Journal of Agricultural and Applied Economics, 39,3(December 2007):489–505

Impact of Program Payments on Time Allocation and Farm Household Income

Joe Dewbre and Ashok K. Mishra

Using a model of farm household resource allocation and data from the USDA–ERS Agricultural Resource Management Survey (ARMS), this study compares the effects of various categories of farm program payments on time allocation by farm operators and spouses. Results suggest that agricultural market transition payments (AMTA) increase leisure hours of both farm operators and spouses. Loan deficiency payments (LDP) and payments that combine market loan assistance (MLA) and disaster payments are shown to reduce leisure. The study also finds that AMTA payments exhibit a much higher degree of income transfer efficiency than the LDP and MLA payments.

Key Words: Agricultural Resource Management Survey, decoupled payments, government programs, income transfer efficiency, time allocation

JEL Classifications: D13, J22, Q12, Q22

This paper features analysis of payments made to farmers under the provisions of three programs:[1] transition payments (AMTA), loan deficiency payments (LDP), and a category that combines disaster and market loss assistance payments, which we label MLA. Analytical effort focuses on quantifying the effects of such payments: first on the time allocation of farm operators and their spouses and then on income transfer efficiency—the increase in farm household income that can be attributed to farm program payments.

The data used in the analysis come from the annual USDA–ERS Agricultural Resources Management Survey (ARMS). The surveys undertaken since 1996 include questions soliciting estimates of dollar amounts of payments received under each of several government payment programs. The ARMS database also contains other data needed for the analysis: household incomes distinguished by farm versus off-farm sources and allocation of work time between on-farm and off-farm activities. The farm household model (Hallberg, Findeis, and Lass; Taylor and Adelman) provides the theoretical framework on which the analysis is developed. The paper begins

Joe Dewbre is a senior economist in the Agricultural Directorate of the Organization for Economic Co-operation and Development. Ashok Mishra is associate professor, Department of Agricultural Economics and Agribusiness, Louisiana State University, Baton Rouge, LA.

The views expressed here do not represent the views of the U.S. Department of Agriculture, the Organization for Economic Cooperation and Development, or its member governments. An earlier version of this paper was presented at the 2002 AAEA annual meetings in Long Beach, CA. We thank Carmen Sandretto, Hisham El-Osta, and two anonymous reviewers for providing many helpful comments.

[1] The U.S. government makes direct payments to farmers under several different farm programs. Their impacts on incomes of farm households depend critically on the criteria farmers must meet to be eligible for payments, the way the program is implemented, and the economic characteristics of the farm households and of the farm covered by the program.

with a graphical exposition of that model to compare potential effects of fully decoupled versus fully coupled government payments on farm household income and the allocation of work and leisure[2] time. Graphical analysis leads to a number of specific hypotheses regarding the direction and relative magnitude of payment effects that are then subjected to empirical testing using ARMS survey data. The practical objective of the empirical analysis was to judge whether the three real-world types of government program payments—AMTA, LDP and MLA—generate policy effects more consistent with the stylized fully decoupled or fully coupled payment types.

Previous Studies

The economic behavior of farm households, including the allocation of time to on-farm and off-farm work and to leisure, has been featured in numerous prior analyses. A collection of papers edited by Hallberg, Findeis, and Lass and published in 1991 constitutes an extremely useful survey of theoretical and empirical studies focusing especially on farm households. Taylor and Adelman review numerous studies using household production models. Huffman first estimated off-farm labor supply/participation models for farm operators using aggregated county-level data, establishing an approach that has been widely applied subsequently.

Of special interest to this paper is the impact of government payments on time allocation. Mishra and Goodwin and El-Osta and Ahearn find that government payments reduce participation in off-farm work. Using farm-level data from the United States, El-Osta, Mishra, and Ahearn find that government payments tend to increase the number of hours operators work on their farm and decrease the hours they work off the farm—a finding they found to hold regardless of payment type (decoupled and coupled payment[3]). More recently, Ahearn, El-Osta, and Dewbre examined the impact of decoupled and coupled payments on off-farm participation of farm households. Using ARMS data they found that government payments, whether coupled or decoupled, have a negative effect on off-farm labor participation of farm operators and spouses. They also compared the impact of overall government payments on off-farm participation by farmers and their spouses between 1996 and 1999. The authors conclude that differences between 1996 and 1999 were the result of the greater magnitudes in total payments rather than the inclusion of decoupled payments in the policy mix.

This study differs from earlier analyses in several ways. First, the analysis is concerned directly with the effects of coupled versus decoupled farm program payments on time allocation among on-farm and off-farm work and leisure as opposed to the off-farm participation decision per se. Second, the study addresses both theoretically and empirically the potential differences between time allocation decisions of farm households with no and with some off-farm work. Finally, the study also investigates the potential effects of decoupled and coupled payments on farm household income—the income transfer efficiency of payments.

Farm Household Income and Time Allocation: A Graphical Representation of the Theory

We start with a farm household comprising two income earners—the farm operator and his or her spouse. We assume the household makes decisions, as a family, on how much money to spend on consumption and on how much of the total time available to each of the income earners is to be spent at work and how much at leisure in order to maximize total

[2] The term "leisure" is used throughout the paper to refer to that time not spent working on the farm or in a job off the farm.

[3] The notion behind a "decoupled" payment is that producers are not required to produce specific commodities in order to receive a subsidy. However, for "coupled" payment landowner and/or producer plant a specified commodity in exchange for receipt of the subsidy.

household utility. The household must also decide how much of each income earner's work time to devote to on-farm versus off-farm work. The focus of the analysis will be on a "representative" farm household making annual decisions on time allocation and spending. We shall assume, however, that even though decisions are taken on an annual basis, the planning horizon for such decisions is sufficiently long term that we can safely ignore savings, investment, or borrowing and assume that money income and expenditures are equal—assumptions that may circumscribe the generality of the findings, especially so in the presence of market failure in farm credit or risk markets. Finally, to simplify the graphical exposition, we treat the household as a single decision-making unit, ignoring potential differences in policy impacts on time allocations between farm operators and spouses. These considerations are, however, addressed in the empirical part of the analysis.

In deciding how much time to devote to on-farm work, off-farm work, and leisure, the farm household confronts three kinds of constraints. First, it cannot spend more money on consumption goods than the money income it receives. Second, neither of the income earners can spend more total time in work and leisure than is available. Third, for a given endowment of owned farm capital, the most important of which being owned farmland and farm-specific human capital, the household's net earnings from farming cannot exceed the level obtained by choosing profit-maximizing levels of farm output and input use. These latter will be dictated by relative prices of farm outputs and inputs and the technical relationships embodied in the farm production function and, in particular, diminishing marginal factor productivity of farm household labor.

Diminishing marginal factor productivity of farm household labor is especially important because of the role it plays in determining both whether to participate in off-farm work and, if so, how much of time will be spent in on-farm versus off-farm work. In theory, the household will allocate additional hours to farm work only so long as the marginal value product of those hours, that is, the implicit wage for on-farm work, is greater than the wage that could be earned in off-farm work.

