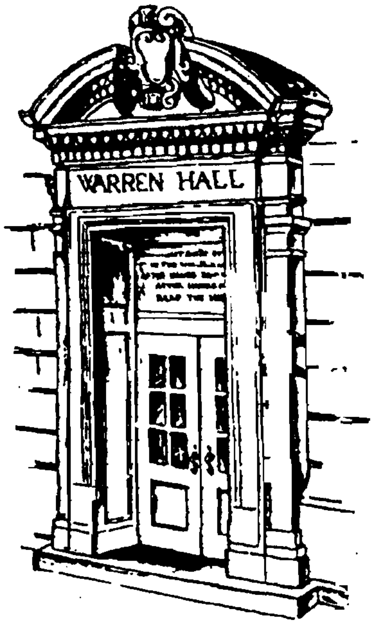

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A Unique Measure of the Welfare Effects of Price Support Programs for Corn on Family-Farm Households by Size Distribution

by

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Abstract

On- and off-farm employment of family farm members has been a permanent phenomenum in U.S. agriculture. In this paper, a family-farm model is extended to include both on- and off-farm labor supply decisions for farm-households in the U.S. corn sector. A unique empirical measure of economic welfare is developed to analyze the effects of government price support programs. Traditional welfare analysis of farm programs ignores on- and off-farm employment decisions by focusing only on 'producer surplus' at the aggregate sector level. We determine that the appropriate measure of welfare for the farm-household includes the 'laborer's surplus'. Theoretical results are derived to show that conventional analysis overstates the benefits of farm price supports because of the tradeoff between producer and laborer's surpluses. Empirical simulations indicate that the laborer's surplus is a significant share of total farm-household welfare, especially for smaller farm sizes that comprise the majority of corn farmers in the United States. Results also show that the government programs may have been misdirected if the goal has been to improve the farm income situation because the few large farms gain much more in aggregate than smaller farms.

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Introduction

On- and off-farm employment of family members has been a permanent and important economic phenomenum in American agriculture (Gardner, 1992; Ahearn and Lee, 1991). Off-farm participation by households increased from 30 percent in 1929 to 53 percent in 1982 (Ahearn and Lee, 1991). The proportion of households working 200 or more days per year increased relatively faster than other categories, from 6.3 percent in 1929 to 34.6 percent in 1982.

Table 1 shows that off-farm income is a significant proportion of total household income. In 1986, an average U.S. farm household earned about $20,212 or 46 percent of total household income from off-farm sources. Off-farm income was relatively more significant for smaller farm sizes. Households with annual sales of less than $40,000 generated $22,534 or 96 percent of their total income from non-farm sources. Large sized households with annual sales of $250,000 and above generated $17,562 or five percent of their income from non-farm sources. The middle income groups with annual sales of $40,00-$99,99 ($100,000-$249,999) generated $13,780 ($12,602) or 13 percent (10 percent) of their total income from non farm sources. Data for 1989 portrayed a similar picture (Gardner, 1992).

Table 2 indicates that household labor represents a significant input in corn production. The data shows that owned (unpaid) labor is utilized on the farm more than hired labor. Small sized/ off-farm participants (non-participants) spent $1.10 ($2.54) per hectare on hired labor, compared with $41.09 ($49.35) per hectare on unpaid labor. Medium sized/ off-farm participants (non-participants) spent $3.92 ($3.17) per hectare on hired labor, compared with $26.13 ($29.34) per hectare on unpaid labor. Large sized households spent more or less equal amounts on hired and owned labor.

Traditional analysis on the social costs of farm price support programs focus only the 'producer surplus' of farm-firms at the sectoral level (Nerlove 1958, Wallace 1962, Gardner 1983, Floyd 1974, Gisser 1993). However, much research has recognized the importance of off-farm income (Huffman 1977, Ahearn and Lee 1991, Gardner 1992, Nilsen 1977,) and the need to study household off-farm labor supply behavior (Sumner 1982, Huffman and Lange 1989, Lass, Findeis and Hallberg 1991). Multiple job holding is an integral component of farm-household optimization. The inclusion of on- and off-farm labor supply decisions by family farm members requires the use of farm-household models in analyzing the welfare economic effects of governmental price support programs.

The purpose of this paper is to overcome two major limitations of the literature so far on the welfare economics of farm price supports. First, we extend the farm-household model to develop a unique welfare measure denoted as laborer's surplus (Nakajima, 1986) to include the effects of on- and off-farm labor supply decisions by family farm members. Own family labor is very significant for the majority of households both as an input in the farm production process and as an off-farm income generator. The concept of laborer's surplus is integrated with the conventional producer surplus analysis of the farm-firm. The implications of the analytical framework developed in this paper are highlighted by an empirical application to the price support program for corn in the United States. Second, we use this unique framework to evaluate the distributional economic welfare consequences of government policy across farm size.

The results show that the conventional analysis overstates the benefits of price supports because of the tradeoff between the conventional producer surplus and the concept of laborer's surplus integrated into the farm-household model in this paper. Empirical simulations indicate that laborer surplus is a significant share of total farm-household welfare, especially for medium and small farm sizes that comprise the majority of corn farms. Sectoral analysis of the current literature masks the true consequences and distributional benefits from farm programs, especially if the primary purpose of price support is to solve the 'farm problem' of low farm incomes and rates of return in agriculture (Gardner, 1992).

The Analytical Model

We employ the basic agricultural household model where a family faces a labor market to hire-in or hire-out labor at a market wage rate (Singh, Squire and Strauss, 1986, Nakajima, 1965; 1986). Variants of the same model have been developed and employed as a basis to empirically estimate off-farm labor supply functions for particular U.S. farm households (Huffman and Lange, 1989; Sumner, 1982; Lass, Findeis, and Hallberg, 1991). The agricultural household model is a relevant tool of analysis for the economics of farm households since it combines household production, consumption and labor supply decisions into a single conceptual framework (Huffman, 1991).

Consider a farm household producing a single commodity Q for a given unit price P. Suppose the farm household faces a competitive labor market in which to hire-in or hire-out labor at an exogenously given wage rate of W. The household maximizes utility of money income I and leisure L, defined as U(I,L). Utility is maximized subject to the farm production constraint $Q(\Gamma;K)$, the time constraint $T=L+\mho$ and the money income constraint $I=V+[PQ-W\Gamma]+W\mho$, where T represents total time endowment, $\mho$ denotes total quantity of owned labor devoted to all work (farming and off-farm), V is property (exogenous) income, Γ denotes total farm labor input (both owned and hired), and K denotes a fixed farm production input (say land).

The objective function and the first order conditions for utility maximization may be summarized as[1]

$$\max_{\Gamma,L,I,\lambda}\left[U(I,L)-\lambda(I-V-PQ(\Gamma;K)-W(T-L-\Gamma))\right]$$

$$PQ_{\Gamma}(\Gamma^{*};K) = W \tag{1a}$$

$$I^{*} = V+\left[PQ(\Gamma^{*};K)-W\Gamma^{*}\right]+W(T-L^{*}) \tag{1b}$$

$$\frac{U_{L}(I^{*},L^{*})}{U_{I}(I^{*},L^{*})} = W \tag{1c}$$

where $Q_{\Gamma}(\Gamma^{*};K)$ is the marginal product of labor, $U_{L}(I^{*},L^{*})$ denotes the marginal utility of time and $U_{I}(I^{*},L^{*}) = \lambda$ is the marginal utility of money income. Since this model consists of a two-staged recursive process, the household first maximizes farm profits as indicated by condition 1a. This is the case since L, I and λ are not among the arguments of equation 1a. This behavior resembles that of the farm-firm whereby the sole motive is profit maximization. Equation 1a is consistent with the farm-firm's optimization where labor is utilized up to a point where the value of marginal product of labor is just equated to the market wage rate. In the second stage of the recursive structure, the household maximizes utility where conditions 1b and 1c are simultaneously solved for L^{*} and I^{*}, subject to the solution from condition 1a.[2]

[1] Note that the farm production constraint and the time constraint were substituted into the income constraint to yield a single constraint problem.

