

Landowners' Riches: 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. The 2002 Farm Bill provides in excess of \$190 billion in financial support to U.S. agriculture, an increase of \$72 billion over previous programs. Our paper is concerned with the distribution of these benefits and their captures by landowners. We use a large sample of individual farm data to investigate the contribution of each of the main types of farm programs to land values. We find that subsidies have a significant impact on farm land values especially the subsidies with a built-in insurance feature. We also report evidence that lease rates incorporate a significant portion of agricultural support, even if the farm legislation mandates that benefits must be allocated to farm operators. Finally, taking advantage of the fact that some farmers rent land on both a cash and share basis, we find that farm programs that are meant to stabilize farm prices provide a valuable insurance benefit. The methodology we use throughout the paper attempts to account for this insurance feature of many agricultural programs. It leads us to formulate a number of caveats associated with existing studies of policy effects on farm land values.

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A recent news report posed the following question. What do 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 recipients include former Worldcom chief Bernard Ebbers, part-owner of a farm that received nearly \$4 million in subsidies between 1996 and 2000, the Chevron corporation, the Caterpillar corporation, and several other Fortune 500 companies. Between 1996 and 2000, farm subsidy checks were mailed to 31 addresses in Beverly Hills, 752 addresses in Miami, and 803 addresses in Washington, D.C.²

Support for U.S. “farmers” is often directed to individuals and corporations that seem to be some distance from the struggling family farm operator politicians love to remind us about. This fact has been the source of considerable debate in recent years, in particular since Congressional support for U.S. agriculture continues to expand.³ However, the distribution of farm benefits does not stop where the checks from the Treasury are mailed. To the extent that eligibility for government benefits is tied to the ownership or operation of scarce assets, the market values and rents of these assets will reflect the portfolio of streams of cash flows to which they give a right. Such is the case with farm land, which gives rights to both returns from agricultural markets and payments from the government.

USDA statistics indicate that about 45% of U.S. farm land is operated by someone other than the owner. Contrary to conventional wisdom, most agricultural landlords (57%) are non-farm corporations or individuals that work in or are retired from non-farm-related activities. A significant proportion of landlords (15%) live more than 150 miles from the land they rent. Almost half (42%) the landlords live in a city, town or urban area.⁴

In light of these facts, a fundamental question arises regarding the distribution of farm support programs: to what extent do agricultural subsidies translate into higher land values and rents? This is a critical issue, not only for policymakers but also for farm operators who should understand the (limited) extent of their gain from the various programs they tend to support. The underlying question is, of course, who are the policies intended to benefit?

¹“Farm Subsidies Help Those Who Help Themselves,” a Fox News report by William LaJeunesse, July 15, 2002.

²Data from the Environmental Working Group’s farm subsidy database (www.ewg.org).

³President Bush signed an omnibus package of farm program support on May 13, 2002. Over the next ten years, the new Farm Bill will transfer about \$190 billion from U.S. taxpayers to the farm sector. On a per year basis, this is about the same magnitude as expenditures on general science, space and technology (source: Budget of the United States Government, <http://w3.access.gpo.gov/usbudget/>.)

⁴Source: USDA Agricultural Economics and Land Ownership Survey (1999), and Mishra et al. (2002).

The capture of agricultural benefits by farm land is particularly problematic if the farm policies aim to support farmers and the farmers do not own their land when the policies are announced. The issue is obvious for the farmers who lease their land. Even if the law indicates that payments should go to the farm operator, the land lease rates are determined by the market. Furthermore, 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.

Concern over the capture of agricultural policy benefits by the land owners is not new. A number of papers have attempted to estimate the capitalization of aggregate agricultural transfers into farm land values.⁵ These papers suffer from a number of shortcomings which we are able to address here through the empirical analysis of a unique set of farm-level data. First, we are able to investigate the differential impact of the main farm programs because we observe the breakdown of government payments at both the farm and the county level. Second, we 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 when relevant. This gives us the unique opportunity 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 enable us to investigate the extent to which the market values the insurance features built into some farm programs, features ignored by the literature.

Our farm level data set is drawn primarily from an annual survey of approximately 8,000 farms per year over the 1998-2001 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 their design. At the other extreme are output price-support payments which are intimately tied to contemporaneous market conditions. We find that price-support payments have the strongest effects on land values. Payments that may signal future benefits, even in cases where they are not a permanent part of farm legislation,

⁵See, for example, Goodwin and Ortalo-Magné (1992), Barnard et al. (1997), 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 previously evaluated.

have lesser effects. Payments that are decoupled from output and were supposed to be transitory yielded the smallest effects on land values.

U.S. farm legislation typically intends benefits to be “shared” between the owner and operator of a farm in the same proportion as they share the risk of farming. Under cash lease arrangements, the tenant commits to a fixed payment to the landlord, independent of market returns and crop performance. In this case, the entire subsidy is sent to the tenant. Under share lease arrangements, the landlord shares in the risk of market returns and thus receives a share of the subsidy directly from the government. As mentioned above, the law does not regulate the lease rates.

Our empirical analysis indicates that owners extract a large proportion of farm policy benefits from tenants through lease rates. From the study of lease rates, we also find that programs with strong insurance objectives (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 this insurance benefit of agricultural policy 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 underlying market conditions and local agricultural output. Instead, a low price-support payment this year may be due to high world market prices and thus may not indicate a decrease in the expected stream of long run benefits from the price support program. This leads us to propose an empirical strategy different from the usual regression of land values on current government payments.

Second, those government transfers whose level are negatively correlated with earnings from agricultural markets decrease the volatility of land returns. To consider how this issue affects the interpretation of our empirical results, we find it useful to think about farm land as a portfolio of securities giving rights to a variety of cash flows (e.g., returns from wheat, from corn, from each type of government transfer). Within this context, it should be obvious that eliminating a security (e.g., price support) whose payoff is determined in part by the performance of other securities in the same portfolio (e.g., returns from wheat) will affect the volatility of the overall portfolio. As a consequence, eliminating one or more type of

farm subsidy would increase the required rate of return on all remaining expected cash flows from farm land. 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 expectations of a more volatile stream of earnings from the land if price support programs were to be dismantled. This argument is different and complementary to the accepted idea that removing U.S. farm policy would affect world market prices.

