Who Really Benefits from Agricultural Subsidies? Evidence from Field-level Data

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Abstract The idea that agricultural subsidies are fully capitalized into farmland values forms the foundation of the argument that removing subsidies would drastically reduce farmland asset values. Surprisingly little evidence substantiates this claim. Using field-level data and explicitly controlling for potentially confounding variables we find that landlords only capture between 14–24 cents of the marginal subsidy dollar. The duration of the rental arrangement has a substantial effect on the incidence. Initially, landlords extract 44 cents of the marginal subsidy dollar, but the incidence falls by 1.5 cents with each additional year of the rental arrangement. This duration effect reveals that rental market frictions play an important role in the farmland rental market.

Introduction

In the twenty-first century, subsidized American farmers have gleaned, on average, $8,824 annually in subsidy payments, making agricultural subsidies one of the largest per-capita transfer programs in the U.S. Farmers, however, might not fully benefit from subsidy payments. According to conventional wisdom, subsidies ultimately are capitalized into land values, benefiting farmland owners.[1] Farmers in the U.S. own only 62 percent of the farmland—non-farmer landlords own the remaining 38 percent. Subsidy recipients are even less-likely to own the land they farm. If the conventional wisdom holds, over half of all farm subsidies end up in the pockets of non-farmers. Surprisingly little evidence, however, substantiates the conventional wisdom. Recent evidence from farm-level data, in fact, indicates that only 23 to 64 cents of the marginal subsidy dollar gets capitalized into farmland values (Goodwin, Mishra, and Ortalo-Magné, 2005; Kirwan, 2009).

One concern with recent estimates is their use of aggregate data. The fundamental unit in the theory of agricultural subsidy incidence is the plot of land being sold/rented, i.e., the field. This paper

[1] Bruce Gardner summed up the conventional wisdom when he testified to the House Committee on Agriculture that, "One of the things that I think is fairly well agreed upon … is that the way in which [subsidy programs] affect farmers' income is … [by] holding up land values and land rental values" (USCongress2001). The Washington Post echoed that sentiment when it reported, "The farm payments have also altered the landscape and culture of the Farm Belt, pushing up land prices and favoring large, wealthy operators" (Morgan, Gaul, and Cohen, 2006). Robert Reich echoed popular sentiment when he wrote in the Wall Street Journal that, "The lavish farm subsidies contained in the new farm bill won't make the nation more secure. They will only stimulate even more production, inflate land values, and make it more difficult for developing nations to export food to us, perpetuating world poverty" (Reich2001).

augments recent farm-level analysis focused on subsidy capitalization by using nationally representative field-level data to test the theory at the appropriate level. These unique field-level data pair a field's subsidy rate with its rental rate. Farm-level analysis, in contrast, pair the farm-average rental rate to the farm-average per-acre subsidy. Although previous analysis (Roberts, Kirwan, and Hopkins, 2003, Kirwan, 2009) used farm-level longitudinal data to control for farm-level unobserved heterogeneity, the incidence question fundamentally calls for field-level data to relate changes in the subsidy per acre to changes in the per-acre rental rate. The farm-level incidence estimate may be biased downward if farmers own most of their subsidized acres and lease unsubsidized acres. In the extreme case where no subsidized acres are rented, but the farmer owns subsidized acres, a farm-level analysis would estimate no relationship between subsidy changes and rental rate changes, even if the implicit rental rate of subsidized acres rises one-for-one with the marginal subsidy dollar

This paper overcomes the farm-level aggregation issue by bringing field-level data to bear on the question. Using a nationally representative sample of soybean and rice fields, we find that landlords extract less than one-quarter of the marginal subsidy dollar through higher rental rates. These findings provide further evidence that subsidies are not fully capitalized into the land values. The findings also restore confidence in the usefulness of farm-level data to address important policy questions.

This paper also begins to explain why theory and evidence diverge substantially by examining the institutions surrounding the farmland rental market. We find evidence that landlords are typically retired and often depend heavily on the income stream provided by the farmland, as if it were an annuity. Evidence of thin rental markets, i.e., few tenants, combines with landlords' inelastic demand for tenants to provide the marginal tenant with substantial bargaining power.