[2] From the first order conditions, equation 1a is solved independently of equations 1b and 1c, meaning that the production side of the model is separable from the consumption side. Optimal

Figure 1 is the graphical counterpart of the model where the farm-household hires-in labor and Figure 2 depicts the household hiring-out labor. In panel (a) of Figure 1, the curve UU' represents the utility function, VvT is the total value product curve and AA' is the money income constraint. In panel (b), the curve GvMP is the value of marginal product curve and CC' is the marginal valuation of family labor curve.[3] Farm profits are maximized at point Q in panel (a) and at point q in panel (b), where the value of marginal product is just equated to the wage rate. Therefore, the producer's surplus is measured by the distance DQ in panel (a) and by area PS in panel (b). Utility is maximized at point L' in panel (a) and point E in panel (b) where conditions 1b and 1c hold (the marginal valuation of family labor CC' equals the market wage rate W). Total wages are W'ELT and total owned labor cost is ELTC. The laborer's surplus is the residual area LS. Economic surplus is area PS+LS, which is the sum of the producer surplus and the laborer's surplus (Nakajima, 1986). The household depicted in Figure 1 enjoys 0L units of leisure and employs Tq' units of labor on the farm. Since the time endowment is 0T, the household hires-in labor of q'L units for farm use.

Figure 2 is similar to Figure 1, with the exception that the household hires-out labor. Farm profits are maximized at point Q in panel (a) and point q in panel (b) where the producer's surplus is recorded at distance DQ or area PS. Utility is maximized at point L' in panel (a) and point E in panel

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values from equation 1a are then used in 1b and 1c, to solve for L^* and I^*. Note that short-run farm profits (the square bracketed term in condition 1b) are fixed by the time the stage two solution is determined.

[3] At any given point along the curve CC', the marginal valuation of family labor (MVFL) is derived by $CC'=U_L/U_I$. The MVFL curve is not identical to the labor supply curve (Nakajima, 1986). The supply curve of any commodity is independent of the price of the commodity in question in that it should not shift due to a wage rate change. Instead, a wage rate change should lead to a movement along a given labor supply curve. Contrary to this, the MVFL curve would shift in response to a wage rate change. That is, there are numerous MVFL curves, each corresponding to a particular wage rate (Nakajima, 1986).

(b) where the laborer's surplus is area LS.[4] Economic surplus is thus measured by the sum of PS and LS. The household enjoys 0L units of leisure and utilizes Tq' units of labor on the farm. Since 0T is the total time endowment, the household commits Tq' units of owned labor on the farm and hires-out Lq' units to off-farm work for wages. Indeed, the producer's surplus measure will understate actual economic surplus in the case where a farm household is a combination of a laborer's household and a farm-firm. This will be the case irrespective of whether or not household members participate in off-farm markets, as evident from Figures 1 and 2.

Economic Effects of a Price Support

We illustrate the importance of using a farm household framework in farm policy analysis with an example of a price support. In Figure 3, the pre-policy farm profits are maximized at point p in panel (a), where Tf units of household labor are devoted to farming. This is also evident in panel (b) where the value of marginal product of labor hk intersects the wage rate line WW' at point q. Household utility is maximized at point x, where 0l units of leisure are consumed. In panel (b), utility is maximized at point e where the marginal valuation (cost) of family labor sr intersects the wage rate line WW'. The household devotes lf units of time to off-farm work in both panels. The pre-policy producer's surplus is hqW' and the laborer's surplus is W'es. Hence, the pre-policy economic surplus is hqes.

The introduction of a price support leads to a shift in the total value product curve from vt to vt' in panel (a). This corresponds to a shift in the marginal value product curve from hk to hk' in panel (b). Now the household maximizes farm profits at point p' in panel (a) and q' in panel (b) where

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[4] Laborer's surplus is based on the sum of owned labor devoted to work (both off-farm and on-farm). Therefore, even where there is no off-farm work, the laborer's surplus still has to be measured as in Figure 1.

Tf units of household labor are devoted to farming. As a result, household labor devoted to farming increases by ff' units. Farm profits are now higher and the household's money income increases, leading to a shift in the budget constraint from ag to a'g' in panel (a). Utility is now maximized at point x' where it has increased from uu' to vv'. As a result, leisure consumption is increased from 0l to 0l' units in both panels. Time devoted to off-farm work declines from M=lf to M'=l'f' units.[5]

The producer's surplus increases by hqq' (from hqW' to hq'W'), and the laborer's surplus declines by see' (from W'es to W'e's).[6] Total economic surplus change of hq'q-see' in panel (b). What this implies is that an increase in the price of the agricultural commodity causes the household to increase its producer's surplus and to reduce its laborer's surplus from working (both on and off the farm). Therefore, when the equilibrium is perturbed by a price support, the marginal benefit from farming tends to exceed the marginal benefit from working. This causes the household to make a trade-off between the two surpluses, until the marginal benefit from farming is just equated to the marginal benefit from working (both on and off the farm). It then follows that the gain in the producer's surplus must be greater than the loss in the laborer's surplus (hqq'>see'). If this was not the case, there would indeed be no incentive for the household to make a trade-off between the two surpluses.

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[5] See Seleka for complete formal comparative statics results.

[6] The graph depicts a rotation in the marginal valuation of family labor curve. This was done for graphical convenience. In reality, the sr curve would shift, meaning that the new intersection with the vertical axis would occur at a higher point than point s in Figure 3. Note however that the vertical distance between sr and sr' narrows as the amount of work time is reduced.

Data and Empirical Application

This section presents the data and empirical methodology used in the analysis of the welfare effects of target prices and acreage controls on U.S. corn farm-households. The fundamental features of the U.S. corn price support program analyzed in this paper are fixed target prices, deficiency payments, and acreage limits and set-aside (Gardner, 1992). Acreage set-asides are calculated as a percentage of a farmer 'base acreage' (determined by a five-year moving average of actual area planted plus set-aside). Deficiency payments are calculated on historical acreage and fixed program yields' (Gisser, 1993). However, a key aspect of farm policy is the voluntary nature of the program whereby some farmers opt out, given the cost of acreage limits and set-aside.

Most of the summary statistics used in this study were obtained from the Economic Research Service (ERS) of the United States Department of Agriculture (USDA). The data set from which group level summary statistics were derived was gathered by ERS through the 1991 Farm Cost and Returns Survey (FCRS). The summary data obtained were: a) group level average corn production cost data per planted acre; b) group level mean values for other pertinent variables; and c) group level income statements for all farm enterprises. Corn farm-households were decomposed into three categories based upon sales size: small, medium and large.[7] The three sales class categories were each further subdivided into two groups based upon whether or not individual households participate in off-farm work. This yielded a total of six groups of farm households. This classification was meant to allow for the determination of how prevailing corn policies affect the respective farm groups as separate economic agents.

The ERS data is contained in Appendix A. Table A.1 provides the per acre production cost

[7] Small producers are those with annual sales of less than $40,000 per farm-household. Medium producers' annual sales fall within the range $40,000-$249,999 per farm-household. Large producer are those with annual sales of $250,000 and over per farm-household.

data for each group's representative household. The variables listed in Table A.1 are self explanatory, and are as obtained from ERS. Group level mean values of other pertinent data are presented in Table A.2. The variables are listed as obtained with the exception that hours of operator and hours of other household members were converted from average weekly hours to total hours per year. Table A.3 contains income statement data for the entire farm (for all farm operations). Additional statistics were obtained from other sources, which we will document along with the discussion of the model calibration procedure, to which we now turn.