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. Section two discusses issues pertaining to model specification, estimation, and measurement of the relevant variables. The third section presents the results of our empirical analysis. The final section offers some concluding remarks.

1 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 6 years by an omnibus “Farm Bill” package of legislation. In addition to this regular 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 (through emergency bills) that is not a part of any budgeted legislation.

Over most of its history, U.S. agricultural policy has used price supports, sometimes coupled with production controls, with the declared objective to provide income support to the farm sector, in particular the ever-struggling “family farm.” Some support was made on the basis of a need for “parity” with the high relative agricultural prices of 1910.⁶ In more recent times, price support was provided only to program 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.” This base acreage reflected historical production (in most cases, acreage during the 1980s).

⁶Though 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.

The fact that price supports were tied to historical production patterns implied a lack of planting flexibility for producers. In addition, soybeans, now 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. Soybeans were made eligible for price supports, which are now provided through the “Loan Deficiency Payment” (LDP) program. LDP payments are made on the basis of the difference between market and support prices (called 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. To compensate producers over this transition, a program of direct payments to those producers with base acreage (historical rights to program benefits) was instituted. 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 established 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.

Ad hoc assistance has been a fixture in U.S. agricultural policy for many years. Periods of drought or poor market conditions frequently trigger ad hoc 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. 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 payments for low market prices, termed “market loss assistance” (MLA), were then instituted. Market loss assistance payments totaled over \$19 billion between 1998 and 2001. These payments were made on the basis of eligibility for AMTA payment benefits. Once again, since AMTA

payments are based on historical production, there was no explicit eligibility requirement that recipients be actively involved in agricultural production.

A number of other programs have been important to agricultural policy. For example, a considerable amount of farm land (approximately 30 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- to fifteen-year lease agreement. Some of this land has base acreage associated with it, thus leading to AMTA and MLA payments on land in conservation reserve. 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.

According to analysis by the Congressional Budget Office (CBO), the 2002 Farm Bill will increase federal spending on agriculture by \$72 billion over the next ten years. Congressional debate over the 2002 farm legislation and the generous level of support that emerged from these deliberations has made clear Congress’s intent to continue taxpayer support for agriculture. Lawmakers chose to provide generous increases in farm subsidies with no real limits on the amount of payments an individual can receive; the issue of the distribution of farm subsidies remains.⁷

2 Modelling Framework

2.1 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 all disaster payment programs including MLA programs have major insurance components. Because the USDA aggregates disaster payments and MLA payments under a single category in the survey data we use, we denote this class of support payments as ad hoc assistance (AHA) payments. 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

⁷Some programs have payment limits, though legislation allows farms to establish multiple entities (up to three), making most limits non-binding. In addition, LDP payments can be made in the form of generic “commodity certificates” that are not subject to limits. It is interesting to note the nature of the binding payment limits that Congress did impose with the 2002 Farm Bill. Producers with an annual adjusted gross income that exceeds \$2.5 million cannot receive payments unless at least 75% of their income is derived from farming, ranching, and forestry activities.

additions to the returns of farming that are uncorrelated with present or future earnings from the market. In addition to these transfers, land may also give 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 use.

$$V_0 = E_0 \left[\sum_{t=1}^{\infty} \frac{\text{MKT}_t + \text{LDP}_t + \text{AHA}_t + \text{AMTA}_t + \text{CRP}_t}{(1+r)^t} \right] + \text{CONV}_0, \quad (1)$$

where MKT denotes earnings from the market, 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 expected cash flows. This risk is not simply the sum of the individual risks because of the non-zero covariances, by design, between MKT payments, LDP and AHA payments.

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

$$V_0 = E_0 \left[\sum_{t=1}^{\infty} \frac{\text{MKT}_t + \text{LDP}_t + \text{AHA}_t}{(1+r_1)^t} + \frac{\text{AMTA}_t}{(1+r_2)^t} + \frac{\text{CRP}_t}{(1+r_3)^t} \right] + \text{CONV}_0, \quad (2)$$

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 valuation formula can be re-arranged as

$$V_0 = E_0 \left[\frac{\text{MKT}_1}{\kappa_1} + \frac{\text{LDP}_1}{\kappa_2} + \frac{\text{AHA}_1}{\kappa_3} + \frac{\text{AMTA}_1}{\kappa_4} + \frac{\text{CRP}_1}{\kappa_5} \right] + \text{CONV}_0 \quad (3)$$

where κ denotes the capitalization rates. 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 capitalization 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, this issue 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.

2.2 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 factors. 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 problem of errors in the explanatory variables. Errors-in-variables may result in biased estimates.⁸ This problem is compounded by the fact that the government operates more than one payment program, 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 the support provided by 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 positively correlated across the programs. The correlation could also be negative. Consider the case of price supports and yield disaster relief (a type of ad hoc assistance payment). In low yield years, market prices are likely to be high and thus price support payments will be low, though yield 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

⁸This 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.⁹

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. Proxy variables should minimize observational errors. We represent the expected payment benefits by constructing average values of each relevant policy variable over recent years. 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.¹⁰

Our use of averages of past values raises one complicating factor. 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 earnings, we therefore utilize averages of past values of real earnings per acre *in the county* where the individual farm is located. We argue that earnings on an individual farm, in contrast, may reflect individual choices and characteristics of the farm operation. Transfer of the land to a new operator may result in different earnings realizations which are better represented using county-level averages. Note also that 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.

The 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

⁹See Goodwin et al. (2003) for a quantitative assessment of this issue in the farm land valuation context.

¹⁰The nature of our data also complicates standard instrumental variables estimation techniques in that we cannot observe cross-sectional units in more than one year. This limits the availability of suitable instruments.

by market and production conditions (price supports and ad hoc assistance payments) that must be proxied.

