Policy Analysis with Integrated Rural/Farm Household Data for the U.S.

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Farming and the economic setting for agriculture have changed. Households have organized their farm businesses to include multiple families, partners, alliances, ventures, contracts and other arrangements. The significance of this transformation is that resource allocation decisions occur at the household level. Farm households manage a portfolio of business, personal finance, and family activities. As a result, we can no longer assume that a household's farm business is its primary economic or financial concern. Households will respond differently to agricultural, resource, trade, tax, development or other policies depending upon how incentives and constraints affect business performance and household well-being.

1. Introduction

Farm programs have far-reaching impacts that touch farm households and rural communities as well as agricultural commodity markets. When first devised, U.S. agricultural policy had a strong commodity orientation, which persists today. Structural change in agriculture has disengaged goals and outcomes of farm policy from the reality of today's farm sector. Farms are fewer and larger with wide differences in production costs, marketing approaches, and overall management capabilities. More importantly, the well-being of farm families is no longer solely (or even primarily) dependent on commodity market outcomes, but is a consequence of farm performance and off-farm employment and business ownership opportunities in rural communities.

Farm household decisions, like decisions made by other self-employed households, reflect both consumption and production.[2] As a result, the farm household structure is a complex system of inter-relationships between and among a variety of internal and external factors. It is a resource-allocating unit, where decisions are made on how scarce household resources are to be distributed among various activities to attain household goals. Often, decisions on resource allocation affect the welfare of the entire household as well as the welfare of individual members of the household. Since the importance of the farm as an activity included in the household portfolio will vary among households, demographic, social, and economic characteristics of households, as well

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[2] Farm operator households exclude households associated with farms organized as non-family corporations or cooperatives, as well as households where the operator is a hired manager. Household members include all persons dependent on the household for financial support, whether they reside in the household or not.

as personal goals held by household members, influence the type of farm business adjustments made in response to changes in farm policy.

An integrated data collection system is necessary to develop consistent performance measures that link rural economies, farm households, business establishments, and commodity enterprises. Important and useful insights are gained from information about several facets of the farm sector, including its contribution to the national economy, the organization and performance of farms, and the income and well-being of farm households. Each facet can be used to examine how changes in economic or policy events may affect households and the farms they operate. Unless households, household members, and their farms are linked statistically through a survey design that implements a household-farm paradigm, the nature of the relationship between the household, household members, the farm, and farm community has to be asserted or inferred from use of disparate data sets when conducting descriptive or more analytical research activities. Perhaps even more troubling, when data are not integrated to measure these relationships, they are often overlooked.   The Economic Research Service (ERS) is working to overcome these traditional household-farm data limitations through the development of a comprehensive micro-level data system that integrates enterprise, farm, and household information in one data collection activity.

The next section describes how content is determined for the U.S. information system driven by the Agricultural Resource Management Survey (ARMS). The ARMS is USDA's primary source of annual information on the financial condition, production practices, resource use, and economic well-being of America's farm households. This is followed by a description of the various means that information from the ARMS is disseminated. We then provide several examples of how policy analysis is supported by the integrated rural/farm household data system.

## 2.   A Comprehensive Information System

The ARMS is critical to the research and analysis mission of the Economic Research Service, and is a key input to estimates across the Department of Agriculture and in other agencies. It provides the information base for sector estimates of value added, income for farms by type of commodity specialization, costs of producing major crop and livestock commodities, indices of prices paid by farmers for production inputs, and a report on the status of family farms. The ARMS also supports the Department's estimates of household income and wealth, and contributes to a variety of applied farm production, management, technology adoption, resource use, and household well-being research applications. While the ARMS became a stand-alone survey beginning with the 1996 calendar year survey, it retained and built upon features of survey activities that date to the 1970's [Johnson and Morehart, 2004].