A non-linear algorithm of GAMS was utilized to solve the U.S. corn model. Initially, the model was calibrated with acreage controls and the target price in place. The production side of the model, with policy in place, was considered first using Table A.1 data. Three production factors were distinguished: unpaid (owned labor); land; and all other inputs. The production function for each group level representative household belonging to sales class I and participation class j was a Cobb-Douglas type, $Q_{ij} = A_{ij}\Gamma_{ij}^{\gamma_{ij}}X_{ij}^{\omega_{ij}}K_{ij}^{\delta_{ij}}$, where A is the efficiency parameter, Γ represents labor (only owned labor for off-farm participants and all labor for non-participants), X denotes all other inputs (including hired labor for households not participating in off-farm work), K is the quantity of land, and γ, ω, and δ are the respective production elasticities. Unpaid labor was distinguished because our interest lies in the time allocation mechanism. It is however worth emphasizing that for households not participating in off-farm work, hired and owned labor were assumed homogenous whereas they were assumed heterogenous for off-farm participants. Therefore, the production coefficient γ is with respect to all labor in the case of households not participating in off-farm work and with respect to only owned labor in the case of households participating in off-farm work.[8]

Land was isolated to be able to determine the effects of acreage reduction. Other inputs were aggregated into a single input category. These include non-labor variable inputs, operating capital, non-land capital, and capital replacement (Table A.1).[9] Total fixed cash costs (Table A.1) were not included among production inputs. Instead, these expenses were included in the calculation of exogenous income, as we will discuss later. Cobb Douglas production elasticities were approximated as factor shares, imposing constant return to scale (CRS).[10] CRS was imposed by dividing expenditure on each factor by total production cost, instead of dividing by the value of output. From Table A.2, we used hours worked by the operator and by other household members and the respective percentages of hours used in corn production, to calculate owned corn hours. The wage rate for each group was then calculated by dividing total value of unpaid labor by annual hours allocated to corn production.

The production side of the model was solved by assuming that, initially, corn output, the corn

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[8] The treatment of labor this way was a judgement call. Since those households participating in off-farm work employ hired labor as well, the time allocation mechanism could not be solved if we were to assume homogeneity since the model under such an assumption would not allow for off-farm work and hired labor employment to occur simultaneously. For households not engaged in off-farm work, the assumption of homogeneity seemed plausible since households hire-in labor and do not participate in off-farm work.

[9] As implied earlier, the all inputs category includes hired labor for off-farm participants.

[10] A proof of the relationship between factor shares and production elasticities is contained in Tyner and Tweeten (1965). Consider the case of a Cobb-Douglas production technology. The factor share for input X may be defined as $(P_X X)/(PQ)$. A profit maximizing firm would equate the value of marginal product of X to the price of X. Therefore, in this case we can write $\partial Q/\partial X = P_X/P$. Multiplying both sides of this equation by X/Q yields the elasticity of production $\epsilon_X = (\partial Q/\partial X) * (X/Q) = (P_X X)/(PQ) = \omega$. This shows that the factor share is equal to the production function coefficient under a premise that competitive equilibrium reigns and profit maximization is attained. Along similar lines, $\gamma = (W\Gamma)/(PQ)$.

producer price (the target price), the wage rate, the price of other inputs (P_X), acreage, and production elasticities are exogenously given. The price of other inputs was set at unity. Output of a representative farm was computed by multiplying yield (Table A.1) by corn acres (Table A.2). The target price of 2.75 was used as the prevailing producer price of corn for 1991 (USDA, 1992).

The pre-policy production side model for a group level representative household contained three equations

$$Q_{ij} = A_{ij}\Gamma_{ij}^{\gamma_{ij}}X_{ij}^{\omega_{ij}}K_{ij}^{\delta_{ij}} \tag{2a}$$

$$W_{ij} = P\gamma_{ij}A_{ij}\Gamma_{ij}^{\gamma_{ij}-1}X_{ij}^{\omega_{ij}}K_{ij}^{\delta_{ij}} \tag{2b}$$

$$P_X = P\omega_{ij}A_{ij}\Gamma_{ij}^{\gamma_{ij}}X_{ij}^{\omega_{ij}-1}K_{ij}^{\delta_{ij}} \tag{2c}$$

where 2a is the production function and 2b and 2c are the two first order conditions for profit maximization, one with respect to labor (owned labor for off-farm participants and all labor for non-participants) and the other with respect to all other inputs. The model was solved for optimal factor demands (Γ and X) and the production efficiency parameter (A), using a non-linear programming algorithm of GAMS. Since optimal farm hours of off-farm non-participants reflect both hired and owned labor, per our assumption of homogeneity, the shares of owned and hired labor in total labor cost were used to decompose quantities of labor into hired and owned. Short-run profits from corn were derived as total corn sales minus the sum of expenditures on all labor and all other inputs (variable production inputs).

Production results were then used to solve for the consumption and the off-farm labor supply components. First, hours of off-farm work were calculated as annual income from off-farm wage and salary income (Table A.2) divided by the wage rate determined above. Total hours of endowment were calculated by assuming an average number of workers of 1.6 persons per representative household in each group. This was multiplied by 24 hours per day and 365 days per year to obtain total time endowment T. Other farm hours (non-corn) were approximated by deducting time allocated to corn from total farm time (Table A.2). Hours of leisure were derived as total time endowment minus the sum of off-farm hours, owned corn hours, and other farm hours (non-corn).

Since households engage in other farm production activities (non-corn), as evident from the income statements (Table A.3), earnings from such activities should be considered to better approximate the household's cash incomes, and total economic surplus. Precisely, restricted farm profits from non-corn activities should be included in calculating money income. Therefore,

$$P_X = P\omega_{ij}A_{ij}\Gamma_{ij}^{\gamma_{ij}}X_{ij}^{\omega_{ij}-1}K_{ij}^{\delta_{ij}} \tag{3}$$

where R^{nc} denotes short-run profits from non-corn farming activities, G denotes gross cash income (Table A.3), E represents variable cash expenses (Table A.3), $\pi^{c*} = PQ - W\Gamma^* - P_X X^*$ is optimal short-run profit from corn (from the production side) and O denotes household time spent on non-corn farming activities. Exogenous (property) income (non-wage off-farm income) was computed from Tables A.2 and A.3 as the sum of net cash income from off-farm business, net cash income from another farm and ranch operation, interest and dividends, and other off-farm income (Table A.2) minus the sum of real estate and property taxes, interest and insurance premium (Table A.3).[11]

[11] As we have noted, fixed cash expenses in Table A.1 were not included among our various input categories. Hence, we include them here in computing exogenous income. Data in Table A.3 includes corn data of Table A.1 and as such fixed corn costs of Table A.1 are a part of those of Table A.3.

Money income (I) for each representative household was then calculated as

$$I_{ij} = \pi_{ij}^{c*} + R_{ij}^{nc} + W_{ij}\mho_{ij} + V_{ij} \tag{4}$$

where $\mho$=T-L denotes total work time by household members (the sum of time spent on all farming activities (corn and non-corn) and off-farm work time). Next, full income (Y) was calculated as the sum of money income and the value leisure time (Y=I+WT). The Cobb-Douglas utility parameter with respect to money income was derived as the share of money income in full income ($\alpha = I/Y$). Similarly, the utility parameter with respect to leisure was computed as the share of the value of leisure in full income ($\beta = WL^{*}/Y$).[12]

Next, the market prices of corn for the respective groups were determined by diving the gross value of production by yield. From these, the market price of corn for the entire U.S. was computed