2.3 Data

The primary source of our farm-level data is a data set collected from a sample of farms through the USDA's National Agricultural Statistics Service (NASS) Agricultural Resource Management Survey (ARMS) project. The ARMS survey is a probability-weighted, stratified sample of about 8,000 U.S. farms each year. The survey collected detailed government payment information for various farm program benefits as well as extensive farm and operator characteristics for the years 1998-2001. Our empirical analysis focuses on these years. All monetary values in our sample were adjusted to 2001 equivalent real values by deflating by the producer price index. Given the short nature of our sample, such deflation had only minor effects on the results.

Besides detailed farm earnings, the survey also reports farm land values. Farm operators are asked to estimate the market value on December 31 of each 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.¹¹

To focus on policies directed at crop farms, the main recipients of farm subsidies, we excluded any farm from our analysis for which livestock product sales accounted for over 50% of overall farm sales or farms in counties where less than 10% of the county's farm acreage was in the main program crops (wheat, corn, cotton, soybeans, rice, oats, and grain sorghum).¹² Farms for which more than 50% of total sales were accounted for by nursery products, fruits, or vegetables were also dropped from our sample. Finally, we also excluded farms for which incomplete data were available. This left us with a small number of extreme outlier observations: 0.8% of our sample with land values exceeding \$10,000 per acre. Such extreme observations represent non-typical agricultural properties and were therefore excluded from the sample.

To carry out our analysis of the determinants of farm land values, we need to observe all the payments to which the land gives right. An issue arises when a farmer uses land under a share lease agreement. In such a case, the government distributes payments to both tenant

¹¹Farmers do not have any obvious incentive to distort their response to the survey.

¹²This excludes farms in counties for which more than 90% of farm land is in pasture, rangeland, or fruits and vegetables production.

and landlord according to the proportion of the sharing arrangement. The survey does not report the government payments sent directly to the landlord. We therefore exclude all farms with one or more share lease contracts when we carry out the land value regressions.¹³ This leaves us with a sample of 5,861 observations for the analysis of land values.

A total of 4,146 farms report cash lease contracts and no share lease contract; 5,121 farms report share lease contracts. We use each of these samples to study the determinants of cash and share lease rates. A total of 3,296 farms report both share and cash lease contracts; this sample of farms enables us to study the factors affecting the difference between share and cash lease rates.

For each farm, the survey reports the various earnings received by the farmer in the year of observation. We use independent data to compute a measure of expected earnings from the market. 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 agriculture. Likewise, the relevance of such a consideration is limited—it is unlikely that the U.S. government will completely remove policies that currently support agriculture.

We start from county-level observations on yield, and state level prices (taken from NASS statistics). Multiplying yields and prices gives us expected gross revenue for each crop. Costs are much more difficult to measure due to data limitations. For wheat, barley, and cotton, we use national, annual average per-acre costs drawn from the ARMS survey. For corn and soybeans, we use cost budgets collected from the Iowa State University Extension Service. For grain sorghum (a minor crop), we use cost figures collected from budgets generated by the University of Arkansas Extension Service. These crops account for the overwhelming majority of U.S. crop-farm earnings; other minor crops were not included in the cost and returns measures. In every case, costs figures exclude the charge for land.

The difference between county-level revenues and costs for each crop provides our measure of county-level market earnings for each crop. We use weights constructed from the allocation of land within a county across the different crops (taken from NASS statistics) to compute the expected market earnings per acre of land. More precisely, the weight for each crop within each county is computed as the ratio between the acreage allocated to that crop in the

¹³USDA statistics indicate that, in 1997, two thirds of all rental arrangements were done on a cash only basis.

county divided by the total acreage allocated to all crops under consideration in the county. It should be noted that, at least for our period of study, crop earnings do vary across counties (according to crop mix) but are less volatile over time. For each farm level observation, we compute the average of this county-level expected earnings over the preceding four years as our measure of expected earnings.

We use historical averages as well to represent expected earnings from aggregate government transfers, as well as LDP and ad hoc assistance payments. We use a four- or five-year average of county-level total payments in our aggregate policy models, and for ad hoc assistance payments. In contrast, because the LDP program was not the main instrument for providing price support prior to the 1996 Farm Bill, we use a two- or three-year average for LDP payments at the county level.¹⁴ Our land value analysis includes the current year's market and program receipts along with the preceding four years (two for LDP) while our analysis of rental rates excludes the current year since receipts were not known at the time lease contracts were determined.

Future CRP and AMTA type payments are known with certainty in advance by all parties up to the point where the political process is expected to review the relevant funding laws. We therefore use realized payments from these programs as proxies for expected future payments.

To the variables aimed at capturing expected cash flows from farming, we add factors intended to represent the additional value of land from the option to convert it to residential or commercial use in areas facing non-agricultural pressures. First, we consider population growth rates and the population density (people per square mile) in each county in the preceding year (U.S. Census Bureau). 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 5=urban. In that very few farms were located in the most urban counties (less than 0.3%), we combined urban categories 4 and 5 into a single category. Finally, to try and represent residential housing pressures beyond what is already captured by the population variables, we include the total value of new housing permits issued in the county in which the farm is located. The permit data were collected from the U.S. Census Bureau. The permits apply to all forms of residential housing, both single-family and multi-family dwellings, and describe the total value of construction.

¹⁴Prior to 1996, a different form of deficiency payments was used to support agricultural prices.

Summary statistics and definitions for the key variables of our analysis are presented in Table 1. Farm population weights were used in deriving summary statistics to account for the stratified nature of the ARMS survey. A detailed list of farm programs is provided in an appendix along with indications as to how we regrouped the programs under the broad headings of our analysis.