The Incidence Question

A common weakness of the subsidy-incidence literature is the inability to credibly identify the causal relationship between subsidies and farmland values. This identification problem arises from estimating a fundamentally unidentified system. Consider the standard workhorse model of farmland value determination: the present value model (e.g., Melichar, 1979; Robison et al., 1985). Many unknowns characterize the present value model. The unknowns of greatest concern are the expected subsidy stream, the discount rate, and the proportion of the subsidy that becomes capitalized into the land value, i.e., the incidence. The present value model, however, is a single equation. As a system, the present value model of land price determination is underidentified. No parameter of this system can be identified without further information or restriction on the other unknown parameters. Typically, investigators assume (often implicitly) that the entire subsidy dollar gets capitalized into the land value, thereby restricting the incidence parameter to equal one.

Consequently, investigators have left unanswered the most policy-relevant question: what proportion of the marginal subsidy dollar is capitalized into land values? The answer to the question confirms or repudiates the conventional wisdom that the landowner primarily benefits from agricultural subsidies, and it clarifies who ultimately benefits from agricultural subsidies and how much they benefit. The incidence question lays the groundwork for welfare analysis of agricultural subsidies and illustrates the distribution of subsidy benefits. Knowing the incidence of the marginal subsidy dollar enlightens our understanding of the political process by illuminating the value transferred to key constituencies.

To study the incidence question, one must appropriately deal with expected subsidies and the discount rate. Roberts, Kirwan, and Hopkins (2003) and Kirwan (2009) demonstrate how to do this

by focusing on the farmland rental market. Because rental rates are per-period prices reflecting the productive value of agricultural land, this approach avoids making assumptions about expectations or the discount rate over future periods. These investigators can cleanly estimate incidence without relying on strong assumptions about other key parameters.

The Farmland Rental Market

In the U.S., farmers rent 360 million acres of farmland, an area equal to 38 percent of all farmland and comparable to all the farmland in the Midwest. Table 1 reports statistics on the farmland rental market from the 1992, 1997, and 2002 Censuses of Agriculture. In 2002, farmers paid $8.7 billion in cash rent, a 47% increase from 1992. This expense accounted for 11.3 percent of total production expenditures by renters. At the same time the number of tenants fell 25 percent while their farm sizes increased 11 percent. The farmland rental market is considerable in size.

Table 1: Farmland Rental Market Descriptive Statistics

		1992	1997	2002
Number of Renters	Total	813,814	763,493	648,147
Number of Farms	Total	1,919,432	1,905,803	1,856,138
Farm size (acres)	Mean	491	482	491
	Median	128	120	108
Farm size of Renters (acres)	Mean	795	794	886
	Median	290	280	300
Acres Rented by Renter	Mean	502	493	540
	Median	160	150	150
Proportion of Farm Rented	Mean	65.31%	64.94%	62.65%
	Median	70.41%	69.81%	66.25%
Cash Rent Expenditures	Total ($ millions)	5.94	6.9	8.71
	Proportion of Total Cash Expenditures	8.89%	9.32%	11.28%
Number of Rented Acres	Total (millions)	409	377	350
Proportion of Farmland Rented		43.4%	41.0%	38.4%

Notes: Data are from the Censuses of Agriculture. Weights used in 2002 constructed to be comparable with 1992 and 1997 weights.

The farmland rental market is also an important market for subsidized land. The 1999 Agricultural Economics and Land Ownership Survey (AELOS) reveals that farmers rent a majority of cropland acres, which are the only type of land that is subsidized. Data from the 1996 Agricultural Resource Management Survey (ARMS) indicate that 45 percent of *subsidized* acres are rented. Assuming no large changes in tenancy between 1996 and 1999, these facts suggest that owners are just a little more likely than tenants to operate subsidized land.

According to the 2007 Census of Agriculture, the average tenant farms about 30 percent more land than the typical subsidized-crop producer. Tenants are also more profitable on average, earning 6 percent more per acre than the average farm, and they are 8 percentage points more likely to receive subsidies.

