The Incidence of U.S. Agricultural Subsidies on Farmland Rental Rates

by

Barrett E. Kirwan

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Department of Agricultural and Resource Economics

The University of Maryland, College Park

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ABSTRACT

Each year U.S. farmers receive more subsidies than needy families receive through welfare assistance or post-secondary students receive through student aid grants. Yet, who benefits from agricultural subsidies is an open question. Economic theory predicts the entire subsidy incidence should be on the farmland owners. Since non-farmers own nearly half of all farmland, this implies that a substantial portion of all subsidies accrue to non-farmers while a significant share of all farmers receive no benefits. Using a complementary set of policy quasi-experiments, I find that farmers who rent the land they cultivate capture 75 percent of the subsidy, leaving just 25 percent for landowners. This finding contradicts the prediction from neoclassical models. The standard prediction may not hold due to less than perfect competition in the farmland rental market; the share captured by landowners increases with local measures of competitiveness in the farmland rental market.

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1 Introduction

The primary goal of U.S. agricultural policy over the past century has been to increase farmers' income. Since 1973, direct payments to agricultural producers have been a vital instrument for supporting that goal.[1] Whether agricultural subsidies actually benefit farmers, however, is an open question. Non-farmers, individuals who do not currently farm any land, own and rent out nearly half of all farmland in the United States. Standard economic theory predicts that subsidies accrue entirely to land owners. Agricultural subsidies may not benefit farmers if non-farmer landlords are able to adjust rental rates to capture the subsidies paid to agricultural producers.

In the United States, agricultural subsidies are a significant transfer program. Between 1998 and 2004, farmers received, on average, $17 billion annually. In comparison, federal Temporary Assistance for Needy Families grants averaged $13.6 billion, while federal aid to post-secondary students averaged $16.1 billion. On a per-recipient basis, agricultural subsidies are one of the largest income support policies. In 2002, the average farm subsidy recipient received $6,947. Compare this to $1,730 annually per recipient household in food stamps; an average total unemployment compensation claim of $4,369; or $6,540 per eligible individual in annual benefits from SSI, an income support for the needy aged, blind, and disabled. The size of the farm subsidy program alone emphasizes the importance of understanding whether the stated policy goals are being met.

The standard model of agricultural subsidy incidence predicts that, due to the extremely inelastic supply of agricultural land, landowners receive the entire benefit of the subsidy. This model is widely used by economists to explain the effects of agricultural subsidies (e.g., Shultze,

[1] See Orden, Paarlberg, and Roe (1997) for a history of agricultural policy.

1971; Schmitz and Just, 2002).[2] According to this model, non-farmers, who own 94 percent of rented farmland and 42 percent of all U.S. farmland, reap a substantial share of the benefits from agricultural subsidies.

Surprisingly little evidence substantiates this model. In spite of a large literature examining the capitalization of subsidies into farmland values, the proportion of the marginal subsidy dollar captured by landowners remains unknown. Rosine and Helmberger (1974) attempt to address this question by simulating producer surplus with and without agricultural policy. They conclude that 92 cents of every dollar generated by farm programs accrues to the landlord. However, fundamental aspects of their simulation model have been questioned (Gisser, 1993; Alston and James, 2002), and modern farm programs, which began in 1973, differ from those examined by Rosine and Helmberger. Instead of estimating the subsidy incidence, the previous literature typically assumes full incidence on land and estimates either the elasticity of land value with respect to subsidies (Traill, 1982; Goodwin and Ortalo-Magne, 1992), the rate at which future subsidies are discounted (Weersink, et al., 1999; Lamb and Henderson, 2004), or the proportion of land value attributable to subsidies (Featherstone and Baker, 1988; Herriges, et al., 1992).

In contrast, I directly investigate the incidence of agricultural subsidies by examining the response of farmland rental rates and tenants' net returns to exogenous agricultural subsidy changes while accounting for several potential sources of bias (see Roberts et al., 2003, for early work in this area). By law, farm operators receive the subsidy directly. Under cash lease arrangements, tenants receive the subsidy check; landlords extract the subsidy to the extent that rental rates rise with the subsidy. Thus, landlord and tenant incidence are measured by the extent to which rental rates and net operating returns, respectively, rise with the marginal subsidy dollar. In this paper I test the

[2] Gardner, speaking before the House Committee on Agriculture in February, 2001 stated, "…one of the things I think is fairly well-agreed upon that [subsidy] programs do is that the way in which they affect farmers' income is not through everything that happens on the farm, but in the particular way of holding up land values and land rental rates."

standard theory that landlords capture the full subsidy by testing whether rental rates rise dollar-for-dollar with subsidies and whether subsidies do not affect tenants' net returns.

As per-period prices, farmland rental rates respond primarily to innovations in expected returns in the current period, including exogenous policy-induced subsidy changes. Three policy changes provide the exogenous subsidy variation this paper uses to estimate the landlord-tenant division of the subsidy dollar. First, the 1996 Federal Agricultural Improvement and Reform (FAIR) Act altered the relative subsidy rate among crops, resulting in subsidy variation due to historic crop choice rather than current behavior. Next, emergency legislation in 1998 and 1999 provide largely unanticipated subsidy changes with which to investigate the subsidy's immediate effect. Finally, the relative policy stability in the years following the 2002 Farm Security and Rural Investment (FSRI) Act set the stage to estimate the medium to long-run effect of exogenous subsidy changes on rental rates and net returns.

Even in this setting, where subsidy variation is plausibly unrelated to farmer behavior, unobserved characteristics of the farm may influence both subsidies and rental rates. Using farm-level data from the 1992 and 1997 *Census of Agriculture*, the 1999 *Agricultural Economics and Land Ownership Survey*, and the 2005 *Agricultural Resource Management Survey*, I control for unobserved heterogeneity with farm fixed effects. This is a particularly credible setting for fixed effects because of time-invariant 'farm-quality' factors that affect subsidies, net returns, and rental rates.[3]

Another source of bias may arise when the relevant subsidy measure, the expected subsidy when rental rates are set, is unavailable to the analyst. Prior to the 1996 FAIR Act, subsidy rates depended on post-harvest commodity prices, which were unknown when rental agreements were

[3] Interestingly, Hoch (1958, 1962) and Mundlak (1961) developed the fixed effects estimator in the context of unobserved farm quality.

made in the spring. The difference between the realized subsidy used in the analysis and the expected subsidy considered when setting rental rates, i.e., the "expectation error," results in measurement error-style attenuation bias. The FAIR Act solves this problem by divorcing subsidies from commodity prices, making subsidies knowable by tenants and landlords when setting rental rates. I use the post-FAIR Act subsidy as an instrumental variable to address the expectation error problem.