3 Empirical Results

An important characteristic of the ARMS data relates to the stratified nature of the sampling used to collect the data. Two estimation approaches have been suggested to deal with the stratification. The simplest involves a jackknife procedure, where the estimation data are split into a fixed number of subsamples and the estimation is repeated with each subsample omitted. Under the jackknife approach, the sample is divided into m subsamples.¹⁵ The model of interest is estimated m times using weighted regression procedures with each of the respective subsamples omitted from the estimation data. A simple expression for the variance is then taken by considering the variability of the estimates across each of the replicated estimates. The jackknife weights included in the ARMS data are constructed for use with the entire sample. In that we are using a subset of the overall sample, only a limited portion of the crop farms, these weights are not appropriate for our use since the pre-defined jackknife groupings would leave us with unbalanced jackknife groups.

An alternative approach involves repeated sampling from the estimation data in a bootstrapping scheme. Ideally, rather than random sampling from the entire estimation sample, an appropriate approach to obtaining unbiased and efficient estimation results involves random sampling from individual strata (see, for example, Deaton (1997)). In the ARMS data, however, this is not possible since the strata are concealed from the researcher. The database does, however, contain a population weighting factor, indicating the number of farms in the population (i.e., all U.S. farms) represented by each individual observation. This can be used in a probability-weighted sampling scheme whereby the likelihood of being selected in any given replication is proportional to the number of observations in the population represented by each individual ARMS observation.¹⁶

¹⁵Estimation programs created by the USDA use 15 subsamples.

¹⁶The findings presented below were robust to the ignorance of stratification in estimation.

We utilize a probability-weighted bootstrapping procedure. The specific estimation approach involves selecting N observations (where N is the size of the survey sample) from the sample data. The data are sampled with replacement according to the probability rule described above.¹⁷ The models are estimated using the pseudo sample of data. This process is repeated a large number of times and estimates of the parameters and their variances are given by the mean and variance of the replicated estimates. We utilize 5,000 replications in the applications which follow.

3.1 Land Prices—Aggregate Government Support

Our analysis of the determinants of land values is conducted in two parts. In this first part, we consider two models that aggregate all program payments into a single category. Such models provide a summary of the impacts of additional federal subsidy dollars on land values at the margin. The first model uses actual, observed payments for each farm. The second uses our county-level measures of expected per-acre receipts from the market and from aggregate farm program payments. Recall again that both expected earnings are represented using the average in the county over current and the preceding four-year period. The results are presented in Table 2. The model using observed farm-level payments (Model I) indicates that \$1 per acre of farm payments tends to add \$3.35 per-acre to the value of farm land. We obtain a similar though somewhat larger estimate for the contribution of \$1 of market earnings. An additional dollar of market earnings raises land values by \$4.81. At the aggregate level, it appears that an additional dollar of support from the government has a similar effect on land values as an additional dollar of market earnings. However, this finding is subject to the measurement issues we raised above.

We have argued that the use of observed payments may result in biased estimates. As an alternative, we have argued in favor of measures of expected earnings. Model II replaces realized cash flows from the government and from the market with the five-year average measures noted above. The results suggest different effects of earnings on land values. In particular, we now find that an additional \$1 of expected market earnings raises land values by \$5.32 per acre, a slightly larger estimate than the earlier \$4.81 effect. The estimate for

¹⁷It should be acknowledged that our approach may result in less efficient estimates than would be the case were sampling from individual strata possible. This could occur in cases where inferences are being made about variables used in designing the stratification scheme in that such information is being ignored by not drawing from individual strata. To the extent that this is relevant to our analysis, the t-ratios reported below represent conservative estimates.

the contribution of government payments is also larger than in Model I, but much more so, \$9.98 instead of \$3.35. Hence, under our preferred formulation, dollars from the government seem to have a much stronger effect on land values, at the margin, than dollars from the market. The use of expected earnings instead of realized contemporaneous earnings does make a difference.

Models I and II also confirm the importance of many other factors aimed at capturing the option to convert land to non farm uses. A higher population growth rate and a greater density of population are associated with higher land values. The USDA indicators aimed at capturing general urban pressures are also significant. The most rural counties were chosen as our default category. When compared to these rural counties, counties with urban indicators of 2, 3, and 4-5, had land values that were approximately \$312, \$445, and \$247 greater per acre, respectively, according to our preferred specification. The option value to convert in the most urban counties might be lower because agricultural land in such counties may be protected by zoning restrictions. It is worth noting that omitting these significant urban control variables has a substantial effect on the estimates of the contribution of each expected stream of cash flow to the value of land. We report the estimates of model II without urban variables in Appendix.¹⁸

3.2 Land Prices—Specific Government Support

A second part of the analysis of land value breaks out the overall government payments into their individual components, generated from different programs. Models III and IV use actual payments and our measure of expected payments, respectively. Empirical results are reported in Table 3. The estimates of the contribution of market earnings are similar to those obtained in Models I and II, around \$5 per dollar of market earnings. The model of observed payments suggests that an additional dollar of LDP payments (price supports) will increase land values by \$4.12 per acre.

Once again, coefficient estimates differ depending on whether we measure government earnings with realized contemporaneous payments or expected earnings. The biggest difference between the alternative models occurs for the LDP payments. The LDP program appears to have the largest effect on land value, \$13.72 per dollar of expected payment. Recall that this program helps farmers not only by increasing mean expected earnings but

¹⁸Hardie 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.

also by decreasing significantly the volatility of their earnings. The insurance nature of this program makes realized earnings particularly poor indicators of expected earnings.

In the case of ad hoc assistance payments, the coefficient obtained under our preferred specification is much smaller than for LDP payments at \$8.22 and is not statistically significant. The major difference between LDP and ad hoc assistance programs during the period of our study is the year-to-year financing of the latter compared to the security granted to the LDP program which was part of the Farm Bill. The fact that ad hoc assistance payments do not significantly influence land values may reflect this year to year funding uncertainty.