According to conventional wisdom, landowners are the primary beneficiaries of agricultural subsidies. In the U.S., non-farmer landlords own 87 percent of rented farmland. Since the vast majority of rented, subsidized land is likely owned by non-farmers, the conventional wisdom implies a significant share of agricultural subsidies leaves the agricultural sector and accrues to non-farmer landlords.

A New Approach

This paper overcomes the potential shortcoming of previous work by using novel, acreage-level data to estimate the incidence of agricultural subsidies on farmland rental rates. In 2006, the USDA's Agricultural and Resource Management Survey (ARMS) phase II survey of soybean and rice fields elicited information on rent paid and subsidy payments received on all cash-rented parcels of land. The survey also obtained information on expected yields and historical rotations, which serve as powerful controls for land quality. The data are unique in that they link subsidies to the specific cash-rented parcels to which the subsidies are tied. Table 2 contains summary statistics from these data.

Table 2 illustrates some differences between soybean fields and rice fields. Notably, the average rice-field rental rate is 30 percent higher than that of the average soybean field. This reflects both the higher yield, 41.6 bushels/acre of soybeans versus 72.7 bushels/acre of rice, and an historically higher price. Rice acres receive substantially higher subsidies, too. At nearly \$60/acre, the average rice subsidy is 3½ times greater than the \$17/acre average soybean subsidy. Further contrasts are that the rice field is almost twice as likely to be harvested for seed, and the crop rotation for rice fields is evenly spread between a rice-soybean rotation, continuous rice, and a rice-fallow rotation. In contrast most soybean fields are in a corn-soybean rotation. Overall, the summary statistics suggest that rice and soybean fields are sufficiently distinct to warrant separate analysis.

Identification

The model we use to estimate the incidence of agricultural subsidies on farmland rental rates is

$$Rent_i = \alpha + \gamma Subsidy_i + \beta X_i + Region_j + \varepsilon_i, \tag{1}$$

where $Rent_i$ is the rental rate for field i. The per-acre Direct Payment subsidy is $Subsidy_i$. X_i is a vector of observable covariates, including field-level costs and returns. Regional differences in production practices are accounted for by $Region_j$, a fixed effect for region j.

To identify the subsidy incidence parameter in equation (1), we exploit an element of randomness in how U. S. farmland subsidies are determined. U. S. farmland subsidies are based on an acre's historic, *realized* productivity. Specifically, an acre's subsidy is determined by the yield of the primary crop grown on the land in 1980-1984 or 1998-2002, called the *program yield*. Because it is based on *actual* production, the program yield is partly determined by the land's underlying productivity, and partly determined by exogenous, idiosyncratic shocks (e.g., weather and pests) during the reference period. This random variation is a key component of the variation used to identify the subsidy incidence.

To isolate this random variation, we must control for the land's inherent productivity. We use the producer's *yield goal* to account for the land's underlying productivity. According to the USDA, "recommended fertilizer application rates are often based on the yield goal of the producer" (RiskManagementAgency2009).

Table 2: Summary Statistics 2006 ARMS, Phase 2

	Soybean Fields		Rice Fields
Rental Rate	81.39		105.45
	(40.04)		(58.40)
Subsidy/Acre	17.20		59.69
	(15.08)		(64.52)
Expected Yield	43.76		–
	(13.05)		–
Actual Yield	41.58		72.73
	(14.86)		(11.53)
Proportion Irrigated	0.078		–
	(0.263)		–
Proportion of Acres Enrolled in a Conservation Program	0.083		0.119
	(0.277)		(0.325)
Proportion Classified as:			
Highly Erodible	0.165		0.006
	(0.372)		(0.079)
Wetland	0.035		0.006
	(0.184)		(0.079)
Proportion of Field Harvested for:			
Beans	0.979	Grain, First Crop	0.967
	(0.141)		(0.171)
Hay	0.002	Grain, Ratoon Crop	0.090
	(0.039)		(0.284)
Seed	0.014	Seed	0.023
	(0.116)		(0.148)
Other	–	Other	0.009
	–		(0.088)
Abandoned	0.006	Abandoned	–
	(0.072)		–
Crop Rotation:			
Corn-Soybeans	0.662	Rice-Soybean	0.313
	(0.474)		(0.465)
Soybeans-Soybeans	0.186	Rice-Rice	0.363
	(0.389)		(0.482)
Idle-Soybeans	0.037	Idle-Rice	0.281
	(0.188)		(0.451)
Other-Soybeans	0.116	Other-Rice	0.044
	(0.320)		(0.205)
Obs	660		160