Contrary to the standard model's predictions, this paper finds that only 20 to 25 cents of the marginal subsidy dollar are reflected in increased rental rates, whereas tenant net returns rise by 70 to 75 cents. Accounting for nearly the full subsidy dollar with these two largely independent estimates provides confidence in an approximately 25/75 landlord-tenant split of the marginal subsidy dollar.

Although previous research assumed full subsidy incidence on the landowner, characteristics of the farmland market, such as imperfect competition and social norms, suggest why this may not be the case. Farm consolidation and growth results in fewer tenants who may enjoy increasing market power in the farmland rental market. Landlords, who forgo the use value of the land without a tenant, may implicitly share the subsidy to attract tenants. I test this possibility using measures of rental market concentration and demonstrate that the landlord's incidence increases when the rental market becomes more competitive. Social norms and fairness also might play an important role in the division of the subsidy dollar.

The paper proceeds as follows. Section 2 details the institutional facts about the farmland rental market and subsidy policy. Section 3 describes the data. Section 4 lays out the empirical strategy employed in this investigation, emphasizing the identifying assumptions. Section 5 presents the incidence on landlords and tenants and provides evidence of the robustness of the estimated incidence. Section 6 explores the short and long-run incidence. Section 7 examines possible explanations for the findings, and section 8 concludes.

2 Institutional Background

2.1 Overview of the farmland rental market

Renting farmland is a common practice in U.S. agriculture, where more than 45 percent of the 917-million farmland acres are rented (USDA 2001b). A typical tenant rents 65 percent of the land he farms, paying either in cash or in shares of production. According to the 1999 Agricultural Economics and Land Ownership Survey (AELOS),[4] 60 percent of rented farmland is paid in cash, 24 percent in shares of production, and 11 percent in a cash/share combination. In 1999, the average cash-rented acre went for $32. Subsidy recipients paid a slightly higher $36 per acre for the land they cash rented. In the United States, non-farmers own 94 percent of the rented land, or 340 million acres—twice the size of Texas (USDA, NASS 2001b). The parties enter into the rental agreements early in the year, typically by March 1st.

2.2 Agricultural Subsidy Policy

The decade from 1992 – 2002 saw three major agricultural subsidy policy changes, each providing a quasi-experiment that can be used to evaluate the incidence of agricultural subsidies. Subsidies were calculated in a broadly consistent way throughout this period. Farm *i*'s total subsidy for crop *k* in year *t*, $subsidy_{ikt}$, equaled

$$subsidy_{ikt} = \delta_{kt}\bar{y}_{ik,1985}b_{ikt}s_{kt}, \tag{1}$$

[4] The Agricultural Economics and Land Ownership Survey is a follow-up survey to the Census of Agriculture conducted every 10 years. This survey asks questions of both tenants and land owners.

where δ_{kt} is a scaling factor; the *program yield*, $\bar{y}_{ik,1985}$, is a farm-specific parameter that equals the average production yield for crop k on farm i between 1980 – 1984;[5] b_{ikt} is the number of acres of crop k on farm i qualifying for a subsidy, called *base acres*, that participate in the subsidy program in year t; s_{kt} denotes the national subsidy rate for crop k in year t. It is important to note that the subsidy is paid to the farm operator, and the program yield and program qualification are specifically tied to an acre of land. As an acre changes ownership or receives new tenants, these parameters stay with the land, and the new operator receives the subsidy. As such, agricultural subsidies are factor-specific subsidies to land.

A. The Federal Agricultural Improvement and Reform Act of 1996

The 1996 Federal Agricultural Improvement and Reform (FAIR) Act was the first, and most significant, policy change during this decade. The FAIR Act changed relative subsidy rates, effectively redistributing subsidies according to the crop historically grown on the farm.[6] It also divorced subsidies from commodity prices and established a seven-year schedule to phase out agricultural subsidies. Subsidies are paid to the farm operator after the harvest. Prior to 1996, the national subsidy rate depended on the commodity's price after harvest, i.e., $s_{kt} = s(p_{kt})$. When negotiating rental contracts in the spring, farmers and landlords knew the program yield and base acres associated with the rental property, but they were uncertain of the subsidy rate. Hence, the rental rate was set conditional on the expected subsidy. Under the FAIR Act, the entire subsidy associated with the land was known in the spring, and rental rates could be set conditional on the actual subsidy.

B. Emergency subsidy legislation of 1998, 1999, and 2000

[5] The exact calculation dropped the highest and lowest yields and averaged yields from the 3 remaining years.
[6] For example, in 1997 the subsidy rate for wheat, s_{kt} in equation (1), nearly equaled the 1990-1995 average subsidy rate, i.e., 63 cents versus 65 cents. The 1997 subsidy rate for corn, however, was substantially higher than its 1990-1995 average, i.e., 49 cents versus 30 cents.

The second quasi-experiment that provides exogenous subsidy variation is a set of three "emergency" policy changes between fall 1998 and summer 2000, which were passed in response to dramatically falling commodity prices. The first of these policies unexpectedly increased 1998 subsidies by 50 percent.[7] Subsequently, the 1999 and 2000 legislation doubled subsidies. In terms of equation (1), these policies affected the scaling factor δ_{ikt}. The analysis below focuses on the impact of subsidies in 1999, the first year farmers could have expected additional subsidies in the face of low commodity prices. This policy change also provides the opportunity to capture the immediate effect of unanticipated subsidies.

C. The Farm Security and Rural Investment Act of 2002

The Farm Security and Rural Investment (FSRI) Act of 2002 provides the final quasi-experiment of the 1992 – 2002 period. Signed into law in May 2002, the FSRI Act replaced the FAIR Act, which was set to expire at the end of 2002. Earlier in the spring of 2002, when rental rates were agreed upon and planting decisions were made, the FAIR Act was in effect while Congress worked to reconcile the Senate version of the bill, which called for reduced subsidies, with the House version, which called for subsidy increases. Ultimately, FSRI increased subsidies and was made retroactive to cover the 2002 crop year. In this climate of uncertainty, 2002 may best be considered a policy transition year rather than a new policy regime. FSRI did, however, usher in a period of policy stability; subsidy policy remained virtually unchanged from 2002 through 2008. I utilize this time of policy stability in the analysis below to investigate the medium to long-run subsidy incidence.

[7] On September 21, 1998 the U.S. Senate introduced language into the fiscal year 1999 agriculture appropriations bill calling for dramatic subsidy increases. By Thanksgiving 1998, farmers received checks that increased their 1998 subsidy by 50 percent.