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[12] The utility function for a group level representative household was specified as a Cobb-Douglas type $U_{ij} = I_{ij}^{\alpha_{ij}} L_{ij}^{\beta_{ij}}$, where α and β are the respective parameters. Equations 1b and 1c may be rewritten as

$$I_{ij} + W_{ij}L_{ij} = Y_{ij} = \pi_{ij}^{c*} + W_{ij}T_{ij} + V_{ij}$$

$$\frac{\beta_{ij}}{\alpha_{ij}}\frac{I_{ij}}{L_{ij}} = W_{ij}$$

Assuming that $\alpha_{ij} + \beta_{ij} = 1$, one can use the fact that $\beta_{ij} = 1 - \alpha_{ij}$ in the second equation and rearrange terms to obtain

$$\alpha_{ij}(W_{ij}L_{ij} + I_{ij}) = I_{ij}$$

Using the first equation, one can substitute Y_{ij} for the bracketed expression of the above equation and rearrange terms to obtain $\alpha_{ij} = I_{ij}/Y_{ij}$. This implies that the elasticity of the utility function with respect to money income may be approximated as the share of money income in full income. Along similar lines, $\beta_{ij} = (W_{ij}L_{ij})/Y_{ij}$, which is the share of full income spent on leisure generating activities.

as a weighted average of prices faced by the respective groups. Constant elasticity domestic and export demand equations were used as approximations of demand equations.[13] The corn domestic and export demand elasticities used were -0.2 and -1.0 (Bullock, 1992). The ratio of corn export was computed using the 1991 export volume of 1,584 million bushels and production of 7,475 million bushels (USDA, 1993). This ratio was then used to decompose corn output (model derived) into domestic demand and export demand. Using the estimate of the consumer price of corn for the U.S. and the estimates of domestic and export demand elasticities and the respective quantities demanded, the constant elasticity demand shifting parameters were derived.

With the base results determined, we then computed the no policy equilibrium data. Acres set aside were restored to the sector. This would ideally shift the output supply curve of each representative farm household to its no policy level. The no policy equilibrium output Q and output price P were solved endogenously by equating aggregate supply to aggregate demand. The following set of equations were then simultaneously solved for the no policy output and output price

$$\begin{aligned} Q_{ij} &= \phi_{ij} P^{\epsilon_{ij}} \\ \phi_{ij} &= \left[\left(\frac{\gamma_{ij}}{W_{ij}}\right)^{\gamma_{ij}} \left(\frac{\omega}{P_X}\right)^{\omega_{ij}} A_{ij} K_{ij}^{\delta_{ij}} \right]^{1/(1-\gamma_{ij}-\omega_{ij})} \\ GQ_{ij} &= n_{ij} Q_{ij} \\ 0 &= \theta_D P^{\eta_D} + \theta_E P^{\eta_E} - \sum_i \sum_j GQ_{ij} \end{aligned} \tag{5}$$

where $\epsilon_{ij} = (\gamma_{ij}+\omega_{ij})/(1-\gamma_{ij}-\omega_{ij})$ is the price elasticity of supply, the first equation is the output supply

[13] The domestic and export demand equations were therefore defined by $Q_D = \theta_D P^{\eta_D}$ and $Q_E = \theta_E P^{\eta_E}$, respectively. P denotes price, η represents the price elasticity of demand and θ is the demand shifting parameter.

function for a group level representative farm (Seleka, 1996), the third expression represents group level output supply curve, and the last equation equates market supply with market demand. Total no policy output was then decomposed into domestic and export demand using the demand parameter estimates from above. Then, no policy variable factor usage, short-run profits and output supply quantities were computed. We then computed group level and total economic surplus measures for the no policy scenario (see Appendix B). These were then compared with their base counterparts to examine the effects of policy on the respective households and the distributional effects across the individual groups.

Empirical Results

Table 3 presents estimates of Cobb-Douglas production technology and utility parameters. As indicated, the production technology efficiency parameter estimates (A's) ranged from a low of 2.225 to a high of 3.199. Production elasticity coefficients with respect to labor (γ's) ranged from 0.053 to 0.210. The production elasticity coefficient with respect to other inputs (ω's) ranged from 0.570 to 0.712, and varied positively with sales class. Production elasticity parameters with respect to land (δ's) are within the range 0.216-0.262 and they seemed somewhat invariant across sales classes, with the exclusion of those for the large-participating and the medium-participating category. The other four groups produced land elasticities of about 0.22 whereas the medium-participating (large-participating) registered an elasticity coefficient of 0.26 (0.24). Therefore, the data would suggest that these latter groups contain farms with a relatively higher return on land, compared with the other four groups whose land coefficients are smaller and somewhat invariant. Table 3 also presents output supply elasticity estimates (ϵ's). As indicated the estimates range from 2.812 though 3.623.

In general, production elasticity coefficients appear to reinforce the previous findings in the literature. Floyd (1965) used an estimate of the share of land of 0.2 and that for labor and capital of 0.8. Rosine and Helmberger (1974) estimated the production elasticities for land within the range 0.1079 (1948) and 0.2158 (1970). The production elasticity with respect to labor (hired and owned) was within the range 0.3918 (1948) and 0.1973 (1970). The land parameter exhibited an upward trend between 1948 and 1970 whereas that for labor declined during this same period. Based upon such a trend and the estimates for 1970, one would conclude that the present estimates are consistent with the results of Rosine and Helmberger (1974). The results of Shumway, Talpaz, and Beattie (1979) were consistent with the findings of Rosine and Helmberger (1974). Gisser (1993) set the CES production function coefficient for land at 0.237 and that for all other inputs at 0.763, in his calibration of the corn model (see p.597). Gisser's estimates were adopted from Kawagoe et al. (1986), who estimated the shares of labor, machinery, land and fertilizer to be 0.403, 0.310, 0.237, and 0.051, for the time period 1930-80.

Utility function parameters are also presented in Table 3. Parameters for money income (α's) fall within the range 0.185-0.836. These parameters increase with sales class, if we separate off-farm participants from non-participants. Within any given sales class, participating households tend to have a higher income share, compared with their non-participating counterparts. A reverse scenario is true for the coefficients for leisure (β's). Within a given participation class, the parameter for leisure declines with the increase in farm size (sales class). And within any given sales class, the leisure coefficient for nonparticipants is higher than that for participants. These results are mainly due to the fact that small-sized farms have lower money income (hence, a smaller share of money income in full income) and that non-participating households devote relatively more time to leisure, compared with their participating counterparts who also devote some of their time to off-farm wage work. We are not aware of any published utility parameter estimates in the literature to compare with the present estimates.

Most of the coefficients for money income are greater that those for leisure, with the exception of those for the small-nonparticipating group and the medium-participating group. The coefficients for money income and leisure are however almost equal at 0.5 for the medium-participating group. What may cause concern is the data for the small-nonparticipating group, which registered the leisure coefficient of 0.815 and the money income coefficient of 0.185. Is it that these households value leisure that much or is it because of other factors such as the unavailability of off-farm work opportunities, which could not be captured by the present model? With the paucity of data, as is the present situation, there is no telling as to the likely cause of such an occurrence. It is also noteworthy that, since a single estimate of the number of adults per household was used across the various classes, the coefficient for leisure will be overestimated for households whose time endowment is much smaller than the average and will be underestimated for households experiencing the reverse. This is because we observed work time (farm and off-farm) and then assigned the residual time to leisure. This procedure was nonetheless the most realistic, given the scarcity of data.

Table 3 also presents estimates of prices. The wage rate varied across groups of farms, and tended to increase with sales class. That is, the smallest sales class faces lower wage rates, compared with medium-sized and large-sized classes. The hourly wage rate falls within the range $3.58-$5.14. The wage rate estimates are lower than published regional and U.S. estimates. For example, USDA (1992) reports U.S average hourly farm wages for 1991 of $5.62, $5.44, $5.35 and $5.70 for farm employees working during January 6-12, April 7-13, July 7-13, and October 16-12, respectively. An attempt to utilize published estimates in the model calibration exercise yielded variable input data that drastically deviated from observed input usage. Hence, a realistic approach was to utilize the wage rate estimates generated from the model.[14]

The price of all other inputs was set at unity. The market price of corn was estimated by dividing total corn sales by output. As shown in Table 3, the market price of corn varied across categories of farms. Precisely, market prices of corn fall within the range \$2.27-\$2.35 per bushel. The corn market price for the entire U.S. was recorded at \$2.31, which was computed as a weighted average of group level prices. Group level prices fell within the range of published state level marketing prices. USDA (1993) reported prices falling within the range \$2.12-\$2.90. The U.S. average marketing price amounted to \$2.37, and was a few cents larger than the present estimate of \$2.31 per bushel. This study has therefore utilized prices that were generated from the summary statistics afforded to us by the ERS (Table A.1), rather than those published in other (USDA) sources.