Notes: Summary statistics reported are mean and, in parenthesis, standard deviation of variables from cash rented fields in Phase 2 of the 2006 Agricultural and Resource Management Survey. Soybean yield is bushels/acre; rice yield is hundredweight (cwt).

Producers have an incentive to set an accurate yield goal; an overly optimistic goal, for instance, leads to higher costs due to greater fertilizer use, but not higher revenue. The reported yield goal, therefore, accurately reflects the field's underlying productivity. Armed with this information, we explicitly control for the fundamental characteristic that typically confounds the incidence analysis, namely each field's inherent productivity. We thereby isolate the random component of subsidy variation and determine the causal effect of subsidies on farmland rental rates.

Results

Rental Rates Incidence

In light of the differences between rice and soybean fields illustrated in table 2, we initially perform the analysis separately for each crop. Results from this analysis are reported in tables 3 and 4. Table 3 contains the results using the sample of soybean fields to estimate equation (1). The first column reports the results of a simple bivariate regression of rental rates on subsidies. At the field level, before controlling for any field characteristics we estimate an incidence of 0.45; in other words, rental rates increase by 45 cents with the marginal subsidy dollar. Even the simple correlation rejects the conventional wisdom that the landlord extracts a substantial portion of the marginal subsidy dollar. Controlling for observable characteristics of the soybean fields, including the farmer's estimate of the underlying productivity, lowers the incidence estimate to 0.25. Accounting for region-specific unobserved heterogeneity, such as marketing channels or large weather shocks, with region fixed effects leaves the result essentially unchanged.

Table 4 contains the results for the sample of rice fields. Here the story is very much the same. The bivariate relationship in column one is very different than the conventional wisdom, which posits the coefficient should equal 1. Here, the coefficient is 0.16, but it is statistically indistinguishable from zero. Adding covariates to control for field level observable characteristics provides a statistically significant estimate of 0.19. Including region fixed effects results in a still-significant 0.14. This estimate is substantially smaller than the soybean-subsidy incidence, suggesting that differences in the farmland-rental market structure could help explain the lower-than-expected incidence estimates.

Although the soybean and rice farmland rental markets appear to be somewhat different, both reveal that landlords capture a surprisingly low portion of the marginal subsidy dollar. Table 5 combines the two crops into a single analysis. The bivariate relationship reveals a 0.27 estimate; the estimate falls to 0.14 after controlling for observable field characteristics, and ultimately the combined analysis yields an incidence estimate of 0.08. In any case, the conventional wisdom that landlords extract a substantial share of the marginal subsidy dollar appears to be wrong.

Net Returns

The analysis above establishes that landlords extract 14-25 cents of the marginal subsidy dollar through higher rental rates. The remaining 75-85 cents might be captured by other input providers, or might be reflected in the tenant's net returns. Whether the remaining subsidy accrues to the tenant or another factor of production owner is an empirical question. Following the identification strategy outlined above, we examine the effect of the marginal subsidy dollar on tenants' net returns, controlling for field quality and farming practices. Column 4 of table 3 reports the results for soybean fields. Sixty-three of the remaining 76 cents are retained by the tenant farmer, implying that other input

Table 3: Field-Level Agricultural Subsidy Incidence: Soybeans

Dependent Variable:	Rental Rate			Net Returns
	Bivariate	Controls	Region FE	Region FE
Government Payments	0.476 †††	0.250 †††	0.240 †††	0.627 ***
	(0.116)	(0.091)	(0.088)	(0.192)
Gross Value		0.147 ***	0.121 ***	–
		(0.018)	(0.018)	
Costs		-0.035	-0.018	–
		(0.024)	(0.024)	
Expected Yield		1.359 ***	1.233 ***	-1.733 ***
		(0.191)	(0.184)	(0.434)
Actual Yield		0.076	0.069	3.641 ***
		(0.163)	(0.156)	(0.295)
Corn-Soy Rotation		14.034 ***	11.683 ***	2.146
		(4.12)	(3.70)	(9.76)
Proportion Irrigated		7.77	14.66 *	-117.16 ***
		(7.66)	(7.57)	(12.75)

