Are "Decoupled" Farm Program Payments Really Decoupled? An Empirical Evaluation

Barry K. Goodwin and Ashok K. Mishra

This analysis utilizes farm-level data to evaluate the extent to which U.S. farm program benefits, particularly direct payments, bring about distortions in production. The issue is important in WTO negotiations and in the debate over the distortionary effects of decoupled ("green-box") payments. Our results suggest that the distortions brought about by AMTA payments, though statistically significant in some cases, are very modest. Larger effects are implied for market loss assistance payments. Probit models suggest that AMTA payments do not influence the likelihood that agents will acquire more land. Our results are reinforced using an aggregate county-level acreage model.

Key words: acreage response, decoupled payments, WTO green box.

U.S. agricultural policy underwent significant changes with the 1996 Federal Agriculture Improvement and Reform (FAIR) Act. In principle at least, the FAIR Act was meant to signal a transition toward a new policy environment characterized by diminished government involvement in agricultural markets. Market price supports and deficiency payment programs were replaced by a program with fixed payments (called "production flexibility contract" or "Agricultural Market Transition Act" [AMTA] payments) and a loan deficiency payment program intended to establish minimum support prices for program crops, including soybeans. AMTA payments were based upon historical production (base yields and acreages) of program crops (i.e., corn, wheat, cotton, grain sorghum, etc.) and thus were considered to be "decoupled" from production decisions. In principle, AMTA payments were intended to decline each year until the FAIR Act expired in 2002.

The extent to which the FAIR Act actually constituted a change in U.S. farm policy is a topic of substantial debate, especially in light of the substantial amount of ad hoc support that followed it and the 2002 Farm Bill that was signed into law on May 13, 2002. The 2002 Bill provided generous increases in support and extended the fixed, decoupled AMTA-type payments for another six years. Not only were the payments extended under the 2002 Act, producers were also given the opportunity to update their base acreages and yields which determine the payments and, perhaps more important, to include historical soybean acreage in their base. Provisions for updating this historical base, especially if such provisions were anticipated by growers, may call into question the extent to which the payments are actually decoupled. Anticipation of future opportunities for updating base acreage reflects an embedded optionality that may influence current and future production decisions, thus breaking the "decoupled" nature of the programs. Such policy actions raise questions regarding the credibility and time consistency of agricultural policies. As Kydland and Prescott (1977) have noted, rational agents react to expected future policies, even when such expectations are counter to the policy rules currently in place. The generous ad hoc support that preceded the 2002 Farm Bill and the substantial benefits provided by the 2002 legislation may generate important credibility problems for agricultural policymakers.

The distortionary effects of domestic farm programs became an important issue in the

Barry K. Goodwin is William Neal Reynolds Professor in the Departments of Agricultural and Resource Economics and Economics at North Carolina State University. Ashok K. Mishra is an economist with the Economic Research Service.

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Uruguay Round of the General Agreement on Tariffs and Trade/World Trade Organization (GATT/WTO) negotiations in the 1980s and 1990s. Along with the conventional focus on export subsidies and market access, domestic farm programs were targeted for reductions in support and other reforms. A philosophy underlying the Uruguay Round agreement on agriculture (URAA) involved a classification scheme whereby domestic policies were characterized by the extent to which they were considered to be "trade-distorting." Policies that were considered to be minimally trade distorting, such as conservation programs, domestic food aid, and research and extension expenditures were termed to be "green box" policies and not subject to limits on overall domestic support. Because they were presumed to be decoupled from production, AMTA payments were considered to be a "green-box" policy and thus are not subject to the negotiated reductions in support. A point of contention underlying this classification system involves the lack of a precise definition of "minimally trade distorting."

The extent to which fixed payments are truly decoupled from production decisions has recently come under debate. Various mechanisms by which decoupled payments may affect production decisions have been discussed. Hennessy (1998) pointed out that agents with declining absolute risk aversion (DARA) preferences will be willing to assume more risk as wealth increases (i.e., because of decoupled farm payments), since such an increase lowers their aversion to risk. Chau and de Gorter (2000) argued that AMTA payments may allow producers to cover fixed costs and thus may allow marginal farmers that would otherwise be forced to shut down to remain in production. In a similar vein, Roe, Somwaru, and Diao (2002) point out that decoupled payments may improve producers' access to credit by raising wealth directly and through increases in land values. They also note that expectations about future farm programs may tie program benefits to production, though they conclude that the distortionary effects of decoupled programs are likely to be modest. It should also be noted that psychological factors regarding farmers' preferences for remaining in production agriculture may be relevant to exit decisions. Foster and Rausser (1991) have provided conceptual and empirical support for such motivations that, at first glance, may appear to be economically irrational. A recent USDA study used an aggregate, computable general equilibrium (CGE) model to conclude that decoupled payments had no effect on production and further suggested that coupled market loan payments had a very modest effect on acreage (Burfisher and Hopkins, 2003). Of course, inferences from CGE models may be limited by their highly aggregate nature. The link between direct payments and investment is also important. In a dynamic sense, wealth transfers today may affect investment decisions and thus have important impacts on production in the future.[1]

The objective of this analysis is to evaluate empirically the effects of decoupled farm program payments on the production decisions of producers. To this end, we utilize a set of detailed farm-level data, collected under the USDA's agricultural resource management survey (ARMS) program. The focus is on farms in the Corn Belt, the major agricultural production region of the United States. We consider acreage devoted to the production of the three principal crops in this region—corn, soybeans, and wheat.[2] Individual farm data are used in conjunction with county aggregates to evaluate the extent to which AMTA payments may appear to have been linked to production decisions in the period that has followed the implementation of the 1996 FAIR Act.

Empirical Framework and Econometric Methods

Agents will act to maximize the expected utility of wealth, including changes brought about by discounted future expected profits. In each period, wealth is given by initial wealth, plus profits derived from production, direct government payments, and nonfarm activities. The agent's problem can thus be characterized as maximizing the expected value of

(1)

$$V_t = \sum_{t=0}^{T} U\Big\{\delta^t\Big(\sum_i P_{it}Q_{it}(A_{it}, X_{it}, A_{it-1}, \epsilon_t) - w'X - C(A_{it-1}) + G_t + PS(P_{it}) + W_{t-1}\Big)\Big\}$$

[1] For a detailed discussion and analytical model of investment, and production decisions made by producers with heterogeneous lines of credit, see Rausser, Zilberman, and Just (1984).

[2] We note at the outset that corn and soybeans are the main crops and that wheat is primarily grown for crop rotation reasons in this region. Our evaluation is of an empirical nature only and thus we do not attempt to identify the exact mechanism (if any) by which decoupled program payments affect production. Instead, we focus on determining whether any such effect can be empirically identified.

where W_t is wealth, P_{it} is the price received for output i, $Q(\cdot)$ is output of product i, which is assumed to be a function of lagged acreage (A_{t-1}, representing rotational issues), acreage, and an exogenous shock, given by ϵ_t, X_t represents a vector of variable inputs, purchased at price w_t, and $C(\cdot)$ represents fixed costs that also are influenced by lagged acreage. Government policies affect the producer's problem in several ways. First, prices received P_{it} may reflect support mechanisms such as loan deficiency payments. Second, payments based upon market conditions, such as market loss assistance payments (MLA; also known as "double-AMTA" payments) may be received at harvest, and thus expectations regarding such payments will play a key role in production decisions. Such payments are represented by $PS(P_{it})$, which represents the fact that such payments may be conditioned on market prices. Finally, direct decoupled payments G_t will be important for their effects on wealth.

