NONPECUNIARY BENEFITS TO FARMING AND DECOUPLED PAYMENTS

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Abstract. The first part of this paper presents a simple labor supply and production model wherein farmers with diminishing marginal utility of income derive nonpecuniary benefits from farming. We use the model to show how lump-sum or "decoupled" government payments could have positive and substantial effects on the supply of agricultural products. The result is simple and intuitive: payments allow those who enjoy farming to continue farming while maintaining a reasonably high living standard. Without payments, a lower living standard leads to higher marginal utility of income, making higher off-farm wages more desirable than lower on-farm wages plus non-pecuniary benefits from farming. Farmers respond to a reduction in payments by shifting their labor off-farm or exiting farming. This effect on labor supply and production is potentially much larger than effects predicted by earlier theoretical models that rely on utility with declining absolute risk aversion. The second part of this paper estimates the hourly nonpecuniary benefits to farming, for farms where the operator or spouse works off-farm, by comparing returns to household labor on-farm and off-farm. Results indicate substantial nonpecuniary benefits to farming. The empirical findings support a necessary (though not sufficient) condition for lump-sum payments having a substantial influence on production via an income effect.

Keywords: Decoupled payments, government payments, nonpecuniary benefits, labor supply, trade.

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1. Introduction

Agricultural policy reforms, beginning in the U.S. with the 1996 Federal Agricultural Improvement and Reform (FAIR) Act, have attempted to minimize production distortions by giving farmers lump-sum payments that are not tied to production decisions or prices. How these "decoupled" payments affect production is an important question in the context of international trade because farm payments can be considered as "green box" – that is, exempt from World Trade Organization limits – if, among other things, they have "no, or at most minimal, trade distorting effects on production" (WTO, 1999). Theoretical or empirical evidence concerning how decoupled payments influence production could play an important role in future trade negotiations and disputes.

Within the academic literature, a great deal of uncertainty remains about how lump-sum payments influence production. With complete and perfect markets, economic theory suggests that lump-sum payments have no effect on production. However, when there are market imperfections – such as incomplete labor markets, transactions costs, or credit constraints – lump-sum payments might influence production (e.g., Roe, Somwaru, and Diao, 2003). Chau and de Gorter (2001) suggest that payments might increase the number of producers who are able to meet their fixed costs and therefore remain in production. They argue that even though lump-sum payments may not affect firm-level output decisions, the payments could influence aggregate output by altering incentives to exit the industry.

Hennessy (1998) provided a widely cited rationale for production distortions from lump-sum payments that has served as the basis for several policy simulations (e.g., Young and Westcott, 2000; Mullen, de Gorter, and Gloy, 2001). He showed that with declining absolute risk aversion (DARA), lump-sum payments raise income and therefore reduce risk aversion, resulting in greater output. Studies finding an income effect on crop allocation decisions have been interpreted as evidence of DARA preferences (Chavas and Holt, 1990). However, DARA preferences alone are unlikely to result in a large income effect because the magnitude of this effect depends on the third derivative of the utility function – i.e., how the concavity (the second derivative) of the utility function changes with a change in income (Just, 2006).[1]

In this paper, we propose a new way lump-sum payments could have a substantial effect on production via an income effect.[2] The income effect we describe does not stem from uncertainty or standard market failures but instead results when farm operators derive nonpecuniary benefits from farming – that is, when operators prefer on-farm work to off-farm work, given the same wage. The intuition is as follows: at low payment levels, farmers cannot "afford" to work more on-farm – they must work off-farm at a higher wage to earn enough to satisfy their basic needs. As payments increase they can increasingly "afford" to consume the nonpecuniary benefits that come with working on-farm. Hence, they work more on-farm, and output increases.

The model developed in the next two sections formalizes this intuition. It shows that farmers allocate their labor to equate marginal utility from labor (labor provides income and nonpecuniary benefits) in on-farm and off-farm work. Higher lump-sum payments (which farmers receive regardless of their labor allocation) lower the marginal utility of income but do not reduce the marginal utility of nonpecuniary benefits. Farmers respond by shifting labor from off-farm to on-farm, which raises the marginal utility of income and lowers the marginal utility of nonpecuniary benefits, restoring equilibrium. Since output is increasing in labor, an increase in lump-sum payments results in greater production.

There exists some empirical support for positive nonpecuniary benefits to farming. Summary statistics for farm income have, for many years, shown that a substantial portion of farmers report negative returns from farming (e.g., Hoppe and Banker, 2006). The fact that farmers appear to earn less on-farm than they could earn in an alternative off-farm occupation is

[1] Using a calibration similar to Rabin (2000), Just (2006) shows that for a lump-sum payment equal to 50 percent of profits to cause a one-percent increase in production would require a 450 percent decrease in absolute risk aversion (implying the implausible condition that a producer who is risk-averse without the lump-sum payment would become risk-loving with the payment).