We assume that the off-farm wage rate (per hour, month, or year) earned by a farm operator or spouse is independent of the amount of time they spend in off-farm work. Likewise, we shall assume that neither the price farmers receive for their output nor the prices they pay for purchased inputs vary with quantities produced or purchased, respectively. Furthermore, we shall ignore how differences in the certainty equivalence of expected on-farm versus off-farm earnings might complicate the picture. Mishra and Goodwin and Mishra and Holthausen analyze implications of variability in farm and off-farm earnings for labor supply decisions of farm households.

The basic ideas underlying the analysis are illustrated in Figure 1, a graphical depiction of the farm household model that draws heavily on presentations in articles by Schmitt, by Sumner, and by Lee. An algebraic version of the model is developed and comprehensively explained in an influential book by Singh, Squire, and Strauss. The model represents the optimal allocation of time, the level of income and utility for a representative farm household. When read from left to right, the horizontal axis in Figure 1 measures the amount of time spent working: zero hours on the extreme left to a maximum of T hours on the extreme right. Correspondingly, when read right to left, that axis measures time spent at leisure such that at the extreme left, all time is spent in leisure and none at work, and at the extreme right, all time is spent at work and none at leisure. Of course, neither of these extremes is realistic—survival generally would require both some minimum of leisure and of work. Thus, here we are concerned with trade-offs within a zone of feasible time allocations.[4]

The vertical axes measure total income and expenditure, traced out by the income possibility curve originating at the origin, point O; passing through the points A, B, and D; and terminating at $Y_{\max}$, the maximum income

[4] As a reviewer noted, the mathematical version of this model might need to include equations formally identifying this feasible zone of time allocations.

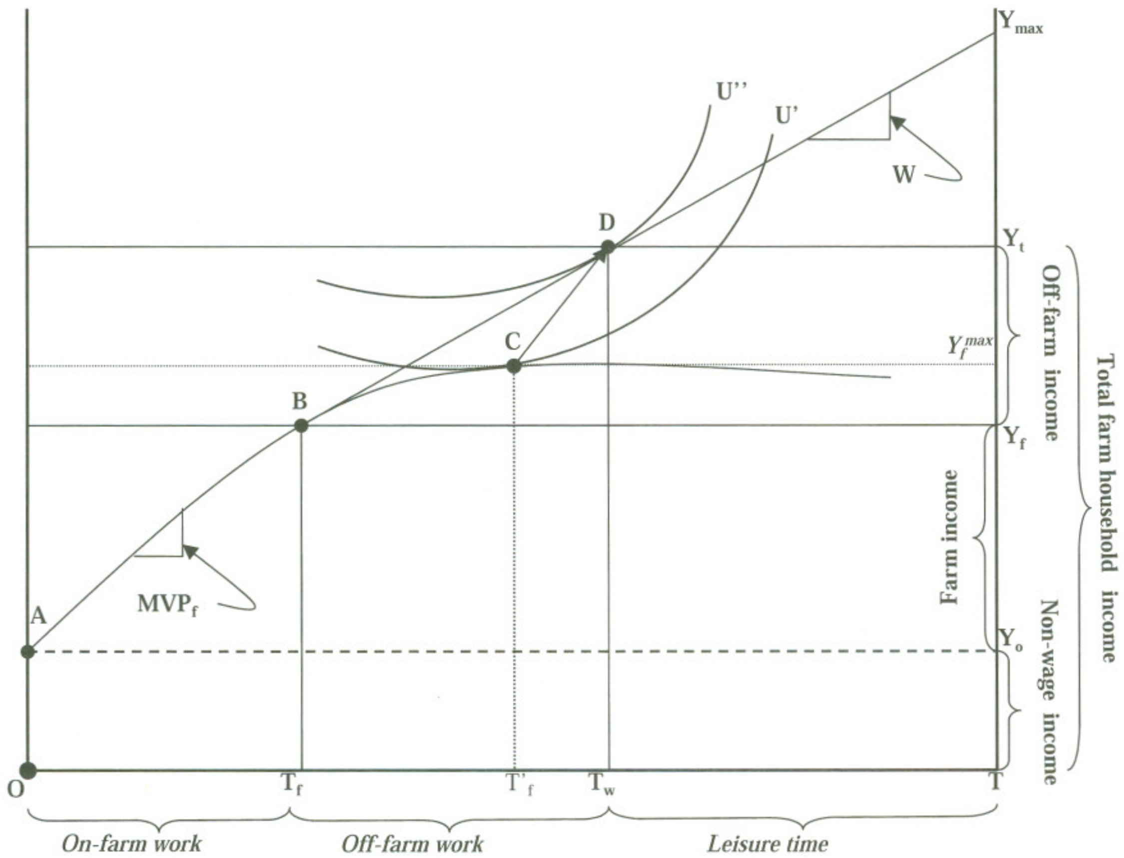


Figure 1. Time Allocation and Farm Household Income

attainable when all available time is allocated to work and none to leisure. Three categories of income are distinguished. The first is nonlabor income and is denoted as Y_o in Figure 1. It is that income a farm household would receive even when zero hours are devoted to work. This category includes such things as retirement income, dividends, and interest, plus, of special importance given the objectives of this paper, farm profits. Profits are taken here to mean residual nonlabor earnings the farm household receives from its farming operations. In a simple version of the story, the main source of nonlabor earnings from the household's farming operation would be returns to owned farmland—money that, in theory, the farm household would receive regardless of whether they or someone else (a renter) farmed the land.

The second category of farm household income represented in Figure 1 is the wage-type income the farm household earns from work time devoted to farming activities—sometimes referred to as returns to farm family labor. The incremental contribution of income from this source is traced out by the curve that starts at *A* and passes through the points marked *B* and *D*. Notice that the slope of this curve declines as more hours are allocated to farmwork reflecting the assumption of diminishing marginal productivity of farm labor. Changes in farm program payments may also, depending on the degree to which the payment is coupled to production, lead to changes in the marginal value product of farm household labor, that is, in the location and slope of the farm income curve. In the equilibrium depicted in Figure 1, the wage-type farm income earned by the farm household (returns to farm family labor) is represented on the right-hand axis as $Y_f - Y_o$. The third category of farm household income is off-farm wage and salary-type earnings, shown as the difference between Y_t and Y_f in Figure 1. Earnings from off-farm work are determined by the off-farm wage rate represented by the (constant) slope of the income possibility curve over the segment B to $Y_{\max}$.

The indifference curves labeled U' and U'' show equal-utility combinations of income (which is the same as total consumption under the above assumptions) and leisure. The household maximizes utility by choosing that combination of work time and leisure yielding the highest attainable utility given the constraints. In the absence of off-farm work opportunities, the farm household would maximize utility by choosing to allocate T_f' hours to on-farm work, zero hours to off-farm work, and $T - T_f'$ hours to leisure at the tangency point C of the indifference curve labeled U' with the income possibility curve. This combination of work and leisure hours yields farm income $Y_f^{\max}$ the optimal maximum ignoring off-farm work opportunities. However, the existence of off-farm work opportunities at wage rate W means the household can obtain the higher income, Y_t, and the higher utility associated with the indifference curve U'' by choosing tangency point D and working only T_f hours on the farm and T_w hours off the farm and spending $T - T_w$ hours in leisure activities. This is because at all points to the right of point B on the income possibility curve, the off-farm wage rate, W, is higher than the marginal value product of farm household labor, MVP_f. Notice that under these conditions the assumption of utility maximization—equating the marginal rate of substitution between income and leisure with the off-farm wage rate—is enough to ensure that the farm household will allocate less time to on-farm work in the presence of off-farm earning opportunities. Compare T_f' versus T_f.