A number of restrictions are relevant to the producer's problem, including capacity constraints and those constraints describing the availability and cost of borrowed capital. If capital markets are perfect, wealth can be adjusted to accommodate situations where revenues are not sufficient to cover costs. However, borrowers are likely to face credit constraints, determined by their credit worthiness. In such cases, decoupled payments may indeed be relevant to production. Agents select acreage and other inputs to maximize the expected value of the utility function. This yields reduced form acreage equations of the form

$$(2) \qquad A_t = f(A_{t-1}, P_t, w_t, G_t, PS_t, W_{t-1}).$$

Output prices and payments based upon market conditions at harvest (PS_t) are unknown at the time planting decisions are made and thus actions will reflect agents' expectation of the harvest-time values of these variables. Thus, an estimable, reduced-form acreage response equation will assume the form

$$(3) \qquad A_t = f(A_{t-1}, P_t^*, w_t, G_t, PS_t^*, W_{t-1})$$

where asterisks correspond to expected harvest-time values, conditional on information available to agents at planting.

In cases where an agent's risk preferences are influenced by their level of wealth (such as constant relative risk aversion [CRRA] or decreasing absolute risk aversion [DARA]), their production decisions may be influenced by their level of wealth. In this way, decoupled payments G_t as well as initial levels of wealth will be important. Of course, as we discuss in greater detail below, for the typical commercial farm in the United States, the support provided by AMTA and other decoupled programs is likely to be small relative to a farm's overall wealth level.[3]

Our analysis is conducted using individual farm data collected under the ARMS project by the National Agricultural Statistics Service of the USDA. The ARMS data are collected annually by means of a survey of individual farmers. The ARMS data represent the USDA's primary source of information about U.S. agricultural production conditions, marketing practices, resource use, and economic well-being of farm households. We focus on data taken from four years of the NASS survey—1998–2001. These years were chosen as representative of the FAIR act policy environment. In addition, the survey collected detailed policy information for these four years. County data from a variety of other sources were matched to the ARMS survey data. In particular, county data for crop acreages were taken from the USDA-NASS database and county-level program payments were summarized from unpublished USDA data.

Although the ARMS data provide a rich and valuable set of detailed farm household data, the database does have an important limitation—the lack of repeated sampling on individual farms. That is, the sample is taken randomly each year and it is thus impossible to observe the same farm in more than a single year.[4] This implies an important reliance on cross-sectional variability and prevents one from conditioning observed events on the preceding year's experience or on fixed farm effects. For example, though it is possible to observe an individual grower's corn acreage in a given year, it is not possible to examine how this acreage compares to the preceding year's

[3] However, as a referee has pointed out, decoupled payments may have a second avenue by which wealth is affected—through increased asset values. One certainly expects that expected future benefits will be capitalized into asset values and AMTA payments may provide important signals about future policy benefits. In this light, our arguments regarding the significance of AMTA payments relative to a farm's overall level of wealth pertain only to the direct payment effects. We acknowledge that effects on asset values may also be pertinent. Our measure of wealth is an aggregate of self-assessed asset values less total liabilities.

[4] This limitation will be addressed in future versions of the ARMS surveys in that surveys will revisit a subsample of farms.

acreage. The potential for confounding effects to complicate the identification of policy responses certainly exists. For example, those farms receiving large AMTA payments had a large base in program crops prior to the FAIR Act. To the extent that fixities make producers slow to adjust acreage, correlation between AMTA payments and current acreage may reflect correlation of both variables with historical acreage. However, it should be noted that we can intuitively assign a direction that such a bias might be expected to take. If both AMTA payments and current acreage are strongly correlated with historical production, we would expect to see a stronger effect of AMTA payments on current acreage than what might be expected in the absence of such correlation. The results that follow should be interpreted with this caveat in mind.

To address this issue, we consider an alternative evaluation of policy effects at the county level. This essentially involves treating each county as a farm. In this case, we are able to condition current production on lagged production. Our reliance on cross-sectional data also raises important concerns regarding simultaneity biases. Many production decisions are made jointly and thus the inability to measure predetermined (i.e., lagged) values of certain variables may make addressing this concern difficult. We attempt to adjust for this issue by relying on exogenous variables to the extent possible. For example, AMTA payment receipts are certainly exogenous to an individual in any given year. Likewise, we utilize county-level farm average MLA payments for the preceding year to represent expectations regarding MLA support. However, one could potentially question the extent to which some explanatory variables, such as insurance purchases and the ratio of debts to assets, may be endogenous to production decisions. Although we partially address this issue below, it remains an important caveat that merits additional research.

Unpublished data on season-average loan rates were obtained from the Farm Service Agency (FSA) of the USDA. Chicago Board of Trade (CBOT) futures market prices for corn, soybeans, and wheat were taken from the Bridge database. An expected price for each county was taken by calculating a state average basis for each state using season average prices collected from USDA-NASS and then adjusting the planting time price for the harvest time contract for the annual, state average basis charge. This yielded a state average expected harvest-time market price.[5] The greater of the expected cash price or the county loan rate was taken to represent the expected commodity price. Unpublished county-level data describing farm program payment receipts in each farm program category were obtained from the USDA. These data were used to measure county-level aggregates of farm program receipts in the form of AMTA payments and MLA payments. These were placed on a per-farm and per-acre basis using county level data on the number of farms and number of farm acres in each county, taken from the 1997 *Agricultural Census*.

Our analysis is intended to focus on mainstream, commercial farms. Thus, we eliminated any farm from the ARMS survey that was defined (using the ERS farm typology index) as a limited resource, lifestyle, or retirement farm. In addition, any farm with less than 50 acres of total land was dropped from our sample. In light of the considerable heterogeneity of crop types, production practices, and policy types across different regions, it is important that a relatively homogeneous group of farms be evaluated. Thus, our analysis is focused on the Corn Belt region of the United States—which we define using the USDA-ERS farm resource region designation of the "Heartland." This region comprises a homogeneous grouping of counties in Illinois, Indiana, Iowa, Kentucky, Minnesota, Missouri, Nebraska, Ohio, and South Dakota. Our focus in on acreage of corn, soybeans, and wheat—overwhelmingly the primary crops in this region.

We have emphasized the important role of risk preferences as a factor determining planted acreage of crops and the potential effects of decoupled payments. The measurement of risk preferences in empirical models is difficult, since preferences are not directly observable and available survey data generally do not collect information about such preferences. We represent risk preferences in our empirical models by using a proxy variable, constructed as the ratio of total expenditures on insurance over total farm expenses. We hypothesize that more risk-averse farms will tend

[5] We utilized the average daily close prices in February for December corn and November soybean futures and the average daily price in September for the July wheat futures on the CBOT. It should be noted that our specification does not explicitly account for basis risk differences across farms in the Corn Belt. To consider the potential effects of this assumption, we considered an alternative model that included state fixed effects. Taken together with the annual dummy variables, such a specification accounts for any state-level basis effects. Very similar estimates were obtained. These results are available on request.

to devote more of their total production expenditures to insurance. We are able to directly measure a farm's wealth. Our measure of wealth is given by total assets less total debts. In order to prevent double counting of AMTA payments, we subtract AMTA payment receipts from total wealth. All financial values are converted to real terms by dividing by the producer price index.