2.1 ARMS Content
A combination of factors guide the type and scope of questions asked in the ARMS (figure1). The ARMS supports key uses of enterprise, farm, and household data that

correspond with mandated activities required by the U.S. Congress, government wide responsibilities delegated to USDA, assessment of USDA policies and programs, and enabling research to inform public and private decision makers on agricultural and farm issues.   Congressionally mandated studies and indicators reporting provide specific direction. For example, costs and return estimates must "include all typical variable costs, interest, a return on fixed costs and return for management along with the various production practices used by farmers in a weighted national average estimate."

Figure 1
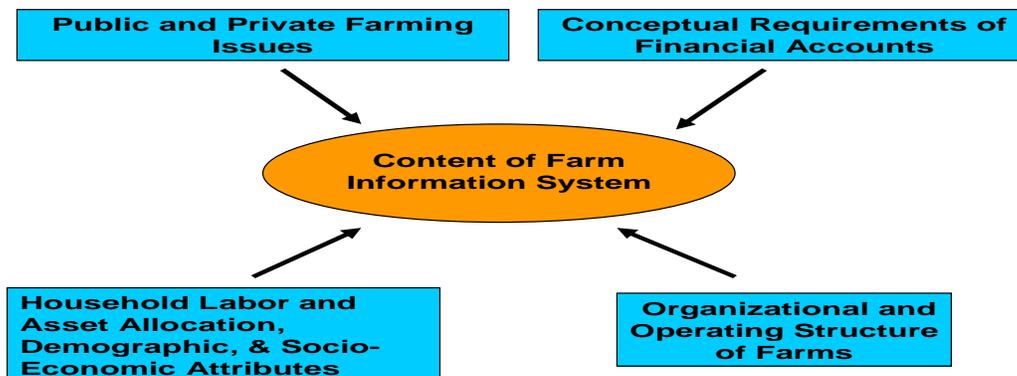
Standardization of components and definitions for financial statements also helps to determine the necessary items to collect.   For example, the Farm Financial Standards Council develops and publishes standardized *Financial Guidelines for Agricultural Producers* that incorporates generally accepted accounting practices (GAAP) for income statement, balance sheet, and financial ratios to the extent feasible for farming businesses. Commodity costs and returns are estimated according to the guidelines established by a task force created by the American Agricultural Economics Association. Guidelines for sector accounting are part of the government-wide standards for national, regional, industry, and international economic accounts (Seskin and Parker). The ARMS is unique in that the collection of information to support financial statements covers all four major levels of interest (commodity enterprises, farm businesses, farm operator households, and the farm sector) within one sample design and set of survey instruments.

In addition to the factors that drive the demand for information, the ARMS content also reflects the circumstances of those who supply the information.   To capture the diversity that exists among farms and farm households, several different attributes are measured. These include operator and spouse labor allocation decisions, educational attainment, age, and other demographic characteristics. The ARMS also captures the wide variety of farm operational and organizational structures that constitute the complexity of modern farming. Specifically, the information system must distinguish among the many stakeholders that participate in agricultural production. They principally include lenders, property owners, and firms with contractual arrangements. In 2002 for example, of the more than 2 million farms, 633,000-rented land for cash,

another 209,000 rented land for a share of production, 910,000 had outstanding debt at the end of the year, and 50,000 grew commodities under contract arrangements. Conceptually correct economic assessment of farms and farm households not only requires that survey content reflect this complexity, but the array of stakeholders must also be taken into account in the survey design.

2.2 *ARMS Design and Coverage*
The ARMS is a multiple phase survey. In the fall, producers of major commodities such as feed grains, food grains, or cotton are surveyed about production practices and land use for a selected field on their operation. In order to link commodity production activities and conservation practices with the farm business and operator household, farmers that successfully complete the fall interview about production practices and input usage are interviewed again in the spring. Spring data collection focuses on the structural and economic characteristics of the farm business and farm operator households.

