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Analyzing Direct Payments to U.S. Farm Households: Addressing the ‘Distribution Gap’

Jeffrey W. Hopkins, Mitchell Morehart and Mary Bohman *

Using data on U.S. farms and the households that farm, we present a distributional analysis of the impacts of decoupled payments on farm household well-being, considering both the unequal distribution of direct payments across the recipient population as well as the unequal pass-through from producers to landowners. Results show that heterogeneity in payments and heterogeneity in program “base acre” ownership combine in important ways. These impacts are important for understanding how production distortions may be caused by the payments, and are not captured by typical “representative agent” models. Results are viewed relative to several dimensions of well-being and relative to using either the firm or the household as the unit of analysis.

In the U.S., from the 1996 farm bill onwards, lump sum subsidy payments were put in place to reform the previous target price and deficiency payment support provided to farmers. The Production Flexibility Contracts (PFC) payments of the new farm policy are directed to producers as a lump sum rather than a per-unit subsidy and are determined by historical production and yields rather than current production. The new policy and the concept of a ‘decoupled’ payment are considered by the World Trade Organization to have minimal effects on commodity market prices and therefore trade. Although decoupled programs don’t intervene in the commodity price received by producers directly as previous programs did, they have been criticized for having non-price effects that can indirectly influence production and trade.

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These indirect effects, also called ‘non-price’ effects because they don’t directly change relative prices, may nonetheless induce farmers to produce more or less than they otherwise would and where sufficiently large could ultimately also be distorting. The most commonly cited non-price effect of a direct payment is the ‘wealth effect’ or the causal effect of exogenous changes in wealth or income on individual behavior. The premise of the wealth effect is that when the value of equities rise people feel more comfortable about consuming things they derive positive utility from, where consumption is defined broadly so as to include leisure. The other non-price effect discussed in the literature is the ‘insurance effect’ or the effect of a payment on the level of risk to which producers are exposed (OECD). The insurance effect occurs when producers who are risk averse and when shielded from risk through a direct payment engage in more risky undertakings than they otherwise would. Non-price effects, then, are conceptually a function of both the lump sum received and the particular characteristics of farms and the households that farm.

Representative agent and other macro-based models are often ill-equipped to estimate non-price effects that emerge due to the particular characteristics of farms and the households that farm when these vary a great deal across the economy. Therefore, the policy prescriptions they provide could exhibit a broad ‘distribution gap’. We point out some additional insights gained through explicit recognition of microdata-based heterogeneity in the evaluation of lump sum transfers, and indicate where the welfare and political economic approaches are most likely to differ. We conclude that the ‘representative agent’ framework adopted by the macroeconomic and general equilibrium literature for policy evaluation becomes increasingly misleading when considering the non-price effects of policies, making explicit consideration of heterogeneity increasingly desirable.

The rest of the paper proceeds as follows. In the next section conditions under which assumptions about heterogeneity can drive the outcomes of a policy evaluation are described, using the USDA farm typology. Then we discuss how decoupled agricultural policies were implemented in the U.S. starting in 1996, with particular attention paid to base acreage distribution in the year the programs were implemented. We show that while payments only slightly affect the overall distribution of wellbeing in agriculture, the gross effect of the payments is clearly distributed unequally across the agricultural sector, with landlords collecting a large share of the payments. Program benefits net of the amounts ‘passed through’ to landlords are much smaller but also more equal than the gross program benefits suggest. We conclude with thoughts on how heterogeneity in response to the programs could be treated in future studies.

Program Evaluations for Heterogeneous Populations

Heckman lays out the case for policy evaluation based on micro data and heterogeneous impact measurement in his Nobel Prize acceptance address (2001), while noting their consistency with the voting theory models used by positive political economists.

General equilibrium and macroeconomists, on the other hand, have traditionally used more aggregative tools for policy evaluation such as consumer and producer surplus, while welfare economists have traditionally used cost-benefit analysis and social welfare functions to evaluate policies. In contrast, positive political economists frequently rely on voting theory that is highly dependent on the initial position held by people within the general population and therefore inherently sensitive to heterogeneity.

At a general level, conflicts between modern welfare and modern political economic approaches revolve, at least in part, around what assumptions are made about heterogeneity of program benefits, heterogeneity among the affected population, and heterogeneity in response to the treatment received. Under the *veil of ignorance* assumption often used in welfare economics the evaluation of policies should be without regard to where within a distribution one is found, i.e. the original position is irrelevant. In contrast, positive political economics views the initial position as the key to seeing how those potentially affected by policies judge them, and recognizes that policy makers take great pains to understand how those potentially affected by programs perceive the benefits to them. Heckman establishes the primacy of initial position to voters as well as policymakers in citing Ronald Reagan’s rhetorical question in the 1980 US presidential campaign “Are you better off today than you were four years ago?”.