[2] We use the term "income effect" rather than "wealth effect" because, like most of the literature cited, we develop a static model. Because policy changes that affect agricultural payments are likely to have long-term consequences for income, changes in wealth are likely to be proportional to changes in income.

consistent with nonpecuniary benefits to farming. The limited research that exists on this topic suggests that attributes associated with farming – such as autonomy over farm management decisions, independence, sense of responsibility, and pride associated with business ownership – are valuable to hog farmers (Gillespie and Eidman, 1998; Gillespie, Davis, and Rahelizatovo, 2004). Outside of agriculture, studies have compared the well-being of the self-employed to paid employees and generally found that the self-employed express greater satisfaction with their jobs (Eden, 1973; Katz, 1993; Vandenheuvel and Wooden, 1997). One influential study found substantial non-monetary benefits to self-employment: individuals were willing to give up about 35 percent of their income in order to be self-employed rather than to be paid employees (Hamilton, 2000).

In the second part of this paper, we estimate the nonpecuniary benefits from farming using data from three annual nationally-representative surveys of farm households. Past empirical studies compared returns to non-farm labor for separate samples of self-employed or paid workers (Brock and Evans, 1986; Rees and Shah, 1986, Borjas and Bronars, 1989; Hamilton, 2000). Here we compare returns to labor for on-farm and off-farm work for the *same* households, which controls for all individual effects – both observable effects (such as differences in education, experience, or location) and unobservable effects (such as motivation, entrepreneurial ability, or intelligence). This provides a compelling estimate of the nonpecuniary benefits to farming for those farm households with members who work off-farm.

The paper is organized as follows. In the next section we describe the basic theoretical model illustrating how decoupled payments can stimulate supply when farmers receive nonpecuniary benefits from farming. The third section provides a graphical illustration of the model and a simple numerical simulation showing how decoupled payments could substantially affect production. The fourth section reviews the literature associated with estimating nonpecuniary benefits and proposes an empirical model for estimating the nonpecuniary benefits to farming. Sections five and six discuss the data used for the estimations and the results. The final section concludes.

2. Theoretical Model

There is an established literature considering the allocation of farm household labor (e.g., Lee, 1965; Gronau, 1977; Sumner, 1982; Singh, Squire, and Strauss, 1986). In the basic model, farm households choose between leisure and labor on and off-farm to maximize utility – workers are indifferent between working on and off-farm at the same wage rate. In this context, "coupled" payments (payments tied in some way to agricultural output) would be expected to raise the returns to farm labor relative to off-farm labor resulting in a shift in labor on-farm. The stimulus effect of an increase in government payments would be counterbalanced to some degree by an increase in the consumption of leisure made possible by the higher farm wage rate. In the standard model, "decoupled" (lump-sum) payments affect labor allocation through the labor-leisure trade-off: higher income results in an increase in the consumption of leisure, with a commensurate reduction in farm and off-farm labor, and consequently a reduction in output. To make a clear distinction with earlier work, to increase the simplicity of the model, and because we expect the income elasticity of labor supply to be approximately zero over the range of payments considered, we do not incorporate leisure into our model.[3]

Consider a unitary farm household that allocates its endowment of labor (L) between on-farm l and off-farm ($L - l$) activities to maximize utility from income y and from the non-pecuniary benefits from farming relative to working off-farm b:

$$(1) \qquad \max_{l} \quad U(l;g) = u(y(l,g), b(l)).$$

[3] Imbens, Rubin, and Sacerdote (2001) estimate the effect of unearned income on labor supply using evidence derived from a survey of lottery players. They found lottery winnings of $15,000 per year for twenty years had little or no effect on labor supply. For winnings of $80,000 per year for twenty years, they found unearned income had a small effect on labor earnings, with a marginal propensity to consume leisure of approximately 11 percent. The marginal propensity to consume leisure from earned income would logically be even less than for unearned income.

Assume positive and diminishing marginal utility of income ($u_y > 0$; $u_{yy} < 0$, where subscripts denote partial derivatives) and positive non-pecuniary benefits from farming ($u_b > 0$). Income depends on labor supplied on-farm and government payments g:

(2) $$y(l,g) = pq(l) + w(L - l) + g \ ,$$

where q is output, $q_l > 0$, and w is the off-farm wage. Nonpecuniary benefits from farming are positive if $l > 0$ and are increasing in on-farm labor ($b_l > 0$). Government payments are lump-sum in that g is fixed—it does not depend on the farmer's labor allocation, agricultural output, or any other decision or outcome.

First consider the case where labor is allocated to both on-farm and off-farm activities (there is an interior solution). In this case, the first order condition for a maximum is

(3) $$U_l = u_y\left(pq_l - w\right) + u_b b_l = 0 \, .$$

Totally differentiating (3) gives: $U_{ll}dl + U_{lg}dg = 0$ or

(4) $$dl/dg = -U_{lg}/U_{ll} \ .$$

From the second order condition for a maximum, $U_{ll} < 0$, so (4) will be positive if

(5) $$U_{lg} = u_{yy}\left(pq_l - w\right) + u_{yb}b_l > 0 \, ,$$

or

(6) $$u_{yb} > -u_{yy}\left(pq_l - w\right)/b_l \ .$$

Since, from the FOC (3):

(7) $$pq_l - w = -u_b b_l / u_y < 0,$$

the right-hand side of (6) is negative. Hence, (4) is positive if $u_{yb} \geq 0$, and may be positive even if $u_{yb} < 0$. If utility is additively or multiplicatively separable (e.g., Cobb-Douglass), the cross-partial would be zero or positive, and (6) will always be true. More generally, we must assume the non-pecuniary benefits from farm labor is not a strongly inferior good.