3 Data

The primary data source is the U.S. Census of Agriculture, a quinquennial census of those who produce at least $1,000 of agricultural goods.[8] The Census of Agriculture contains farm-level production information, information on the corporate structure of the operation, and demographic information on the primary operator. In addition, the Census employs a stratified sampling procedure to select a subset of farms from which it collects detailed financial information, such as variable expenditures, land values, and revenue.[9]

3.1 Sample Creation

In the main analysis I use two years of the Census of Agriculture, 1992 and 1997, to create a balanced panel of farming operations. Each year, roughly 1.6 million farms respond to the Census. About one million farms are observed in consecutive census years, and approximately three-quarters of these farms grow a subsidized crop in either year. The first two columns of table 1 contain the summary statistics for the population of farms that grow subsidized crops.

Nearly half of farms growing subsidized crops cash rent some land. The summary statistics reported in table 1 columns 3 and 4 reveal that cash-renting farms are slightly larger and more profitable than the average farm. In 1992, cash-renting farms were 200 acres larger (about 30 percent) on average and earned on average $4 more per acre (about 7 percent) in net returns. Cash renters were also more likely to receive subsidies (64 percent versus 55 percent) and received a 50-cent higher subsidy per acre than the average farm in 1992 ($16.22 versus $15.73).

[8] These data are confidential micro files accessed under an agreement with the USDA Economic Research Service and the USDA National Agricultural Statistics Service (NASS). The data are available at NASS in Washington, DC. Any interpretations and conclusions derived from the data represent the author's views and not necessarily those of NASS.

[9] Farms are stratified based on expected revenue. All farms with very high expected revenue are selected, and approximately one-in-four of all other farms also receive the Census' long form. I use Census-provided sample weights when appropriate to account for this sample composition.

I construct the sample for the final analysis by limiting the sample to farms that report paying cash rent in both years.[10] The summary statistics of the final analysis sample, contained in the last two columns of table 1, reveal that the final analysis sample is representative of the population of cash renters. The only substantial difference between the population of cash renters and my sample is in the mean rental rate, reflecting the presence of large outliers in the population; note that the median rental rates, reported in brackets, are very similar between the sample and the population. The final analysis sample consists of 59,934 farms observed over two years.

Sample Selection Bias

Farms used in the final analysis reported paying cash rent in both 1992 and 1997. This poses a problem if the propensity to rent farmland in 1997 is influence by the 1996 policy change. For example, this source of endogeneity could bias the incidence estimate downward if farms experiencing a high subsidy pass-through stopped renting, but those experiencing low rental-rate incidence continue to rent. I investigate the potential sample selection bias using a Heckman selection model. The first stage includes both characteristics of the land and characteristics of the farmer, such as age and principal occupation, which likely influence the propensity to rent land.[11] The second stage excludes the demographic characteristics of the farmer. Although the farmer's characteristics likely influence the decision to rent, the rental rate is primarily determined by the characteristics of the land. The results of this analysis are reported in appendix table 1. Based on the exclusion restrictions, the likelihood ratio test fails to reject the null hypothesis that the error

[10] All variables are winsorized at the 1st and 99th percentile to limit the influence of outliers. Non-negative variables are only winsorized at the 99th percentile.

[11] The demographic covariates are as follows: whether the farm is a family farm, whether it is a partnership, whether the farmer resides on the farm, whether farming is the principal occupation, number of days worked off farm, farming experience, experience squared, age, age squared, race.

terms from the selection and regression equations are uncorrelated.[12] The propensity to cash rent in both years appears unrelated to the subsidy. Furthermore, the incidence estimate remains the same as the values reported below, demonstrating its robustness to this specification.

3.2 Variable Creation

A. Dependent Variable

The Census of Agriculture does not report the per-acre rental rate, however respondents do report the total amount paid in cash rent. The total acres rented on a cash, share, or free basis also are reported. From these two variables, I create the per-acre rental rate by dividing total cash rent by total acres rented. Admittedly, the resulting rental rate will be too small for farms that cash rent part of the land and share rent another part.[13] As long as this measurement error in the dependent variable is uncorrelated with the regressors, only the intercept will be confounded. However, if the measurement error is correlated with the magnitude of government payments, the estimated effect of government payments on rental rates will be biased. Evidence from the 1999 Agricultural Economics and Land Ownership Survey (AELOS) demonstrates that if a bias exists, it is likely to be slightly positive.[14]

B. Independent Variables

The subsidy variable is constructed from the reported government payments variables. Every agricultural producer is asked to report the "total amount received for participation in federal

[12] The chi-squared statistic equals 0.11, with a p-value of 0.73. In the two-step procedure, the coefficient on the inverse-Mills ratio is -1.07 with a standard error of 2.58. Details available in appendix table 1.
[13] According to the 1999 AELOS, 17.5 percent of farms that rent some land do so using both cash and share leases. On average, fifty percent of rented acres on these farms are under cash lease.
[14] I investigate this source of bias using the microfiles of the 1999 AELOS, which asked for detailed information about the type of lease arrangement, the total cash rent paid, and the value of the share of production paid as rent. Using these data I construct an estimate of the non-classical measurement error, and I estimate the relationship between the measurement error and government payments. Appendix table 2 reports the estimates. The coefficient represents the potential bias. With state fixed effects, the incidence estimate is 0.03 greater than the truth. However, with county fixed effects, I find no relationship between government payments and the measurement error, implying no bias in the primary analysis. Details of this analysis are available from the author upon request.

farm programs." Producers are asked to report both total payments received and payments received from the Conservation Reserve Program (CRP).[15] By subtracting CRP payments from the reported total payments, I construct an approximate measure of subsidy receipts. In 1992, land-specific subsidies accounted for 70 percent of direct government payments net of Conservation Reserve Program payments.[16] Of the remaining 30 percent, 6.5 percent were price support payments and 22.5 percent were from disaster relief and other programs (author's calculations from administrative data). In 1997, subsidies account for virtually all (96 percent) of non-CRP direct government payments (USDA, NASS, 2001a). As reported in table 1, average subsidies per acre fell from \$15.65 to \$13.03 between 1992 and 1997. Subsidies are measured per farmland acre.[17]

The remaining covariates employed below are sales revenue per acre, variable production expenditures per acre, the natural log of farm size, proportion of acres irrigated, proportion of acres in pasture, proportion of sales revenue in 19 product categories, and yields of the subsidized crops and soybeans. These were constructed directly from variables contained in the Census of Agriculture.

4 Empirical Strategy – Identification

Here I lay out the obstacles that must be overcome to identify the effect of government subsidies on farmland rental rates. First, unobserved productivity factors confound the subsidy-rental rate relationship. Second, expectation error attenuates the estimate. After setting out a fixed-effect estimation equation to address the first concern, I detail the instrumental variables procedure necessary to overcome attenuation bias in the econometric model.