Consider an evaluation of benefits as a comparison of outcomes, where Y^0 (without policy outcome) and Y^1 (with policy outcome) correspond to two policy states for an individual that we wish to compare. The process of policy evaluation can be broken down into two separate tasks. First, determine who is affected by a policy and where they are in the initial overall distribution. Second, determine where they end up in the overall distribution and how much they gain.

The fundamental problem within this two-step process of program evaluation is that of simultaneously observing the same person inside the program and outside the program. Under certain conditions, including the case of a lump-sum transfer, the appropriate counter-factual representation (in the decoupling case, what would happen in the absence of a direct payment program) is simply the difference between the range of all outcomes of program recipients relative to the range of all outcomes found in a similar non-participant population. One often-implemented work-around in econometric evaluation has been invoking an assumption about a single, common effect for the entire population. The common effect model works best where eligibility is observable or universal and treatment under the programs is predictable, which is to say that the approach works best under very strong assumptions. To see this, consider three possible cases, each of which present a varying degree of challenge to estimation of impacts, and limit the use of common effect models using a representative agent framework.

Case 1: Uniform Effect Model

Case 1 is the textbook general equilibrium and welfare economic situation where the benefits are equal across the population. For example, consider F_0 as the distribution of household incomes for all households considered ‘farm households. Now, a direct payment of \$5,000 is given to each household. The new distribution of incomes F_1 is greater by \$5,000 in every part of the distribution because all people regardless of their level of incomes receive the same level of subsidy, so $F_1 - F_0 = \$5,000$. In this case Δ_q (the change in outcomes at quantile q of the population distribution) is everywhere the same (i.e. the distribution is degenerate). Case 1 also occurs when actual benefits are randomized across a population, such as a random drawing among all farm households determining who gets the entire quantity of direct payments. The expected impact on the distribution of incomes remains degenerate and equal to Δ_q . In Case 1, distributional impacts are well represented by the average, and a single, representative agent is adequate to evaluate the welfare impacts of the program.

Case 2: Variable Effects Model

Case 2 arises where program benefits vary among people by some observable and predictable design. Such easily verifiable participation characterizes many common social programs designed to target assistance. For example, the U.S. Earned Income Tax Credit program sets the level of benefits according to income levels and the number of children supported within a household, while in agriculture PFC payments vary by the number of eligible ‘base’ acres and the history of crop yields on those ‘base’ acres. Although the impact of the program is variable, Case 2 maintains that program participants in the program do not forecast their gain as any different from their peers with similar characteristics, e.g. “a base acre is a base acre is a base acre”. In the case of agriculture, use of Case 2 follows from the assumption that people are not ‘farming the government program’, meaning that people do not respond to payments in a way that affects the level of payments received. Although benefits vary across a population, conditioning factors can make a finite number of representative agents that do the job of explaining the variability.

Case 3: Variable Effects with Selection Model

Finally, Case 3 arises from fundamental differences in how people make decisions as a result of being in a program. When people make decisions according to what they expect their own personal or idiosyncratic gains are likely to be, it becomes more difficult to quantify the benefits or to predict out of sample outcomes, because of the inability to identify how people would react without the program. This is the ‘selection’ problem in program evaluation, and Heckman (2001) suggests that heterogeneity in decisions relative to outcomes in practice occurs frequently, although most applications have been in human capital accumulation and migration decisions.

Synthesis of Cases 1-3

Heckmans Cases 1, 2, and 3 are useful for thinking of how to carry out an evaluation of direct payments. Deciding how selection occurs in the case of agricultural programs is not obvious. Unlike coupled programs, in which firms choosing to maximize government payments may do things that are inconsistent with profit maximization absent the programs, decoupled programs leave little opportunity for producers to alter the amount of money received. As a result, decoupled programs are compatible with profit maximization and ‘farming the government program’ is not possible. Although farm program benefits are not uniform, they are predictable for a given set of land characteristics (Hoppe et al.; Environmental Working Group). Moreover, the benefits are transferable with land ownership and therefore allow entry and exit in agriculture, making them further amenable to representative agent models. However, non-price effects are fundamentally a story of heterogeneity in levels of wealth and nonlinear preferences across a set of risky alternatives. These conditions allow ample room for idiosyncratic response to programs relative to the level of benefits received from programs. For example, utility theory makes predictions about how wealth changes the marginal propensity to consume, but the effect is not a uniform one and depends on how people choose to spend their leisure time. Where non-price effects such as these interact jointly with program gains in ways that are not easily observable, the task of constructing a finite number of representative agents becomes increasingly questionable.