A number of important econometric issues underlie our empirical analysis. 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 for problems such as this involving stratification. The simplest involves a jacknife procedure, where the estimation data are split into a fixed number of subsamples and the estimation is repeated with each subsample omitted.[6] 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 not identified. The database does, however, contain a population weighting factor, representing 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. 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.[7] 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.[8]

An important econometric problem also involves the fact that a censoring issue underlies our empirical acreage models. Not every farm produces every crop in each year. In particular, 90.32% of farms in our sample produced corn, 89.41% produced soybeans, and 37.44% produced wheat. This may reflect specialization issues for individual farmers or crop rotation patterns. To address this censoring issue, we utilize the recently introduced modeling procedures of Shonkwiler and Yen.[9]

Empirical Results

Our empirical analysis is conducted in three segments. In the first, a large sample of data drawn from individual farms is used to consider three acreage equations—for corn, soybeans, and wheat. In a second segment of the analysis, we consider an evaluation of several alternative measures of farmland usage. In particular, we consider factors, including farm program payments, affecting the ratio of nonharvested to harvested farm acres. The 1999 ARMS survey contained two additional measures of farmland usage pertinent to our analysis. The first considered the extent to which owned farmland was placed in uses other than crop production and orchards (e.g., pasture, conservation reserve, fallow, etc.). The second involved a query of producers regarding whether they had acquired ownership of new land over the year. Production distortions from decoupled programs may manifest themselves through the acquisition of new productive resources—i.e., land. Thus, we consider the extent to which new land acquisitions were associated with farm program payments by using a probit model to evaluate the probability that

[6] Under the jacknife approach, the sample is divided into m subsamples. Estimation programs created by ERS use 15 subsamples. This approach is subject to a number of limitations. First, it is not clear that the stratification scheme does not alter likelihood functions beyond simple weights, though this remains an important topic for future research. Similarly, the appropriateness of the predefined jacknife weights in a subsample of the overall data such as our case is unclear.

[7] To be precise, if observation i represents n_i farms out of the total of M farms in the population, the likelihood that observation i is drawn on any given draw is n_i/M. It 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.

[8] We utilize 2,000 replications in the applications that follow.

[9] Shonkwiler and Yen propose a two-step estimation procedure, whereby a discrete variable indicating a noncensored observation is evaluated using a probit model and then used to construct correction terms that account for censoring. We apply White's heteroskedasticity-consistent covariance matrix in our estimation. It should be noted that a specific form of heteroskedasticity is implied by the two-step procedures. However, our reliance on cross-sectional variability in a heterogeneous sample leads us to suspect that other unknown forms of heteroskedasticity may also be relevant. Thus, we use a more general correction.

Table 1. Variable Definitions and Summary Statistics

Variables	Definition	Mean	Std. Dev.
Corn acres	Corn acreage	372.9658	478.7375
Soybean acres	Soybean acreage	385.8964	493.2744
Wheat acres	Wheat acreage	41.2196	133.3294
Corn price	Max(basis adjusted futures price, county loan rate)	2.4669	0.2429
Soybean price	Max(basis adjusted futures price, county loan rate)	5.6194	0.7165
Wheat price	Max(basis adjusted futures price, county loan rate)	3.2756	0.4987
Farm size	Total farm size	1,007.6800	1,131.7800
Disaster	Disaster payments received per acre ($/acre)	5.2782	8.8549
MLA	County average market loss payments ($t-1$)	7.5667	7.3587
AMTA	AMTA payments received ($/acre)	13.7438	12.9069
Debts/assets	Debt-to-asset ratio	0.1907	0.2213
Insurance	Ratio of insurance expenses to total expenses	0.0420	0.0361
Wage	State average farm wage rate ($/hour)	8.0227	0.5741
Fertilizer price	State average nitrogen price ($/lb.)	0.2020	0.0439
Gas price	State average gasoline price ($/gallon)	0.9032	0.1559
Not Harvested	Proportion of farm acres not harvested	0.1671	0.1888
Mean Yield	Average normalized yield (farm yield/county yield)	0.9947	0.1762
Not Cropped	Proportion of owned acres not in crops or orchards	0.2323	0.2545
Acquire land	1 if farm acquired owned land in 1999, 0 otherwise	0.0494	0.2167
Livestock	Ratio of livestock sales to total sales	0.3032	0.3645

Note: Numbers of observations are 2,615 for all variables except for Not Harvested, which had 2,263 observations and Not Cropped and Acquire Land, which each had 806 observations.

an agent acquired land in 1999.[10] Finally, a third segment of our investigation expands our empirical analysis to a consideration of acreage allocations at the county level. In our analysis of county-level data, the sampling undertaken in the ARMS survey is not dense enough to permit the construction of reliable county aggregates and thus a slightly different specification is adopted.[11]

Farm-Level Acreage Analysis

Variable definitions and summary statistics for our sample of "Heartland" region farms are presented in table 1. Our sample consists of 4,121 farm-level observations. The average farm planted 373 acres of corn, 386 acres of soybeans, and 41 acres of wheat. Of course, these averages reflect the substantial proportion of farms that did not grow wheat in a given year, such that the average acreage for farms growing wheat was much higher (115 acres). Aggregate price risk and other factors that are likely to be constant across all farms in a given year are likely to be important factors affecting acreage decisions. We include annual dummy variables to capture such fixed annual effects. These factors represent price risk (assumed to be constant across all farms in the region in a given year), systemic yield risk and weather, and other unobservable factors that may be relevant to production.[12]

The first segment of our empirical analysis considers acreage response equations for individual farms in the "Heartland" region. Equations for corn, soybeans, and wheat, the dominant crops in the region, were estimated. Parameter estimates and summary statistics are presented in table 2.[13] Parameters representing price effects are of the correct sign, though the price coefficient for corn is not statistically significant. The estimates correspond to acreage elasticities of 0 and 1.39 for corn and soybeans, respectively. A large elasticity (1.25) is implied for wheat, though when the elasticity is evaluated using acreage for only those farms growing wheat, a more reasonable estimate of 0.46 is implied.

The role of AMTA payments is central to our analysis of the production effects of

[10] Data on land acquisition and disposal were only available in 1999.

[11] In particular, the ARMS survey consists of approximately 10,000 farm observations per year. With 3,142 counties in the United States, this implies an average of about 3 farms per county. Of course, stratified sampling and the geographic concentration of agriculture affects this count. Thus, the sample is not dense enough to permit county-level analysis.

[12] We also considered models that omitted these fixed effects. Results were similar and the overall implications of the analysis were robust to the inclusion of fixed annual effects.

[13] First-stage probit models (not presented here) included lagged county-level yields, acreage, operator age, farm machinery assets, and assets associated with irrigation equipment.