Changes in the off-farm wage rate, in the marginal value product of farm household labor or in the level of nonlabor income could all potentially change the location and slopes of the income possibility curve. Any such change will lead to reallocations of a farm household's total time endowment between work and leisure and, depending on the nature of the change, a reallocation of work time between on-farm and off-farm activities. Our concern is with shifts in the curve and changes in its slope caused by changes in different kinds of government program payments.

We can use the model depicted in Figure 1 to anticipate some of the findings in this respect. The equilibrium depicted there is one in which the household optimally allocates some of its time to off-farm work. However, many farm households have preferences for work and leisure, or they confront off-farm work opportunities that lead to an equilibrium in which none of their available work time is allocated to off-farm work. The effect of government payments on time allocation may be different depending on whether, in the initial situation, the household allocates some or none of its time to off-farm work.

Decoupled Government Payments, Time Allocation, and Farm Household Income

Consider first the potential impact of a small increase in a farm program payment that is completely decoupled from farm production decisions—AMTA payments are generally considered to fit such a description. Figure 2a illustrates the case for a farm household that has no off-farm work; Figure 2b the case where in the initial situation the farm household allocates some of its work time to off-farm work. In both cases, a decoupled payment would be expected to have an effect qualitatively similar to that of an increase in nonlabor income; that is, it would merely shift the income possibility curve upward, giving a tangency with an indifference curve at a higher level of total farm household income and utility. Assuming that farm households regard leisure as a normal good (an assumption we shall maintain throughout), such an increase in income would lead to an increase in the amount of time demanded for leisure activities and a reduction in total time spent working. If, in the initial situation, none of the available work time was allocated to off-farm work, as in Figure 2a, the response would simply be to reduce the number of hours

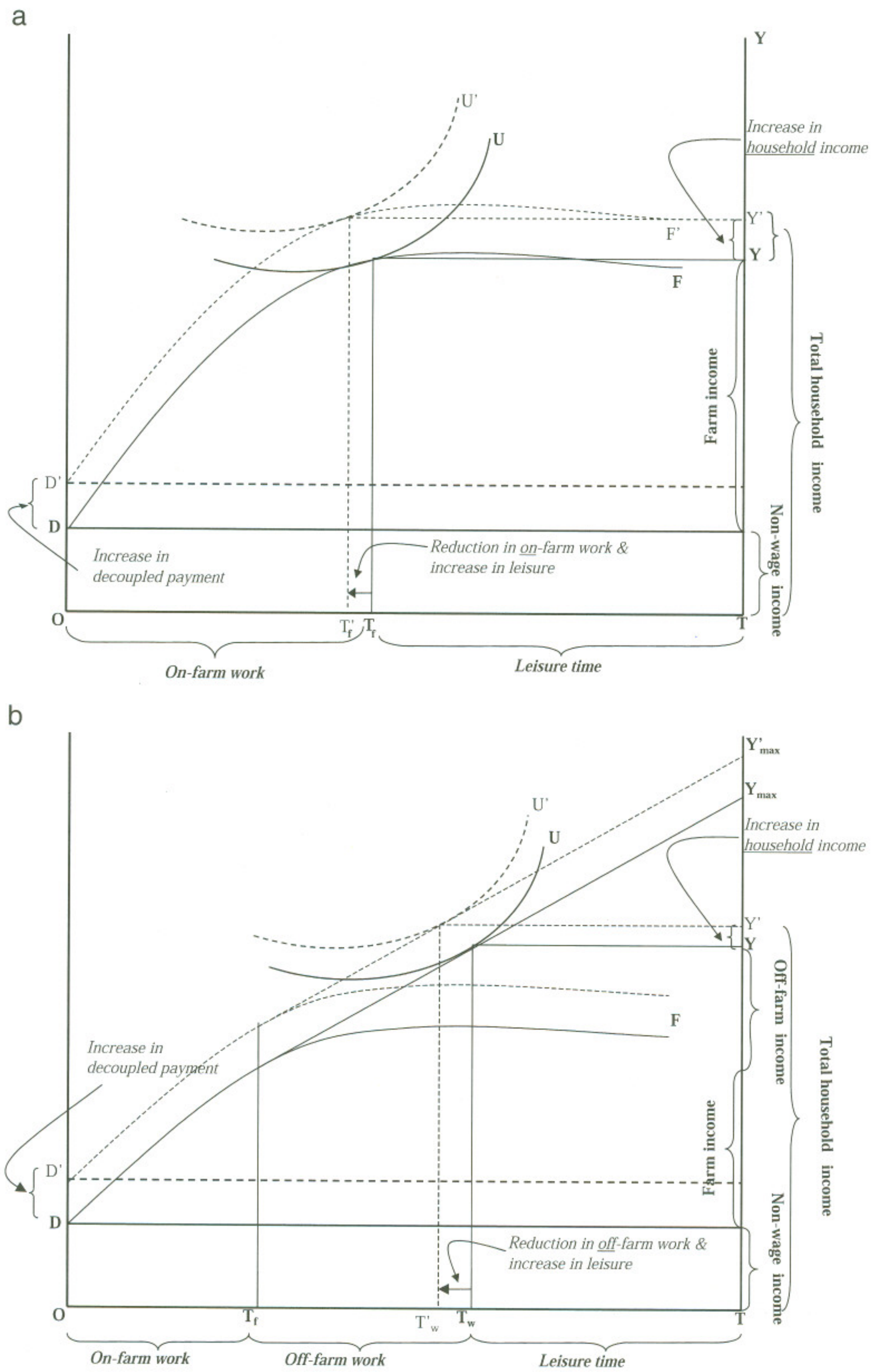


Figure 2a. Effect of Decoupled Payment on Time Allocation and Farm Household Income, No Off-Farm Work. **Figure 2b.** Effect of Decoupled Payment on Time Allocation and Farm Household Income, Some Off-Farm Work

worked on the farm—shown in the figure as the reduction in work hours/increase in leisure equal to $T_f - T_f'$. Alternatively, if in the initial situation the farm household allocates some of its time to work off the farm, as in Figure 2b, the response to the extra income brought in by the decoupled payment would be to reduce the number of hours worked off the farm, by $T_w - T_w'$, with possibly no implications for the amount of time worked on the farm (except, of course, if the change were large enough to induce the farm household to stop working off the farm altogether, in which case we might expect a reduction in on-farm working hours as well). Thus, we see that whether the farm household allocates some or none of its available work time to off-farm work, a decoupled payment would be expected to reduce time spent working and increase time spent in nonwork activities.