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[15] The Conservation Reserve Program provides an annual "rental" payment for farmland that has been removed from production under 10-15 year contracts and upon which a long-term, resource-conserving cover crop has been established.

[16] I address possible measurement error-induced attenuation bias below using administrative data to instrument for the Census-reported subsidies.

[17] Analysis performed using log-levels produces very similar results. The per-acre analysis is presented in order to maintain a more natural interpretation of the coefficient.

4.1 Unobserved Heterogeneity

The econometrician cannot observe many farm characteristics that influence both subsidies and farmland rental rates. Among these are soil properties and farmer skill, which positively affect subsidies through the program yield parameter in equation (1). The positive correlation between government payments and the time-invariant unobserved factors that influence productivity will upwardly bias the estimated effect of subsidies on rental rates. Transient shocks, such as drought or pests, also may affect rental rates and government subsidies. Farm and time-varying county fixed effects address these sources of bias.

The main estimation equation is

$$r_{ijt} = \alpha + g^{*}_{it}\gamma + X'_{it}\beta + f_i + C_{jt} + \varepsilon_{ijt}, \qquad (2)$$

where r_{ijt} is the average rental rate for farm i in county j and year t. The per-acre subsidy expected by the farm operator in the spring, when rental contracts are negotiated, is g^{*}_{it}, and f_i is the fixed effect for farm i. The parameter C_{jt} is a time-varying county effect that allows for shocks, such as weather or pests, that impact all farms within the county. X_{it} is a vector of observable covariates comprised of sales revenue, expenditure, production yield of the seven subsidized crops and soybeans, the share of sales revenue for 19 commodity groups, proportion of acres irrigated, proportion of acres in pasture, and farm size.

The estimating equation used in this study is obtained from equation (2) by first differencing the data to absorb the farm effect, resulting in

$$\Delta r_{ij} = \Delta g^{*}_{i}\gamma + \Delta X'_{i}\beta + \Delta C_j + \Delta\varepsilon_{ij}. \qquad (3)$$

4.2 Expectation Error

The remaining problem to be addressed is expectation error. Rental rates are set in the spring according to *expected* receipts after harvest, including expected subsidy payments.

Expectation error causes attenuation bias. Actual government payments will equal the expected government payment and an expectation error,

$$g_{it} = g_{it}^{*} + \varepsilon_{it}^{g} . \tag{4}$$

Assuming the expected subsidy and the expectation error are uncorrelated, i.e. $Cov\left(g_{it}^{*}, \varepsilon_{is}^{g}\right) = 0 \ \forall t, s$, implies that substituting realized government payments, g_{it}, for the expected subsidies in equation (2) has the same effect as classical errors in variables, namely attenuation bias.

The 1996 FAIR Act reduces the complexity of the problem by eliminating expectation error in 1997. Recall that in 1996 the subsidy rates were exogenously predetermined for the next seven years. Because of this feature of the legislation, in 1997 expected subsidies equaled actual subsidies, $g_{i97}^{*} = g_{i97}$.

Substituting for expected subsidies in equation (2) and first differencing results in

$$\Delta r_{ij} = \gamma\left(g_{i,97} - g_{i,92}\right) + \Delta X_i'\beta + \Delta C_j + \Delta\varepsilon_{ij} + \varepsilon_{i,92}^{g}\gamma . \tag{3'}$$

An instrumental variables strategy may overcome the attenuation bias induced by the expectation error. Instruments that address the bias due to expectation error should be correlated with the deterministic component of the subsidy (program yield and base acres) and uncorrelated with the idiosyncratic component (the 1992 subsidy rate). As illustrated in equation (1), the 1997 subsidy is a known, deterministic function of the underlying program parameters that also determined the 1992 subsidy. Inasmuch as the farm-level program parameters remain unchanged between 1992 and 1997, the deterministic component of the 1997 subsidy level will be highly correlated with the deterministic component of the 1992-1997 subsidy change. Thus the 1997 subsidy level will be a good instrument if the subsidy shock in 1992 contained no information for the expected subsidy in 1997, a reasonable assumption.

5 Estimation and Results

A. Subsidy Incidence on the Landlord

The approach taken by this paper has the advantage of controlling for unobserved characteristics of the farm, such as the operator's entrepreneurial skill and the productivity of the land, that confound the subsidy's effect. I illustrate the insight gained from this approach by first ignoring the panel nature of the data. As reported in the first column of table 2, bivariate regression of the rental rate on subsidies per acre obtained by pooling the 1992 and 1997 Censuses of Agriculture data yields an incidence estimate of 0.66. The second column of table 2 reports that the incidence estimate falls to 0.44 when controls are included in the regression. Even before accounting for unobserved heterogeneity there is evidence that the characteristics of the farmland rental market do not correspond with conventional wisdom. Column 3 of table 2 reveals the effect of controlling for unobserved heterogeneity by estimating equation (3). The incidence estimate falls to 0.13, and it is statistically different from one. In other words, 13 cents of the marginal subsidy dollar is reflected in higher rental rates.

Since the expectation error depicted in equation $(3')$ attenuates the estimate, the fixed effects estimate may be too low. I address possible attenuation bias by instrumenting for the subsidy change with the 1997 subsidy level. As noted above, the permanent components of the subsidy will ensure correlation between the subsidy level and its change, and the surety of 1997 subsidy payments alleviates expectation error concerns regarding the instrument.

Table 2 column 4 reports the instrumented incidence estimate. Appendix table 3 reports the results from the first stage. A Shea's partial R^2 of 0.22 and an F statistic of 7,575 demonstrate the statistical strength of the instrument. After instrumenting for expectation error the incidence estimate increases to 0.21, indicating that landlords ultimately capture just 21 cents of the marginal subsidy dollar.

B. Subsidy Incidence on the Tenant

Standard theory suggests that if the supply of variable inputs is perfectly elastic, the remaining 79 cents of the marginal subsidy dollar will accrue to the tenant. I estimate the tenant's incidence by replacing the rental rate in equation (3) with per-acre net returns, calculated as total revenue less variable costs divided by total farmland acres. For the reasons listed above, namely unobserved heterogeneity and the substantial importance of local production shocks, the specification remains the same. Since net returns are realized after the subsidy payment, expectation error is not a concern, and I do not instrument for the subsidy variable.