In the model with realized payments, the fixed AMTA payments have a small though statistically significant effect on land values. In the model with expected program benefits, AMTA payments still have a positive though not statistically significant effect. The degree to which AMTA payments influenced land values depended on land owners' expectations that such benefits would be extended beyond the expiration of the 1996 FAIR Act. The payments were intended to decline in magnitude each year and expire with the FAIR Act in 2001. In light of the fact that Congress generously extended AMTA payments, it will be interesting in future years to see whether such supposedly decoupled instruments continue to have only a minimal effect on land values.¹⁹

The CRP variable measures payments received under the conservation reserve program. Empirical estimates suggest that farmers receiving CRP payments tend to work with less valuable land. This negative effect is in line with expectations since the land that ends up covered by the program tends to be land with weak prospects of market returns and more prone to erosion. Likewise, land committed to CRP contracts is necessarily removed from production. If this land is transferred through sale to a new owner, the new owner assumes the responsibility for fulfilling the terms of the contract. If the new owner does not succeed to the CRP contract, the original owner must refund all rents and cost sharing expenditures. Such restrictions likely have a depressing effect on CRP land that is subject to transfer through sale.

The effects of urban pressures, population growth, housing pressures, and market returns are very similar to what was implied by the aggregated policy models. In every case, urban pressures play an important role in determining agricultural land values. Although these urban effects are interesting in their own right, it is important that they be accounted for

¹⁹As we discuss in greater detail below, Congress extended direct payments and allowed landowners the option of updating the program parameters that determine the level of payments and incorporating oilseeds as a "program" crop eligible for the payments.

(a step that has generally been neglected in previous analyzes) in order to obtain accurate measures of the policy effects on land values. As with our aggregated-payments specifications, we obtain substantially different result if we omit all urban indicators (see Appendix).

In all, the above results provide strong evidence that land captures policy benefits. In contrast to the existing literature, we have argued in favor of measures of expected payments instead of typical measure of current payments as determinant of land values. We find substantive differences in estimates depending on which of the two types of measure we use. This finding is particularly true for LDP and ad hoc assistance payments, the two programs with the most significant insurance component built in and hence the two programs for which current payments are a poor indicator of expected future government support.

This capture of policy benefits by the land raises the issue of appropriation of the policy benefits by the current owners of land versus the one who owned the land at the times when federal programs were (or are) announced. When the farm operator owns his land, the transfers go to him. Depending on policy expectations when he bought his land, the transfers are either pure gain or compensation for the price premium he paid when purchasing his land.

This is not the only way in which the land market affects the distribution of farm benefits. If land values depend on policy transfers it must be that land rents reflect policy transfers; expected future rents are a key component of the value of land. The extent to which the rental market shifts government transfers from farmer to landlord is the issue we turn to now.

3.3 Lease Rates

Almost half of the U.S. farm land is operated by someone other than the owner. This raises the following question—how do the provisions for support of agriculture affect those farmers that lease the land they farm? Again, the stated intent of the legislation is a “fair and equitable” sharing of program payments. Owners that do not share in the production risk (i.e., rents under cash lease arrangements) are meant to receive no direct benefit from the government. The answer to the above question lies in an evaluation of the terms of lease arrangements—do lease rates reflect policy benefits and thus transfer to landowners benefits supposedly aimed at the farmers?

In the Agricultural Resources Management Survey, the farmers that were engaged in leasing land reported the lease rates paid per acre for land leased under cash and share

arrangements. Cash rents are set at the start of the season. The farmer commits to pay the landlord a given cash amount, independent of returns from the land. A large proportion of leases are oral agreement running from year to year with regular rent adjustment. Written lease rate adjustment appear to follow a similar ad hoc process with small regular increases from year to year except following big changes in production pattern, technology or returns, with possibly some lag due to the time it takes for both parties to become aware of any changes and their economic consequences. As we note below, changes in the policy environment may also stimulate the renegotiation of lease agreements.

For share leases, specific sharing arrangements are set ex ante. The exact payment to the landlord is set ex post once all uncertainty about earnings has been resolved. Under a cash lease, the landlord does not share any of the production risk and therefore does not receive any direct benefits from farm programs. Under a share lease, the government splits farm payments between landlord and tenant along the same proportion as they share of the revenues from the land. Of course, even if policy-makers control who receives what check, they do not control lease rates and thus the potential of reallocation of policy benefits through the land market.

We consider 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 Table 4. As expected, higher levels of market returns are correlated with higher rental rates, though it is interesting to note that anticipated LDP payment benefits have a larger effect on rental rates than is the case for expected market returns. Our analysis indicates that an additional dollar per acre of LDP payments raises the cash rental rate by \$0.57, suggesting that landlords are quite effective in extracting a considerable share of the benefits. This occurs in spite of the legislative mandate that such payments be directed to the operator. Each dollar of expected ad hoc assistance payments increases cash rental rates by \$1.16. In the case of AMTA payments, an additional dollar per acre of payments raises cash rents by \$0.66 per acre.²⁰ Thus, a large proportion of AMTA payments, which are known with certainty prior to the execution of any lease arrangement, goes to the landowners. CRP payments are associated with substantially lower cash lease rates. Again, this result is not surprising given use restrictions and lower quality of such land. Land committed to CRP contracts is of very limited use to tenants over the term of the contract

²⁰The AMTA payment is the value that was known to landlords and tenants at the time lease contracts were determined.

and the assumption of management responsibilities for absentee landowners may result in lower overall rental rates when a rented farm has some CRP land. This effect may also be reflected in the estimates. Indicators of urban pressures are generally not significant.

Table 4 also presents regression results for a model of share rents. Recall that those farms with share leases were omitted from the analysis of land values and cash rental rates since we only observe the share of payments going to the operator. Thus, our analysis of share leases pertains to a different sample of farms. It is also important to recognize that our inferences in the model of share leases differ in that they pertain only to that portion of the payments that goes directly to the farm operator; we do not observe the portion that goes directly to the landowner. This may explain why LDP payments do not appear to exert a significant effect on share rental rates. In the case of the LDP program, the landlord gets his share of payments directly, a payment not accounted for here. Other effects are also likely relevant. A large literature addressing the choice of rental arrangements has concluded that share lease arrangements are often risk sharing mechanisms and thus include a risk premium that is not present in cash rents. It is thus possible that price support payments have several effects on lease arrangements that partially offset one another—increases due to the direct wealth effects and decreases due to a lower degree of market risk.