Table 4 presents policy induced changes in endogenous variables and household economic surplus measures. Let us evaluate the effects of this program sequentially. The results indicate that the implementation of the program under review has caused an increase in variable farm input usage. The increase in labor F falls within the range 52-216 hours, and it is positively correlated with farm size. The increase in other inputs X falls within the range 530-9,937 units (dollars), and it is also positively related to farm size. Hired labor for non-participants increased by 23 (118) hours from zero hours for small-nonparticipating (medium-nonparticipating) households. These households witnessed a transition from hiring-out to hiring-in labor. Therefore, these households would have participated in off-farm wage work in the absence of government intervention. The large-nonparticipating class saw an increase in hired labor of about 317 hours, following the implementation

[14] As we have noted, wage rate estimates were generated by dividing the value of unpaid labor by the observed quantity of operator and other household labor. Therefore, any alteration of the wage rates generated will certainly alter hours of owned labor devoted to corn.

of the policy under review.

Farm output increased in response to a net increase in variable factor usage. The increase in farm output is also positively related to farm size, and falls within the range 235-2,868 bushels per farm. Next, short-run farm profits from corn PS increased. As evident, the producer's surplus change varies positively with farm size. Small-sized farms record a producer surplus increase amounting to about \$200 (\$250) for non-participants (participants), whereas large-sized farms record an increase of about \$2,445 (participating) and \$3,281 (non-participating). Medium-sized farms come second with a producer surplus increase of about \$831 (\$887) per farm for participants (non-participants). The increase in short-run profits from corn then led to an increase in full income. The changes in full income are identical to those for short-run profits as indicated in Table 4 (i.e $Y=\pi+WT+V \Rightarrow dY=d\pi$; $dT=dV=dW=0$).

The increase in full income further led to an increase in leisure and money income. The increase in leisure falls within the range 30-105 hours, and appears to generally vary positively with class size. The increase in money income is also positively correlated with farm size. Now, since both leisure and owned corn hours have increased, with other farming hours and the time endowment held unchanged, off-farm time declined drastically enough to just offset the combined increase in leisure hours and owned corn hours (Table 4). Because of the increase in leisure (or the net decrease in total work time), the valuation of owned work labor increased and the laborer's surplus declined as a result. Small-sized farm households registered a laborer's surplus reduction of about \$180 per farm, whereas medium-sized farms experienced a decline of about \$340. The large sized-participating category recorded a laborer's surplus decrease of \$568 per farm, whereas the large-nonparticipating category registered a decrease of \$283 per farm.

The producer's surplus increase should more that offset a laborer's surplus decrease so that, in net, this policy would lead to a positive economic surplus change. The results in Table 4 confirm this. The economic surplus change varied positively with farm size. The range was $21 through $2,713 per farm. The results of this section indicate that the conventional analysis producer surplus changes, at the exclusion of the laborer's surplus change, would generally lead to an overstatement of economic surplus change. Therefore, we now have adequate empirical evidence to suggest that, following the convention of sole reliance on the producer surplus change, it would be quite likely to overstate the improvement in household welfare, resulting from any particular market oriented government program.

The implication of the distributional effects of the corn program are very clear. It is evident that the benefits to small-sized farms are relatively negligible. This class records an economic surplus increase of only $21 ($65) per farm for non-participating (participating) households. The medium-sized class saw an economic surplus increase of about $494 ($532) per farm for participating (non-participating) households. Large-sized farms on the other hand saw the highest economic surplus increase of $2,163 ($2,713) per farm for non-participants (participants). These results would not justify government support, if the overall objective of government intervention is to improve the well-being of poor farm families. Therefore, the gains from government activity in the corn market appear to be misdirected. Hence, the objective of improving low farm incomes is clearly unrealized.

Concluding Remarks

The central objectives of this paper were to show that the producer's surplus is not an accurate measure of farm-household welfare and that welfare consequences of farm policies vary across producers. Empirical estimates of the laborer's surplus indicate that the economics of farm households calls for the inclusion of the laborer's surplus in measuring welfare. Two observations can be made concerning the measurement of economic surplus. Ignoring the laborer's surplus would (a) understate the magnitude of welfare currently enjoyed by farm households, and (b) overstate the improvement in welfare resulting from the implementation of any market oriented policy. That is, utilizing only the producer's surplus change to measure economic surplus change (induced by market oriented programs), at the exclusion of the laborer's surplus change, would normally overstate household welfare improvement. The reason is that, market oriented policies intended to increase the producer surplus, would also lead to a reduction in the laborer's surplus, as households reallocate their labor among competing alternatives. These results reinforce the argument that the household can be viewed to allocate its resources in a way that maximizes the sum of the laborer's surplus and the producer's surplus. Therefore, any time a market oriented (producer biased) policy is introduced, the household would make a tradeoff between the two surpluses, in a way that would lead to a net gain in household welfare. In particular, any policy geared towards increasing the producer's surplus would lead to a reduction in the laborer's surplus, but the net effect would be a net increase in economic surplus.

We also examined the distributional consequences of the corn program among the various groups of farms. The empirical results showed that the U.S. corn program aids large-sized farms relatively more than small-sized and medium-sized ones. Moreover, medium-sized farms have seen greater economic surplus improvement, compared with small-sized farms. In point of fact, policy induced improvement in the well-being of small-sized farms is so negligible that economic surplus increases may be safely rounded to zero. A welfare improvement of $21 ($64) per farm was recorded for small-nonparticipating (participating) households. It would indeed be not persuasive to argue that small-sized farms would have been worse off in the absence of the program.

These results question whether program objectives are being realized in aiding the poor farmer. Indeed, program benefits appear to be misdirected to households who do not seem to require government support, at the expense of small and more needy farm households. Therefore, the implications of these results are a clear indication that government involvement or activity in the U.S. corn market needs to be revised/revisited. If the objective is to sustain the poorest farm families in farming, non-market oriented policies such as lump-sum transfers may be more effective since they can target support to the most needy farm-households..

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Appendix B

Economic Surplus Measurement

In stage 1 of optimization, the farm household determines optimal *producer's surplus* (π):

$$\pi_{ij}^{c*} = p_q Q_{ij}^{*} - W_{ij}\Gamma_{ij}^{*} - p_X X_{ij}^{*} \tag{B.1}$$

Note here that producer surplus is identical to restricted (shot-run) profits.[15]

In stage 2, the optimal amount of the laborer's surplus is determined subject to optimal producer's surplus. Therefore, following the first stage, the income constraint (equation 1b) may be rewritten as

$$I_{ij} = FI_{ij} + W_{ij}\mho_{ij} \tag{B.2}$$

where $FI_{ij} = \pi_{ij}^{c*} + R_{ij}^{nc} + V_{ij}$ denotes fixed income and the second term where $\mho_{ij} = T_{ij} - L_{ij}$ denotes the variable component of money income. Note that $\mho_{ij} = T_{ij} - L_{ij}$ represents total work time (off-farm and farming time).