Heterogeneity in U.S. Agriculture

We believe that an evaluation of decoupled agricultural programs in practice could allow for either models conditioned under the assumptions of Heckmans Case 2 or Case 3. Nonetheless, their analysis is limited to Case 2 in order to show heterogeneity of impacts without explicit measurement of heterogeneity in response. As a Case 2-type analysis, our evaluation could presumably be replicated using a finite number of representative agents to derive the mean (but not the distributional impacts).

As long as the mean value is the only focus of attention and all effects are uniform, representative agent approaches are likely to be sufficient. When other measures are of interest or where benefits are highly variable the number of representative agents necessary to describe the sector makes the distributional approach more satisfying. Among many others, issues of agricultural structure, sustainability and reversibility, poverty, and income and wealth inequality have important distributional dimensions and are therefore better candidates for distributional analysis rather than representative agent examination.

In the case of U.S. farm policy, substantial variability is found in both the level of payments and the economic well-being of farm businesses and their associated farm households. Earlier attempts to characterize this farm and household variability re-

sulted in the U.S. farm typology (Hoppe, Perry, and Banker 2000) and the condensed farm typology used in the recent USDA publication *Taking Stock for the New Century*. The farm typology uses data on observable or self-reported characteristics such as occupation, legal organization, size, and economic status to classify farms into groups. The condensed typology distinguishes commercial farms (family farms with more than \$250,000 in sales and non-family farms), intermediate farms (family farms reporting farming as their primary occupation but with less than \$250,000 in sales), and rural residence farms (includes limited-resource, retirement, and residential lifestyle farms).

Table 1 shows the average level of PFC payments received by each of the three groups in 1996, as well as group averages for three household-related indicators and three business-related indicators. The population considered is PFC-recipient farms which make up about 25 percent of all farms in the U.S. The important item to note is that, in general, commercial farms receive the greatest levels of payments, have highest measured levels of household well-being along multiple criteria (incomes, wealth, and consumption) and have superior measured business performance along multiple criteria (profits, higher ratios of sales to total economic costs, and greater residual returns to land). Intermediate and rural residence farms change their relative orderings depending on the outcome measure used. Intermediate farms receive a greater level of payments and have higher levels of wealth than rural residences but lag them in total income and expenditures. Rural residences in general have worse farm business performance than intermediate farms, but for both groups losing money is the average outcome. Because the programs are lump-sum payments and do not contain explicit counter-cyclical or safety net orientations one should not expect a correspondence between direct payments and indicators of farm performance or household well-being.

Figure 1 shows the cumulative distribution of outcomes for the three household measures of well-being, while Figure 2 shows the three measures of firm returns for the ARMS sample. Technically, the cumulative distribution of the random variable Y shows the probability that an outcome Y will be less than or equal to some particular level y , i.e. $F(y) = P(Y \leq y)$. The group averages for the condensed farm typology shown in Table 1 are shown directly on each of the distributions to help orient the reader ¹.

Payment Pass-through

In this section we differentiate between gross payments, payment pass-through, and net payments. The economic models of Gardner and Floyd predict that returns from innovations in agriculture are shared among owners of the factors of production (principally land, labor, and capital) relative to their current levels of use, how easily their use can be scaled up and down, and how substitutable they are in production. The decomposition of total returns by factor of production is not just an academic

¹All distributions were estimated using the statistical package R and routines modified from the `hmisc` library of Harrell.

exercise, but is important for the practical reason that owners of the factors may be different people. For example, in the U.S. about 50% of all cropland is rented out rather than farmed by the landowner. The empirical models of Gardner and Floyd demonstrate that land, in inelastic supply, garners most but not all excess returns, with owners of labor and capital each receiving small shares. Land values, set by market forces, increase to reflect the future earnings that result from the innovation, a process known as ‘capitalization’.

Lump sum payments, because they do not depend on the agricultural production process, do not automatically get divided up among the factors of agricultural production as predicted by Gardner and Floyd. Instead, returns accrue to whatever characteristic of the farm or the household provides access to the payment, which in turn is dependent upon how the program is implemented. Although PFC payments are distributed to individual farmers who operate base acreage enrolled in the PFC program, payment ‘pass-through’ from tenants to the landowner results in the landowner being the ultimate beneficiary.