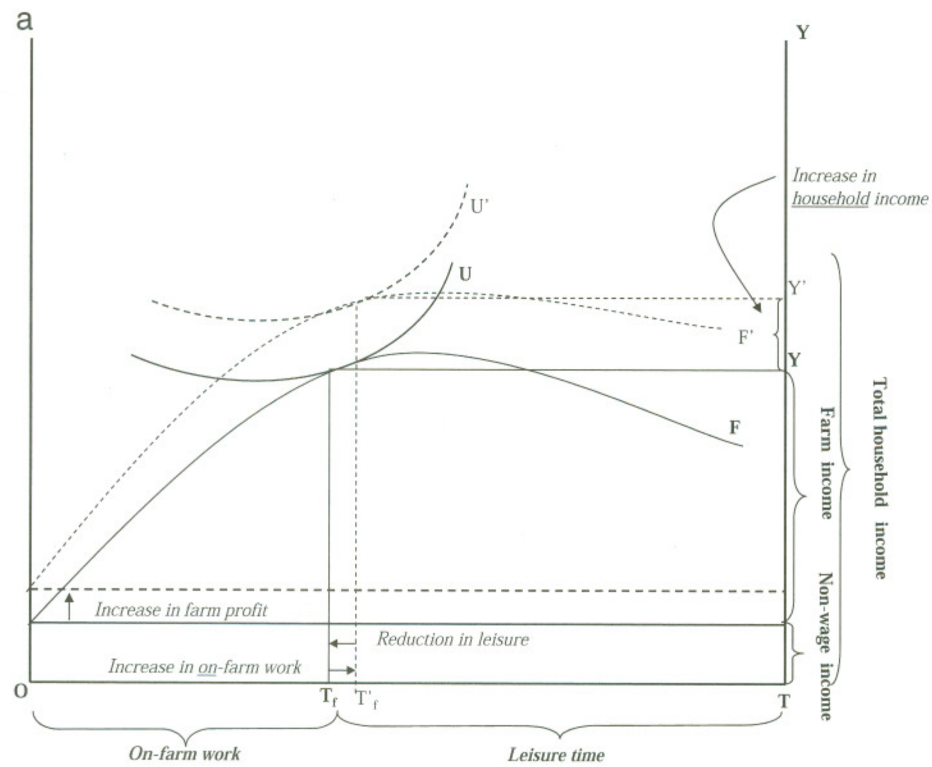
What is the expected transfer efficiency of a decoupled payment; that is, what fraction of the payment ends up as net gain in total farm household income? In Figures 2a,b, this fraction is the ratio $(Y - Y')/(D - D')$. Generally, there are two main reasons why the observed gain in farm household income may be less than dollar for dollar even for a completely decoupled payment (Organization for Economic Cooperation and Development [OECD]). First, depending on contractual arrangements, some of the government payment received by the farm household may be paid out as increased rents on assets owned by other people, land being undoubtedly the most important example. In collecting the data for the ARMS survey, respondents are asked how much money the farm *operation* received in government payments—not how much goes to the *farm household* itself. Some of the money will be paid out in the form of higher rents to landlords. Barnard et al. (1997, 2001) and Goodwin, Mishra, and Ortal Magne discuss the pass-through effects of farm program payments to cropland values and rents.

Second, if measured in terms of the induced change in money income, the transfer efficiency even for that part of the payment kept by the farm household could be less than 100%. The vertical axes in Figures 1–3 are measured in units of money income. If, as concluded in the above discussion, the decoupled payment leads to an increase in leisure/reduction in work time, then wage-type money income also would fall. Only if leisure time were valued by the household at the same money wage as work time and transfer efficiency measured in terms of the induced change in full income would transfer efficiency, even for that part of the payment kept by the farm household, be 100%. (Full income is the sum of money income and an estimate of the money value of leisure time. Usually the wage rate is used to estimate the per hour value of leisure time [Deaton and Muellbauer].)

Coupled Government Payments, Time Allocation, and Farm Household Income

Consider now the impact of a change in a government payment fully coupled to production: a deficiency payment that leads to a higher effective price paid for farm output for example. This case is illustrated in Figure 3a for a household with no off-farm work and in Figure 3b for one that initially does engage in some off-farm work. The assumed increase in the effective output price would cause an increase in the marginal value product of all productive factors including farm household labor and would be revealed in both a leftward rotation and an upward shift of the farm income segment of the income possibility curve. The leftward rotation comes from the revaluation of time devoted to farmwork and the upward shift from the induced increase in farm profits. The combination introduces some ambiguity into the expected net impact of the policy change on the allocation of household time—an ambiguity that is of slightly different nature depending on the household's initial situation with respect to off-farm work.

Look first at Figure 3a, depicting the situation of a farm household with no off-farm work. The induced increase in the marginal value product of farm labor encourages an expansion of work time and a reduction in leisure time, while the induced increase in both wage-type and nonlabor



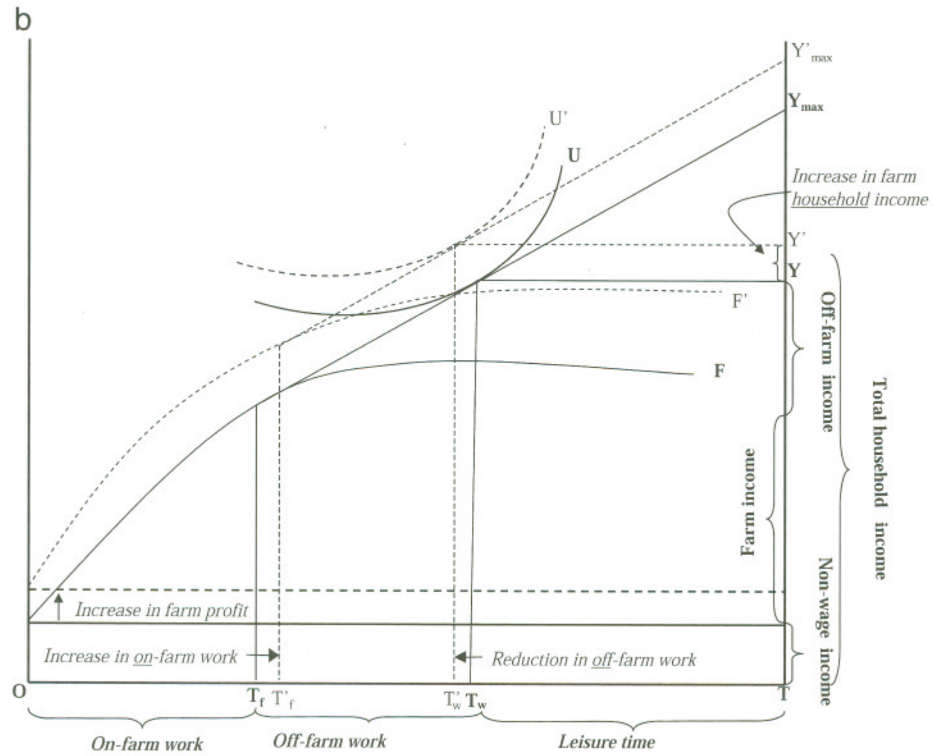


Figure 3a. Effect of Coupled Payment on Time Allocation and Farm Household Income, No Off-Farm Work. **Figure 3b.** Effect of Coupled Payment on Time Allocation and Farm Household Income, Some Off-Farm Work

Table 1. Key Insights from Theoretical Analysis

	Predicted Effect of Program Payment on:			
	Leisure Time for Farm Households with:			
Payment Type:	Some Off-Farm Work	No Off-Farm Work	On-Farm Work Time[a]	Farm Household Income (Transfer Efficiency)
Decoupled	+	+	0/−?	Less than dollar for dollar (i.e., less than 100% transfer efficiency)
Coupled	−/+?	−/+?	+	Less than decoupled payment

[a] Refers only to those households allocating some of their time to off-farm work.

income increases the demand for leisure. Which effect dominates is an empirical question whose answer depends on, among other things, the relative magnitudes of the price and income elasticities of demand for leisure. The possibility illustrated in Figure 3a is one in which the effect of the increase in marginal productivity of work time dominates the induced increase in demand for leisure such that following the policy change the farm household allocates less time to leisure and more to work time.