While the above analysis considers only interior solutions, corner solutions (l = 0 or l = L) do not change the basic results. Under given assumptions, the first-order condition is monotonic, so if on-farm labor begins at l = 0, an increase in g may leave labor allocation unchanged or increase it, and if on-farm labor begins at l = L, an increase in g necessarily implies labor will remain at l = L. Thus, on-farm labor supply is weakly increasing in g. In sum, unless the nonpecuniary benefits to farming are a strongly inferior good, an increase in lump-sum payments will result in an increase in on-farm labor supply, and therefore an increase in output.

3. A Graphical Illustration and Numerical Simulation

The effect of lump-sum payments on the household labor allocation decision is illustrated in figure 1. In the model, a farmer can allocate labor to both on-farm and off-farm work. For clarity, we illustrate graphically only the choice between working full time on-farm and full time off-farm. The figure shows an individual's utility working either on-farm or off-farm, both with and without a lump-sum payment g. Income from full-time off-farm employment is Lw, equal to total labor allocation L multiplied by the off-farm wage w. Income from full-time on-farm employment is Lw^f, where w^f is the implicit on-farm wage. The lower utility line shows diminishing marginal utility of income without non-pecuniary benefits of farm labor. The higher utility line shows additional utility from farm labor relative to non-farm labor (non-pecuniary benefits). Without the lump-sum transfer (g), utility is higher when working full-time off-farm compared to working full time on-farm, $u(Lw, b(0)) > u(Lw^f, b(L))$. With a lump transfer, utility is higher for working full time on-farm, $u(Lw + g, b(0)) < u(Lw^f + g, b(L))$. The figure clearly illustrates how lump-sum payments increase the supply of labor on-farm, which would result in greater production.

As further illustration, we provide a simple numerical example using a plausible parametric utility function and plausible income values. The example is summarized in table 1. Let the utility function be of the form $u = \ln(y) + 0.35s$, where y is income from all sources (labor on and off-farm plus lump-sum payments), s is the share of labor allocated to on-farm employment, and $0.35s$ represents non-pecuniary benefits from on-farm employment. We choose the parameter 0.35 because it indicates non-pecuniary benefits comprise approximately 35 percent of utility, which corresponds well with Hamilton (2000), mentioned above and in more detail below. Natural log utility assumes a modest degree of risk aversion: it is the utility function at the limit as the coefficient of relative risk aversion tends to one. The table considers off-farm wage income of $40,000 (column 1), on-farm wage income of $20,000 (column 2), and annual lump-sum payments varying from 0 to $50,000 (column 3). With diminishing marginal utility of income and additively-separable non-pecuniary benefits, the assumed utility function implies an annual dollar value of non-pecuniary benefits from full-time on-farm employment that range from $8,381 to $29,335. The value increases with income because the utility function assumes non-pecuniary benefits are constant in *utility* ($u_{yb} = 0$). In this simple example, changing lump-sum payments from $15,000 to $40,000 causes the share of on-farm labor supply to increase incrementally from 0 to 1.

While the result relies on risk aversion, the level of risk aversion necessary to induce considerable supply response in the example is modest—less, in fact, than that typically estimated in the literature. More risk aversion would lead to a stronger effect from lump-sum payments. The critical assumption in the example – and in the theory more generally – is that non-pecuniary benefits from farming are economically significant. The rest of the paper focuses on an empirical assessment of this key assumption.

4. Estimating Nonpecuniary Benefits to Farming

Existing research on the nonpecuniary rewards to farming has focused mainly on differences between independent and contract livestock production. These studies did not compare farm and non-farm employment, but contract farming has some similar characteristics to off-farm work. Gillespie and Eidman (1998) surveyed hog farmers to elicit utility functions and preferences for various contract structures and estimated that farmers had positive nonpecuniary net benefits from independent (versus contract) production. Key (2005) estimated positive nonpecuniary benefits to independent production based on the distribution of returns for contract and independent hog producers.

Outside of agriculture, several studies have compared earnings of employees and self-employed workers (analogous to off-farm and on-farm employment). Some studies have found that the potential wages of entrepreneurs are not significantly different from the wages of paid employees (although growth trajectory of their wages differ) (Brock and Evans, 1986; Rees and Shah, 1986, Borjas and Bronars, 1989). Hamilton (2000) points out that these studies generally suffer from two shortcomings. First, mean earnings are strongly influenced by high income entrepreneurial “superstars”, so mean earnings may not characterize the self-employment returns of most business owners. Second, measures of self-employment income used in past studies tend to underestimate true entrepreneurial income because individuals had an incentive to underreport these earnings. Hamilton addresses these shortcomings and finds self-employment offers substantial nonpecuniary benefits for many workers. His comparison of median earnings showed that paid employment offers both higher initial earnings and greater earnings growth. After ten years in business, median entrepreneurial earnings are 35 percent less than the predicted alternative wage for a paid job of the same duration.

In this study, we estimate the average nonpecuniary benefits for those farm households in which either the farm operator or spouse works both on and off the farm. This estimate is unbiased for this sub-sample of farms, which represents more than half of all farms. However, this may not be an unbiased estimate for the entire population because of sample selection bias. This issue is addressed in a different study by the authors.

