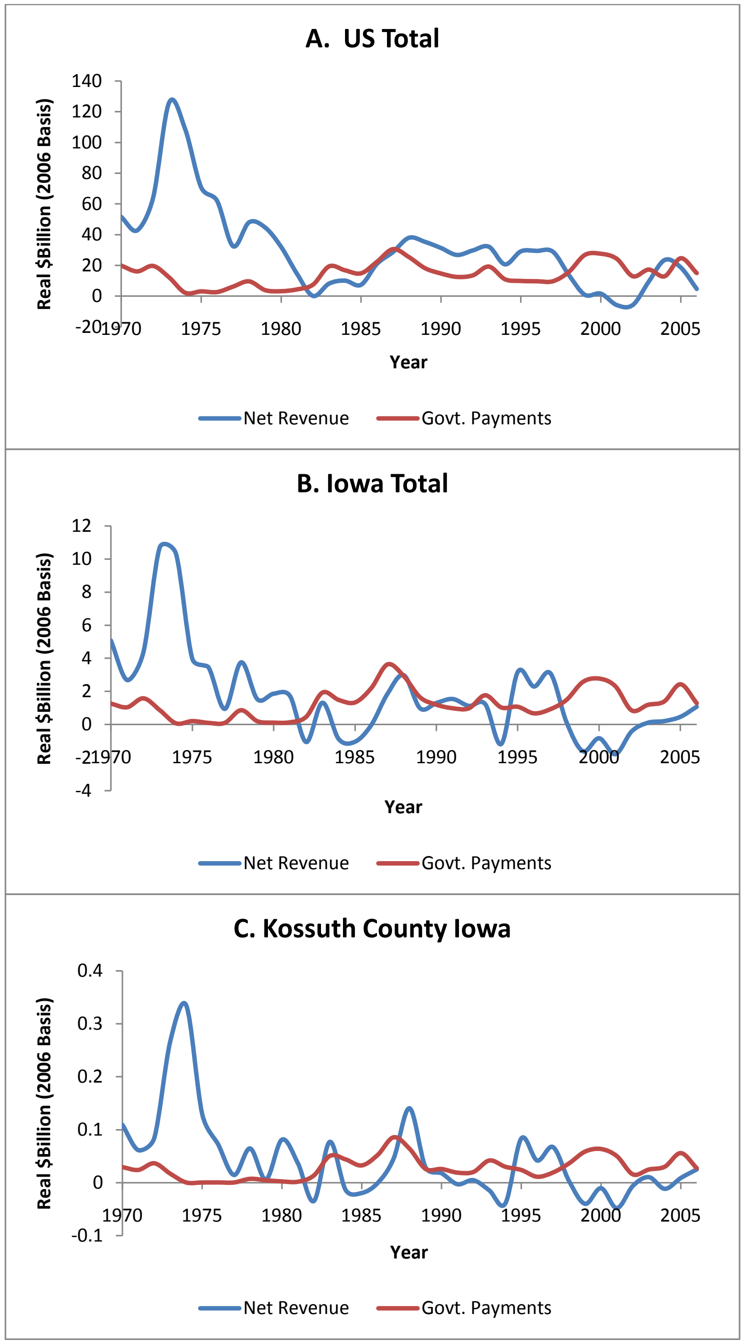

Figure 3: Net Revenues and Government Payments for US, Iowa, and Kossuth County Iowa

Appendix Table 1. USDA Program Payments by Category:

Outlays, and Number of Recipients (1990-2005)

Program	Total	No. Recipients
.... Coupled Payments		
Acreage Grazing Payments	11,475,210	9,386
Barley Assessment Deficiency	37,303,627	89,793
Cotton Deficiency	3,434,395,526	694,440
Crop Special Grade Rice LDP	4,719,159	285
Feed Grain Deficiency	15,328,664,623	6,072,369
LDP, Non-Contract PFC Growers	85,305,152	58,536
Loan Deficiency	29,732,547,354	5,192,213
Market Gains	4,476,129,696	633,196
Rice Deficiency	3,338,380,074	218,421
Rice Marketing	34,014,757	20,274
Wheat Deficiency	7,923,366,487	3,223,695
Winter Wheat Deficiency	682,864,667	248,373
.... Direct Payments		
Amlap - Apportioned	94,934,998	7,647
Apple Market Loss Assistance	166,373,534	13,160
Dairy Market Loss Assistance	968,612,817	187,732
Direct And Counter Cyclical	25,068,153,272	4,218,971
Lamb Meat Adjustment Assist	86,071,348	71,706
Marketing Loss Assistance	18,260,407,458	5,366,287
Oilseed Program	950,113,825	1,184,806
Peanut Marketing Assistance	119,010,211	27,094
Peanut Marketing Asst Pgm III	53,924,599	17,277
Production Flexibility	35,210,684,603	9,667,805
Suplemental Oilseed Payment Program	418,811,924	586,572
Supplemental Tobacco Loss	127,461,626	335,871
Tobacco Loss Assistance	346,044,295	361,113
WAMLAP II - Apportioned	18,637,475	20,985
WAMLAP III - Apportioned	16,730,874	20,974
Wool and Mohair Market Loss Asst.	10,228,857	18,629
.... Disaster Payments		
01-02 Crop Disaster Assistance	2,547,849,688	389,516
2000 Florida Nursery Losses	29,437	3
AILFP – Apportioned	6,480,878	1,180
American Indian-Livestock Feed	12,458,007	2,389
Apple and Potato Quality Loss	34,199,943	1,681
Avian Influenza Indemnity Prog	52,980,294	163
Cattle Feed Program	136,401,954	49,580
Citrus Losses In California	2,154,433	987
Crop Disaster Program	3,060,477,581	555,263
Crop Loss Disaster Assistance	1,857,480,163	249,555