Pass-through, along with capitalization, is an important concept in the analysis of cropland markets. While capitalization is what allows current landowners to capture future payments from a land buyer, pass-through is what allows current landowners to capture the gains from present payments from a land renter. Although pass-through is important in evaluating who benefits from decoupled payments, it is not considered in most analysis because of data limitations. For example, many studies of the distribution of government payments, including the Environmental Working Group analysis of administrative data, ignore payment pass-through with the result that tenants receiving payments are counted as beneficiaries rather than as ‘conduits’ for PFC payments.

Confirmatory evidence that payment pass-through is important is found in the markets for cropland, which as predicted have risen in recent years despite lower commodity prices. Farmland rental markets have tended to track farmland purchase markets. The unchanging ratio of farmland rental prices to farmland values indicate that landowners extract both current and future payments from farmland renters and buyers, without operating the base acres themselves. Because over half of all cropland is rented rather than owned, we treat payment pass-through as a separate component of our study of the ‘distribution gap’ in the analysis of direct payments.

The decomposition of distributional effects allows consideration of how the impact of payments and tenure patterns interact. Our decomposition would not be possible without the very specific data on how base acre ownership and rental patterns varies among farm operations. Data on base acre ownership and operation is collected only periodically through the ARMS survey, rather than every year. Data used in this paper come from 1996, the year the FAIR Act was implemented and the last year such data was collected. For an individual farm household i receiving payments, the effect on business performance is estimated as:

Gross Effect $GE_i = Y_i^1 - Y_i^0$, where 1 signifies with-payment and 0 signifies the

without-payment level of well-being Y for observation i

Pass Through Effect $PT_i = \alpha_i \cdot GE_i$, where α_i is the share of base acres that are not owned for observation i

Net Effect $NE_i = GE_i - PT_i$, the difference between the gross and pass-through effects for observation i

Studies of the effects of payments can use either the farm business as the unit of analysis or the farm household. The farm household is a more inclusive measure of well-being because it subsumes all relevant farm information while including important non-farm activities. While decomposition using the farm business as the unit of analysis was computed as above, decomposition at the household level must also consider the case of farms that support more than one household. Multi-family operations are common in U.S. agriculture, with an average of 1.1 households sharing in the management of each farm in the U.S.

Cumulative distributions of well-being with lump sum payments, as shown in Figures 1 and 2, can be computed for well-being without the lump sum payments. Likewise, we can simulate well-being after payment pass-through occurs for those farms renting land. These three distributions of well-being can be used to construct ‘effect distributions’ for comparing effects at different points (quantiles) across the payment recipient population. In switching from a measure of impacts at the level of firm or household i to impacts at quantile q of the distribution we begin to address the distribution gap directly. Distribution-level impacts can be estimated in a way analogous to the observation-level impacts:

Gross Effect $GE_q = F_{Y_q^1} - F_{Y_q^0}$

Pass Through Effect $PT_q = F_{Y_q^1} - F_{Y_q^{1,\alpha}}$

Net Effect $NE_q = GE_q - PT_q$

A focus on quantile impacts captures vertical equity features of the program, measuring the presence of differential treatment among equal-sized proportions of the population. Treatment of vertical equity allows for a clear statement about whether the payments constitute a uniform or variable impact. One negative implication of tracking impacts by quantile q rather than by observation i is that re-ranking, or movement across quantiles recorded by households, is ignored. The impact of re-ranking within a distribution, also known as ‘horizontal equity’, is an important distributional component of farm programs and will be treated in future work.

Distributional Analysis Results

We present our distributional analysis in two sections, separately reporting results for the variables of Table 1 that use the firm as the unit of analysis and the variables

using the household as the level of analysis. The alternating use of firm and household units does not stem from competing views of whether the payments are used to support the economic performance of farm businesses or used to support the well-being of farm households. Rather, the use of different units of analysis and multiple outcome variables demonstrate how lump sum payments are correlated across each distribution. Strong correlations, aside from showing where payments impact well-being the most, may also reveal ways that lump sum payments may have production impacts.

Direct Payments and Household well-being

Figure 3 shows the distribution of gross, pass-through, and net transfers in Panel A, B, and C, respectively. Impacts at quantile q are shown for the expenditure, household income, and wealth outcome distributions. The circles in each graph represent the impact at 50 evenly spaced nodes across the distribution from the lowest (i.e. the 1st percentile) to the highest (i.e. the 99th percentile) of farm households. In each of the nine graphs the vertical axis shows the differences between the two distributions where comparisons are calculated at population quantiles. All graphs include a non-parametric regression line of the circles, calculated using the lowess estimator. Any deviations from a zero-slope regression line are interpreted as evidence of non-uniform effect of payments across the population.