In ARMS, the household of the senior or dominant operator is enumerated. Other contributing households and operators are identified. Survey instruments used with the farms are developed to provide sufficient data to develop for each farm an indication of value contributed to national output, net income after accounting for capital use and inventory adjustments, and for the disposition of income among parties that have an ownership interest in production. For the farm's controlling household, data are obtained to establish human capital, financial and other asset allocations to farm and non-farm activities.
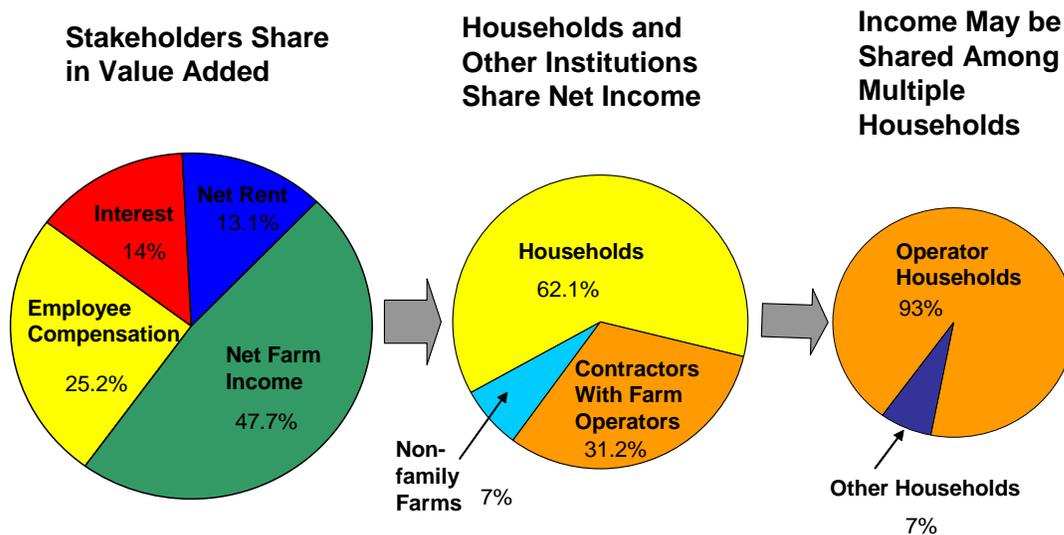
Within each phase of the survey, there are also multiple questionnaire versions. The commonality of questions across versions provides one facet of integration.   In the fall data collection, the target commodity distinguishes questionnaires. In addition to the commodity follow-up interviews, the spring data collection has two distinct survey instruments. The larger of these two versions (both in terms of sample size and content) is personally enumerated and designed to collect important policy related information, in addition to basic farm and operator household financial and demographic information. A smaller core version, which collects essential farm and household financial information, ensures a sufficient sample to generate statistically reliable information for major agricultural states. The core version is enumerated using three stages of collection beginning with a mail questionnaire form, followed by phone and, if necessary, personal interview.

Entities sharing in the risk of production encompass not only individual proprietors, but also a myriad of individual investors and legal entities. These stakeholders contribute resources with the expectation of receiving financial rewards commensurate with their share in the risks of production. The ARMS captures the financial participation of these various stakeholders in a manner consistent with the value added accounting framework. In some cases, payments to stakeholders occur prior to production (land, labor, and capital) and are relatively straightforward to determine. The questionnaire

also captures more complex, production-related relationships such as contracts so that expense and income can be correctly attributed to the appropriate stakeholders.

Embedded in the value-added measurement of farm sector income is the return to farm operator households from farming activities (figure 2). Stakeholders' shares in net value added vary depending on region of the country, type of farm or ranch, and size of operation. Many factors influence these differences, including the mix of commodities on the operation, the types of inputs used, the prevalence of business arrangements such as contracting and share leasing, the size of operation and number of operators on the farm, the mix of operator versus hired labor services, and the use of debt. The ARMS is uniquely equipped to correctly attribute income and expenses to the different stakeholders and measure the diversity of outcomes for farm businesses and operator households. The result is a consistently derived annual measurement of value added to the farm sector, farm business performance, operator household well-being, and the profitability of commodity production.