Empirical model

The difference between average hourly off-farm wage and average hourly return to on-farm labor provides a reasonable estimate of the average nonpecuniary benefits per hour from farming. For simplicity, we assume the monetary value of nonpecuniary benefits of farm labor increases proportionately with time spent working on-farm: $b(l) = b \cdot l$. At the optimum labor allocation, the marginal utility of one dollar's worth of nonpecuniary benefits equals the marginal utility from one dollar of income, so $u_b = u_y$. From (3) it follows that:

(8) $$b = w - pq_l .$$

If we use the average on-farm return to labor as an approximation for the value marginal product of labor on-farm, then the expected value of the nonpecuniary benefits per hour b_i is:

(9) $$E[b_i] = E[w_i - w_i^f],$$

where w_i is the off-farm wage and w_i^f is the on-farm return to labor per hour (for simplicity, we will refer to w_i^f as the on-farm wage). For the sample of N_o farms that provide labor off-farm, an unbiased estimate of the nonpecuniary benefits to farming is:

(10) $$\bar{b}_o = \frac{1}{N_o}\sum_{i=1}^{N_o}\left(w_i - w_i^f\right).$$

5. Data

Data for the analysis are from the 2002, 2003, and 2004 Agricultural Resource Management Study (ARMS) – the USDA's primary vehicle for collecting data about the financial conditions of U.S. farms.[4] ARMS collects detailed information about the farm business and the farm operator household, including income, expenses, debt, assets, land operated, crop production, and the allocation of household labor on and off the farm.[5]

Because operator household data are not defined for non-family farms, we consider only family farms – farms that are not operated by a hired manager and that are organized as proprietorships, partnerships or family corporations. Family farms represented approximately 98 percent of all operations.

In 2002, 2003, and 2004, ARMS collected information about the hours of labor worked on-farm and off-farm for both the operator and the operator's spouse, but information is not available about on-farm labor time for other family members. Consequently, on-farm labor is defined as the total annual hours the principal operator and spouse worked on-farm (paid and unpaid) and to be consistent, off-farm labor is defined as the total annual hours the operator and spouse work off-farm. The appendix describes in more detail the construction of the key variables using the ARMS data.

The on-farm labor income (on-farm income attributable to farm household labor) is defined as the household income from farming minus farmland rental income. Household labor income includes wages paid to the operator and household members by the farm business. Farmland rental income is not included in our measure of on-farm labor income because rental income is not attributable to farm labor. On-farm labor income may overestimate returns to

[4] Surveys from earlier years were not included because questions about spouse off-farm labor supply were asked in only version 1 of the survey – a small subset of the total survey sample.
[5] For more information about ARMS see http://www.ers.usda.gov/Briefing/ARMS/.

farm labor (and hence underestimate nonpecuniary benefits) because farm business income includes government payments, which to some degree are decoupled from production and do not depend on farm labor. We explore this in more detail in the next section.

To some degree our measure of farm labor income is biased upward. ARMS uses an accounting-based measure of income that captures net cash flow minus reported depreciation. The income measure therefore includes returns to owned land and capital used on-farm, in addition to labor.[6] As a result, we overestimate the implicit on-farm wage and therefore underestimate the non-pecuniary benefits to farming. An alternative measure of farm labor income could be obtained by subtracting an estimate of the opportunity costs of the owned capital and land used on-farm, but this would introduce a new set of assumptions (see for example Mishra and Morehart, 2001). For the purpose of this paper, we prefer to report a conservative estimate of nonpecuniary benefits.

Off-farm labor income is defined as all off-farm income attributable to off-farm work (including off-farm wages, salaries, and off-farm business income). Off-farm labor income does not include components of off-farm income not attributable to labor, such as interest, dividends, capital gains, social security, and public assistance.

Because the measures of on-farm and off-farm labor income include wages from all household members, these measures overestimate returns to operator and spouse labor. We can investigate the extent of the overestimate using data from the 2001 survey because in that year it is possible to distinguish the contributions to off-farm labor income by the operator, spouse, and other family members. Of the total average household off-farm income of $33,626, operators earned $20,644 (61%), spouses earned $11,924 (35%), and other family members earned $1,058 (3%). Hence, the contribution of other family members to household off-farm wages is small. If other family members contributed nothing to on-farm wages, this would only minimally bias our estimate of nonpecuniary benefits upward. On the other hand, if other family members contribute more to on-farm wages than off-farm wages, this would have the effect of biasing our estimate of

[6] Income from renting out owned land or capital is not included in our measure of income.

nonpecuniary benefits down. In the next section, we separately consider the sub-sample of households with only two members (table 3) and show that the results do not differ substantially from the full sample.

Table 2 summarizes the key labor, income, and wage variables used in the study for each of the three survey years. In general, the median income and wage estimates were more stable over time than the mean values. The average on-farm labor income was substantially higher in 2004 compared to 2002 or 2003. Despite this, both the average and median nonpecuniary benefits were only slightly lower in 2004 compared to 2002. Estimates of the median nonpecuniary benefits (for those farms where the operator or spouse worked off-farm) were stable across the three surveys – varying from $21.08 to $24.85 per hour.

There were 51,429 total observations for the three years of data. Limiting the sample to those households where the operator or spouse worked on farm resulted in 51,396 farms. Of these, 40,177 respondents provided information on how much they worked on-farm (they did not refuse to provide this information). Dropping observations located in regions with missing information on county wages or land quality reduced the total sample to 39,899. Of these, there were 22,388 households where either the operator or spouse worked off-farm and 17,511 where the operator and spouse worked only on-farm.