For a Cobb-Douglas utility function, the marginal valuation (cost) of family labor may be expressed as

$$\Omega_{ij} = \frac{U_L(I,L)}{U_I(I,L)} = \frac{\beta_{ij}}{\alpha_{ij}}\frac{I_{ij}}{L_{ij}} = \frac{\beta_{ij}}{\alpha_{ij}}\frac{I_{ij}}{(T_{ij} - \mho_{ij})} \tag{B.3}$$

Evidently, the marginal valuation of family labor (equation B.3) is a function of work time (or leisure time) and income. But since money income is also a function of work time (or leisure), we can utilize equation B.2 to rewrite equation B.3 as

$$\Omega_{ij} = \frac{\beta_{ij}}{\alpha_{ij}}\left[\frac{FI_{ij} + W_{ij}(T_{ij} - L_{ij})}{L_{ij}}\right] = \frac{\beta_{ij}}{\alpha_{ij}}\left[\frac{FI_{ij} + W_{ij}\mho_{ij}}{T_{ij} - \mho_{ij}}\right] \tag{B.4}$$

Equation B.4 indicates that the marginal valuation (cost) of family labor curve is upward sloping with respect to owned work time and downward sloping with respect to leisure, as was drawn

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[15] Note that producer surplus is defined as the triangle-like area above the output supply curve and below the product price line. This area is equivalent to restricted profits in the case where we have concave production functions with respect to variable production factors. This should be obvious because $\partial\pi(P_q)/\partial P_q = Q(P_q)$. From this result, it follows that $\int Q(P_q)dP_q = \pi(P_q)$. Therefore, integrating the output supply curve should precisely define short-run farm profits.

in Figures 1 and 2.[16] The laborer's surplus can therefore be calculated as

$$
\begin{aligned}
&= W_{ij}\bar{\mho}_{ij} - \frac{\beta_{ij}}{\alpha_{ij}}\int_0^{\bar{\mho}_{ij}} \frac{FI_{ij}+W\mho_{ij}}{T_{ij}-\mho_{ij}} d\mho_{ij} = W_{ij}\bar{\mho}_{ij} - \frac{\beta_{ij}}{\alpha_{ij}}\int_{\bar{L}_{ij}}^{T_{ij}} \frac{FI_{ij}+W_{ij}(T_{ij}-L_{ij})}{L_{ij}} \\
&= W_{ij}\bar{\mho}_{ij} + \frac{\beta_{ij}}{\alpha_{ij}}\left[\left(W_{ij}T_{ij}+FI_{ij}\right)\left(\ln\bar{L}_{ij}-\ln T_{ij}\right)+W_{ij}\left(T_{ij}-\bar{L}_{ij}\right)\right]
\end{aligned}
\tag{B.5}
$$

where $\bar{\mho}=T-\bar{L}$ denotes the optimal amount of time devoted to work (farm and off-farm) and $\bar{L}$ is the optimal amount of leisure time.[17] Total economic surplus for a representative household (ES_{ij}).

[16] This can be shown by partial differentiating equation B.4 with respect to leisure or total work time to obtain

$$\frac{\partial\Omega}{\partial L} = -\frac{\beta}{\alpha}\left[\frac{FI+WT}{L^2}\right] = -\frac{\partial\Omega}{\partial\mho} < 0$$

where the ij's have been dropped.

[17] It is noteworthy here that

$$\frac{\beta}{\alpha}\int_0^{\bar{\mho}} \frac{FI+W\mho}{T-\mho} d\mho = \frac{\beta}{\alpha}\int_{\bar{L}}^{T} \frac{FI+W(T-L)}{L} dL = -\frac{\beta}{\alpha}\left[(WT+FI)(\ln\bar{L}-\ln T)+W(T-\bar{L})\right]$$

where the ij's have been dropped. Note that this expression denotes total valuation (cost) of family labor devoted to work (all work). Therefore, the laborer's surplus is precisely calculated as total wage income (farm and off-farm) minus total cost of owned labor. Recall that farm work is assumed to be remunerated at the same wage rate as does off-farm work when calculating the producer's surplus. The value unpaid (family) labor was, among other variable inputs, deducted from farm revenues to compute the producer surplus. Thus, the producer's surplus does not capture returns to family labor. The laborer's surplus calculation, therefore, is concerned with measuring net returns to family labor put to work (farm and off-farm).

Table 1 Distribution of off-farm income by sales class, 1986.

Agricultural Subsector	Percent of sector's farms	Off-farm income Average $	Off-farm income Total ($000,000)	Percent total cash income from off-farm sources	Percent of sectors's off-farm income
All farms	100	20,212	44,708	46	100
Sales class					
Less than $40,000	73	22,534	36,336	96	81
$40,00-$99,999	13	13,780	4,053	37	9
$100,000-$249,999	10	12,602	2,648	17	6
$250,000 or more	4	17,562	1,670	5	4

Source: Extracted from Ahearn and Lee (1991), Table 1.2

Table 2 Corn Production Costs Per Acre

Variable	Sales Class: less than $40,000 (Small)		$40,000-$249,999 (Medium)		$250,000 and over (Large)	
	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No
Total number of farms (expanded)	52,898.10	64,609.21	114,215.82	128,440.54	26,335.81	36,905.04
Total number of farms (sample)	83.00	88.00	179.00	213.00	53.00	92.00
Average yield per acre	85.69	80.05	112.27	105.85	119.80	114.51
Gross value of production	194.43	186.48	256.51	242.96	281.04	266.92
Hired labor	1.10	2.54	3.92	3.17	12.63	14.28
Other Variable inputs	113.73	106.16	122.67	127.60	138.34	156.94
Total variable cash costs	114.83	108.70	126.59	130.77	150.97	157.97
General Farm overhead	11.25	16.60	10.77	10.35	8.46	10.61
Taxes and insurance	16.29	17.15	19.01	18.82	15.87	18.04
Total Interest	15.91	4.85	17.53	13.03	21.42	18.76
Total fixed cash costs	43.46	38.59	47.31	42.20	45.75	47.42
Total cash costs	158.29	147.29	173.91	172.97	196.73	205.39
Gross value of production less cash costs	36.14	39.19	82.60	69.99	84.31	61.53
Capital replacement	21.99	22.04	23.26	25.95	29.13	33.83
Operating capital	3.12	2.96	3.44	3.56	4.11	4.30
Nonland capital	10.17	10.11	9.33	10.19	10.12	11.23
Net land rent	52.78	54.51	67.13	57.26	64.17	61.22
Unpaid labor	41.09	49.35	26.18	29.34	14.35	13.58
Total economic costs	271.53	281.41	285.73	286.23	297.19	310.79
Gross value production less economic costs	-77.10	-94.93	-29.22	-43.27	-16.15	-43.86

Source: USDA, Economic Research Service

Table 3 Parameter Estimates and Prices

Variable	Sales class					
	less than $40,000 (Small)		$40,000-$249,999 (Medium)		$250,000 and over (Large)	
	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No
Production Parameters						
A	2.692	2.977	3.199	2.678	2.225	2.425
γ	0.168	0.210	0.102	0.126	0.053	0.099
ω	0.615	0.570	0.635	0.651	0.712	0.684
δ	0.216	0.220	0.262	0.223	0.235	0.217
ϵ	3.623	3.544	2.812	3.490	3.252	3.608
Prices (dollars)						
Wage rate	3.725	3.584	4.267	4.560	5.129	5.138
Price of other inputs	1.000	1.000	1.000	1.000	1.000	1.000
Producer Price (weighted AVG= 2.309)	2.269	2.330	2.276	2.295	2.346	2.331
Utility Function Parameters						
α	0.550	0.185	0.607	0.473	0.836	0.789
β	0.450	0.815	0.393	0.527	0.164	0.211

Table 4 Effects of the Corn Program (Changes in Exogenous Variables)