Figure 2

Stakeholders Share in Value Added

Households and Other Institutions Share Net Income

Income May be Shared Among Multiple Households

Net Rent 13.1%
Interest 14%
Employee Compensation 25.2%
Net Farm Income 47.7%

Households 62.1%
Non-family Farms 7%
Contractors With Farm Operators 31.2%

Operator Households 93%
Other Households 7%

Source: 2002 Agricultural Resource Management Survey (ARMS), USDA.

3. How the Information System Supports Policy Analysis

Important insight into how ARMS unit-level data contribute to policy analysis can be gained by comparing unit-level data, such as the ARMS, to aggregate net cash farm income, a statistic collected and published by USDA since 1910 and frequently used as a policy benchmark [Morehart et al., 2001]. Net cash farm income tends to track well with both global and domestic events, but problems can arise when changes in the statistic are interpreted as changes in farm household well-being. Because aggregate data can only reflect the total or the average, difficulties also arise when impacts from domestic or international events are unevenly distributed, as they most often are.

Increasingly, the distribution across regions of the country, farm types, and commodity specialization is used to reveal both where impacts are greatest as well as where policy intervention has been most successful.

Some are willing to forego distributional content for the parsimony and simplicity that a single aggregate number provides. Even these find net farm income to be problematic as a policy benchmark because it is overly-restrictive as a measure of well-being. Net cash farm income excludes off-farm income, a significant determinant of well-being for over 60 percent of farm operators who report that their primary occupation is something other than farming. The measure also omits debt obligations, the capacity of farm businesses to service their debts, and is not indicative of farm business failures. As a flow measure of returns, it doesn't reflect the ability of families to increase the level of well-being by accumulating wealth. Morehart *et al.* point out that a more comprehensive measure than net farm income is needed to track the financial health, needs, and well-being of farm businesses and households. Desirable characteristics of an aggregate measure include an ability to subsume both farm and off-farm components of income and wealth for the households involved in farming, as well as the capacity to distinguish between farm business and farm household financial well-being.

3.1 Research on Policy Issues – 3 examples
Policy analysis, including how farmers cope with risk, adjust to policy shocks, and make labor and technology adoption decisions, is greatly assisted with data on the economic activities of individual farm households. The utility of the research is considerably enhanced by the ability to carry out disaggregated analysis. Disaggregation ranges from a group-wise estimate of financial well-being based on farm and/or household characteristics (e.g. the ERS farm typology) as well as behavioral hypothesis testing with unit-level data.

3.1.1 Savings, Income Volatility, and Basic Needs
We begin with the case of what agricultural policy might do to address income volatility of farm households. Simple comparisons such as Figure 3 reveal that farm household income is more volatile than household incomes in the economy as a whole. Maintaining emergency savings to draw on during income shortfalls is one way that households can address volatility in their entire earning portfolio, and the U.S. has considered programs that seek to increase the level of farm household savings.

One analysis, by Mishra and Morehart, shows that individual farm households vary greatly in their use of savings (including liquid accounts, financial assets including stocks and bonds, retirement accounts, and residential or other nonfarm real estate). Mishra and Morehart's analysis suggests that those farms that are best positioned to weather a volatile income stream are the ones that would be most likely to participate, substantially cutting into the overall net benefits of a subsidized savings program, and also suggestive of important interactions with other risk management tools such as crop insurance.