The coefficient on government payments from this regression, reported in table 2 column 5, is 0.80 with a robust standard error equal to 0.059. Recall that renters own about a third of the land they farm and consequently receive the entire subsidy dollar on those acres. Accounting for this in the 0.80 net returns incidence implies that tenants receive about 70 cents of the marginal subsidy dollar on rented land.[18] In other words, nearly the entire subsidy dollar on a rented acre of land can be accounted for as either a 21-cent increase in the rental rate or a 70-cent increase in the tenant's net returns. Accounting for nearly the entire subsidy dollar demonstrates that measurement error is an unlikely cause of the remarkably low rental rate incidence estimate.[19] Ultimately, the landlord and tenant share roughly a 25/75 split of the marginal subsidy dollar.

5.2 The Heterogeneity of Subsidy Incidence across Regions and Farm Size

Regions within the U.S. differ substantially in the crops grown and the predominant lease contract type. Noting that each crop is subsidized separately, one might worry that the incidence

[18] $0.80 \approx 0.33(1) + 0.67(0.70)$

[19] I further investigate the role of measurement error using county-level administrative data obtained through a Freedom of Information Act request from the Farm Services Agency of the USDA. Instrumenting for farm-level self-reported subsidies per acre with the county-average subsidy per acre from administrative data reveals a nearly identical rental rates incidence estimate of 0.22 (s.e. 0.099, clustered at the county level).

differs according to crop and subsidy regime. Farm size might also influence the size of the incidence. For instance, perhaps large farms are better able to negotiate for lower rental rates, and they are driving the relatively low incidence.

I explore the robustness of the results by estimating the incidence separately for different regions[20] and different farm sizes.[21] The incidence appears very stable across resource regions and sales class. The rental rate incidence point estimates for five of the nine resource regions lie between 0.16 and 0.48, while the rest are indistinguishable from zero. Six of the nine net returns incidence estimates lie within 0.1 of the main estimate. When estimated across sales classes, the rental rate incidence estimates cluster around the main result, ranging from 0.06 to 0.32. The tenants' net returns incidence estimates range from 0.71 to 1.09, except for the statistically insignificant estimate in the lowest sales class. The uniformity of incidence estimates spatially and across firm size gives further confidence in a 25/75 incidence split.[22]

6 Further Evidence

A. Short-run Response: Emergency Legislation in 1998 and 1999

The surprisingly low rental rates incidence might result from landlords preemptively adjusting rental rates in anticipation of the 1996 policy change. The emergency legislation passed in 1998 and 1999 provides a unique opportunity to observe the short run effect of unanticipated subsidies on farmland rental rates. I investigate this using the 1999 AELOS, which contains financial information on a sample of 26,553 farms. I create a dataset of the 1997-1999 change by merging these data with the 1997 Census of Agriculture. I estimate equation (3') using data from

[20] The USDA has established 9 resource regions corresponding to predominant crop mix and farming practices.
[21] Following USDA classification, e.g., http://www.ers.usda.gov/Briefing/FarmStructure/Gallery/farmsbyconstantdollars.htm
[22] Details available in appendix tables 4 and 5.

the resulting 5,587 farms.[23] The 1999 AELOS provides data on total government payments. However, according to administrative data, in 1999 land subsidies accounted for only half of government payments. I address this measurement error with a second instrument, derived from administrative data: the county-level average subsidy per acre. This IV strategy precludes the use of time-varying county effects in the estimation. However, since rental rates are set prior to, and independently of, local shocks, the model may not be misspecified by omitting the time-varying county effect. Table 3 reports the rental rate incidence estimate in the first column. Accounting for the measurement error results in a rental rate incidence estimate of 0.34, higher than that found in the main analysis, but still statistically (and substantially) less than 1. The second column of table 3 reports the subsidy coefficient in the net returns regression. Because of the importance of local production shocks in determining net returns, this specification continues to include time-varying county effects rather than use the county-level instrument to correct for measurement error. At 0.55, the estimated incidence on the tenant is similar to that found in the main analysis although somewhat attenuated, potentially due to measurement error.

B. Long-run Response: The Food Security Reform Act of 2002

Over time rental rates may adjust to more fully reflect the subsidy change. To investigate this claim I focus on the period of policy stability following the 2002 FSRI Act, when subsidy policy remained relatively unchanged until 2008. I estimate the long run subsidy incidence by connecting farms from the 1997 Census of Agriculture with their responses to the 2005 Agricultural Resource Management Survey (ARMS). ARMS is a nationally representative survey of 15,000 – 25,000 farm businesses and households conducted annually by the USDA. Because the 2002 FSRI

[23] Similar to the selection criteria used previously, the sample consists of all cash renting farms in 1999 that also cash rented in 1997 and grew subsidized crops or received subsidies in 1997. The 1999 AELOS does not contain production data, thereby preventing product mix and yield controls and limiting the set of covariates to those explicitly reported in table 3.

Act was implemented in stages throughout 2002, I treat 1997 as the base year and use the 1997 Census of Agriculture, rather than use the census data from 2002. I examine the nine-year difference, with three full years following the implementation of the 2002 FSRI Act, using 2,972 farms that meet the selection criteria, namely renting in both years and growing a program crop in the base year.

Columns 3-7 of table 3 report the results of this investigation. In addition to the amount of land-specific subsidies, upon which this paper is focused, the ARMS data provide information on loan deficiency payments, a production subsidy that first received widespread use in 1998. The first row of table 3 reveals the long-run incidence estimates corresponding to land-specific subsidies, while the second row controls for the effect of production subsidies. Column 3 reports a rental rate incidence estimate of 0.14 from the fixed effects specification. Instrumenting for potential measurement error with the county-level average subsidy, derived from administrative data, reveals an incidence estimate of 0.38, reported in column 4. Because of the potentially increased influence of outliers in this smaller dataset, column 5 reports the results of a robust regression that uses Huber weights (1973) and biweights to limit the influence of outliers. This specification demonstrates the influence of outliers on several covariates, e.g. the coefficient on variable costs changes sign and magnitude to more closely correspond to the estimate in the main analysis. At 0.15, the land-specific subsidy incidence estimate remains similar to the fixed effects specification in column 3. Columns 6 and 7 report the tenant's incidence. The fixed effects specification yields a statistically insignificant 1.13, while the robust regression estimate is 0.61.

The standard caveats of the efficacy of fixed effects in a long difference of dynamic businesses apply here. Unobserved, time-varying heterogeneity remain unaccounted for. In addition, the relatively small sample size, which diminishes by more than 20 percent when including time-varying county effects due to single observations within a county, reduce the power to discern the incidence. In spite of this, the incidence estimates in columns 3-7 suggests that the subsidy incidence does not substantively change in the medium to long-run.

7 Potential Explanations

Conventional wisdom holds that competitive farmland markets enable landlords to extract the entire marginal subsidy dollar, resulting in perfect subsidy incidence on farmland. The less than full subsidy incidence found here warrants reconsideration of the fundamental assumptions. This section considers possible exceptions to the underlying assumptions of the farmland incidence model. I examine the role of competition in the less-than-perfect incidence finding and suggest the possible role of social norms.