Viewing Figure 3 as a whole initially, note that all payment impacts are strictly positive. This is because no part of the population distribution is worse off in an absolute sense as a result of the payments. Also, note that the greatest level of impact at any quantile does not exceed \$4,000, or somewhere in between the commercial, intermediate, and rural residence group averages reported in Table 1.

The gross effect of transfers shown in Panel A of Figure 3 of appears to reject the uniform effect models for all variables shown. Gross transfers relative to expenditure and wealth variables are upward-sloping, indicating that households with higher levels of expenditures and higher levels of wealth received greater payments than low-expenditure and low-wealth households. The gross impact of payments on household incomes, on the other hand was greater on both the low and high end, as these received more than those in the middle of the distribution.

The effects of PFC payment pass-through (Figure 3, Panel B) were felt more equally throughout the distribution than the gross effect, although payment pass-through across the expenditure distribution was the only instance of a near-uniform effect. Income and wealth pass-through effects were similar to the gross effects. In the case of household incomes, pass-through was greatest for low and high-income farm households relative to middle-income farm households. The high pass-through rates at low incomes is of particular concern, because many of these households experienced large losses in 1996. Compensation for large losses is often a motivator for payments in the first place. However, many of the households at the lowest end of the distribution

had business losses from farming that were even larger than salaries or passive sources of income earned off the farm. Because large losses are not sustainable, it may be the case that households at the very lowest end have high levels of consumption and/or wealth and therefore would not be considered ‘poor’. Although pass-through increased slightly with wealth, the least wealthy farm households passed through nearly \$1000, or nearly all of their payments to landlords. Tenant farmers are found at all levels of wealth (especially among larger farms) so some pass-through is expected even for the wealthiest farms, but in general farm households with low levels of wealth own little land and therefore pass nearly all of their payments through to landlords.

The net effect of direct transfer payments (Figure 3, Panel C) shows the amount of payments that are left for the farm household after pass-through to landowners. In the case of expenditures and household income the net impact is much more uniform than the gross impacts suggest. This may be an indication that the programs do not induce as much inequality as administrative data alone might suggest. In contrast, trends are even more magnified in the case of the wealth distribution, with greater payments retained at higher levels of household wealth.

Direct Payments and Farm Performance

Figure 4 shows gross, pass-through, and net effects of lump sum payments using the farm business as the unit of analysis, rather than the farm household. Like the case of farm household impacts, gross impacts of payments appear to reject the uniform-effect models, as substantial variability is recorded across the population. The nine graphs in Figure 4 show the Gross effect, the pass through effect, and the net effect as in Figure 3. In each graph, business performance improves left to right, so that impact curves that slope upwards represent the case where firms with better performance receive greater levels of payments, and U-shaped curves represent the case where the extremes of the distribution benefit more than the middle.

The gross effects of the payments were U-shaped in the case of return on all assets and returns on land operated. Like the case of household income, both those at the low and high end of the profits and land returns distribution received greater gross payments. The two measures are in fact similar in the sense that they both measure the amount of money left over after covering costs, with the land return measure more inclusive of the costs of borrowing capital rather than relative to the asset base. The lower end of both distributions is largely populated by firms that suffered losses in their business in 1996. The gross effect on the ratio of sales to economic costs shows a more monotonic relationship, with firms that are the most successful at covering their total economic costs receiving the greatest level of benefit.

The pass-through effects largely mirrored the gross effects, which served to lessen many of the disproportionate gains made by the upper and lower ends of the gross effect distribution. This implies tenancy arrangements used by successful farms drastically may alter some of the gains observed in the gross measure of benefits.

The net effects of payments, after adjusting for pass-through, are fairly uniform for ratio measures of returns over assets and returns over all economic costs, indicating that much of the inequality is passed through to landowners. In contrast, the returns to land measure retains a slight downward slope after pass-through, indicating that low-return farms received more than high-return farms. This uniform-effect and declining-effect results for business brings considerable doubt upon the belief that payments to more efficient farms enable investment and expansion to maintain their competitive advantage.

Conclusions

We present evidence on the heterogeneity among the farm population and heterogeneity in the way program benefits were distributed for to farmers in the US during 1996. Uniform-effects models often employed in aggregate-level analysis can replicate average results, which is often sufficient for many evaluations that use modern welfare economic methods such as cost-benefit analysis. However, where emphasis is on targeted portions of the distribution or when people do not use the *veil of ignorance* may view the programs differently than the representative agent. Such information will ultimately be useful in policy analysis.