Figure 3

Farm household income and nonfarm household income
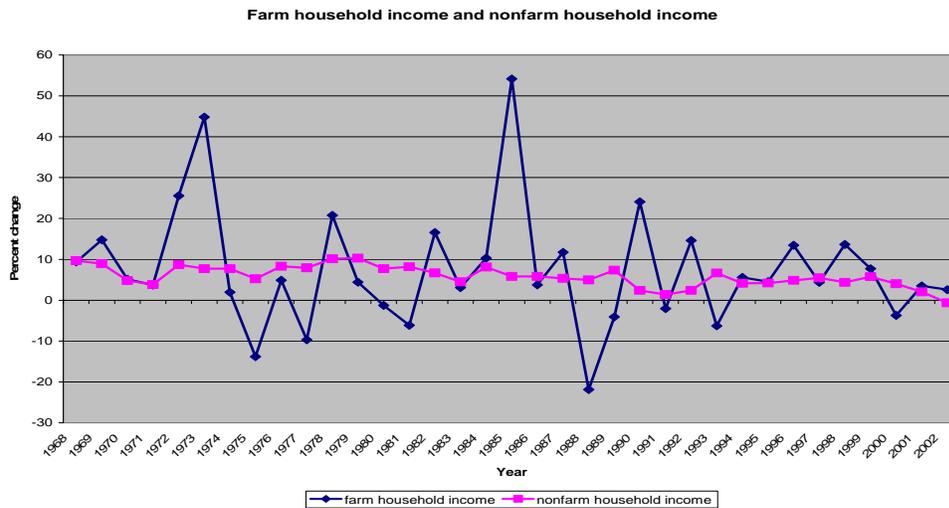
Average farm household income declined by 3.7 percent in 2000 and increased by 3.5 percent in 2001. However, despite the swings in average income, ARMS data reveal that in each year about 18 percent of farm households had lower incomes than the previous year. Because households may make different choices in the face of financial stress such as an income shortfall, especially when income drops below the basic need level, an accurate measure of an income shortfall is necessary. Indeed, about one third of those households with an income shortfall in 2001 earned income below their stated "basic needs" level (the remaining two thirds reported earnings above basic household needs). Although not all farm households found themselves under financial stress due to farm business performance, Hopkins et al., showed that farm-associated income shocks and shocks associated with sickness or divorce were more likely to prevent a household from meeting basic needs than an income shortfall due to a reduction in off-farm wages or off-farm business losses. Accordingly, diversification in earnings, to include off-farm earnings by the operator and spouse as well as a diversification in agricultural production, were characteristic of those households that had income shocks but still managed to meet basic needs. In contrast, aggressive cost reduction in the farm business, and higher levels of debt relative to assets were important predictors of failure to meet basic needs and could be considered ultimately inefficient short-term coping strategies. Intuitively, the evidence suggests that households with greater capacity to cope with income shortfalls tend to have diversified income streams, while those more reliant on debt and cost-cutting are less likely to be able to meet their basic needs. While off-farm income shocks also occur for farm households, these are less likely to prevent farm households from meeting their basic needs.

ARMS data on non-farm assets, the size and the source of negative shocks to farm household income, and a self-assessment of basic needs were used in a policy-relevant study of the decisions that farm households make in the face of volatility and risk. Without unit-level ARMS data, both the assessment of the risks that farm households undertake, and the consequences for well-being, would have been considerably more open to speculation.

3.1.2. Farm Household Impacts from Policy Reform

The preceding analyses treat income shocks but not policy-induced shocks. In fact, little work has been done on how households respond when subsidies are removed or when global trade rules are liberalized. The principal tool that policymakers have used to address the negative impacts on farmers from trade liberalization is through Trade Adjustment Assistance programs (established under the Trade Act of 1974). However, more localized effects within a group of commodity producers attract considerable attention from producers, consumers, and policymakers. If they can, producers and households that are affected by trade or subsidy reform will shift resources away from production, employment, or investment in sectors where returns are falling, and into the sectors where returns are rising. Opportunities for alternative investments or alternative ways to allocate labor are region-specific. A study by Burfisher, et al. shows that local gains will ultimately be determined by variability in exposure to policy reform as well as variability in the capacity to respond to policy reform. To reflect variability in the impact as well as the means to respond to policy shocks, general equilibrium gains from trade liberalization were simulated based on existing commodity specialization, farm production efficiency, and the ability to find employment off the farm. Using ARMS data, household-specific exposure and adjustment response showed that impacts were highly variable, and that most of the gains from commodity price changes were captured by either the largest, most efficient farm households or those households that were able to compensate for commodity price declines by entering off-farm labor markets. Burfisher *et al.* (figure 4) show that the net benefits after considering response heterogeneity were even more unevenly distributed than exposure to price changes. ARMS data on the heterogeneity of response to policy reform – some find it economical to switch farm enterprises, some seek alternative labor opportunities, and some have little opportunity at all to adjust – provides information that policymakers need weigh the benefits of trade liberalization as well as improve domestic adjustment capacity.