Table 2. Parameter Estimates and Summary Statistics: Farm-Level Acreage Equations

Variables	Corn	Soybeans	Wheat
Intercept	−20.7016	−551.9640	98.2126
	(128.1941)	(120.4402)*	(226.4504)
Corn price	24.4231	−93.9133	−2.5116
	(40.6762)	(38.4238)*	(63.1047)
Soybean price	−3.9111	101.6672	−32.1289
	(35.6250)	(31.4855)*	(49.9225)
Wheat price	6.2037	−1.4071	44.8814
	(5.7010)	(5.6236)	(12.6058)*
Farm size	0.3558	0.3996	0.0712
	(0.0169)*	(0.0132)*	(0.0269)*
MLA/acre$_{t-1}$	5.8076	0.8315	−0.6167
	(0.7530)*	(0.6124)	(0.7917)
AMTA/acre	0.9152	0.6103	0.3569
	(0.2708)*	(0.2508)*	(0.3669)
AMTA × debts/assets	0.8715	0.7729	−0.2148
	(0.7893)	(0.6360)	(1.4696)
AMTA × Insurance	−2.1575	−0.5598	−0.9231
	(2.8920)	(2.8453)	(3.3561)
Wage	8.3341	13.0637	9.3424
	(5.5331)	(4.7221)*	(7.9739)
Fertilizer price	−577.2572	594.5935	−45.2468
	(185.2804)*	(165.2445)*	(283.5646)
Gas price	−20.6282	0.8496	−40.4422
	(49.5540)	(42.1453)	(96.2913)
Wealth	1.6122	−1.1645	−1.2250
	(1.1822)	(1.3840)	(1.9362)
Livestock	−59.7864	−98.8104	−17.7424
	(5.9478)*	(6.2063)*	(6.3333)*
Debts/assets	9.0658	2.4683	5.4313
	(16.7142)	(14.7324)	(27.1922)
Insurance	−128.5892	−99.2492	−109.5046
	(44.9584)*	(36.1050)*	(39.4763)*
D_{99}	−42.2477	73.7970	−15.3287
	(23.4889)*	(21.3507)*	(34.9640)
D_{00}	32.0945	−51.6104	−0.1945
	(59.5269)	(48.9233)	(82.5079)
D_{01}	−21.7965	38.4174	0.9480
	(33.5510)	(30.2467)	(35.6587)
δ_i	−23.0843	3.7451	−43.3174
	(24.1447)	(18.1616)	(7.5143)*
R^2	0.7835	0.8060	0.3488

Note: Numbers in parentheses are standard errors. An asterisk indicates statistical significance at the $\alpha = 0.10$ or smaller level. Note that δ_i is the censoring correction term.

direct farm payments. Conceptual considerations suggest three different avenues through which decoupled payments might operate to influence production. In the first avenue, risk-averse agents may find that the additional wealth provided by AMTA payments lowers their aversion to risk and thus encourages greater production of risky commodities. We represent individuals' risk aversion by including the proportion of total expenses accounted for by insurance purchases (which includes all forms of insurance purchased by the farm).[14] We allow the response to AMTA payments to vary according to this effect by including an interaction term. Following Pope and Just (1991), we also include the farm's level of wealth (total

[14] As a referee has pointed out, this specification is only indirectly related to the conceptual framework outlined above. We acknowledge the potential limitations associated with this measure of risk aversion, including possible distortions brought about by actuarially unfair crop insurance. This measure is used in lieu of any direct or indirect representation of risk preferences.

assets, less total debts, and AMTA payment receipts). We adjust for AMTA payments to prevent double counting, although for the typical farm such payments represent small changes to overall wealth. We also have hypothesized that agents that are capital constrained may respond to AMTA payments by increasing production (acreage). We represent the likely degree of financial leverage for an individual farm by considering the ratio of total debts to total assets. Again, we include an interaction term with the AMTA payments variable to permit farms to have variable responses to the payments according to their degree of financial leverage. Finally, we have hypothesized that any anticipation of the opportunity afforded producers to update program parameters under the 2002 Farm Bill may have affected acreage decisions. Such an effect is impossible to gauge directly using our data, though AMTA payments should convey an important signal regarding the expected benefits of future farm policy for an individual farm. Thus, the overall effect of AMTA payments depends on parameters involving a direct effect plus the interaction effects with insurance and leverage.

The direct effect of AMTA payments on acreage decisions is statistically significant in the corn and soybean equations, though the estimated coefficients are quite small in every case. In the case of corn, the coefficient implies that an additional $1.00 per acre in AMTA payments would increase corn acreage by 0.92 acres. In the case of soybeans, the direct effect of such an increase is 0.61 acres. Finally, for wheat, an additional $1.00 of AMTA payments raises wheat acreage by 0.36 acres, though the effect is not statistically different from zero. In elasticity terms, the corresponding elasticities (not including the interaction terms) are 0.0317 for corn, 0.0204 for soybeans, and 0.0428 for wheat. The corner solutions implied by the large number of farms that grow no wheat are accounted for by the δ_i correction term, which is significant only in the case of the wheat acreage equation.[15]

Of course, in a strict interpretation, these direct effects yield an elasticity value applying to farms with no insurance and no debt. The debt to asset interaction terms are not statistically significant in any of the equations. This may suggest that the capital constraints discussed above and identified in other work (e.g., De Gorter, 2000) do not have an important effect on acreage decisions, at least for this sample of farms. A similar result is implied in the case of the insurance-AMTA interaction terms, which are negative though statistically insignificant in every case. It is important to note that, even if such a crude measure captures the relative degree of risk aversion for producers, it is impossible to determine exactly how this degree of risk aversion changes with AMTA payments. The overall elasticities, including both the insurance and debts-to-assets ratio interaction effects, are 0.0344, 0.0246, and 0.0333 for corn, soybeans, and wheat, respectively. Note that the parameter estimates for the wheat effect may be somewhat misleading in light of the relatively small number of farms that produce wheat. The elasticity estimates account for the censoring and thus results that are similar to the other crops are obtained for wheat after adjusting for censoring.

The overall implications are that the AMTA payments implied very small though in some cases statistically significant acreage responses. The exact mechanism by which AMTA payments are affecting acreage response—wealth effects, changes in risk preferences, capital constraints, or changes related to the anticipation of future benefits—is not identified by our analysis. It is, however, clear that allegations regarding the substantial production effects (which were termed "flashing amber box" effects by DeGorter, 2000) are not supported, at least for these data. This is not to say that there is not at least a limited potential for distortions to arise as a result of the provision of AMTA payments. We have examined only one dimension of production distortions—acreage allocation effects. It is possible that, although acreage is not significantly changed, agents change their production and marketing techniques in a manner that produces distortions. For example, the risk effects discussed above could assert themselves through changes that involved the adoption of riskier production practices (e.g., decreased application of fertilizer and chemicals) rather than a simple expansion or reallocation of crop acreage. It is also important to recognize that, for reasons discussed above, a positive bias in the effects of such payments may be inherent in these results.