Notes: The data are from the 2006 Agricultural Resource Management Survey, Phase 2 and consist of cash-rented rice fields on 160 distinct farms. The fixed effects specification controls for region effects. Regressions also control for proportion of field harvested as first-crop rice, ratoon, or seed, rice-soybean rotation and a fallow-rice rotation, as well as measure of the environmental sensitivity of the land, i.e., whether classified as highly erodible or as a wetland. Heteroskedasticity-robust standard errors are in parenthesis. †† indicates significant difference from one at the 99th percentile. * indicates significance at the 90th percentile. ** indicates significance at the 95th percentile.

Table 4: Field-Level Agricultural Subsidy Incidence: Rice

Dependent Variable:	Rental Rate		
	Bivariate	Controls	Region FE
Government Payments	0.163 ††	0.185 ††	0.140 ††
	(0.101)	(0.086)	(0.058)
Actual Yield		1.12 **	0.49 **
		(0.38)	(0.21)
Proportion of Field		81.39 **	-(5.23)
Harvested for Seed		(22.88)	(15.30)
Rice-Rice Rotation		53.52 **	37.88
		(23.35)	(23.50)

See notes to table 3.

Table 5: Field-level Agricultural Subsidy Incidence: Soybeans and Rice

Dependent Variable:	Rental Rate		
	Bivariate	Controls	Region FE
Government Payments	0.266 ††	0.138 ††	0.07 9 †
	(0.062)	(0.056)	(0.042)
Actual Yield		0.534 **	0.280 **
		(0.093)	(0.081)
Proportion of Field		42.642 **	24.750 **
Harvested for Seed		(10.971)	(7.937)
Corn-Soy Rotation		33.623 **	27.250 **
		(4.232)	(4.003)
Rice-Rice Rotation		-2.511	-8.970
		(15.740)	(15.675)

See notes to table 3.

providers gain just 13 cents from the marginal, land-specific subsidy dollar. The important conclusion is that, contrary to conventional wisdom and standard economic theory, the vast majority of the marginal subsidy dollar stays with the tenant farmer.

Discussion

The full capitalization of farmland-specific subsidies, e.g., Direct Payments under the current farm bill, is one of the simplest, most basic theories in economics. Our findings, however, fail to support the theory. Why? We posit some possible explanations, and look to the institutions surrounding farmland rental markets for support.

One of the fundamental assumptions behind the standard model of economic incidence is perfect competition. Yet the farmland rental market might not be perfectly competitive. Kirwan (2009) found evidence that tenants have some market power. Market power may arise as farms grow larger and distance between parcels embodies transactions costs that could limit local competition. Additionally, Young and Burke (2001) hypothesize that social norms may play a role in share-rent contracts, and they find evidence supporting this hypothesis. Examining the available data on the farmland rental market and the tenant-landlord relationship could inform us of the degree of market competition and the reasonableness of Young and Burke's social norms hypothesis.

Farmland Rental Market Frictions

The empirical results demonstrate the failure of the standard economic model to explain the farmland rental market. As with many other markets, the perfect-information, frictionless-markets assumptions may be untenable. Explaining the incidence results requires a closer look at how the farmland rental market functions. One exceptional characteristic of the farmland rental market is the longevity of tenant-landlord relationships. Allen and Lueck (2002) report an 11.5-year average tenant-landlord

relationship duration in Nebraska and South Dakota. In Illinois, Sotomayor, Ellinger, and Barry (2000) report the mean tenant-landlord relationship duration to be 14.4 years. According to the 2006 ARMS data, the average rental duration among soybean producers is 13 years, and the median duration is 10 years.