Figure 4
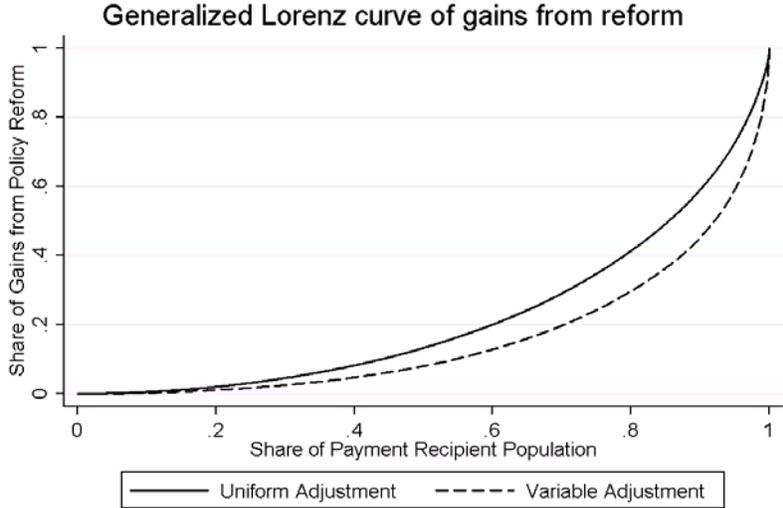
Source: Author calculations using ARMS, U.S. Dept. of Agriculture, 1999

3.1.3. On-farm Technology Adoption
The final area of policy analysis with ARMS data that we consider is the adoption of new technologies by farm households. Economic assessments of technology adoption using the traditional tools of agricultural economists pioneered by Grilliches have been demonstrated to be inadequate and incapable of explaining differing adoption rates of agricultural innovations introduced in recent decades. The standard measure of farm profitability, net returns to management, gives an incomplete picture of economic returns because it excludes the value of management time. Management time on modern operations is a scarce resource, and is often used in off-farm employment. Recent work (Smith; Fernandez-Cornejo and McBride; Fernandez-Cornejo and Hendricks) is suggestive of the emergence of a new classification of technological innovations as either management-saving or management-using. Particularly for smaller farms that spend a great deal of time off of the farm in wage-earning activities, technologies that do not appear to change the net returns in farming can in fact increase overall household well-being as management time is released. It appears that farm households are increasingly making technology adoption decisions based on how total household income is affected rather than simply residual farm income. Without ARMS data on the range of farm household activities, less would be known about what can constrain on-farm adoption of newer production and conservation technologies. Moreover, ARMS data are a key component in the evaluation of incentive-based and voluntary programs put in place to encourage adoption of conservation practices in meeting domestic environmental protection goals.

4. Implications

The farm household serves as the focal point for understanding how policy impacts farm production activities, the ownership of production assets, the disposition of income, and, even, operational and strategic management of the business. From an agricultural industry perspective, the U.S. agricultural income accounting system is not diminished in its ability to generate national estimates of value-added to the U.S. economy and to track sector-wide trends over time. The accounting system has been honed to more accurately account for the participation of multiple operators/households in farm business establishments along with other entities. This enables the income accounting system to recognize multiple owners of assets and to correctly distribute income to participants. This new system explicitly recognizes that an operator household may not receive all the income generated by its farm business, and that farming income is but one source of earnings for the dominant share of farm households.

ARMS is structured to develop for each farm an measure of value added, net income, and the disposition of income among stakeholders, including the controlling household of the senior or dominant operator. For the farm's controlling household, data are obtained to establish human capital, financial and other asset allocations to farm and non-farm activities. This integrated data collection system enables the development of farm business and household accounts for the same unit of observation. A result has been the development of a series of income measures each of which contributes to a clearer understanding of the contribution of farming to the U.S. economy, the

performance of farms as business establishments, and the welfare of households of farm operators.

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