Imperfectly competitive rental markets may play a role in these findings. Although landlords potentially could receive the subsidy on unrented, idle land, without a tenant they would forgo the use-value of the land.[24] Landlords may have low reservation rents since agricultural land has few alternatives outside farming. In a market with many landlords and few renters, the landlords may implicitly share the subsidy dollar in an attempt to attract tenants.

To examine the hypothesis that rental market concentration affects the landlord's ability to extract the subsidy, I interact the farm-level subsidy with a county-level rental market concentration measure and include it in the main specification. I measure rental market concentration with two Herfindahl indices. One index defines market share over total county farmland rental expenditure. The other defines market share over the total number of rented farmland acres.

The Herfindahl indices reveal slight to moderate concentration that is increasing over time. The Herfindahl index with respect to rental expenditures increases from a mean (median) of 0.106

[24] Prior to the 1996 FAIR Act landlords could not directly receive subsidies on idle, unrented land.

(0.058) in 1992 to 0.121 (0.068) in 1997. The average (median) Herfindahl with respect to rented acres increases from 0.045 (0.018) to 0.046 (0.019).[25,26]

The effect of market concentration on rental rate incidence is reported in table 6. Column 2 reports how the incidence changes as rental market concentration varies. A 0.01 increase in the expenditure Herfindahl causes the incidence to fall by 0.026, and a 0.01 increase in the acreage Herfindahl leads to a 0.19 drop in the incidence. These estimates imply a 0.02-0.04 fall in the rental rate incidence due to average concentration growth between 1992 and 1997. Column 1 reports the incidence as the market approaches perfect competition. As measured by the expenditure Herfindahl, incidence approaches 0.3 as concentration goes to zero; incidence approaches 0.45 as concentration goes to zero when measured by the acreage Herfindahl. Imperfectly competitive rental markets appear to play a role in the lower-than-expected rental rate incidence.

The structure of rental contracts suggests that social norms also may play a role in the incidence estimate.[27] The long-term tenant-landlord relationships commonly observed facilitate the role of trust in the rental contract. Trust may play an important role in overcoming the principal-agent problem (Arrow, 1968), allowing the landlord to ensure the tenant provides wise stewardship of the land on threat of losing trust and the associated social capital. A 25/75 subsidy split, in favor of the tenant, may in part underscore the value of trust and the cost of violating that trust. Fairness also provides a possible explanation for these findings.[28] Similar to the findings from ultimatum games in the lab (Guth, 1982), landlords may "return" a positive amount of the subsidy to the tenant due to a sense of fairness.

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[25] In the analysis, where the Herfindahls are averaged over tenants rather than counties, the mean (median) of the expenditures Herfindahl increases from 0.035 (0.024) to 0.041 (0.029) and the acres Herfindahl increases from 0.014 (0.008) to 0.015 (0.009) between 1992 and 1997.
[26] The U.S. Dept. of Justice classifies a market with a Herfindahl index below 0.1 as unconcentrated and between 0.1 and 0.18 as moderately concentrated. (http://www.usdoj.gov/atr/public/guidelines/horizon_book/15.html)
[27] Robison et al. (2001) provide evidence that social capital affects prices in the farmland market. Young and Burke (2001) demonstrate the influence of custom in determining contracts in the farmland rental market.
[28] I thank an anonymous referee for pointing out this possible explanation.

8 Conclusion

This paper examines the proportion of the marginal subsidy dollar captured by farmland owners. Using a nationally representative panel of farms to account for unobserved heterogeneity and exploiting exogenous subsidy variation caused by legislative changes to identify the effect of subsidies on rental rates and farmer net returns, the analysis demonstrates that landlords capture about one-fifth of the marginal subsidy dollar through higher rental rates. Seventy of the remaining 80 cents are accounted for in the tenant's net returns. The remaining 10 cents may be extracted by other input providers or may be lost due to measurement error. The approximately 25/75 landlord-tenant subsidy split holds across farm sizes and across regions in the U.S. The same pattern holds immediately following a subsidy change and in the medium to long-run.

Ultimately, farm policy appears to accomplish its stated purpose to increase farmers' income. This effect occurs directly, rather than indirectly through increased asset values, thereby benefitting all farmers, tenants and owner-operators alike. According to the 1996 Agricultural Resource Management Survey, 46 percent of subsidized acres are rented. Considering that 94 percent of landlords are not farmers, a back-of-the-envelope calculation suggests that only about 9 percent of farmland subsidies leave the agricultural sector.

This paper speaks more generally about the capitalization of location-specific policy effects into land values. Standard economic theory predicts that location-specific policy effects are capitalized into land values through competitive land markets. Relying on this theory, researchers have estimated the value of many non-market goods, e.g., the value of clean air (Greenstone and Chay, 2005) and health risks (Davis, 2004). However, this paper's findings suggest that the standard assumptions may not always apply. Imperfect farmland rental markets play a role in the low incidence of subsidies on landlords. This finding needs to be explored in other settings through careful attention to institutional details and the competitive environment.