Long-lived contracts may be indicative of several rental-market frictions. For instance, heterogeneous land and farmer quality might result in a landlord-tenant matching problem. This explanation implies that once tenants and landlords find a suitable match, the likelihood of separation will be low and decreasing with longer-lived matches. Alternatively, transaction costs could explain long-lived contracts, but this implies that the separation likelihood would increase with contract length as fixed transaction costs are spread over a longer period.

We explore the role of rental arrangement duration in the incidence findings by introducing the duration of the landlord-tenant relationship into the model and interacting it with the subsidy measure. Table 6 contains the results of this analysis. Column 1 repeats the results from column 3 of table 3. Column 2 reports the results of introducing relationship duration as a regressor. The rental duration has a substantial direct effect—it reduces the rental rate by 32 cents for every year of rental arrangement. A tenant in the 10th year renting form the same landlord (the average relationship duration is 10.2 years) pays $3.20 less per acre than a tenant renting from a landlord for the first time.

Table 6: Subsidies Interacted with Rental Duration: Soybeans

Dependent Variable:	Rental Rate		
	(1)	(2)	(3)
Government Payments	0.240 †††	0.243 †††	0.431 †††
	(0.088)	(0.087)	(0.150)
Rental Duration		-0.320 ***	-0.169
		(0.114)	(0.141)
Gov't Payments*Rental Duration			-0.015
			(0.009)

Notes: Full model with covariates and regional fixed effects.

Notably, the incidence estimate is unaffected by directly controlling for the rental duration. Column 3 reports the results of including the interaction of the subsidy with rental duration, along with the main effects. Interestingly, interacting the rental duration with the subsidy results in a substantial change to the direct incidence estimate, which nearly doubles to 0.44. The direct effect of the rental duration becomes insignificant, while the interaction term is marginally significant with a p-value of 0.105. According to these estimates, the rental rate incidence falls by about 1.5 cents for every year of rental duration. At the median duration (10 years) the rental rate is 15 cents (roughly 33 percent) lower than in the first year of the rental arrangement.

The Tenant–Landlord Relationship

The tenant-landlord relationship is an important, yet relatively unstudied aspect of the farmland rental market. Allen and Lueck (2002) report simple contractual arrangements, often "sealed with

a handshake." Typically, rental contracts are renegotiated annually (Allen and Lueck, 2002), but, as noted above, tenant-landlord relationships appear to be quite long-lived. Little more, however, is known of the representative tenant-landlord relationship. Nationally representative data do not exist to answer fundamental questions such as: How do tenants and landlords match? Why are tenant-landlord relationships so long-lived? Do rental rates adjust annually, or only when there is a new tenant-landlord match?

Understanding tenant and landlord characteristics can facilitate a better understanding of tenant-landlord relationships. Plausibly, market dynamics and tenant's bargaining power differ when negotiating with investor-employed land management company compared to a local retired farmer. We may gain insight into the unexpected incidence findings by examining the characteristics of landlords.

Generally, farmland rental contracts are between a farmer and a non-farmer landlord; the 1999 AELOS, which surveys every landlord associated with a random sample of farm operators, gives a glimpse at the characteristics of non-farmer landlords. As reported in table 7, the median non-farmer landlord is retired (52 percent are), and nearly half (42 percent) of the retired landlords are retired farmers. The median age among retired landlords is 74. Figure 1 illustrates the importance of rental income as a share of total income by landlord type. Overall, 39.27% of landlords derive less than 1% of their income from farmland rentals. On average, farmland rents comprise between 1%-25% of total income for 38.58% of landlords. The remaining 22.15% of landlords receive more than 25% of their income from farmland rent. The overall averages, however, mask substantial variation across landlord types. As illustrated in figure 1 and reported in table 7, rental income comprises more than half of total income for 11 percent of non-farmer landlords. Retired farmer landlords are particularly dependent on rental income; 29 percent of them derive over half of their income from renting out farmland.