In the case of decoupled payments it is obvious that researchers must entertain the possibility that the payments could have non-price effects that could indirectly impact production decisions and lead them to be labelled as trade-distorting. Where non-price effects are prevalent their effects are unlikely to be uniform because of heterogeneity in the farming population and because of nonlinear preferences. Establishing a counter-factual distribution for program participants in the case of policy-production interactions is more difficult than the alternative uniform-effects representation, but fortunately agricultural economists are not alone in addressing these problems.

Relative to the current study, a greater understanding of landlord-tenant relations would help to assess the pass-through effect, including who tenants tend to rent from. Evidence suggests that often landlords are retired farmers and surviving spouses, for example 97% of all landlords are retired from farming or have some other occupation than farming, and 86% of land rented out is owned by someone who is retired from farming or has some other occupation (NASS). In other words, only 3% of the landlords and 14% of the land is rented out by a landlord declaring farming as their primary occupation. In this sense, many beneficiaries of pass-through either are no longer active producers or perhaps never made farming their primary occupation. Pass-through, then, could be viewed either as a transfer from one end of the farmer life-cycle to the other or as leakage of the payments from the sector.

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Table 1: Mean Direct Payments and Average Levels of Well-being

	Farm Type		
	Commercial	Intermediate	Rural Residences
Panel A. Farm Household Measures of Well-being (per-capita)			
Direct Payments per capita	9,335	2,299	676
Total Household Income	41,140	17,755	17,405
Wealth	373,998	225,236	171,878
Household Expenditures	10,707	9,646	7,687
Panel B. Farm Business Measures of Well-being			
Direct Payments	22,159	5,497	1,565
Return on Assets Ratio	7	1	(10)
Total Production to Economic Costs Ratio	117	99	84
Total Production less Economic Costs (\$/acre)	101	(78)	(155)
Panel C. Transfers to Landlords			
Government Direct Transfers	3,158	1,068	230
Operator Direct Transfers	32,221	5,490	2,392

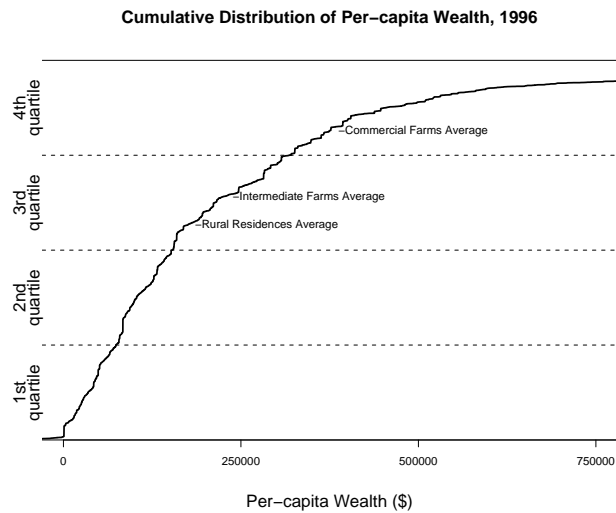
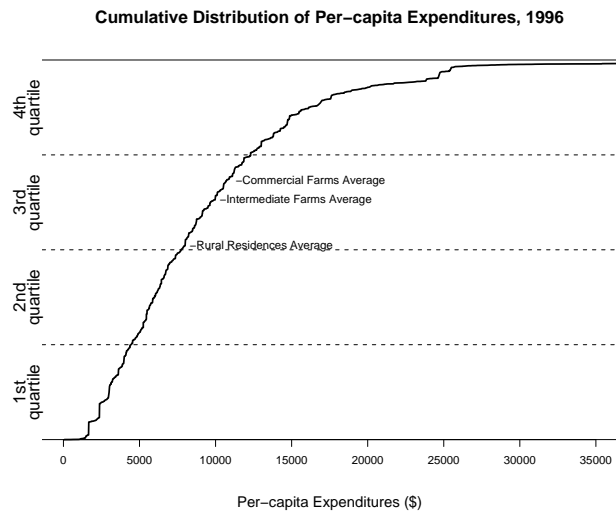
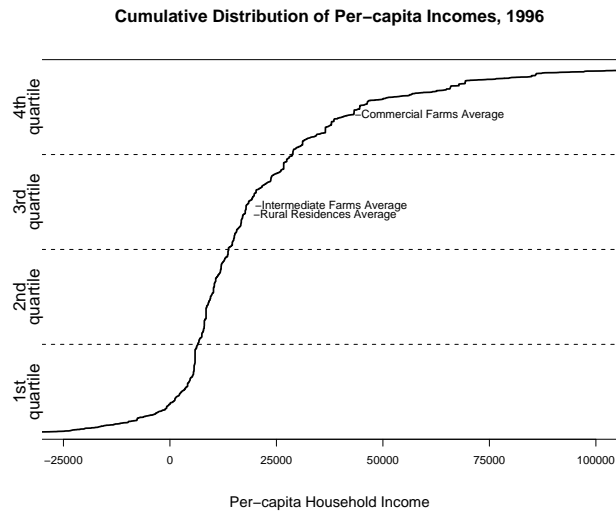