6. Empirical Results

Table 3 reports the mean and median on-farm and off-farm hourly wages and nonpecuniary benefits (the difference between on- and off-farm wages) for farm households in which the operator or spouse worked off-farm. The table also reports a t-test against the null hypothesis that the difference between on-farm and off-farm hourly wages is zero. The estimates of nonpecuniary benefits from farming are unbiased for the subset of farm households where the operator or spouse works off-farm.

Statistics in the first row in the table are for all farm households in the sample where the operator or spouse worked off-farm – a group that represents about 56 percent of all farms and which produces about 32 percent of the total value of agricultural production. Results indicate that for those farms where either the operator or spouse works off-farm, households receive a median value of $24.00 per hour in nonpecuniary benefits from farming. For comparison to our hypothetical example above (table 1), this amounts to a full-time annual (2000 hours) non-pecuniary benefit of about $48,000.

To explore the robustness of the results, table 3 reports the estimated nonpecuniary benefits for several sub-samples. The second row excludes households in the top and bottom 1 percent of on-farm and off-farm wages. This limits the sample to households earning between negative $105.58 (financial losses) and $207.20 per hour on-farm, and between $1.68 and $360.95 per hour off-farm. Row 3 removes the wage outliers and farms where the operator and spouse spent less than 480 hours working on-farm and 480 hours off-farm. Row 4 removes the wage outliers and farms with operators over 64 years old. Row 5 excludes wage outliers and farms with more than two members. For all five samples the median nonpecuniary benefits are very consistent – with a value between $22.39 and $24.37 per hour.

Rows 6 and 7 in table 3 limit the sample by farm size. Row 6 removes the wage outliers and farms with a total value of production less than $100,000. Row 7 removes the wage outliers and farms with production worth less than $250,000. Not surprisingly, the larger farms are more profitable on average, so have a higher on-farm hourly wage. Because, the off-farm hourly wage is about the same for the larger farms, the mean and median nonpecuniary benefits per hour are smaller. However, even for farms with a value of production of at least $250,000, the nonpecuniary benefits were substantial: with a mean value of $6.81 per hour and a median of $5.38 per hour.

Because we are primarily interested in the supply response to government payments, it is useful to examine the nonpecuniary benefits of those farm households receiving payments. Table 4 continues the analysis of table 3 for households with different levels of payments. The samples exclude on-farm and off-farm wage outliers as before. The top half of the table shows that mean and median nonpecuniary benefits declines as the level of payments increases. Farms receiving more payments earn higher on-farm wages when payments are included in wages, resulting in smaller nonpecuniary benefits. Average nonpecuniary benefits are substantial for all payment groups except the largest (more than $50,000 of payments per year). For that group there is no statistically significant difference between on-farm and off-farm wages.

As mentioned in the previous section, when government payments are included in on-farm wages, we underestimate the true nonpecuniary benefits. Some of the government payments received in 2002–2004 are lump-sum or "decoupled" – that is, tied to farmland and not dependent on the quantity of on-farm labor, and should not be included in on-farm wages. The bottom of table 4 reports the same statistics with government payments deleted from on-farm wages. When payments are not included in on-farm wages, differences between on and off-farm wages are substantial and statistically significant, and there is no obvious relationship between nonpecuniary benefits and the level of payments. This result suggests substantial nonpecuniary benefits for farms receiving payments in of all size categories. However, by not including payments we may overestimate nonpecuniary benefits to the extent that payments depend on on-farm labor, so the results in the bottom of table 4 can be viewed as an upper bound.

Finally, it is worth discussing the reliability of the information we are using to compare farm and off-farm income. First, our estimates of nonpecuniary benefits would be biased upward to the extent that the farmers underreported on-farm income. While there could be an incentive for households to underreport sales and over-report costs for tax purposes, it is not clear whether there is also an incentive to underreport on-farm income to USDA survey enumerators. However, even with a substantial degree of underreporting, the reported average on-farm income is so low that the nonpecuniary benefits likely remain large even after accounting for the underreporting.[7] Second, as discussed above, our measure of the on-farm wage includes returns

[7] For example, if the actual sales were 25 percent higher than reported, then the average on-farm income would equal $9.28 per hour (compared to $0.57 per hour reported). This higher on-farm income per hour implies nonpecuniary benefits of $20.71 per hour (compared to $29.51).

to land and capital, which biases our estimates of nonpecuniary benefits downward. Third, there may be costs associated with working off-farm, including transportation costs, the opportunity cost of time spent commuting, and away-from-home meal expenses. Factoring in these costs would reduce the effective off-farm wage, and therefore also nonpecuniary benefits. On the other hand, there could be substantial non-wage benefits to off-farm work, including retirement and health insurance benefits, and paid vacation and sick time. Accounting for these benefits would raise the effective off-farm wage and nonpecuniary benefits. Unfortunately, our data do not allow us to account for these non-wage costs and benefits.

7. Conclusion

We used farm household data to compare the difference between returns to operator and spouse labor on-farm and off-farm. The average difference between on-farm and off-farm wages provided an estimate of the nonpecuniary benefits to farming for the sub-sample of farms where the operator or spouse works off-farm. The empirical results indicate substantial nonpecuniary benefits to farming for this sub-sample.