Turning now to Figure 3b, representing the case of a farm household that initially spends some of its time in off-farm work, recall that an optimizing farm household will allocate time to farmwork so long as the marginal value product of time spent in on-farm work activities is greater than the wage rate. Thus, if in the initial situation the farm household allocates some of its time to off-farm work, an increase in the marginal value product of farm household labor leads unambiguously to an increase in hours devoted to farming activities and a decrease in hours devoted to off-farm work. However, we cannot say on the basis of theoretical considerations alone whether such a change would lead to an increase, a decrease, or no change in the total number of hours worked.

The transfer efficiency of a coupled payment would, as for a decoupled payment, also be expected to be less than 100%. This for the reasons cited in discussing the transfer efficiency of a decoupled payment and more. In reckoning the transfer efficiency of a coupled payment, we must acknowledge some additional sources of transfer efficiency loss. There are first of all the opportunity costs of resources the farm household diverts from other productive activities to production of the supported commodity. These include the reallocations of work and leisure time traced out in Figures 3a,b as well as the reallocations of land and possibly other assets owned by the farm household.

Consider, as a concrete example, the effects of a deficiency payment for wheat. Let us suppose that farm households responded by increasing the quantity of wheat they produce. This might mean that some portion of a farm household's available work time formerly spent working off the farm might now be spent producing wheat. It might also mean that some land, formerly used for growing other crops or for pasture, is planted instead to wheat. The consequent reduction in off-farm income and in other crop and livestock enterprise returns would have to be subtracted from the extra wheat earnings to arrive at the net gain in farm income. There can also be leakages of payment benefits if induced changes in factor mix cause the prices of some factors the farmer purchases off the farm to increase (OECD). All other things the same, then, we might expect the income transfer efficiency of a coupled payment to be less than that of a decoupled payment.

Policy Insights from Graphical Analysis

Table 1 accumulates several key insights regarding policy effects on time allocation and household income gleaned from the above graphical analysis. Potential effects are distinguished according to whether the payment is coupled to or decoupled from production and then according to whether the recipients do or do not have off-farm work. The second and third columns of the table show the expected effects, positive (+) or negative (−), of decoupled and then coupled payments on leisure time. Note that for a farm household with no off-farm work, the expected payment impact on work time is merely the opposite of the expected effect on leisure. The fourth column thus completes the story of payments effects on time allocation showing the expected effects on on-farm work time for those households that initially allocate some time to off-farm work. The last column of the table contains the two insights obtained with respect to payment effects on farm household income, that is, the expected transfer efficiency of the two payment types.

Table 1 show results for six combinations of initial situation: some versus no off-farm work and policy effect on leisure, on-farm work, or off-farm work. Of these six possibilities, there are only two where our simple model suggests unidirectional, unambiguous effects: (1) decoupled payments increase leisure, and (2) coupled payments reduce off-farm work time. In one other case, the ambiguity is unidirectional: when the farm household has some off-farm work, a decoupled payment leading to an increase in leisure and a reduction in off-farm work could also lead to a reduction in on-farm work. In no other case do theoretical considerations alone permit us to say very much.

Empirical Analysis

We adopted a simple reduced-form empirical strategy comprising linear ordinary least squares regression analysis wherein the dependent variables are alternatively indicators of time allocation and farm household income and wherein the different kinds of government program payments are the key independent variables. We ignore other variables that might prove significant explanatory variables in a more complete model: off-farm wage rates, prices of farm outputs and purchased inputs, indicators of the socioeconomic characteristics of farm operators and spouses, and so on. Some of these variables could themselves be affected by government program payments, and thus our results might change with their inclusion. Likewise, fully accounting for the response of time allocations to government payments over the full range of potential variation in the variables would require acknowledging the possibility of nonlinear response. We chose the linear form for its simplicity of interpretation and in light of our main interest in measuring changes in time allocations at the margins.

The Economic Research Service and the National Agricultural Statistics Service conduct the ARMS survey annually. ARMS uses a multiphase sampling design and allows each sampled farm to represent a number of farms that are similar in the population, the number of which being the survey expansion factor (for more technical detail, see Dubman). The expansion factor, in turn, is defined as the inverse of the probability of the surveyed farm being selected. The survey collects data to measure the financial condition (farm income, expenses, assets, and debts) and operating characteristics of farm businesses, the cost of producing agricultural commodities, hours worked on and off the farm (by both the farm operator and the spouse), and money incomes by source for farm operator households.

The target population is operators associated with farm businesses representing agricultural production across the United States. A farm is defined as an establishment that sold or normally would have sold at least $1,000 of agricultural products during the year. Farms can be organized as sole proprietorships, partnerships, family corporations, nonfamily corporations, or cooperatives. Data are collected from one operator per farm, the senior farm operator. A senior farm operator is the operator who makes most of the day-to-day management decisions.

For the purpose of this study, we combined observations from surveys taken in 1998, 1999, 2000, and 2001 and then dropped out observations in the following categories of operator households deemed not especially relevant to our analytical objectives: (1) those organized as nonfamily corporations or co-operatives, (2) those in the typology of farm households covered by ARMS (see Hoppe) that are classified as retirement and residential/lifestyle farm households, and (3) those farm households that did not receive either AMTA or LDP or MLA payments.

Finally, we split the sample in two: one subsample contains those households (15,142 of them) reporting some off-farm wages and salaries and the other households (6,677 of them) reporting no off-farm wages and salaries. Table 2 presents definitions and means of variables used in the regression analysis. Both subsamples contained information on the number of hours worked, both on farm and off farm and separately for the farm operator and the spouse. We calculated leisure hours as the residual of total hours available to either operator or spouse (24 × 7 × 50 = 8,400 hours) less the reported number of hours of work time.[5]

We undertook two kinds of regression analysis corresponding to the relationships presented in Figures 1–3. In the first of these, we investigated selected hypotheses about the effects of government payments on time allocated to work versus leisure time separately for farm operators and spouses. In the second, we estimated the effects of government payments on the total income of farm households.

The three regression equations we used to investigate these hypotheses were the following:

$$LEISURE_{i},j = f(ACRES, AMTA, LDP, OTHERINC, D\_PAYMENT, REGIONS) \tag{1}$$

$$ONFARM_{i,1} = f(ACRES, AMTA, LDP, OTHERINC, D\_PAYMENT, REGIONS) \tag{2}$$

$$TOTHHI = f(ACRES, AMTA, LDP, D\_PAYMENT, REGIONS), \tag{3}$$

where $i = 1, 2$ for operator and spouse, respectively, and $j = 1, 2$ for households having some and no off-farm work, respectively. Note that because of the constraint on total hours, the effects of a change in leisure for on-farm work hours for farm households having no off-farm work is implied by the results for Equation (1). That means that Equation (2) needs to be estimated only for the sample of farm households having some off-farm work. Finally, although not shown above, all these equations contained regional and year dummy variables to condition for possible differences in results attributable to location or time period when observations were taken.