Figure 1. Distribution and Group Averages of Household Well-being, Payment Recipients

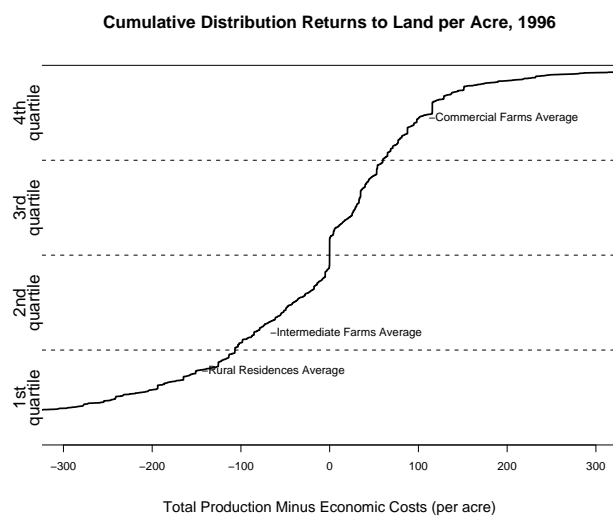
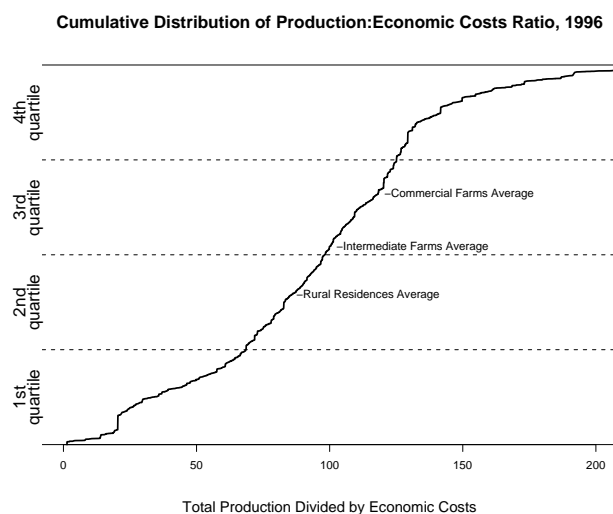
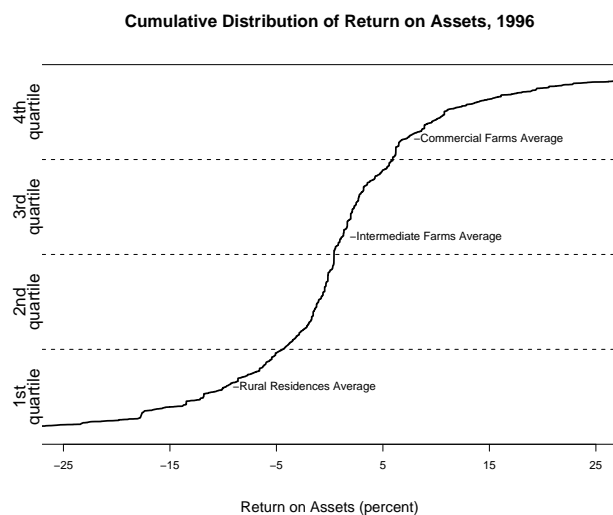


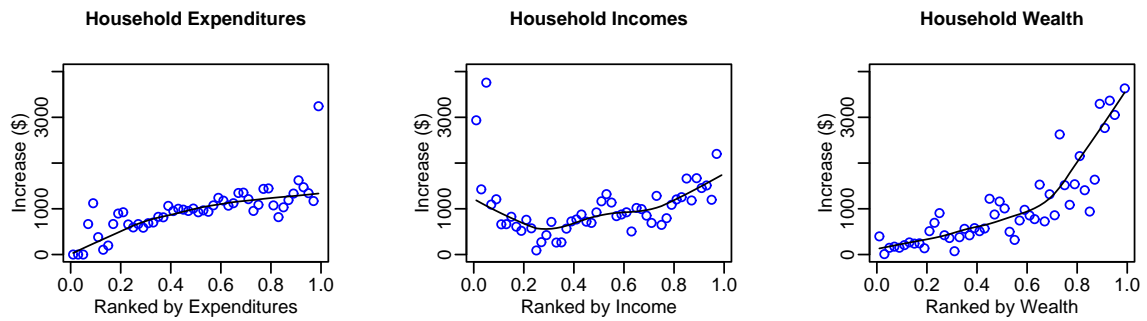
Figure 2. Distribution and Group Averages of Business Well-being, Payment Recipients