A second important dimension of farm program support in the post-FAIR environment involves the provision of ad hoc disaster assistance, including MLA payments. In the case of the ARMS survey data, information regarding MLA payments is grouped together with

[15] This is not surprising in light of the prevalence of corner solutions for wheat as compared to corn and soybeans.

overall disaster relief. It is important to note that these payments are generally based upon market conditions at harvest and thus cannot be anticipated with certainty when acreage decisions are made. In this light, we are interested in obtaining a proxy measure of producers' expectations regarding the MLA payments. Again, the fact that we are unable to observe an individual farm over time limits our analysis. Ideally, we would prefer to have information about the payment receipts of producers in the year preceding the period in which planting decisions are made. As an alternative, we utilize the county average of MLA payments per farm acre in the preceding year MLA_{t-1}. It is important to note that MLA payments were based upon base acreages, and thus would be expected to be more highly associated with events in traditional program crop markets (i.e., corn and wheat). This is not to say that MLA payments are not expected to affect soybean production, since many payment recipients produced soybeans in their crop mix and prices of corn and wheat are correlated with soybean prices.

A somewhat stronger effect seems to be implied for expected MLA payments than was the case for AMTA payments, at least for corn. The coefficient on the preceding year's MLA payments is highly significant for corn, though it does not appear that MLA payments had a significant effect on wheat or soybean acreage. In addition, the effect for corn is quite strong, implying that an additional dollar of MLA payments per acre in the preceding year tends to raise corn acreage, other things constant, by 5.7 acres. The corn MLA elasticity is 0.10. In that large acreage responses are not implied for wheat or soybeans, one would assume that such an increase would involve a reallocation of land away from other crops or the introduction of uncultivated land (e.g., pasture or fallow land) into corn production. Of course, these are changes at the margin and thus large shifts in program payments could conceivably have different effects. Implications that MLA payments had larger effects on corn than on wheat and soybeans are not really surprising since ad hoc support to oilseed producers was much smaller than that directed to those producers with corn and wheat base acreage. Recall that MLA payments were paid on those crops that had base acreage under the old farm programs, though an "oilseed program" also made payments on soybeans. Payments made under the oilseed program are included in the MLA statistics. The fact that wheat acreage is not strongly affected is also not a surprise. Wheat is not a major crop in the Corn Belt states evaluated in this study and is generally grown for crop rotation purposes.

Provision of the MLA payments may have served as a signal to producers that income shortfalls for such crops that are based upon low market prices may be offset to a degree by ad hoc MLA payments. However, the conceptual link is somewhat tenuous since the MLA payments, though indirectly based upon market conditions for an individual crop, are not based upon a producer's specific level of production of that crop (or on production of any crop for that matter). In particular, an individual producer may have received MLA payments for a crop regardless of whether that particular crop was grown in the relevant year. The determining factor involved base acreage, which is reflected in AMTA payments. The link with market conditions may also be subject to challenge, since the statutory authority underlying the MLA payments does not tie their provision to prices or conditions in a particular market. However, by definition, the payments are intended to assist producers because of poor market conditions. Thus, in spite of such ambiguity, the link between market conditions and MLA payments seems to exist, though the exact connection is certainly subject to debate. In light of their link to market conditions, MLA payments would appear to assume the role of informally supporting prices.

Using aggregate data, Pope and Just (1991) found that wealth tended to be positively correlated with the acreage of potatoes in Idaho. They interpreted this finding to represent differences in risk preferences that result from constant relative risk aversion preferences. We included total farm wealth in each of the acreage models. In every case, total wealth does not appear to be significantly correlated with acreage of the three crops. It should be acknowledged, however, that we control for the scale of a farm by including total acreage. One would certainly expect that total acreage of a farm operation would be highly correlated with wealth, such that the effects of wealth on acreage may be captured in the effect of total acreage when both are included as regressors in the acreage models. In every case, as would be expected, total farm acreage is positively correlated with acreage of each crop. This raises a concern as to whether AMTA payments may provide an incentive for producers to acquire additional farmland, thus making total farm size heavily correlated with the fixed

payments. We address this possibility below in a consideration of factors influencing the acquisition of new land in 1999.[16] Certainly, this possibility raises concerns regarding the potential endogeneity of total farm acres to individual crop acreages or other variables in the model. While acknowledging this possibility and the fact that we have assumed total acreage to be fixed for a farm, we would argue that crop acreages are more likely to respond to the total scale of a farm than would be the opposite case.[17] As expected, the scale of a farm, represented by total size, is highly correlated with the total number of acres grown for any of the crops. The coefficients correspond to crop mixes that are similar to what is realized for the region. For example, the average allocation of farm acreage to each of the three crops in the region was 32% for corn, 33% for soybeans, and 5% for wheat.

We included the proportion of total farm sales accounted for by livestock farms. It is not surprising that farms with livestock production have fewer acres of corn, soybeans, and wheat. An interesting result lies in the response to fertilizer price changes. Regions with higher fertilizer costs tend to grow more soybeans and less corn. This is expected since corn is much more demanding in terms of fertilizer requirements.

In all, our analysis of farm-level data suggests that AMTA payments had a relatively modest, though statistically significant effect on the acreage of corn, soybeans, and wheat in the "Heartland" region of the United States. The acreage responses are, however, very small, with elasticities for corn and soybeans (the major crops) being about 0.03–0.04. However, it does appear that the provision of MLA payments, which were disbursed alongside AMTA payments, may have resulted in a more substantial increase in corn acreage. Our results are similar to those obtained from an aggregate model by Burfisher and Hopkins (2003). Our results suggest that acreage is not affected by wealth, thus perhaps implying that any risk preference shifts caused by different levels of wealth do not appear to affect crop acreage. This is in contrast to the findings of other work (e.g., Chavas and Pope, 1985; Pope and Just, 1991; Hennessy, 1998) that has suggested important wealth effects on risk preferences and production. In interpreting these results, it is important to keep in mind the caveats raised above. In particular, our inability to observe individual farms over time may suggest a potential for an upward bias in the implied effects of AMTA and MLA payments on acreage. Thus, these elasticities should be interpreted within this context as upper bound estimates. We address this limitation in the aggregate analysis that follows below.

Analysis of Idled Acreage

An alternative and more general evaluation of the effects of fixed payments on production practices involves measures of the extent to which farmland is placed in alternative practices other than crop production. Such alternatives might include conservation reserves, pasture, forest, set-asides, fallow, and other idling practices. Two alternative measures of land idling/waste were constructed. In the first, we considered the ratio of total harvested acres to total farm acres to represent crop land usage. Thus, one minus this ratio yields a measure of the proportion of farm acres idled (*Not Harvested*).

The 1999 ARMS survey collected detailed data relating to land ownership and land acquisition. Detailed information about the usage of owned land was elicited. For this single year, we constructed an alternative measure (*Not Cropped*) reflecting the idling and waste of owned farmland resources. This measure is slightly different in that it pertains only to owned resources and thus omits production on leased acreage. It thus may provide a less accurate view of overall production/acreage effects of program payments.

For our data, the alternative waste/idling measures ranged from 16.7% for Not Harvested to 23.2% for Not Cropped. Table 3 contains parameter estimates for each of the alternative measures of land usage. In both cases, the results suggest that higher AMTA payments do tend to be associated with more intensive use of land. This is not unexpected, since farms with more productive land are more likely to have less waste and are also more likely to have a crop base. In elasticity terms, the elasticity of the proportion of total farm acres idled with respect to AMTA

[16] It is important, however, that acreage of individual crops be conditioned on farm scale since larger farms will, by definition, have more acreage in individual crops. Our inclusion of both AMTA payments and farm size allows us to evaluate the extent to which AMTA payments affect acreage, conditional on holding farm size constant.