AMTA payments have a significant effect on share lease rates, raising the rate by \$0.52 for each dollar of payments to the farmer. In contrast to the case of cash rents, ad hoc assistance payments tend to raise share lease rates, by a very substantial amount, \$3.50 per acre for each dollar of payments to the farmer. This very substantial effect likely reflects the fact that ad hoc assistance payments are, by definition, targeted toward risky areas and crops. Thus, the very large effect on share rental rates is likely associated with the fact that a much larger risk premium is associated with land that receives ad hoc assistance payments.

It is difficult to directly compare the effects of various factors on cash and share lease rates since the lease rates are drawn from different farms. However, such a comparison is possible for a subsample of farms that rented land both by cash and share rental arrangements. Though rental arrangements may differ across different tenants and landlords, this at least holds all tenant characteristics constant across the two different types of rental arrangements. The difference in lease rates for such farms is the focus of our analysis in the following section.

3.4 Insurance Benefits

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 how the remaining streams of cash flow are capitalized into the price of land.

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? To answer this question, we take advantage of the fact that some farmers rent land under both cash lease and share lease arrangements. Cash lease rates are set ex-ante while the share payment depends upon the actual earnings of the parcel, thus implying a different risk sharing arrangement.

The main program designed to reduce the variability of farm earnings and insure the cash flow to farmers is the LDP program. Ad hoc assistance payments are not budgeted and suffer from the uncertainties of the political process from year to year. If the insurance component matters, we should find that higher LDP payments should be correlated with a lower risk premium on rental arrangements. This risk premium is represented by the difference in cash and share lease rates on the subset of 3,296 farms that report renting land under both types of 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.

To evaluate this risk premium, we regressed the share-cash rental premium on policy benefits and other factors suspected to be relevant to rental rates. These results are also presented in Table 4. We find that LDP payments do indeed tend to significantly decrease the share-cash premium. An additional dollar in expected LDP payments lowers this premium by \$1.74. In contrast, ad hoc assistance payments tend to substantially raise the premium. This is certainly to be expected since the ad hoc assistance payments naturally are targeted toward areas more likely to suffer a disaster (a crop failure)—in other words, riskier areas. With the exception of market returns and the population growth rate, which have a modest positive

influence on the share-cash differential, the other factors do not appear to significantly affect the risk premium implied by the rental rate differences.

3.5 Caveats

Although this paper benefits from much more detailed data than previous attempts at quantifying the impact of agricultural policy on farm land values, that does not mean our estimates provide a better answer as to the total contribution of agricultural policy to farm land values. In spite of frequent attempts in the literature to do so, such measurements cannot be extrapolated from land value regression estimates such as ours for several reasons. First, regressions yield the effects of the marginal dollar for each type of policy. Second, without US agricultural policy, agricultural commodity prices and markets would be different. Both caveats are well known even if often ignored in the policy debate.²¹

The literature has however overlooked four more issues. First, thinking again 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. In terms of the analysis of the contribution of government programs to land values, 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.

Second, the analysis focused on assessing the proportions of various types of support programs reflected in land lease rates and prices. That does not imply that the remainder goes to the farm operator. As Floyd (1965) pointed out, there is no theoretical reason to assume that other participants in the agricultural and food industry do not capture at least some of the government payments that are not captured by the land.

Third, we should expect farmers to change their crop allocation in response to any deviation in the policy mix offered to them. For example, we know that soybean acreage increased dramatically when it was brought under the coverage of the LDP program in 1996. If crop allocations respond to farm support increases, they will also respond to farm support decreases. Within our portfolio view of farm land this tells us that we should expect farmers to vary the weights they give to each underlying security (wheat, corn, soybean, ...) in response to changes to any of the government financed streams of cash flow. This arguments

²¹See, for example, the recent USDA report of Barnard et al. (2001).

provides another reason why coefficients from regressions such as ours should not serve as the basis for the computation of the total contribution of agricultural policy to farm land values.

Finally, it should be acknowledged that the U.S. government supports agriculture through a number of other programs that provide benefits indirectly rather than through direct payments. For example, farmers benefit from subsidized interest rates, subsidized crop insurance, federally-funded education and research programs, and a myriad of other programs. Such program benefits are also likely to affect asset values, though the link is less direct. Our analysis essentially holds such program benefits constant across different farm during our period of study.

4 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 within and outside of Washington. For example, consider the annual “Farm Aid” events intended to draw attention to the plight of the American farmer. Many have challenged this view putting forward evidence on the high proportion of farm policy funds going to wealthy farmers on the one hand and to non-farmers on the other.

Our analysis goes further. We demonstrate that substantial benefits from agricultural policy do not remain with the farm operator but are captured by landowners through higher land values and higher lease rates. This is particularly problematic given that in many cases land owners are different from the farmers whose plight we are 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 capital loss if such support were to be withdrawn. Furthermore, all landowners 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 Farm Bill with its large increase in federal support may have been one such surprise.

Tenants also gain from positive surprises as long as cash lease rates do not adjust instantaneously. However, the 2002 Farm Bill seems to have inhibited this avenue for a temporary increase in the share of transfers captured by farm operators. One important provision of

the bill is that it offers the opportunity to update the factors which determine the level of some government payments. In particular, landowners were given the option to update the determinants of the decoupled payments (base yields and acreage) on the basis of production on their land between 1998 and 2001. The fact that the power to decide whether or not to update has been given to the owners of the land, not the operator has required more than the usual interaction and review of policy matters by both landlords and farmers. Not surprisingly, tenant farmers have complained that the updating provision of the 2002 Bill provided landowners with the opportunity to renegotiate the terms of their leases in order to better capture the increased benefits provided by the legislation. This represents a missed opportunity for farm operators but a bonus for landowners.

Furthermore, Congress now faces a credibility issue regarding decoupled support. By allowing landowners to update the determinants of such support, Congress has established a precedent that signals that future “decoupled” support may be tied to current or future production—a fact that has not gone unnoticed by U.S. competitors in ongoing WTO discussions. In light of such policy developments, one is left to wonder whether Congress is ignorant about the workings of the farm land market and the distribution of farm policy benefits to non-farmers, or whether Congress is purposefully serving another constituency with these transfers.