Using a general theoretical model, we showed that lump-sum payments increase farm labor supply under two key assumptions: (1) farmers prefer working on-farm to off-farm given the same wage and (2) declining marginal utility of income. Our finding that the non-pecuniary benefits from farming are large provides empirical support for the first assumption. The second assumption, though not empirically examined here, is plausible and generally supported by experimental evidence. For large commodity-crop farmers, payments might be large enough to have a significant influence on the marginal utility of the dollar, and consequently potentially substantial production effects. The income effect we model does not rely, as other studies, on other market imperfections or on changes in the third derivative of the utility function - which are probably small.

While the theoretical question of how lump-sum payments influence supply remains unresolved, some recent research has sought to econometrically estimate the link between post-FAIR Act payments and production. Though these payments may not be truly lump-sum and the econometric estimations might be confounded by non-payment factors, the studies generally find a positive association between these mostly "decoupled" payments and production (Adams, et. al, 2001; Goodwin and Mishra, 2005; Goodwin and Mishra, 2006), and sometimes the link is strong (Key, Roberts, and Lubowski, 2005).[8] This paper provides a theory and supporting empirical evidence that could help explain the findings of a strong link between participation in largely "decoupled" agricultural programs and production as well as the somewhat puzzling result that PFC payments under the 1996 FAIR Act are not entirely capitalized into rents and land values (Roberts, Kirwan, and Hopkins, 2003; Kirwan, 2005). While this paper focused on the production effects of lump-sum payments, "coupled" payments that are tied to production or prices would also raise household income, so with nonpecuniary benefits to farming we would expect a similar income effect for coupled payments as the one considered in this paper.

[8] These payments may not be truly lump-sum because restrictions under the FAIR Act preclude plantings of vegetable or conversion of land to nonagricultural uses. In addition, under the 2002 Farm Act, farmers were permitted to update their base acres in a way that depended on their 1997-2002 plantings. This meant that planting decisions after the 1996 Act ultimately influenced payment levels after 2002.

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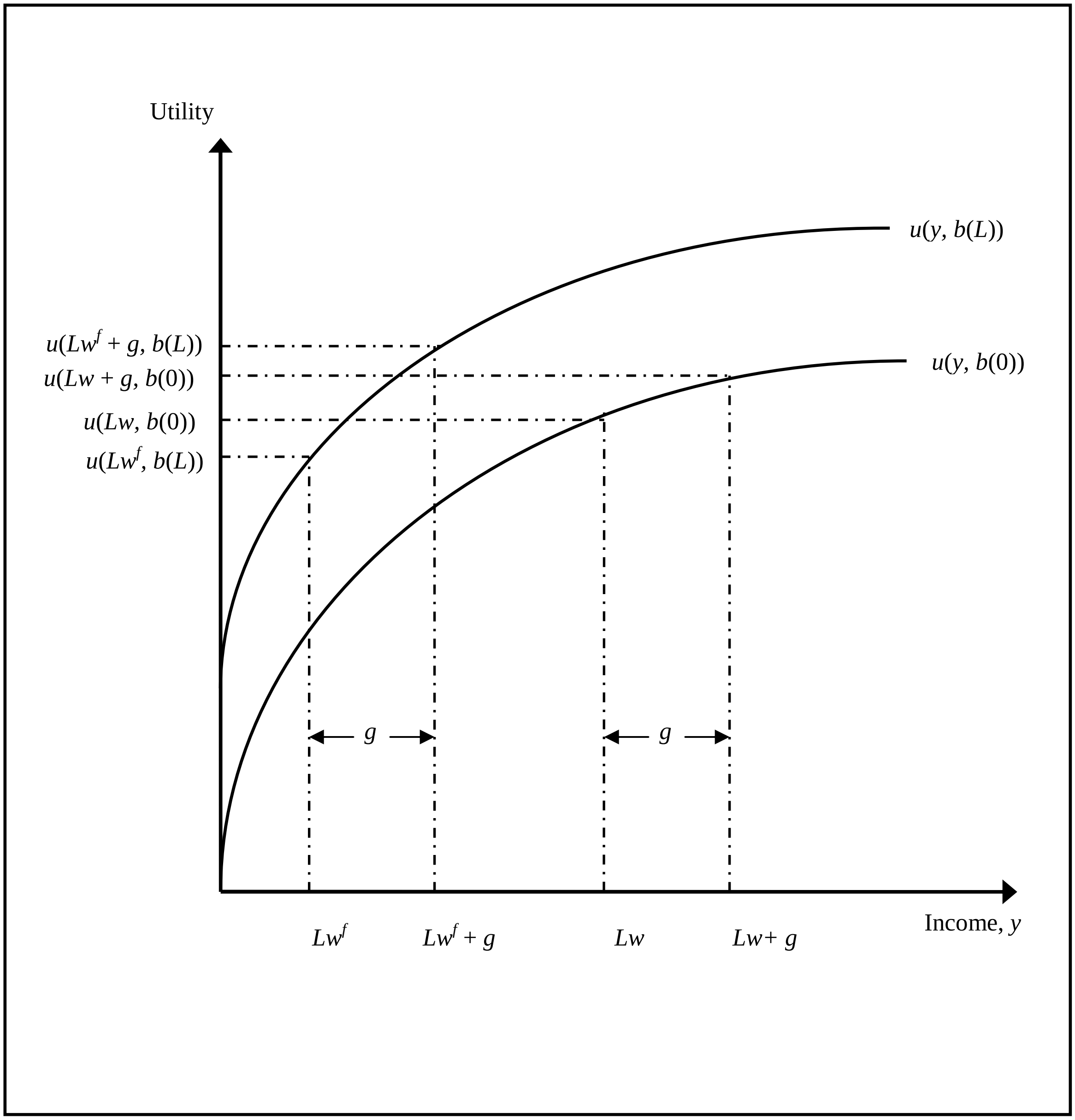
Figure 1. Lump-sum payments and utility of employment on-farm and off-farm