Results

Estimated Effects of Program Payments on Time Allocation

Table 3 contains the ordinary least squares estimates of regression coefficients for the *LEISURE* and *ONFARM* Equations (1) and (2). The adjusted R^2 range between 0.34 and 0.38—levels of explained variation are fairly typical when analyses are based on cross-sectional data (Hensher and Johnson).

The *ACRES* variable was included in the regression to control for farm size under the expectation that, regardless of the level or type of government payment received, the larger the farm, the more time the farm operator and spouse would devote to on-farm work. Regression results tend to confirm this hypothesis with coefficients on this variable in the *ONFARM* equation that are positive and statistically significant for both farm operators and spouses. The results for the *LEISURE* equations suggest additionally that the larger the farm is, the less time the farm operator and spouse devote to leisure—with all the associ-

[5] In a few cases, survey respondents reported an unrealistically large number of hours of off-farm work. To avoid these observations having undue influence on the results, we introduced a maximum of 4,000 hours, imposing the restriction that neither the farm operator nor the spouse could possibly work more than two full-time jobs off the farm.

Table 2. Variable Definition and Summary Statistics

Variables	Definition	Sample Average for Farm Households with: Some Off-Farm Work	No Off-Farm Work
ACRES	Total acres operated	980 (32.021)	971 (37,324)
AMTA	Total Agricultural Market Transition Act payments received by the farm ($)	8,085 (33,836)	7,384 (37,853)
LDP	Total loan deficiency payments received by the farm ($)	7,180 (33,666)	6,825 (36,713)
D_PAYMENT[a]	Total market loss assistance and agricultural disaster payments received by the farm ($)	5,907 (48,993)	5,756 (67,807)
OTHERINC[b]	Other income ($)	12,532 (40,496)	18,466 (47,405)
FARMHR_O	Hours worked on the farm by the operator in a year	2,409 (1,027)	2,134 (1,063)
FARMHR_S	Hours worked on the farm by the spouse in a year	493 (899)	555 (1,037)
OFFHR_O	Hours worked off the farm by the operator in a year	456 (745)	0
OFFHR_S	Hours worked off the farm by the spouse in a year	752 (949)	0
WORKHR_O	Total number of hours worked by the operator (yearly)	2,865 (1,104)	2,134 (1,063)
WORKHR_S	Total number of hours worked by the spouse (yearly)	1,245 (1,184)	555 (1,037)
LEISURE_O	Leisure hours of the operator in a year	5,534 (1,104)	6,085 (1,063)
LEISURE_S	Leisure hours of the spouse in a year	7,154 (1,315)	7,844 (1,135)
R_HEART	= 1 if farm is located in the Heartland region of the United States, 0 otherwise (%)	33	28
R_NORTHC	= 1 if farm is located in the Northern Crescent region of the United States, 0 otherwise (%)	14	16
R_NPLAINS	= 1 if farm is located in the Northern Plains region of the United States, 0 otherwise (%)	10	9
R_PGATE	= 1 if farm is located in the Prairie Gateway region of the United States, 0 otherwise (%)	17	18
R_EUPLAND	= 1 if farm is located in the Eastern Upland region of the United States, 0 otherwise (%)	7	9
R_SSBOARD	= 1 if farm is located in the Southern Seaboard region of the United States, 0 otherwise (%)	6	7
R_FRIM	= 1 if farm is located in the Fruitful Rim region of the United States, 0 otherwise (%)	5	7
R_BRANGE	= 1 if farm is located in the Basin and Range region of the United States, 0 otherwise (%)	2	2
TOTHHI	Total household income ($)	54,263 (277,761)	44,039 (337,004)
Sample size		15,142	6,677

Numbers in the parentheses are standard errors.

[a] Includes payments in the form of market loss assistance and other federal and state agricultural program payments.

[b] Includes income from interest and dividends, off-farm sources such as net rental income from nonfarm properties, private pension, annuities, disability, social security, military retirement, and other public retirement and public assistance programs.

Source: Agricultural Resource Management Survey (ARMS) 1998, 1999, 2000, and 2001.

Table 3. Ordinary Least Squares Estimates of Leisure Hours and On-Farm Hours Equations

	Leisure Hours					
	Some Off-Farm Work		No Off-Farm Work		On-Farm Work Hours	
Variables	Operator	Spouse	Operator	Spouse	Operator	Spouse
INTERCEPT	4,980.260 (22.2227)	6,486.97*** (21.683)	5,812.32*** (48.0657)	7,946.263*** (47.6021)	2,747.365*** (20.252)	537.255 (15.564)
ACRES	−0.0030** (0.0002)	−0.0023 (0.0021)	−0.0068*** (0.0019)	−0.0034** (0.0019)	0.0078*** (0.0019)	0.0026*** (0.0015)
AMTA	0.6672** (0.3291)	0.7022 (0.4186)	1.2000** (0.3729)	0.1631 (0.3693)	1.1272*** (0.3910)	−0.3149 (0.5531)
LDP	−0.2479 (0.4285)	−0.2897** (0.1501)	−1.1614*** (0.3832)	0.0204 (0.3795)	1.6403*** (0.3905)	0.4229 (0.5500)
D_PAYMENT	−0.4000 (0.4829)	−0.6888** (0.3400)	−0.4398*** (0.1891)	0.0015 (0.1872)	2.0752*** (0.4400)	1.3473** (0.6408)
OTHERINC	1.7725*** (0.3472)	2.1552*** (0.3388)	2.0481*** (0.2676)	1.0544*** (0.2649)	−2.5357*** (0.3164)	−0.0267 (0.2431)
YEAR1998	88.0828*** (31.0977)	144.699*** (30.3378)	5.1354 (34.9510)	36.425 (34.6144)	29.361 (28.334)	−43.459** (21.776)
YEAR2000	345.391*** (77.5193)	141.811** (75.6251)	−1.7062*** (32.8140)	70.480*** (32.498)	−210.679*** (70.633)	−313.285*** (54.2827)
YEAR2001	407.643*** (76.8861)	114.289 (75.0074)	130.618*** (37.1370)	80.082*** (36.7795)	−298.010*** (70.0556)	−365.399*** (53.839)
R_HEART	291.666*** (80.5764)	−97.264 (78.6076)	−160.835*** (50.2000)	−313.7350*** (49.7152)	109.760 (73.418)	217.484*** (56.4235)
R_NORTHC	−714.598*** (88.4838)	−212.60*** (86.3217)	−775.787 (54.0235)	632.124*** (53.5024)	750.600*** (80.623)	442.874*** (61.9606)
R_NPLAINS	−431.190*** (91.9247)	−269.65*** (89.6786)	−331.702*** (60.5649)	−530.594*** (59.9807)	230.497** (83.758)	474.453*** (64.370)
R_PGATE	315.488*** (86.5016)	−172.79*** (84.3924)	−61.5035 (52.2244)	−320.944*** (51.7207)	160.192** (78.821)	281.705*** (60575)
R_EUPLAND	244.303*** (107.2824)	11.373 (104.661)	−212.348*** (67.3794)	408.862*** (66.7295)	104.254 (97.751)	253.828*** (75.124)
R_SSBOARD	26.875 (90.6274)	−97.883 (88.412)	−141.920*** (57.4285)	−238.735*** (56.8745)	−4.825 (82.576)	147.509*** (63.461)
R_FRIM	−326.313*** (99.8342)	5.9296 (97.394)	−272.891*** (55.3826)	−221.298*** (54.8484)	150.380* (90.965)	240.298*** (69.908)
R_BRANGE	−508.275*** (123.2017)	−237.71** (120.191)	−271.082*** (80.6076)	−469.949*** (79.8300)	407.666*** (112.256)	476.843*** (86.271)
R^2 (adjusted)	0.38	0.35	0.36	0.34	0.33	0.31