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Table 1. Variable Definitions and Summary Statistics*

Variable	Definition	Mean	Std. Dev.
Value	\$/acre reported value	1598.90	1339.15
Market Return	Market return using market prices	17.58	65.93
Market Average	Average market return over preceding 5 years	78.55	83.23
Total Payments	Total program payments	41.08	38.32
Mean Total Payments	Average total payments over preceding 5 years	27.73	15.91
LDP	Loan deficiency payment receipts (\$/acre)	15.17	21.82
Disaster	Disaster payment receipts (\$/acre)	6.88	15.38
CRP	CRP payment receipts (\$/acre)	1.04	4.19
AMTA	AMTA payment receipts (\$/acre)	14.64	18.25
Mean LDP	Average LDP payments over preceding 3 years	9.35	9.64
Mean Disaster	Average Disaster payments over preceding 5 years	6.80	5.33
Population	County average persons per square mile	91.69	162.32
Population Growth Rate	Population growth rate (proportion)	0.58	2.45
Urban ₂	1 if Urban category 2, 0 otherwise	0.11	0.32
Urban ₃	1 if Urban category 3, 0 otherwise	0.12	0.32
Urban ₄₅	1 if Urban category 4 or 5, 0 otherwise	0.15	0.36
Housing Starts	Total value of housing permits (\$ten-million)	5.42	23.29
Cash Rental Rate	Cash rental rate	71.38	73.27
Share Rental Rate	Share rental rate	100.82	162.16
Share-Cash Difference	Share-cash rental rate difference	40.68	185.88

*Summary statistics computed from the sample of farms used in the land value regressions except for the cash and share lease rates and share-cash rate differences, which were computed from the relevant sub-samples.

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

Variable	Model I	Model II
Intercept	957.3694 (24.6729)*	556.1613 (29.3796)*
Market Return	4.8140 (0.3423)*	
Mean Market Return		5.3226 (0.3228)*
Total Payments	3.3454 (0.4825)*	
Mean Total Payments		9.9752 (0.9787)*
Population	2.2871 (0.2584)*	2.2552 (0.2460)*
Population Growth	61.7979 (7.5237)*	56.2346 (7.4351)*
Urban ₂	292.3509 (41.1070)*	312.4992 (41.2505)*
Urban ₃	391.8491 (52.6928)*	445.3673 (51.4297)*
Urban ₄₅	210.2989 (69.1956)*	247.2557 (67.2508)*
Housing Starts	1.5857 (2.4452)	1.8121 (2.2000)
.....		
Number of Observations	5,861	5,861
R^2	0.2443	0.2772

* Indicates statistical significance at the $\alpha = .05$ or smaller level.

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

Variable	Model III	Model IV
Intercept	982.6627 (25.2914)*	650.1232 (29.4179)*
Market Return	4.8763 (0.3446)*	
Mean Market Return		5.5940 (0.3397)*
LDP	4.1172 (0.8479)*	
Mean LDP		13.7179 (2.3020)*
AHA	5.4359 (1.6357)*	
Mean AHA		8.2220 (5.2411)
CRP	-21.4903 (2.5554)*	-21.2223 (2.5742)*
AMTA	3.4837 (0.9791)*	1.3482 (1.0185)
Population	2.2563 (0.2574)*	2.1940 (0.2442)*
Population Growth	62.7714 (7.4061)*	54.4664 (7.3463)*
Urban ₂	281.6149 (40.6874)*	304.5258 (40.7360)*
Urban ₃	400.0240 (52.3076)*	450.3329 (50.9148)*
Urban ₄₅	210.3499 (68.5741)*	238.6320 (66.4483)*
Housing Starts	1.3202 (2.4507)	1.6517 (2.1945)
.....		
Number of Observations	5,861	5,861
R^2	0.2579	0.2914

* Indicates statistical significance at the $\alpha = .05$ or smaller level.

Table 4. Models of Land Lease Rate Determinants:
Parameter Estimates and Summary Statistics

Variable	Cash Rents	Share Rents	S-C Difference
Intercept	21.0234 (1.8182)*	31.6418 (3.2780)*	8.1967 (5.3824)
Mean Market Return	0.3177 (0.0196)*	0.4797 (0.0313)*	0.1628 (0.0472)*
Mean LDP	0.5680 (0.1520)*	0.3214 (0.3686)	-1.7419 (0.6753)*
Mean AHA	1.1614 (0.5050)*	3.5003 (0.9774)*	5.4205 (1.8471)*
CRP	-0.3625 (0.1261)*	-0.8217 (0.2746)*	-0.4010 (0.3556)
AMTA	0.6577 (0.0791)*	0.5199 (0.1412)*	0.0700 (0.2169)
Population	-0.0095 (0.0052)*	0.1171 (0.0653)*	0.1316 (0.0911)
Population Growth	0.6161 (0.5890)	1.6189 (0.7199)*	2.1462 (1.2303)*
Urban ₂	-5.0102 (1.6963)*	10.1044 (9.2209)	9.6341 (14.1443)
Urban ₃	-0.8311 (1.9022)	13.4975 (7.9577)*	18.2024 (12.7836)
Urban ₄₅	5.9170 (4.0947)	-13.3274 (7.4882)*	-19.6445 (11.0854)*
Housing Starts	-0.1733 (0.0602)*	-0.5399 (0.6923)	-0.7280 (1.0416)
.....			
Number of Observations	4,146	5,121	3,296
R^2	0.2629	0.0974	0.0203

* Indicate statistical significance at the $\alpha = .05$ or smaller level.