Notes: Income from full-time off-farm employment is *Lw*, equal the total labor allocation (*L*) multiplied by the off-farm wage (*w*). Income from full-time on-farm employment is Lw^f, where w^f is the implicit on-farm wage. The lower utility line shows diminishing marginal utility of income without non-pecuniary benefits of farm labor. The higher utility line shows additional utility (non-pecuniary benefits) from farm labor (*b*(*L*)) relative to non-farm labor (*b*(0)). Without the lump-sum transfer (*g*), utility is higher for working off farm, $u(Lw, b(0)) > u(Lw^f, b(L))$. With a lump transfer, utility is higher for working on farm, $u(Lw + g, b(0)) < u(Lw^f + g, b(L))$.

Table 1. Hypothetical Example Illustrating the Influence of Lump-sum Payments

(1) Off-farm labor income ($)	(2) On-farm labor income ($)	(3) Lump-sum payments ($)	(4) Non-pecuniary benefits of full-time on-farm work (utils)	(5) Utility (ln) full-time off-farm work (utils)	(6) Utility (ln) full-time on-farm work (utils)	(7) Dollar value of non-pecuniary benefits of full-time on-farm work ($)	(8) Optimal share of work on farm (s)
40,000	20,000	0	0.35	**10.60**	10.25	8,381	0
40,000	20,000	5,000	0.35	**10.71**	10.48	10,477	0
40,000	20,000	10,000	0.35	**10.82**	10.66	12,572	0
40,000	20,000	15,000	0.35	**10.92**	10.81	14,667	0
40,000	20,000	20,000	0.35	**11.00**	10.95	16,763	0.14
40,000	20,000	25,000	0.35	**11.08**	11.06	18,858	0.39
40,000	20,000	30,000	0.35	11.16	**11.17**	20,953	0.64
40,000	20,000	35,000	0.35	11.23	**11.27**	23,049	0.89
40,000	20,000	40,000	0.35	11.29	**11.35**	25,144	1
40,000	20,000	45,000	0.35	11.35	**11.43**	27,239	1
40,000	20,000	50,000	0.35	11.41	**11.51**	29,335	1

Notes: In this hypothetical example, utility has a functional form $\ln(y) + 0.35s$, where y is income from all sources, s is the share of labor allocated to on-farm employment, and $0.35s$ represents non-pecuniary benefits from on-farm employment. Columns 5 and 6 compare utility of working full-time off-farm and working full-time on-farm; the boldface values indicate which is highest. With diminishing marginal utility of income and additively-separable non-pecuniary benefits, the dollar value of non-pecuniary benefits increases with income (column 7). The optimal allocation of labor on-farm is given in column 8. When this share does not equal 0 or 1, it yields utility slightly greater than that the levels reported in columns 5 or 6.

Table 2. Labor Supply and Income by Year

	Mean			Median		
	2002	2003	2004	2002	2003	2004
On-farm hours (operator)	1,370.22	1,416.17	1,720.00	1050	1113	1495
On-farm hours (spouse)	264.45	326.44	353.14	0	0	0
On-farm hours (operator and spouse)	1,634.66	1,742.61	2,073.14	1250	1300	1690
On-farm labor income	3,533.86	7,235.07	25,027.65	-2,453.91	-2,076.87	850
On-farm hourly wage	1.57	2.84	12.55	-2.7	-2.11	0.84
Off-farm hours (operator)[1]	1,458.42	1,506.78	1,324.89	2000	2000	1785
Off-farm hours (spouse)[1]	1,141.07	1,178.86	1,256.16	1400	1440	1560
Off-farm hours (operator and spouse)[1]	2,599.48	2,685.64	2,581.05	2340	2340	2250
Off-farm labor income (earned)[1]	68,289.65	67,845.34	72,263.94	47,251.25	49,683.78	53,750.00
Off-farm hourly wage (op. and sp.)[1]	49.28	33.59	54.53	19.63	19.17	20.27
Nonpecuniary benefit per hour[1]	51.23	34.02	45.78	24.85	23.8	21.08
Observations	11,495	16,805	11,599			
Observations[1]	6,478	9,304	6,606			

Note: The nonpecuniary benefit per hour is defined as the off-farm wage per hour minus the on-farm wage per hour.

[1] These statistics are for operations where the operator or spouse works off-farm.