Variable	Sales class					
	less than $40,000 (Small)		$40,000-$249,999 (Medium)		$250,000 and over (Large)	
	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No
Inputs: F	52	54	76	110	143	216
X	711	529	2,014	2,593	9,937	7,713
Owned hours	1,255	1,679	11,372	1,968	1,430	1,598
Hired Labor (non-part)		23		119		317
Output (bu): Per farm	266	235	530	883	2,868	2,528
Group Level	14,083,420	15,189,250	60,553,070	113,376,800	75,542,210	93,285,190
Time endowment	0	0	0	0	0	0
Corn hours	1,255	1,679	1,372	1,968	1,430	1,598
Other farm hours	0	0	0	0	0	0
Off-farm hours	-1,285	-1,725	-1,448	-2,070	-1,535	-1,699
Leisure hours	30	46	77	103	105	100
Incomes per household						
Property Income	0	0	0	0	0	0
Off-farm wage income	-1,285	-1,725	-1,448	-2,070	-1,535	-1,699
Net incomes for non-corn	0	0	0	0	0	0
Money income	137	38	504	420	2,744	1,930
Full income	250	204	831	887	3,281	2,445
Welfare Changes						
PS: Household level	250	204	831	887	3,281	2,445
Group level	13,218,070	13,189,160	94,934,130	113,968,800	86,407,800	90,246,630
LS: Household	-185	-183	-338	-355	-568	-283
Group level	-9,796,450	-11,839,800	-38,548,700	-45,608,700	-14,966,700	-10,428,500
R: Household	0	0	0	0	0	0
Group level	0	0	0	0	0	0
ES: Household	65	21	494	532	2,713	2,163
Group level	3,421,622	1,349,313	56,385,420	68,390,080	714,411,300	7,981,813