Another important characteristic of non-farmer landlords is their proximity to the rented land. A majority (51 percent) of non-farmer landlords live within 5 miles of the land they rent out. Nearly 70 percent live within 25 miles, and only 13 percent live more than 150 miles away. Although landlords generally live near their farmland, not all landlords are rural residents. Forty-eight percent of all landlords live in a non-rural setting. Thirty-eight percent of all landlords live on a farm. These data provide some insight into the workings of the farmland rental market and the landlord-tenant relationship. They indicate that landlords are close enough to their land and, since they are retired, have enough time to monitor the tenants' use of the land. Landlords also might be subject to social norms as Young and Burke (2001) suggest. Since most landlords are local, they likely interact with their tenants in other settings. Because rental income can be a large share of landlord income, it is important for landlords to find a tenant rather than leave their land idle. These characteristics suggest that tenants will have some bargaining power. That power derives from the landlord's social and search costs associated with breaking a relationship with a current tenant and establishing a relationship with a new one. While such costs are likely bi-lateral, it is not difficult to imagine how these departures from perfect competition could allow tenants to extract a share of subsidy benefits.

Conclusion

Economists have long suggested that agricultural subsidies become fully capitalized into farmland values, and that subsidies only benefit farmers inasmuch as they are landowners. This paper refutes

Table 7: Characteristics of Non-farmer Landlords by Occupation

	All	Retired, non-farm related	Retired, farm-related	Private, Non-farm Employ-ment	Self-employed, Non-farm related	Government Employee	Self-employed, farm related	Other
Proportion of All Non-farmer Landlords	100.00	31.61	23.53	21.92	9.86	5.46	2.27	5.35
Median Age	67	73	77	52	56	53	57	63
Median Household Income	58,200	60,000	39,469	75,000	102,808	70,000	40,496	60,000
Median Total Rent Receipts	3,300	2,681	6,858	1,943	3,231	2,253	6,430	2,933
	Proportion of Landlords in Each Category							
Share of Household Income from Rent								
<1%	39.27	43.24	18.40	52.10	48.38	47.09	16.85	39.85
1-25%	38.58	41.39	31.92	38.59	42.48	45.19	31.86	40.16
26-50%	11.04	9.32	20.78	6.28	6.26	4.07	22.22	9.03
51-75%	5.28	3.74	13.28	1.36	1.73	2.21	9.48	3.10
76+%	5.83	2.31	15.63	1.67	1.15	1.43	19.59	7.86
Type of Residence								
On-farm	30.09	24.50	41.04	29.55	21.52	27.36	43.63	30.03
Rural Off-farm	25.46	24.10	21.84	29.99	27.80	28.40	27.09	22.92
Non-rural/Urban	44.45	51.40	37.12	40.47	50.68	44.23	29.28	47.05
Proximity of Residence to Rented Land								
0-5 miles	53.13	47.64	62.12	56.90	44.11	48.71	59.61	49.04
6-25 miles	19.66	20.24	23.47	15.28	21.39	14.47	24.77	17.45
26-50 miles	5.90	5.69	4.70	6.01	8.27	7.90	4.62	6.10
51-150 miles	7.29	8.28	3.60	8.31	8.21	12.08	5.35	7.64
151+ miles	14.02	18.15	6.10	13.51	18.02	16.84	5.65	19.77

Notes: Data from the 1999 Agricultural Economics and Land Ownership Survey. Median household income is imputed using total rent received and a question categorizing the share of rent in total household income in five categories: 0-1%, 1-25%, 25-50%, 50-75%, and 75-100%. Imputed income is based on category midpoints.