Panel A. Gross Effects

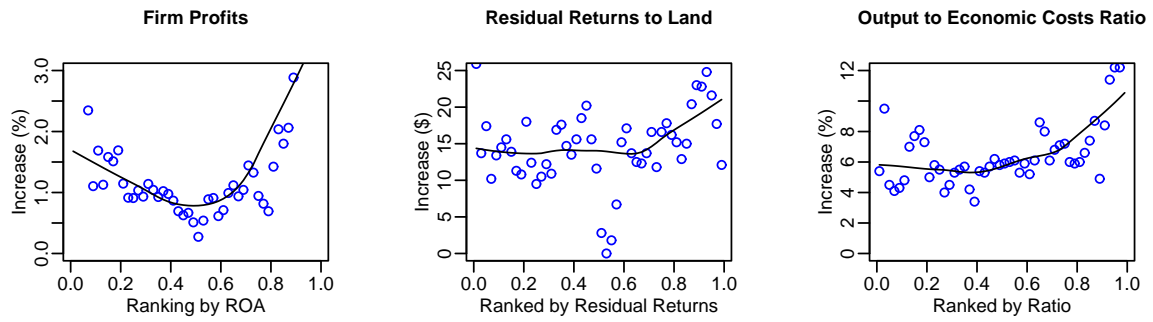


Panel B. Pass-through Effects

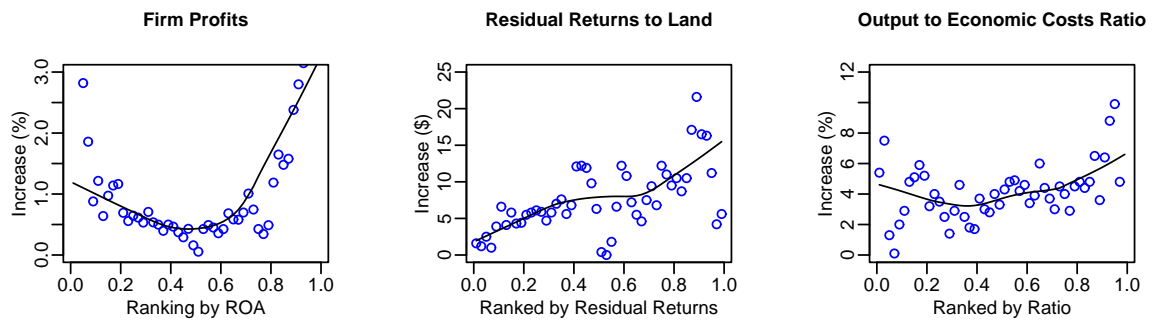


Panel C. Net Effects

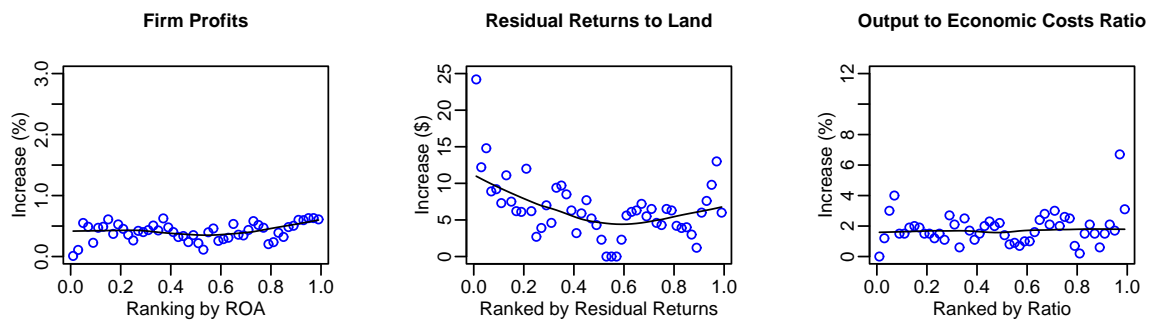
Figure 3. Distribution of Transfers, Farm Households, 1996



Panel A. Gross Effects



Panel B. Pass-through Effects



Panel C. Net Effects

Figure 4. Distribution of Transfers, Farm Businesses, 1996