Table 3. Nonpecuniary Benefits per Hour for Various Samples

Samples	Obs.	Mean On-farm Wage per Hour	Mean Off-farm Wage per Hour	Mean Nonpecuniary Benefit per Hour	Median Nonpecuniary Benefit per Hour	Paired t-stat
1) All farms where operator or spouse works some time off-farm	22,388	0.06	43.30	43.25	24.00	-7.11***
2) Exclude hourly wage outliers	21,222	-1.59	28.37	29.96	23.89	-103.79***
3) Exclude hourly wage outliers and farms where spouse and operator works less than 480 hours off-farm and less than 480 hours on-farm	17,886	-1.14	25.70	26.84	22.39	-103.85***
4) Exclude hourly wage outliers and farms with operators 65 years and older	19,154	-1.58	27.78	29.36	24.01	-99.37***
5) Exclude hourly wage outliers and households with more than 2 members	9,905	-1.80	29.53	31.32	24.37	-71.42***
6) Exclude hourly wage outliers and farms producing less than $100,000 of output	10,243	15.76	28.45	12.69	9.26	-25.07***
7) Exclude hourly wage outliers and farms producing less than $250,000 of output	6,358	21.98	28.79	6.81	5.38	-9.88***

Notes: *** indicates paired t-statistics have a p-value < 0.0001. The paired t statistic associated with the test of the null hypothesis that the paired difference (d_i = *off-farm wage*$_i$ - *on-farm wage*$_i$) is zero is defined: $t = \bar{d} / \left(s_d / \sqrt{n} \right)$, where $\bar{d}$ is the sample mean of the paired differences, s_d is the sample variance of the paired differences, and n is sample size.

Table 4. Nonpecuniary Benefits per Hour by Government Payments Category

Samples	Obs.	Mean On-farm Wage per Hour	Mean Off-farm Wage per Hour	Mean Nonpecuniary Benefit per Hour	Median Nonpecuniary Benefit per Hour	Paired t-stat
Government payments included in on-farm income						
1) Government payments > 0	13,454	4.05	26.78	22.73	18.65	-60.31***
2) Government payments ≥ 10,000	7,495	15.32	27.17	11.85	9.43	-20.58***
3) Government payments ≥ 25,000	4,378	22.51	28.19	5.68	5.88	-7.16***
4) Government payments ≥ 50,000	1,996	30.35	31.23	0.88	0.08	-0.66
Government payments not included in on-farm income						
5) Government payments > 0	13,454	-5.22	26.78	32.00	23.37	-73.81***
6) Government payments ≥ 10,000	7,495	-1.81	27.17	28.99	19.72	-40.73***
7) Government payments ≥ 25,000	4,378	0.60	28.19	27.58	21.71	-32.37***
8) Government payments ≥ 50,000	1,996	-2.58	31.23	33.81	26.44	-22.37***

Notes: Sample includes farms where operator or spouse works some time off-farm and excludes on-farm and off-farm wage outliers. *** indicates paired t-statistics have a p-value < 0.0001. The paired t statistic associated with the test of the null hypothesis that the paired difference (d_i = *off-farm wage*$_i$ - *on-farm wage*$_i$) is zero is defined: $t = \bar{d}/\left(s_d/\sqrt{n}\right)$, where $\bar{d}$ is the sample mean of the paired differences, s_d is the sample variance of the paired differences, and n is sample size.

Appendix: Definition and Construction of Key Variables Using ARMS Data

Variables in *ITALICS* are taken directly from the ARMS survey data (not constructed by the authors). Variable in **bold** are constructed using the ARMS data. The following documents the variables used in this study using the 2004 ARMS survey. There are a few differences in variable names in the 2002 and 2003 ARMS surveys that are not shown. Further documentation for ARMS variables and surveys are available at: http://www.ers.usda.gov/Data/ARMS/GlobalDocumentation.htm .

Off-farm labor income = *EARNED* (income from off-farm work) where:

EARNED = *OFFBUSI* + *ADJWAGE* (off-farm business income + off-farm wages)

ADJWAGE = *A950* + *A951* + *A952* (off-farm wages + salaries + other earnings)

Note: annual off-farm wage does not include interest and dividends, off-farm capital gains, social security and public assistance, or other off-farm income.

On-farm labor income = *FARMHHI* – *FARMRENT* (household income from farming – income from farmland rental)

FARMHHI = *FARMBHH* + *FARMRENT* + *OTFBUSI* + *OPPD* + *SPPD* + *HMPD* (farm business income to household + income from farmland rental + other farm business income + wage paid to operator for farm work + wage paid to spouse for farm work + wage paid to other household members for farm work)

FARMBHH = (*FARMBUSI*) * (*FOHHPER*/100) (farm business income * percent of farm income received by household)

FARMBUSI = *INCFI* – *ENDEPR* – *V13A* – *OPPD* (net cash farm income - depreciation expense – income from land rented to others – income paid to operator)

INCFI = *V16* - *V41* (gross cash farm income – total cash operating expenses)

V16 = *V3A* + *V15* (livestock and crop income plus net CCC loans + total other farm income, including government payments)

Off-farm hours worked = *R933*R935* + *R934*R936* (annual hours operator worked off-farm + annual hours operator's spouse worked off-farm)

*R933*R935* = operator's weeks of off-farm work per year * hours of off-farm work per week
*R934*R936* = spouse's weeks of off-farm work per year * hours of off-farm work per week

On-farm hours worked = *OPHRS* + *SPHRS* (annual hours operator worked on-farm + annual hours operator's spouse worked on-farm)

Off-farm hourly wage = **off-farm labor income/off-farm hours worked**

On-farm hourly wage = **on-farm labor income/on-farm hours worked**