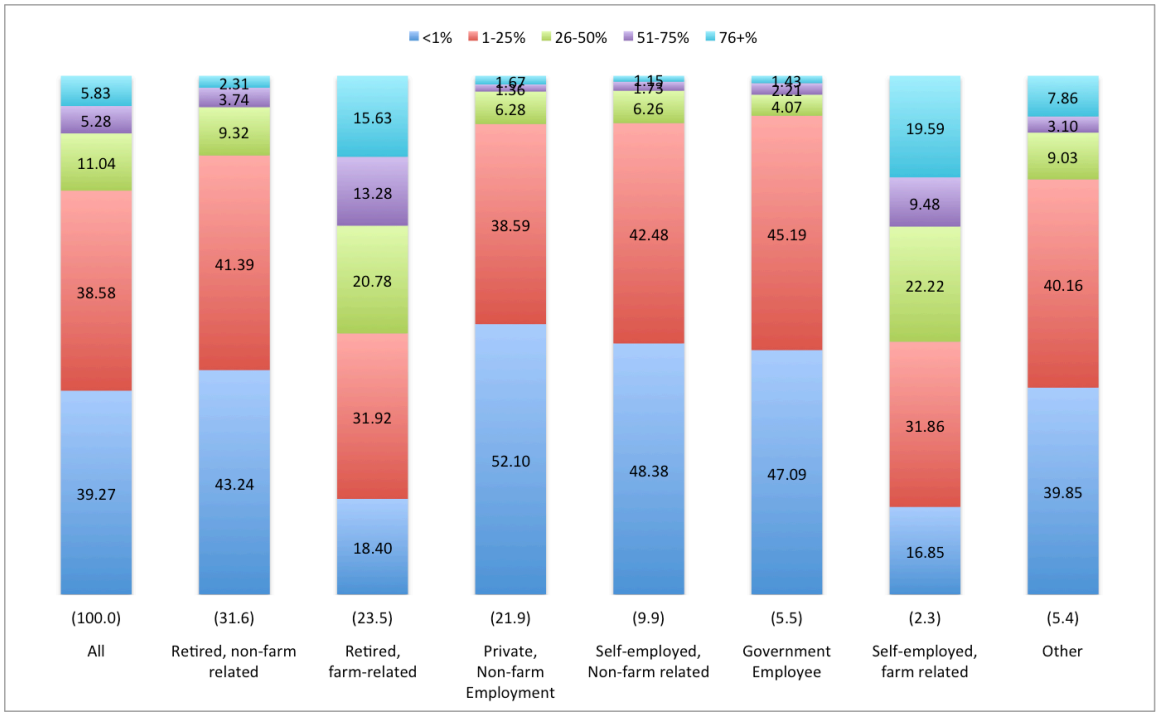

Figure 1: The Share of Landlord's Income From Farmland Rentals

that notion by demonstrating that the landowner captures only 14 – 24 cents of the marginal subsidy dollar. Notably, this estimate is nearly identical to that found by Kirwan (2009) using farm-level data.

This paper improves on previous analysis by using data at the appropriate level of aggregation and explicitly controlling for each field's fundamental productivity, thereby overcoming omitted variable bias. Subsidies are a positive function of the subsidized land's underlying productivity, hence, failure to account for the land's fundamental productivity results in an upward biased incidence estimate. We explicitly control for the farmland's underlying productivity by using farmers' self-reported expected productivity of the field. Using field-level data, which is commensurate with the unit of analysis in standard incidence theory, we find that farmland rental rates for subsidized soybean fields increase by 24 cents with the marginal subsidy dollar, and subsidized rice field rental rates increase by only 14 cents.

To explain the low incidence estimate we look to the limited data on the farmland rental market structure. Available evidence on tenant-landlord relationships indicates that landlords have a relatively inelastic demand for tenants. Coupled with the increasing size of tenant farms, tenants appear to have substantial bargaining power, enabling them to extract most of the subsidy rents.

Our findings about the incidence of subsides on land rents could have broader implications. Many articles in the popular press, for example, have informally connected subsidies to land values and growth in large farms [cites—old Becker articles?]. The explanation we propose—tenant bargaining power—is consistent with evidence that subsidies contribute to farm-size growth and farm consolidation (Key and Roberts, 2006). By capturing the majority of the subsidy, tenant farmers effectively pay less rent on subsidized land. Tenants who face a lower marginal rental rate will rent more subsidized land and, consequently, have larger farms. This mechanism is self-reinforcing: the larger

the farms, the greater their market power in the local land market, and the greater tenant farmers' incidence of subsidy benefits. More work and data in this area are needed.

This paper overcomes several endogeneity concerns and uses unique data to answer one of the most fundamental questions of agricultural policy analysis: How much of the marginal subsidy dollar accrues to the landowner? We also highlight the need for more data on the farmland rental market to adequately explain the severe departure from basic economic theory, and we explain how subsidy incidence could have broader implications for the future structure of farming.

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