Numbers in the parentheses are standard errors.
* Indicates two-tailed statistical significance at the .10 level.
** Indicates two-tailed statistical significance at the .05 level.
*** Indicates two-tailed statistical significance at the .01 level.

ated coefficients negatively signed and statistically significant in all but one case, namely, spouses who spend some time in off-farm work. This finding is consistent with those reported in Lass and Gempesaw, Mishra and Goodwin, Mishra and Holthausen, and Sumner.[6]

The working hypothesis for the regression analysis was that AMTA payments are decoupled and LDPs coupled, giving expected signs for their respective regression coefficients as in Table 1. We presume that market loss assistance and disaster payments (MLA) may help keep some farmers and spouses who might otherwise allocate more time to off-farm work or possibly quit farming altogether to remain in business, leading us to suspect the sign of the estimated regression coefficient on this variable to be more similar to that of LDPs than AMTA payments.

In the *LEISURE* equations, all the estimated signs of the regression coefficients on AMTA variable are positive—statistically significant in the farm operator equations but not so in either of the spouse equations. These results are in line with assumptions that (1) AMTA payments are indeed decoupled and that (2) the income elasticity of demand for leisure is positive. The latter assumption finds support in the results obtained for *OTHERINC* variable in those same *LEISURE* equations. This variable combines income received by the farm household in the form of stocks and dividends, interest, social security payments, and so on, that is, that income the household receives whether it devotes any time to work activities or not. Because we assume that leisure is a normal good, we expect that an increase in such income would unambiguously increase leisure and decrease work time—an expectation borne out by the signs and statistical significance of the associated regression results. Note, however, that the estimated coefficients obtained for the *OTHERINC* variable in the leisure equations are significantly larger than the corresponding coefficients for the AMTA variables.

Estimated AMTA coefficients in the *ONFARM* equations (estimated only on the samples of farm operators and spouses who allocate some work time to off-farm work) are negative but not statistically significantly different from zero in the spouse equation but positive and statistically significant in the farm operator equation. Recall from the graphical analysis that the expected effect of a decoupled payment on on-farm work time was either zero or negative; that is, the result in the farm operators' equation contradicts the prediction from our theoretical model. Of course, the reality of farm household time allocation decisions is more complicated than could possibly be captured in our simple model. In Ahearn, El-Osta, and Dewbre, a similar finding was interpreted as indicating that AMTA payments might be no less coupled to production than other kinds of government support. Other interpretations are possible. In some cases, for example, the intrahousehold reallocation of work time among leisure, off-farm work, and on-farm work could favor an expansion of on-farm work by the farm operator but a reduction in the combined total for the household.

The estimated coefficients for the LDP and MLA variables in the *LEISURE* equations are, with only one exception (spouses with no off-farm work), negative and, with only two exceptions, statistically significant. Correspondingly, their estimated coefficient in the *ONFARM* equations are positive and with only one exception statistically significant. Taken together, these findings sit much better with the assumption that such payments are coupled to rather than decoupled from production.

Estimated Transfer Efficiency of Government Payments

In estimating the transfer efficiency, we use farm household income as the dependent variable. Farm household income originates from both farm (net farm income) and off-farm sources (see Mishra et al.). Off-farm

[6] Both Lass and Gempesaw and Sumner also used total acres as an indicator of farm size.

Table 4. Ordinary Least Squares Estimates of Transfer Efficiency

Variables	Some Off-Farm Work	No Off-Farm Work
INTERCEPT	47.154*** (2.574)	11.084 (8.768)
ACRES	0.002*** (0.0005)	0.004*** (0.0005)
AMTA	0.960*** (0.092)	0.979*** (0.117)
LDP	0.553*** (0.092)	0.832*** (0.117)
D_PAYMENT	0.490*** (0.107)	0.591*** (0.120)
YEAR1998	1.062 (3.488)	−0.634 (5.083)
YEAR2000	1.182 (10.540)	−12.590** (4.883)
YEAR2001	−4.059 (10.512)	−7.707 (5.043)
R_HEART	−11.218 (10.588)	22.956*** (8.774)
R_NORTHC	−4.899 (11.560)	24.790** (9.324)
R_NPLAINS	−11.080 (11.552)	21.935** (10.105)
R_PGATE	−17.558* (11.081)	28.592*** (9.122)
R_EUPLAND	−1.030 (12.590)	18.792 (10.140)
R_SSBOARD	12.871 (12.590)	39.054*** (10.660)
R_FRIM	36.282*** (13.629)	53.781*** (10.626)
R_BRANGE	4.431 (15.993)	37.290** (15.253)
R^2 (adjusted)	0.26	0.29
NB: share of land owned	48%	64%

Numbers in the parentheses are standard errors.
* Indicates two-tailed statistical significance at the .10 level.
** Indicates two-tailed statistical significance at the .05 level.
*** Indicates two-tailed statistical significance at the .01 level.

income includes income from off-farm businesses, wages and salaries, interest and dividends, and sources such as social security. While off-farm wages predominate, income from other businesses, such as machinery repair shops, seed agencies, or insurance agencies, also shore up household income. Income from interest and dividends includes the interest income from savings and investment accounts. Dividends earned by the household are from investments in equities such as stocks or mutual funds. Additional sources of nonfarm income include pensions, annuities, military retirement, unemployment, social security, veteran benefits, other public retirement and public assistance programs, and rental income from nonfarm properties.

Table 4 contains regression results for transfer efficiency equations. The two samples of observations, farm households with some off-farm work and farm households with no off-farm work are the same as used in the time allocation analysis reported above. The estimates of transfer efficiency of government payments obtained are in all instances statistically significant and consistent with prior expectations that they be positive, greater than zero, and less than unity. Additionally, the estimated coefficients on the AMTA payments are significantly greater than those found for the other categories—another finding supporting their interpretation as relatively more decoupled. An *F*-test found that the regression coefficients on the AMTA variable were higher than those for either the LDP or the disaster payment (which includes MLA) variables at the 5% level of significance. The estimated results suggest that, for farm households with some off-farm work, each dollar of AMTA payment translates into more than 96 cents of extra income for farm households, while each dollar of LDP and disaster payments (including MLA payments) yields, on average, around 50 cents of extra income for farm households. On the other hand, for farm households with no off-farm work, each dollar of AMTA payment translates into more than 98 cents of extra income for farm households, while each dollar of LDP yields, on average, around 83 cents of extra income for farm households. Further, each additional dollar of disaster payments (including MLA payments) yields around 60 cents of extra income for farm households.