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Table 1

Summary Statistics: U.S. Census of Agriculture Micro Files

	Program Crop Producers		Cash Renters		Sampled Renters	
	1992	1997	1992	1997	1992	1997
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Sample Size	672,090	579,606	157,419	120,502	59,934	59,934
Sum of Sampling Weights	774,218	652,911	337,948	298,463	194,872	194,872
Size (Acres)	651.62	729.13	865.11	940.39	825.46	881.17
	[290.00]	[320.00]	[465.00]	[500.00]	[480.00]	[508.00]
Cropland (Acres)	336.87	408.94	484.64	574.13	615.05	658.93
	[167.00]	[196.00]	[300.00]	[345.00]	[400.00]	[415.00]
Total Sales ($)	129,681.10	159,835.70	191,823.40	226,402.00	188,602.30	213,435.60
	[50,435.71]	[58,500.00]	[102,218.20]	[113,000.00]	[113,348.50]	[120,535.50]
Crop Sales ($)	84,830.89	116,478.30	128,916.30	168,381.30	111,287.70	155,041.00
	[28,315.24]	[37,917.50]	[56,067.03]	[74,487.00]	[50,425.00]	[72,975.00]
Sales ($/acre)	309.48	328.46	323.23	348.09	317.43	323.18
	[171.66]	[188.24]	[215.17]	[231.67]	[229.63]	[241.12]
Net Returns ($)	27,630.68	39,082.05	38,220.97	52,683.74	47,216.09	55,018.49
	[7,612.73]	[9,596.00]	[15,409.27]	[18,731.00]	[24,212.93]	[26,885.00]
Net Returns ($/acre)	59.57	68.46	63.74	75.69	72.84	77.86
	[28.24]	[33.80]	[32.90]	[40.19]	[48.57]	[54.45]
Positive Net Returns (prp. of farms)	0.693	0.714	0.720	0.741	0.749	0.757
Proportion of Farms Irrigating	0.129	0.140	0.146	0.156	0.137	0.141
Irrigated Acres	361.61	429.35	435.55	505.44	407.59	466.94
	[200.00]	[223.00]	[247.00]	[275.00]	[229.00]	[253.00]
Proportion of Total Acres Irrigated	0.470	0.489	0.454	0.470	0.440	0.445
	[0.426]	[0.453]	[0.392]	[0.410]	[0.375]	[0.375]
Subsidized Farms (prp of farms)	0.551	0.646	0.647	0.728	0.609	0.751
Subsidies ($)	10,202.63	8,006.11	12,790.65	10,117.84	14,019.60	9,967.58
	[4,923.44]	[4,000.00]	[7,006.60]	[6,000.00]	[8,440.40]	[6,252.00]
Subsidies ($/ Acre)	15.73	13.51	16.22	13.48	15.65	13.03
	[11.22]	[9.65]	[11.98]	[10.47]	[13.08]	[10.91]
Cash Renters (prp of farms)	0.437	0.459	--	--	--	--
Cash Rented Acres (acres)	--	--	548.94	601.10	532.66	553.87
	--	--	[262.00]	[296.00]	[300.00]	[300.00]
Cash Rented Acres (prp of total acres)	--	--	0.660	0.661	0.664	0.633
	--	--	[0.694]	[0.694]	[0.711]	[0.667]
Rental Rate ($/ Acre)	--	--	44.77	56.70	42.88	44.81
	--	--	[27.53]	[30.00]	[29.54]	[30.77]

Notes: The data are from the 1992 and 1997 confidential Census of Agriculture microfiles. Mean values are unbracketed, median values are bracketed. Columns 1 and 2 contain summary statistics for all farms that produced a program crop in that year. Columns 3 and 4 contain summary statistics for all farms that produced a program crop and cash rented some land in that year. Columns 5 and 6 contain summary statistics for the sample used in the analysis. The sample consists of all farms that returned the Census of Agriculture's long form in both 1992 & 1997, payed cash rent in both years, and reported growing program crops in 1992. Total irrigated acres and proportion of acres irrigated are conditional on using irrigation. Subsidies and subsidies per acre are conditional on receiving some subsidy. All monetary values have been adjusted to 1997 dollars.

Table 2 - Agricultural Subsidy Incidence 1992 - 1997

	Rental Rate								Net Returns per Acre	
	Pooled				FE		IV-FE		FE	
	(1)		(2)		(3)		(4)		(5)	
Government Payments	0.658	††	0.439	††	0.134	††	0.206	††	0.803	**
	(0.011)		(0.013)		(0.017)		(0.041)		(0.059)	
Sales			0.044	**	0.0310	**	0.0311	**		
			(0.001)		(0.0019)		(0.0019)			
Variable Costs			-0.018	**	-0.0049	*	-0.0051	*		
			(0.002)		(0.0023)		(0.0023)			
Farm Size (log acres)			-2.188	**	-8.1073	**	-7.976	**	-17.166	**
			(0.183)		(0.5268)		(0.5305)		(1.947)	
Proportion Irrigated			15.617	**	11.325	**	11.102	**	46.095	**
			(0.740)		(2.2797)		(2.2815)		(8.212)	
Proportion Pasture			-18.689	**	-6.776	**	-6.518	**	-38.423	**
			(0.819)		(1.5997)		(1.6025)		(5.529)	

Notes: The data are from the 1992 and 1997 confidential Census of Agriculture microfiles and consist of 59,934 farms that cash rented in both years and grew a subsidized crop in the base year. Fixed effects specifications control for a farm effect and a time-varying county effect. Regressions also control for proportion of sales revenue in 19 commodity groups and yield for 7 subsidized crops and soybeans. Heteroskedasticity-robust standard errors are in parenthesis. †† indicates significant difference from one at the 99th percentile. * indicates significance at the 95th percentile. ** indicates significance at the 99th percentile.

Table 3 - Agricultural Subsidy Incidence, Unanticipated and Long-run

	1997-1999		1997-2005				
Dependent Variable	Rental Rate	Net Returns	Rental Rate			Net Returns per Acre	
	FE-IV	FE	FE	FE-IV	Robust Regression	FE	Robust Regression
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Land Subsidy	0.347 ††	0.563 ††	0.136 ††	0.377	0.151	1.125 **	0.613
	(0.136)	(0.236)	(0.077)	(0.349)	(0.029)	(0.715)	(0.216)
Production Subsidy			-0.248	3.509	0.006	3.179	1.547
			(0.156)	(2.530)	(0.079)	(1.673)	(0.577)
Sales	0.014 **		-0.0150 **	-0.016	0.0061		
	(0.004)		(0.0076)	(0.008)	(0.0014)		
Variable Costs	-0.006 **		0.0424	0.0419	-0.0049		
	(0.005)		(0.0097)	(0.0102)	(0.0017)		
Farm Size (log acres)	-6.499 **	-50.850 **	-4.145 **	-3.643	1.614	-76.092 **	6.799
	(3.195)	(17.172)	(3.697)	(4.124)	(1.286)	(32.942)	(9.689)
Proportion Pasture	-11.976 **	27.438 **	1.242 **	4.802	-14.669	44.470 **	-75.752
	(6.242)	(41.039)	(11.397)	(11.992)	(3.362)	(111.382)	(28.794)
Time-varying County Effect	Y	Y	N	N	N	Y	Y
Obs.	5,587	5,587	2,972	2,972	2,972	2,307	2,307

Notes: The data are from the 1997 Census of Agriculture microfiles, the 1999 AELOS microfiles, and the 2005 ARMS. Each dataset consists of farms that cash rented in both years and grew a subsidized crop in the base year. Fixed effects specifications control for a farm effect and a time-varying county effect where indicated. The IV specifications in columns 1 and 4 use the county-level average subsidy, derived from USDA-Farm Services Agency administrative data obtained through a Freedom of Information Act request, to instrument for the relevant, potentially mismeasured farm-level subsidy. The 1997-2005 regressions also control for proportion of sales revenue in 19 commodity groups and yield for 7 subsidized crops and soybeans. Except for the robust regrssions, heteroskedasticity-robust standard errors are in parenthesis. †† indicates significant difference from one at the 99th percentile. ** indicates significance at the 99th percentile.