[17] Consideration of various instruments for evaluating the extent of any such endogeneity concerns remains a topic of current research. The lack of repeated sampling in the ARMS survey is an impediment to the identification of appropriate instruments.

Table 3. Parameter Estimates and Summary Statistics: Crop Land Idle/Waste Equations

Variable	Not Harvested	Not Cropped
Intercept	1.4630	1.1918
	(0.1965)*	(0.5658)*
Mean yield	−0.2109	−0.1218
	(0.0183)*	(0.0363)*
Corn price	0.1634	0.2394
	(0.0538)*	(0.1656)
Soybean price	−0.0646	−0.0178
	(0.0471)	(0.1209)
Wheat price	−0.0249	0.0336
	(0.0099)*	(0.0588)
Farm size	0.0000	0.0000
	(0.0000)*	(0.0000)
AMTA	−0.0040	−0.0029
	(0.0004)*	(0.0012)*
County corn acres$_{t-1}$	0.0000	0.0000
	(0.0000)*	(0.0000)*
MLA	−0.0091	−0.0041
	(0.0010)*	(0.0044)
AMTA × debts/assets	−0.0025	−0.0027
	(0.0006)*	(0.0040)
Wage	−0.0388	−0.0580
	(0.0071)*	(0.0373)
Fertilizer price	−3.1040	−1.7329
	(0.3051)*	(1.2815)
Gas price	0.0680	−0.5104
	(0.0775)	(0.3079)*
AMTA × insurance	0.0148	−0.0106
	(0.0040)*	(0.0176)
Wealth	−0.0002	−0.0062
	(0.0006)	(0.0032)*
Livestock	0.1818	0.0944
	(0.0101)*	(0.0274)*
D_{99}	−0.0396	
	(0.0468)	
D_{00}	−0.0460	
	(0.0766)	
D_{01}	0.3340	
	(0.0903)*	
Number of observations	4,121	884
R^2	0.2871	0.1496

Note: Numbers in parentheses are standard errors. An asterisk indicates statistical significance at the $\alpha = 0.10$ or smaller level.

payments is −0.33 for the first model and −0.16 for the second model. The AMTA interaction terms are significant in the first model but are not statistically significant in the second model. When the elasticities are evaluated at the mean values of the insurance and relative debt variables, AMTA elasticities are −0.31 and −0.22, respectively. These results indicate that AMTA payments are correlated with lower amounts of land being put in fallow or set aside, though the extent to which this reflects the fact that farms with more crop land naturally are those that have higher historical base and thus higher AMTA payments is unclear. The preceding results would tend to suggest that this does not occur through substantial increases in corn, soybean, or wheat acreage.

Other factors affecting land usage have the expected signs. The average of the normalized yield across all crops grown on a farm has the expected negative effect, implying that farms with higher relative yields tend to have less land idled.[18] Higher soybean and wheat prices are associated with less land being idled. Though a positive effect on idling is indicated for corn prices, the corn price effect is statistically significant only in the first model. This result is not consistent with expectations, though it may reflect basis pattern correlations with soil productivity or other local factors related to land use. Higher MLA payments (for the county in the previous year) imply less waste or idling of land in the first model, but do not have a statistically significant effect in the second model. The elasticity for market loss payments is again quite large at −0.39, though this effect is statistically significant only in the first model. Thus, expectations regarding the provision of MLA payments appear to have a significant effect in reducing the idling and waste of farm acreage. In general, higher input prices, fertilizer and labor in particular, lead to more idling of land resources. Finally, wealth does not appear to be significantly related to land idling in the overall farm acreage measure, though wealth does reduce idling when only owned acreage is considered.

In general, the two models of land idling suggest that the provision of direct government payments, even in cases where the payments are not tied to production of a particular crop, may lead to less idling of land and thus may result in more land being in production. The larger sample that includes a consideration of the entire land operated by a farm suggests that the greatest effect is likely to be realized from MLA payments. This is as would be expected, since such payments are seemingly more tied to the market place, as they are triggered (at least in theory) by market events, which motivate legislators to other support. In the case of our analysis of owned land usage in 1999, the results suggest that AMTA payments may

[18] The normalized yield is calculated by taking the farm's yield and dividing by the NASS county-average yield for the year in question. This removes the effects of county-wide yield shocks and thus places yields in relative terms.

be associated with less idling of land. This may reflect either the wealth or risk effects noted above. Alternatively, these results may provide evidence consistent with these policies easing capital constraints on agents and thus permitting greater use of land resources. However, the result is smaller than what is implied for all land operated by the farm. In all, although AMTA and MLA payments appear to exert a statistically significant effect in reducing idling of farm acreage, the elasticities are quite inelastic, ranging from −0.16 to −0.39 for AMTA and MLA payments. We must acknowledge, however, that this result may reflect the fact that land with base is likely to be more productive and thus less subject to idling than would be the case for land without program base.

Analysis of Land Acquisition

Finally, the 1999 ARMS survey data allowed us to consider the acquisition of new owned land resources by farms in that year. A relatively small proportion of the farms (4.94%) actually acquired land in 1999. We were interested in evaluating whether the provision of fixed payments might have been associated with the acquisition of new land—yet another indication of potential production distortions. Of course, for every agent buying land, another is selling and thus it is not clear that such transactions actually lead to more production.[19] Land transactions could lead to more land being used in production or, if new owners idle their newly acquired land, even less production. Parameter estimates and summary statistics for a probit model of the land acquisition decision are presented in table 4. An interesting result is that the direct effect of AMTA payments on the decision to purchase land is not statistically significant. The effect does not appear to vary with the ratio of debts to assets though it does vary significantly with insurance purchases. The results suggest that farms that are strong insurers are less likely to be acquiring new land. The overall marginal effect of AMTA payments, which is largely driven by the insurance interaction term, is given by $f(X\beta)\beta_i$, where $f(\cdot)$ represents the normal probability density function (pdf). The overall marginal effect, incorporating the insurance and leverage ratio interaction effects, is −0.0007, implying that raising AMTA payments $1 per acre would lower the probability of acquiring new land by 0.07%. If we consider the direct effect, for farms with no insurance and no debts, the marginal effect implies that increasing AMTA payments by $1 per acre raises the likelihood of acquiring new land by 0.01%.