Implications and Needs for Further Work

In general, farm program payments are expected to alter the time farm households allocate to on-farm versus off-farm work and to leisure. Theoretically, these effects should differ for decoupled versus coupled payments and for farm operators and spouses who allocate some versus none of their time to off-farm work. The main testable insights obtained from theoretical analysis are that decoupled payments should increase leisure time for farm operators and their spouses and without regard to their initial situation with respect to off-farm work. Those with some off-farm work in the initial situation would be expected to increase leisure at the expense of off-farm work time; those with no off-farm work in the initial situation would be expected to increase leisure at the expense of on-farm work time. Theory is ambivalent with respect to the effects of coupled payments on leisure, not ruling out the possibility that coupled payments could reduce time allocated to leisure and strongly suggesting that this category of payments would increase the amount of time devoted to on-farm work.

Theory also suggests that the transfer efficiency of all forms of program payments should be less than 100% but greater for decoupled than for coupled payments. A government payment that delivers one dollar of income benefits to farm households for each one-dollar outlay of taxpayer funds necessarily has no effect on production or trade (Dewbre, Anton, and Thompson; Schmitz and Vercammen). But the reverse need not hold. That is, a completely decoupled payment can be less than 100% efficient.

The regression analysis revealed that, insofar as their effects on household time location and income are concerned, AMTA payments exhibit characteristics generally consistent with those of decoupled payments, while loan deficiency payments and payments in the category that combines market loss assistance and disaster payments exhibit characteristics consistent with their being coupled payments. AMTA payments were found to increase leisure, and the other program payment types were found to reduce leisure. Reinforcing this conclusion, the income transfer efficiency of AMTA payments was found to be significantly greater than was the case for the other program types. If valid, these are significant findings with implications for international discussions about the way that support measures are classified for trade negotiations.

One finding concerning AMTA payments is potentially inconsistent with their characterization as decoupled payments. For both farm operators with and without off-farm work, such payments were found to increase time allocated to leisure. In the case of farm operators with no off-farm work, this automatically implies a reduction in time allocated to on-farm work. However, in the case of farm operators having off-farm work, AMTA payments were found to increase the amount of time they spend working on the farm. The explanation for this finding could lie in the effects of different kinds of payments on intrahousehold time allocation decisions—a subject fully deserving of further research.

The scope of transfer efficiency analysis in this paper was confined to the relation between the amount of payment a farm operation receives and the associated increase in farm household income. A fuller treatment of this important issue would consider administrative costs and the deadweight losses that occur when citizens are taxed to obtain the funds (Alston and Hurd) as well as the potential effects that arise through induced changes in market prices of inputs and outputs (OECD).

[Received January 2007; Accepted May 2007.]

References

Ahearn, M.C., H. El-Osta, and J. Dewbre. "The Impact of Coupled and Decoupled Government Subsidies on Off-Farm Labor Participation of U.S. Farm Operators." *American Journal of Agricultural Economics* 88(May 1993):149–56.

Alston, J.M., and B.H. Hurd. "Some Neglected Social Costs of Government Spending in Farm Programs." *American Journal of Agricultural Economics* 75(November 1993):149–56.

Barnard, C.H., G. Whittaker, D. Wesenberger, and M. Ahearn. "Evidence of Capitalization of Direct Government Payments into U.S. Cropland Values." *American Journal of Agricultural Economics* 79(December 1997):1642–50.

Barnard, C.H., R. Nehring, J. Ryan, R. Collender, and B. Quinby. "Higher Cropland Value from Farm Program Payments: Who Gains?" *Agricultural Outlook*, November 2001:26–30.

Deaton, A., and J. Muellbauer. *Economics and Consumer Behaviour*. Cambridge: Cambridge University Press, 1993.

Dewbre, J.H., J. Anton, and W. Thompson. "The Transfer Efficiency and Trade Effects of Direct Payments." *American Journal of Agricultural Economics* 83(December 2001):1204–14.

Dubman, R.W. "Variance Estimation with USDA's Farm Costs and Returns Surveys and Agricultural Resource Management Study Survey." Washington, DC: Economic Research Service, U.S. Department of Agriculture, *AGES 00–01*, 2000.

El-Osta, H., and M. Ahearn. *Estimating the Opportunity Cost of Unpaid Farm Labor for US Farm Operators*. Washington, DC: U.S. Department, Economic Research Service Technical Bulletin 1848, 1996.

El-Osta, H., A. Mishra, and M. Ahearn. "Labor Supply by Farm Operators under 'Decoupled' Farm Program Payments." *Review of Economics of Households* 2(June 2004):367–85.

Goodwin, B.K., A.K. Mishra, and F. Ortal Magne. "What's Wrong with Our Models of Agricultural Land Values?" *American Journal of Agricultural Economics* 85(August 2003):744–52.

Hallberg, M., J. Findeis and D. Lass, eds. *Multiple Job Holding among Farm Families*. Ames: Iowa State University Press, 1991.

Hensher, D.A., and L.W. Johnson. *Applied Discrete Choice Modelling*. London: Croom Helm, 1981.

Hoppe, R.A. "Structural and Financial Characteristics of U.S. Farms, 1996." *21st Annual Family Farm Report to the Congress*. Washington, DC: Economic Research Service, U.S. Department of Agriculture, AIB #735, 2000.

Huffman, W. "Farm and Off-Farm Work Decisions: The Role of Human Capital." *Review of Economics of Statistics* 62(February 1980):14–23.

Lass, D.J., and C.M. Gempesaw. "The Supply of Off-Farm Labor: A Random Coefficient Approach." *American Journal of Agricultural Economics* 74(May 1992):400–11.

Lee, J. "Allocating Farm Resources between Farm and Non-Farm Uses." *American Journal of Agricultural Economics* 47(February 1965):83–92.

Mishra, A.K., H. El-Osta, M. Morehart, J. Johnson, and J. Hopkins. "Income, Wealth and Well-Being of Farm Households." Washington, DC: Economic Research Service, U.S. Department of Agriculture, Agricultural Economics Report 812, July 2002.

Mishra, A.K., and B.K. Goodwin. "Farm Income Variability and the Supply of Off-Farm Labor." *American Journal of Agricultural Economics* 79(August 1997):880–87.

Mishra, A.K., and D.M. Holthausen. "Effect of Farm Income and Off-Farm Wage Variability on Off-Farm Labor Supply." *Agricultural and Resource Economics Review* 31(October 2002):187–99.

Organization for Economic Cooperation and Development. "Farm Household Incomes: Issues and Policy Responses." Paris: OECD, 2002.

Schmitt, G.H. "What Do Agricultural Income and Productivity Measurements Really Mean?" *Agricultural Economics* 2(October 1988):139–57.

Schmitz, A., and J. Vercammen. "Efficiency of Farm Programs and Their Trade-Distorting Effect." *GATT Negotiations and the Political Economy of Policy Reform*. G. Rauser, ed. Berlin: Springer, 1995.

Singh, I., L. Squire, and J. Strauss, eds. *Agricultural Household Models*. Baltimore: Johns Hopkins University Press for the World Bank, 1986.

Sumner, D.A. "The Off-Farm Labor Supply of Farmers." *American Journal of Agricultural Economics* 64(August 1982):499–509.

Taylor, J.E., and I. Adelman. "Agricultural Household Models: Genesis, Evolution and Extensions." *Review of Economics of the Household* 1(January 2003):33–58.

U.S. Department of Agriculture–Economic Research Service. Internet site: www.ers.usda.gov/Briefing/ARMS (Accessed April 29, 2005).

———. Agriculture Resource Management Survey (ARMS) 1998, 1999, 2000, and 2001. Washington, DC: USDA–ERS.