Table 4 - The Effect of Rental Market Concentration on the Subsidy Incidence
Coefficient on Government Payments & the Interaction Term Reported

	1992-1997			
	Main Effect		Interaction	
Interaction Term	(1)		(2)	
Herfindahl	0.301	**	-2.621	
Market Share = Rental Expenditures	(0.077)		(1.922)	
Herfindahl	0.451	**	-19.787	*
Market Share = Acres Rented	(0.113)		(8.723)	

Notes: See Table 1 and Table 2 notes for sample and covariates. The dependent variable is change in the cash rental rate. The Herfindahl indexes treat market share as a farm's proportion of total rental expenditure in the county, and a farms proportion of the total acres rented in the county. The instruments are the per-acre subsidies in 1997 and the per-acre subsidies in 1997 interacted with the measure of rental market concentration . * indicates significance at 95th percentile. **99th percentile

Appendix Table 1 - Selection into Renting Both Periods
Heckman Selection Estmation

	A. Selection				B. Rental Rates			
	ML		Two-Step		ML		Two-Step	
	(1)		(2)		(3)		(4)	
Government Payments	0.004	**	0.004	**	0.140	††	0.140	††
	(0.0004)		(0.0004)		(0.014)		(0.015)	
Revenue	0.0001	**	0.0001	**	0.0277	**	0.0277	**
	(0.0000)		(0.0000)		(0.0010)		(0.0010)	
Variable Costs	-0.0001	**	-0.0001	**	-0.0085	**	-0.0085	**
	(0.0000)		(0.0000)		(0.0012)		(0.0012)	
Farm Size (acres)	0.553	**	0.553	**	-7.856	**	-7.952	**
	(0.010)		(0.010)		(0.645)		(0.766)	
Proportion Irrigated	0.378	**	0.378	**	13.573	**	13.517	**
	(0.043)		(0.043)		(1.815)		(1.831)	
Proportion Pasture	-0.167	**	-0.167	**	-7.584	**	-7.550	**
	(0.035)		(0.035)		(1.503)		(1.510)	
Family Farm	-0.091	**	-0.090	**				
	(0.018)		(0.018)					
Partnership	0.046	*	0.046	*				
	(0.021)		(0.021)					
Residence on Farm	0.209	**	0.209	**				
	(0.014)		(0.014)					
Farmer is Primary Occ.	0.177	**	0.178	**				
	(0.033)		(0.033)					
Days Worked Off Farm	-0.0001		-0.0001					
	(0.0001)		(0.0001)					
Tenure as Farm Operator	0.017	**	0.017	**				
	(0.001)		(0.001)					
Tenure Squared	-0.0003	**	-0.0003	**				
	(0.0000)		(0.0000)					
Age	0.002		0.002					
	(0.003)		(0.003)					
Age Squared	-0.0001	**	-0.0001	**				
	(0.0000)		(0.0000)					
Rho					-0.014		-0.0226	
					(0.041)			
Sigma					47.342		47.344	
					(0.137)			
Lambda					-0.670		-1.071	
					(1.917)		(2.5776)	

Notes: Selection outcome is renting in 1997 conditional on renting in 1992. †† indicates significant difference from one at the 99th percentile. * indicates significant difference from zero at 95th percentile. ** indicates significance at the 99th percentile.

Appendix Table 2 -
Correlation Between Dependent Variable Measurement Error and Subsidies

	(1)		(2)		(3)
Government	0.066	**	0.033	**	0.003
Payments	(0.008)		(0.006)		(0.006)
Fixed Effects	None		State		County
N	11,924		11,924		11,924

Notes: The dependent variable is the difference between cash rental expenditures over all rented acres and cash rental expenditures over cash-rented acres. The data are from the 1999 Agricultural Economics and Land Ownership Survey. The sample consists of all farms that reported cash renting or both cash and share renting. Heteroskedasticity-robust standard errors are shown in parentheses. The covariates are the amount of sales per acre, the total cost per acres excluding rent, the value of assets per acre , the value of debt per acre, and the value of new machinery per acre. All dollars have been deflated to 1997 dollars. ** indicates significance at 99th percentile.

Appendix Table 3 -
1992-1997 FE-IV First Stage
1997 Subsidy as Instrument

1997 Government Payments	0.645	**
	(0.007)	
Sales	-0.0010	
	(0.0003)	
Variable Costs	0.0020	**
	(0.0004)	
Farm Size (acres)	-1.119	**
	(0.1304)	
Proportion Irrigated	1.312	**
	(0.6733)	
Proportion Pasture	-2.999	**
	(0.3385)	
First Stage F-stat	7,576	
Partial-R^2	0.222	

Notes: See notes to Table 1 and Table 2. Control variables are the same as those used in Table 2. Heteroskedasticity-robust standard errors are in parenthesis. * indicates significant difference from zero at 90th percentile. ** indicates significance at the 99th percentile.

Appendix Table 4 - Regional Incidence Estimates
Coefficient on Government Payments Reported

Region	Rental Rate Incidence		Net Returns Incidence	
Heartland	0.324	**	0.811	**
	(0.059)		(0.104)	
Northern Crescent	0.011		0.411	**
	(0.107)		(0.168)	
Northern Great Plains	0.048		0.135	
	(0.133)		(0.162)	
Prarie Gateway	-0.151		0.915	**
	(0.119)		(0.174)	
Eastern Uplands	0.484	*	0.910	**
	(0.248)		(0.372)	
Southern Seaboard	0.270	**	0.716	**
	(0.139)		(0.184)	
Fruitful Rim	0.392	*	0.939	**
	(0.203)		(0.218)	
Basin and Range	-0.342		0.758	
	(0.428)		(0.721)	
Mississippi Portal	0.165	*	1.070	**
	(0.094)		(0.098)	

Notes: Heteroskedasticity-robust standard errors are shown in parentheses. * indicates significance at 90th percentile. ** indicates significance at 95th percentile.

Appendix Table 5 - Sales Class Incidence Estimates
Coefficient on Government Payments Reported

	IV Fixed Effects			
1992 Sales	Rental Rates Incidence (1)		Net Returns Incidence (2)	
< $10,000	0.181		2.351	
	(0.557)		(6.842)	
$10,000 - $100,000	0.061		1.095	**
	(0.146)		(0.246)	
$100,000 - $250,000	0.165	**	0.762	**
	(0.076)		(0.107)	
$250,000 - $500,000	0.133	**	0.706	**
	(0.064)		(0.087)	
$500,000 +	0.318	**	0.897	**
	(0.087)		(0.126)	

Notes: ** indicates significance at 95th percentile. Sales class taxonomy defined by the USDA Economic Research Service.