Thus, the estimates suggest that the provision of AMTA payments may lead to more land ownership transactions, though the effect is not significant for the average farm in our sample and is very small even for farms that have no insurance or debts. This may reflect a

Table 4. Probit Parameter Estimates and Summary Statistics: Discrete Land Acquisition Equations

Variables	Parameter
Intercept	−1.4983
	(8.2596)
Mean yield	0.4934
	(0.4602)
Corn price	−0.2064
	(3.0764)
Soybean price	−1.0394
	(1.5241)
Wheat price	−0.0989
	(1.1711)
Farm size	0.0003
	(0.0001)*
AMTA	0.0142
	(0.0125)
County corn acres$_{t-1}$	0.0000
	(0.0000)*
MLA	−0.0197
	(0.0509)
AMTA × debts/assets	0.0196
	(0.0251)
Wage	0.1125
	(0.7324)
Fertilizer price	18.3291
	(18.0226)
Gas price	0.7396
	(5.3605)
AMTA × insurance	−0.5745
	(0.2141)*
Wealth	0.0057
	(0.0159)
Livestock	−0.3641
	(0.3367)
McFadden's R^2	0.1400

Note: Numbers in parentheses are standard errors. An asterisk indicates statistical significance at the $\alpha = 0.10$ or smaller level.

[19] A full understanding of the effects of policy on the acquisition and disposal of land and other productive assets requires a conceptual model of the land market of the sort developed by Rausser, Zilberman, and Just (1984) and observations on land bid and offer schedules. Such an analysis is beyond the scope of this article, especially in light of our limited data on land acquisitions. The topic remains an important issue for future research.

general lack of capital constraints that could inhibit the acquisition of land. Even if a larger effect were indicated, one could not necessarily conclude that this will involve the introduction of new land into production, since this may merely involve the exchange of ownership of land that was already in production.[20]

County-Level Acreage Analysis

Although the preceding empirical analysis provides rich inference by using farm-level data, our analysis is clearly limited by its reliance on cross-sectional variation—individual farms are not observed over time. This limits our ability to condition on historical values of key variables and thus may complicate the identification of causal effects of policy variables. For example, AMTA payments are based upon historical base acreage for program crops. It is likely that farms that planted a large number of acres to corn in the post-FAIR policy environment also had considerable acreage in corn during the pre-FAIR regimes, and thus are also receiving large AMTA payments. Thus, a large acreage of corn may be correlated with large AMTA payment receipts, although it is not necessarily the case that AMTA payments are "causing" producers to plant corn. As we have noted, to the extent that such an effect is present, one would expect the overall effect would be to infer a larger influence of AMTA payments on acreage than actually exists.[21]

Ideally, in cases where adjustment is costly or occurs with a lag, one will condition on the outcomes of prior planting decisions (i.e., in the preceding year or perhaps under the previous policy regime). As we have previously noted, the ARMS data are too sparsely sampled to permit one to derive meaningful county-level aggregates or averages.[22] Thus, our county-level analysis does not include the basic measures of risk aversion (i.e., insurance purchases), financial leverage (the ratio of debts to assets), and wealth. However, we are able to observe other basic factors typically associated with planting decisions, including measures of AMTA payment receipts (per farm acre in the county) and average MLA payments (per farm) in each county.

Table 5 presents parameter estimates and summary statistics for county-level acreage equations for corn, soybeans, and wheat, estimated over the same 1998–2001 period. The aggregate results suggest positive supply elasticities for soybeans and wheat. The corn acreage response to price is again not significantly different from zero. Lagged acreage of each respective crop exerts a strong influence on acreage, representing the conventional partial adjustment process that is universally found to be relevant to planted acreage.

Probably of greatest interest is the finding that AMTA payments again appear to have a positive relationship with crop acreages at the county level, though once again the effect is very small. The AMTA effects on acreage are statistically significant for soybeans. In the case of soybeans, the results imply that an additional dollar per acre of AMTA payments will add 168 acres of soybeans. No statistically significant effect is revealed for corn or wheat. Such a small marginal effect implies very modest elasticities. In particular, the AMTA acreage elasticities for corn and wheat are essentially zero for corn. In the case of soybeans, the AMTA elasticity is 0.018. In every case, the county-level estimates imply a smaller elasticity than do the farm-level estimates. In both cases, however, the estimated elasticities are very modest and suggest that the fixed payments have only a very small effect on acreage. These results are largely in agreement with those presented at the disaggregated level. In the case of MLA payments, a significant relationship with acreage is implied only for corn and soybeans, where an additional dollar per acre of MLA payments appears to raise county acreages by 225 and 138 acres, respectively. Again, this corresponds to a very small elasticity estimate of less than 0.01 in each case, which although statistically significant, is very close to zero. Thus, at the county level, the results do not imply large effects from AMTA payments or the MLA payments. It should be acknowledged that our county-level models rely on aggregated data for which much of the variation in explanatory factors has been removed. Indeed, the fixed-effects parameters may account for much of the variation, especially in policy, that affected production in the post-FAIR years.

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[20] We were concerned that, to the extent that land purchased may be debt financed, the debt-to-asset ratio may be endogenous to land purchases. To address this concern, we estimated an alternative two-stage probit model in which the debt to asset ratio was allowed to be endogenous. The resulting estimates (not presented here) were very similar.

[21] That is, we know the direction that any such bias in our inferences would assume. Any such correlation that is not captured by our model would tend to exaggerate the effects of AMTA payments on acreage. Thus, our estimates provide a conservative upper bound on the effects of decoupled payments on acreage decisions.

[22] The stratification scheme used in collecting the ARMS data also complicates aggregation.

Table 5. Parameter Estimates and Summary Statistics: County-Level Acreage Equations

Variable	Corn	Soybeans	Wheat
Intercept	4,736.5240	−8,364.1000	−13,602.5000
	(2,972.2720)	(2,773.0480)*	(1,721.0730)*
Corn price	−888.7030	−7,965.4400	6,056.8820
	(2,063.8230)	(1,937.5000)*	(1,215.3980)*
Soybean price	2295.6350	3577.1780	−996.3100
	(933.6118)*	(874.6612)*	(548.0211)*
Wheat price	−3,201.1500	1,970.7100	1,021.4200
	(461.1421)*	(434.7740)*	(273.1260)*
County farm acres	0.0103	0.0158	0.0020
	(0.0024)*	(0.0023)*	(0.0009)*
Acres_{t-1}	0.9522	0.9432	0.9215
	(0.0056)*	(0.0057)*	(0.0058)*
AMTA/farm	−46.7855	167.7565	−0.1713
	(47.1465)	(40.5604)*	(24.4509)
MLA/farm_{t-1}	225.5854	138.1505	13.9352
	(45.9700)*	(43.0587)*	(26.0915)
Fertilizer price	−35,752.9000	−644.1460	−2,477.2500
	(4,167.9660)*	(3,898.4240)	(2,448.8470)
Income CV	−0.3431	11.8935	−1.9650
	(20.8113)	(19.4296)	(12.2548)
D_{98}	−532.7320	−596.3490	275.3825
	(430.7310)	(404.3131)	(254.4218)
D_{99}	−288.9660	−70.6130	13.5886
	(453.3811)	(425.1351)	(267.3603)
D_{00}	−6.1379	178.6800	436.9469
	(441.3311)	(414.2154)	(260.4836)*
System-weighted R^2		0.9875	

Note: Numbers in parentheses are standard errors. An asterisk indicates statistical significance at the $\alpha = 0.10$ or smaller level.