Appendix Table 1. (continued)

Program	Total	No. Recipients
Disaster Payments (continued)		
Dairy Disaster Assistance	7,495,444	1,161
Dairy Indemnity	2,450,691	456
Disaster	5,532,181,025	1,504,547
Disaster – Non-Program Crops	42,215	29
Disaster – Program Crops	-112,369	74
Disaster Reserve Assistance	145,110,728	85,247
Emergency Conservation	312,905,164	124,459
Emergency Conservation Program	70,106,623	26,205
Emergency Feed	-1,029,779	1,303
Flood Compensation Program	706,144	38
Idaho Oust Program	4,888,638	71
Karnal Bunt Fungus Payment	38,897,325	912
LIP - Contract Growers	1,031,180	1,229
Livestock Compensation Program	1,096,133,267	578,840
Livestock Emergency Assistance	1,550,736,935	781,983
Livestock Indemnity Program	305,696	164
NAP-Supplemental Appropriation	3,917,572	1,379
Noninsured Assistance Program	672,291,473	170,099
Nursery Losses - Florida	7,316,930	195
Pasture Flood Compensation	20,387,735	12,252
Pasture Recovery Program	52,971,866	35,093
Poultry Enteritis Syndrome	1,768,271	136
Quality Losses Program	148,615,562	35,246
Sugar Beet Disaster Program	45,636,494	2,745
Tobacco Disaster Assistance	2,696,981	343
Other Payments		
Additional Interest	56,214	279
Agricultural Conservation	1,132,520,907	739,873
Agricultural Management Assist	5,752,517	796
Animal Waste Management	256,368	26
Arkansas Beaver Lake	2,464,632	477
Auto Ag Cons Pg Env. Long Term	402,632	109
Auto Ag Con Pg Env. Annual	1,163	1
Auto Ana-Conservation Annual	1,875	2
Auto CRP - Cost Shares	353,698,363	143,683
Auto EQIP	173,468,007	37,592
Auto LTA-Conservation Long Term	704,059	164
Clean Lakes	9,999	1

Appendix Table 1. (continued)

Program	Total	No. Recipients
.... Other Payments (continued)		
Colorado River Salinity	31,832,222	1,992
Cotton Diversion	-15,095	22
CRP Annual Rental	24,695,070,732	5,701,530
CRP Cost-Shares	840,994,086	429,665
CRP Incentives	483,637,540	219,732
Dairy Termination	237,026,377	19,893
Environment Quality Incentives	477,768,620	126,317
Extended Farm Storage	171,409,332	72,879
Extended Warehouse Storage	44,481,468	18,694
Feed Grain Diversion	-395,250	4,040
Finality Rule	1,007,752	1,403
Forestry Incentive - Annual	51,322,552	25,100
Forestry Incentive - Long Term	12,254,173	6,120
Fresh Market Peaches Program	783,991	126
Grasslands Reserve Program	9,275	4
Hard White Winter Wheat	3,517,590	3,301
Interest On CCC-6'S	1,624	38
Interest On NAP Payment	4,678	184
Interest Payments	29,003,888	1,046,365
Klamath Basin Water Program	-4,299	4
Milk Diversion	30,576	20
Milk Inc Loss Contr Transition	547,209,081	73,836
Milk Income Loss Contract	1,403,354,665	247,585
Milk Marketing Fee	265,896,171	249,035
National Wool Act	895,921,293	442,720
NRCS EQIP	283,707,027	32,930
Options Pilot Program	39,762,496	4,128
Payment Limitation Refund	-6,983,394	2,411
Peanut Quota Buyout Program	1,220,640,857	80,080
Potato Diversion Program	20,263,929	1,222
Rice Diversion	-12,567	11
Rural Clean Water	3,126,831	618
Small Hog Operation Program	121,376,613	57,952
Soil/Water Conservation Assist	10,358,605	2,383
Sugar PIK Diversion Program	180,690,205	15,126
Tobacco Payment Program	50,887,278	297,921
Water Bank - Annual	43,879,235	30,317
Water Bank-Practice Cost/Share	11,046,258	7,682
Wetlands Reserve	34,315,395	1,830
Wheat Diversion	-2,237	85