Appendix Table 1. Commodity Credit Corporation Payment Categories and Outlays (1994-2001)

Program	Per-Farm Average 1999 US\$	No. Farms Receiving	Total Outlays 100,000s 1999 US\$
..... Deficiency Payments			
Barley Assessment Deficiency	244.32	413	1.01
Cotton Deficiency	2,809.38	277,995	7,809.94
Feed Grain Deficiency	1,513.10	2,373,141	35,908.00
Market Gains Early	2,883.55	17,817	513.76
Rice Deficiency	14,011.45	93,647	13,121.30
Rice Marketing	97.86	3,862	3.78
Wheat Deficiency	1,083.59	1,206,539	13,073.94
Winter Wheat Deficiency	1,735.82	92	1.60
..... AMTA Payments			
Production Flexibility	3,927.56	7,977,960	313,339.17
..... Loan Deficiency Payments			
Acreage Grazing Payments	1,377.27	4,236	58.34
Crop Special Grade Rice Ldp	15,484.99	285	44.13
Ldp, Non-Contract Pfc Growers	1,371.94	58,524	802.91
Lip - Contract Growers	792.29	1,229	9.74
Loan Deficiency	5,742.58	3,249,871	186,626.44
Market Gains Late	7,483.91	354,644	26,541.24
..... Ad Hoc Assistance Payments			
Ailfp - Apportioned	5,361.16	1,050	56.29
American Indian-Livestock Feed	5,069.59	2,389	121.11
Amlap - Apportioned	11,609.85	7,647	887.81
Citrus Losses In California	2,041.30	987	20.15
Crop Disaster Program	5,195.28	548,307	28,486.08
Crop Loss Disaster Assistance	7,444.63	249,505	18,574.72
Dairy Disaster Assistance	6,512.61	1,161	75.61
Dairy Indemnity	5,955.03	215	12.80
Dairy Market Loss Assistance	4,928.94	187,709	9,252.06
Disaster	4,820.76	458,603	22,108.15
Disaster - Non-Program Crops	-626.76	1	-0.01
Disaster - Program Crops	-5.18	1	0.00
Disaster Reserve Assistance	1,688.82	83,367	1,407.92
Emergency Conservation	2,446.12	102,788	2,514.32
Emergency Feed	-3,802.68	545	-20.72
Flood Compensation Program	17,574.48	38	6.68
Karnal Bunt Fungus Payment	48,729.44	653	318.20
Lamb Meat Adjustment Assist	831.88	26,400	219.62
Livestock Emergency Assistance	1,741.29	631,191	10,990.87
Marketing Loss Assistance	3,297.56	5,364,709	176,904.50
Nap-Supplemental Appropriations	2,654.72	1,378	36.58
Noninsured Assistance Program	2,709.44	87,710	2,376.45
Nursery Losses - Florida	39,562.62	155	61.32
Oilseed Program	754.04	1,184,715	8,933.22
Pasture Flood Compensation	1,558.14	12,237	190.67
Pasture Recovery Program	1,418.56	34,612	490.99
Peanut Marketing Assistance	4,146.14	27,079	1,122.73
Peanut Marketing Asst Pgm Iii	2,920.30	17,264	504.16
Poult Enteritis Syndrome	12,159.09	136	16.54
Quality Losses Program	2,919.67	16,800	490.50
Supl Oilseed Payment Program	667.76	586,241	3,914.68
Supplemental Tobacco Loss	354.97	335,613	1,191.33
Tobacco Disaster Assistance	7,436.30	343	25.51
Tobacco Loss Assistance	938.26	343,992	3,227.54
WAMPLAP II - apportioned	831.69	20,920	173.99
WAMPLAP III - apportioned	744.50	20,581	153.23
Wool & Mohair Market Loss Asst	518.49	18,584	96.36

Appendix Table 1. (continued)

Program	Per-Farm Average 1999 US\$	No. Farms Receiving	Total Outlays 100,000s 1999 US\$
.....Conservation			
Agricultural Conservation	1,697.63	286,787	4,868.58
Arkansas Beaver Lake	4,751.71	220	10.45
Crp Annual Rental	4,373.45	2,750,839	120,306.57
Crp Cost-Shares	2,153.74	248,309	5,347.93
Crp Incentives	1,729.85	62,130	1,074.76
Emergency Conservation	2,446.12	102,788	2,514.32
Rural Clean Water	5,443.42	90	4.90
Soil/Water Conservation Assist	3,984.59	199	7.93
Water Bank - Annual	1,469.54	7,097	104.29
Water Bank-Practice Cost/Share	1,536.03	7,225	110.98
Wetlands Reserve	7,097.91	258	18.31
.....Miscellaneous			
Additional Interest	91.11	193	0.18
Arkansas Beaver Lake	4,751.71	220	10.45
Dairy Termination	-3,094.10	6	-0.19
Extended Farm Storage	1,152.30	19,632	226.22
Extended Warehouse Storage	1,199.69	3,964	47.56
Feed Grain Diversion	-1,150.18	17	-0.20
Finality Rule	817.14	724	5.92
Fresh Market Peaches Program	6,222.15	126	7.84
Interest On Ccc-6'S	8.39	1	0.00
Interest On Nap Payment	24.99	184	0.05
Interest Payments	26.70	723,122	193.07
Milk Diversion	-579.86	2	-0.01
Milk Marketing Fee	1,237.73	199,452	2,468.68
National Wool Act	2,351.07	154,311	3,627.96
Options Pilot Program	9,115.39	3,164	288.41
Payment Limitation Refund	-2,834.04	2,271	-64.36
Potato Diversion Program	16,619.29	918	152.57
Small Hog Operation Program	2,094.50	57,951	1,213.78
Sugar Pik Diversion Program	12,806.77	10,216	1,308.34
Wheat Diversion	-19.95	1	0.00

Appendix Table 2. Models With Urban Control Variables Omitted

Variable	Model II	Model IV
Intercept	985.2346 (34.7595)*	979.8616 (33.4482)*
Mean Total Payments	6.3238 (1.0409)*	
Mean Market Return	6.2471 (0.3398)*	6.5104 (0.3514)*
Mean LDP		6.9960 (2.4522)*
Mean Disaster		21.7108 (5.5922)*
CRP		-23.6953 (2.7366)*
AMTA		-0.6543 (1.0820)
..... R^2	0.1129	0.1355