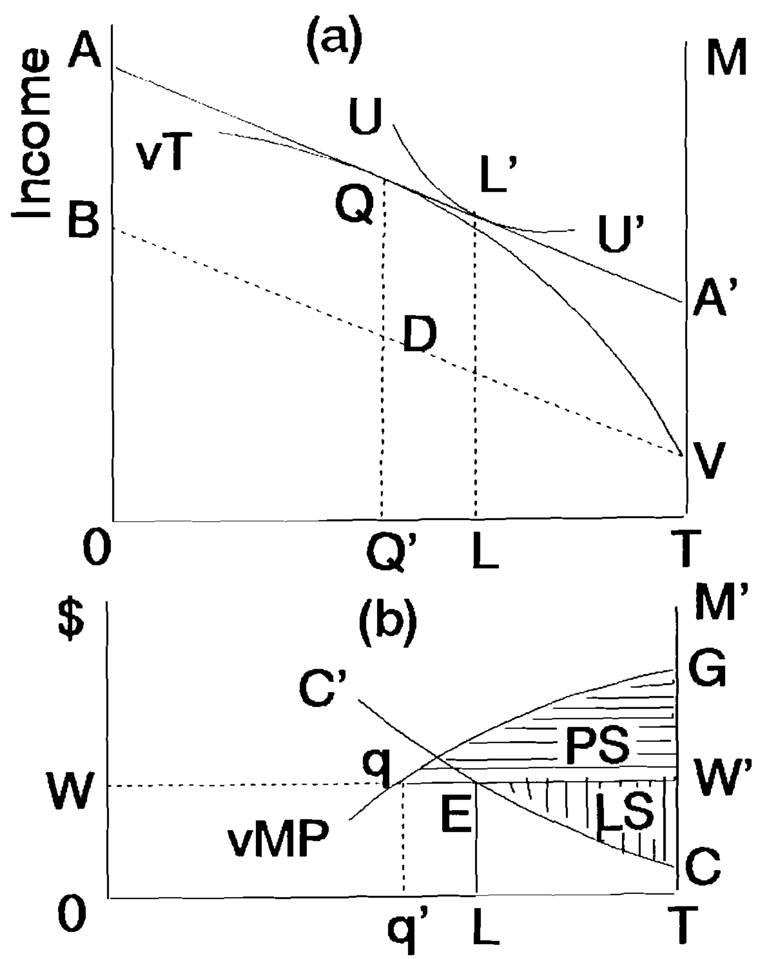

Figure 1 Economic Surplus with Labor Hired-in

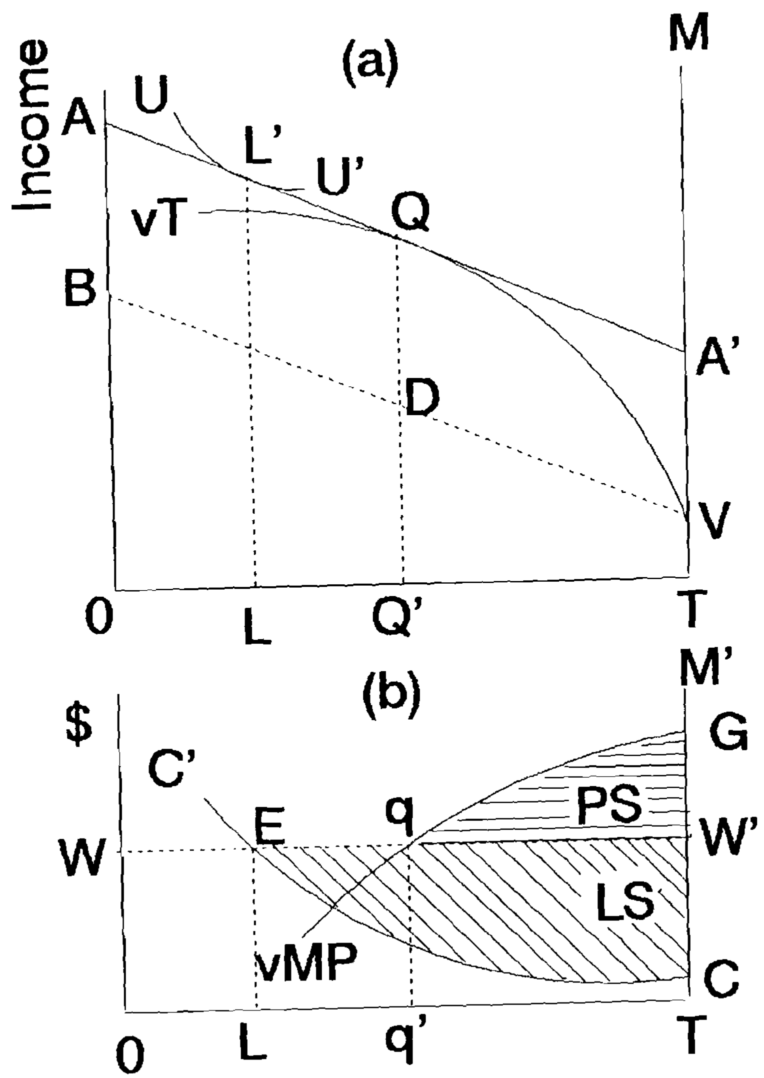

Figure 2 Economic Surplus with Labor Hired-out

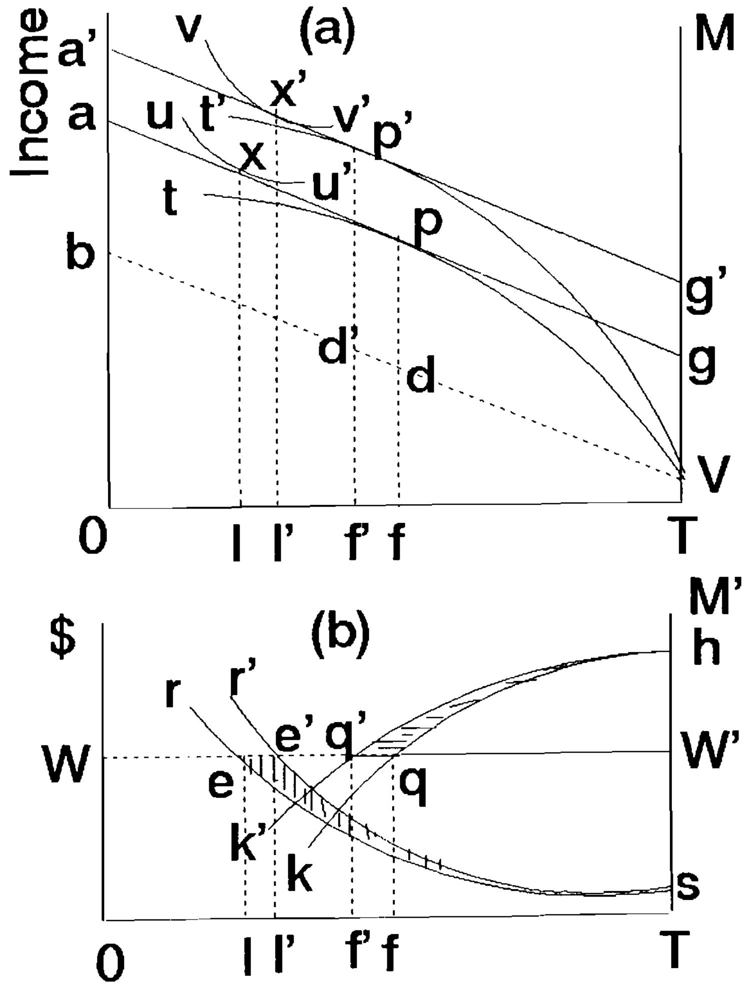

Figure 3 Effects of a Price Support

Appendix A

Data Used in Model Calibration

Table A.1 Corn Production Costs Per Acre

Variable	Sales Class					
	less than $40,000 (Small)		$40,000-$249,999 (Medium)		$250,000 and over (Large)	
	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No
Total number of farms (expanded)	52,898.10	64,609.21	114,215.82	128,440.54	26,335.81	36,905.04
Total number of farms (sample)	83.00	88.00	179.00	213.00	53.00	92.00
Average yield per acre	85.69	80.05	112.27	105.85	119.80	114.51
Gross value of production	194.43	186.48	256.51	242.96	281.04	266.92
Hired labor	1.10	2.54	3.92	3.17	12.63	14.28
Other Variable inputs	113.73	106.16	122.67	127.60	138.34	156.94
Total variable cash costs	114.83	108.70	126.59	130.77	150.97	157.97
General Farm overhead	11.25	16.60	10.77	10.35	8.46	10.61
Taxes and insurance	16.29	17.15	19.01	18.82	15.87	18.04
Total Interest	15.91	4.85	17.53	13.03	21.42	18.76
Total fixed cash costs	43.46	38.59	47.31	42.20	45.75	47.42
Total cash costs	158.29	147.29	173.91	172.97	196.73	205.39

Table A.1 (Continued) Corn Production Costs Per Acre						
Variable	Sales Class					
	less than $40,000 (Small)		$40,000-$249,999 (Medium)		$250,000 and over (Large)	
	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No
Gross value of production less cash costs	36.14	39.19	82.60	69.99	84.31	61.53
Capital replacement	21.99	22.04	23.26	25.95	29.13	33.83
Operating capital	3.12	2.96	3.44	3.56	4.11	4.30
Nonland capital	10.17	10.11	9.33	10.19	10.12	11.23
Net land rent	52.78	54.51	67.13	57.26	64.17	61.22
Unpaid labor	41.09	49.35	26.18	29.34	14.35	13.58
Total economic costs	271.53	281.41	285.73	286.23	297.19	310.79
Gross value production less economic costs	-77.10	-94.93	-29.22	-43.27	-16.15	-43.86

Source: USDA, Economic Research Service

Table A.2 Other Pertinent Data

Variable	Sales Class					
	Small		Medium		Large	
	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No
Hours of operator per year	1,575	1,907	2,663	2,938	2,880	3,123
% hours for corn	28	23	30	28	33	25
Hours of other household members per year	714	647	893	1,237	1,889	1,747
% hours for corn	17	11	15	12	26	14
Other sources of farm income						
Customs work for others	708	51	1,312	1,049	4,918	4,653
Grazing of livestock	0	0	46	11	1,918	390
Cooperative patronage dividends	72	140	452	691	1,132	868
Sales of farm machinery and vehicles	189	19	436	214	310	2,200
Insurance indemnity and payments	84	151	698	684	1,574	1,024
Hunting, fishing and outdoor recreation	0	0	5	3	0	27
Off-farm income						
Cash wages and salaries	22,500	0	12,500	0	17,500	0
Net cash income from off-farm business	500	1,750	500	500	500	500
Net cash income from another farm or ranch	0	500	0	0	0	0
Interest and dividends	500	1,750	500	500	1,750	1,750
Other off-farm income	500	1,750	500	500	1,750	500
Acres planted to corn						
Irrigated acres	1	0	12	22	102	142
Non-irrigated acres	51	37	140	129	413	246
Set-aside acres	4	2	12	12	41	32

Source: USDA, Economic Research Service

Table A.3 Income Statement for Farm Business, 1991 FCRS, Corn Version

Variable	Sales Class					
	less than $40,000 (Small)		$40,000-$249,999 (Medium)		$250,000 and over (Large)	
	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No
Total number of farms (expanded)	52,898	64,609	114,216	128,441	26,336	36,905
Total number of farms (sample)	83	88	179	213	53	92
Total acres operated	229	214	471	526	1,855	1,764
Corn acres planted	51	38	157	156	519	398
Other crop acres planted	18	28	48	45	50	148
Average cash rent per acre	55	30	60	38	73	46
Average cash rent and AUM expense	2,232	588	8,641	5,642	27,764	26,990
Shared rent estimate incl. livestock	2,293	1,028	14,425	16,142	30,414	28,797
Gross Cash Income	20,351	20,842	102,971	110,097	443,771	592,418
. Livestock sales	7,386	9,875	43,529	53,853	207,108	335,670
. Crop sales	10,492	8,300	47,898	45,026	199,968	214,753
. Government payments	1,352	1,077	5,681	5,581	20,049	19,921
. Other farm-related income	1,120	1,590	5,863	5,637	16,646	22,074

Table A.3 (Continued) Income Statement for Farm Business, 1991 FCRS, Corn Version

Variable	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No	Off-farm=Yes	Off-farm=No
Less: Cash Expenses	22,808	19,529	81,360	82,518	352,387	454,926
- Variable	15,838	15,552	58,709	62,259	269,540	377,041
. Livestock purchases	1,134	910	5,853	5,522	59,370	124,265
. Feed	1,716	1,959	10,991	11,456	37,767	72,705
. Other livestock expenses	179	114	333	537	1,170	1,849
. Seed and plants	1,445	1,154	4,679	4,489	18,139	14,166
. Fertilizer and chemicals	3,776	4,018	13,257	13,405	54,379	48,708
. Labor	390	744	2,562	3,558	25,056	32,948
. Fuel and oils	1,600	1,453	4,534	4,783	19,392	16,419
. Repairs and maintenance	2,631	2,456	7,144	7,994	25,477	22,541
. Machine-hire and custom work	561	563	1,827	2,455	7,734	12,143
. Utilities	672	790	2,316	2,498	6,696	9,631
. Other variable expenses	1,433	1,038	3,666	3,746	9,503	14,137
-Fixed	6,967	3,977	22,651	20,258	82,847	77,885
. Real estate, property taxes	1,125	1,576	2,047	2,763	9,198	8,186
. Interest	2,614	916	8,806	8,394	35,035	26,898
. Insurance premium	940	875	2,670	2,947	7,463	13,058
. Rent and lease payments	2,288	610	9,128	6,155	31,151	29,743
Equal: Net cash farm income	-2,453	1,313	21,611	27,580	91,384	137,492
Less: Depreciation	3,428	2,325	10,466	11,480	28,571	30,648
Labor, non-cash benefits	2	58	68	270	1,405	2,064
Plus: Value of inventory change	3,917	2,049	2,285	2,344	27,222	11,164
Nonmoney income	2,495	3,084	2,667	2,632	4,898	5,053
Equals: Net farm income	529	4,063	16,027	20,805	93,527	121,002

Source: USDA, Economic Research Service

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