Results for the other factors hypothesized to be relevant to acreage shifts are very similar to what was obtained for the disaggregated, producer-level data. A large effect is implied for input prices. Again, higher fertilizer prices appear to have large effects on acreage, with shifts being implied from corn and wheat to soybeans. Finally, we wanted to determine the extent to which farm financial risk might have had important acreage effects. Recall that it is difficult to obtain such a measure for individual farms in the ARMS sample since we do not observe the farms over time. However, such a measure can be constructed at the county level. We considered a measure of risk at the county level—the ten-year coefficient of variation on net farm income for the county, calculated from the U.S. Department of Commerce's Regional Economic Information System database. This measure was not statistically significant in any of the equations. Whether this reflects weaknesses in our measure of risk or rather implies that acreage decisions are not especially sensitive to income risk is unclear.

We repeated the county-level acreage response analysis using the level of acreage produced in each county in 1995 (immediately before the FAIR act was implemented) rather than lagged acreage. Our goal was to condition on acreage prior to the implementation of the FAIR act and the beginning of AMTA payments. The results were very similar to those included in table 5 and thus are not presented here.[23]

Concluding Comments

The objective of our analysis was to utilize farm-level data to consider the extent to which U.S. farm program benefits, particularly the AMTA and MLA payments, may bring about distortions in production. Previous research has pointed out that wealth effects operating through risk preferences or the effects of payments on capital-constrained borrowers may result in distortions, in spite of the fact that

[23] These results are available from the authors on request.

the benefits of these programs are not directly tied to the production of a particular crop. Decoupled payments may delay or prevent farmers' from being forced to exit production. The issue is important in light of the recent U.S. Farm Bill, which expanded these decoupled payments, as well as the upcoming WTO negotiations and the debate over the distortionary effects of such decoupled ("green-box") payments on markets. To address this question, we consider farm level and aggregate empirical models of acreage allocations to evaluate the extent to which decoupled payments have affected production decisions.

We utilize farm level data to consider acreage allocation decisions. This analysis is reinforced by an aggregate analysis of county-level acreage allocations. The overarching question underlying our analysis pertains to whether decoupled payments evoked a discernable acreage effect. Our focus is empirical and thus we do not develop a detailed conceptual framework for considering policy. Several important findings emerge from our analysis. First, there is modest evidence that AMTA payments may lead to increased production of corn, soybeans, and wheat. However, the acreage effects are very small. For an analysis of individual, farm-level data, acreage elasticities for the major crops, corn and soybeans, are about 0.025 to 0.035. Though statistically significant, a 95% confidence interval ranges from about 0.01 to 0.04. These results suggest that even a very large increase in these decoupled payments would not be expected to significantly increase acreage.[24] A somewhat different implication is implied for MLA payments that, at least for corn, appear to have a more significant effect on acreage. In particular, the elasticity of corn acreage with respect to MLA payments was 0.10, suggesting that such payments may indeed lead to more corn production. In order to examine the extent to which unobserved correlation with historical production patterns may have affected our farm-level estimates, we considered a county-level analysis that allowed us to condition on previous acreage levels. In this case, even smaller effects were suggested, with acreage AMTA and MLA elasticities of 0.01 or less. Our analysis does not imply important wealth effects, at least for our sample of Corn Belt farms.

We also considered how decoupled payments may affect the acreage idling decisions of producers. AMTA payments appear to evoke modest though generally significant effects, leading to less idling of land. A larger effect is implied by MLA payments, at least in the case of the models of the entire farm. Increasing MLA payments tends to make producers less likely to idle or waste land.

Finally, we considered probit models of the acquisition of new owned land for 1999. In this case, our results suggest that AMTA payment benefits did not appear to lead to strong incentives for agents to acquire new farmland assets. Likewise, MLA payments do not appear to be correlated with incentives to acquire ownership of new farmland.

Overall, our results imply that decoupled farm program payments have only modest effects on acreage. In particular, although these payments do have a statistically significant effect on acreage of the major crops in the U.S. Corn Belt, the effects are very small, with elasticities in the order of 0.01–0.03. This result is not surprising given the fact that such payments, though often large, are decoupled and represent relatively minor changes in the overall wealth of the typical Corn Belt farm. In particular, AMTA payments over these years averaged 1.8% of the typical farm's overall net worth. The conclusions are not as favorable for the neutral position of the ad hoc MLA payments. Our results implied an acreage elasticity of 0.10 for corn in response to MLA payments. These payments were linked to market events and thus bring about distortionary effects, although the payments were disbursed along with decoupled payments. Of course, producers' expectations regarding such payments, which are received after production decisions are made, are unobservable and thus our results are conditional on our proxy measurement of such expectations.

A number of research questions remain unanswered by our analysis. Our cross-sectional analysis is limited by our inability to observe an individual farm over time. As we discuss above, this limits our ability to condition our analysis on certain factors and thus may make it difficult to identify those effects we are evaluating. Having noted this possibility, it should also be pointed out that one would expect that this would lead to biases that would tend to overstate the importance of AMTA payment benefits on acreage decisions. Thus,

[24] Note that the standard caveats regarding the use of local marginal effects to interpret large policy changes are applicable here. Care must be used in interpreting these estimates when considering the elimination of decoupled payments or the counterfactual question of never having had decoupled payments in the first place.

even in light of the potential for such effects, our results do not imply large acreage effects as a result of AMTA payments. These limitations suggest that our estimates should be viewed as an "upper-bound" estimate on the effects of decoupled payments on the acreage of corn, soybeans, and wheat in the Corn Belt region. It is also important to acknowledge that our empirical model is broad in its focus and that a deeper understanding of the exact mechanisms underlying the effects of decoupled payments on production conditions requires a more complex conceptual framework that recognizes the dynamic nature of production and investment decisions. Development of such a framework is an important next step in this avenue of research.

Anecdotal evidence suggests another important effect necessarily neglected by our analysis. Farmers may have anticipated the opportunity to update program parameters such as yields and base. Thus, farmers may not have wanted to move to nontraditional crops or to idling land because they would not want to lose the opportunity to secure an updated base. The 2002 Farm Bill certainly supports such a suspicion. The 2002 Act provided a number of generous provisions for farmers to update their program base and yields that determine the fixed payments. In light of this fact, farmers may have been slow to adjust to market conditions or other factors outside of policy because they were anticipating the provisions to allow base yields and acreages to be updated. This may complicate an analysis of the production effects of farm program payments since AMTA payments were based upon historic base acreages and farmers may have anticipated having the opportunity to update base in the near future.

This raises an interesting question. Were farmers surprised by the generous provisions of the 2002 Farm Bill and did this legislation affect their expectations for future farm policy benefits? Allowing producers to update their base acreage and yields which form the basis for fixed payments certainly must be interpreted as tying the program benefits more closely to production decisions. To the extent that farmers expect that current production will be an important determinant of future program benefits, their production decisions may be altered by policy, even when such policy is administered through fixed payments. This is, of course, a research question that must await future policy developments. It will be important to evaluate acreage decisions under the new farm legislation to determine whether the 2002 provision to allow updating of program yields and base had an important effect on the relationship between fixed payments and acreage decisions.

Our analysis has been based upon the ARMS survey data. In the future, repeated sampling of individual farms may allow much richer inferences to be drawn from these data. In addition, potentially important endogeneity concerns that we have largely ignored are certainly an important area for future research. This research must be updated as new data on production patterns and policy benefits under the new Farm Bill become available.

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