# Policy Research Center

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## Running Hard and Falling Behind: A Welfare Analysis of Two-Earner Families

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# EXECUTIVE SUMMARY

This paper investigates the commonly asserted proposition that long term economic changes have put the family in a financial bind. Using a family utility model to estimate the parameters of a family utility function, we find evidence indicating that the average 1990's two-earner family would prefer to receive the 1980's real wage package (were it available) instead of the real wage package that it actually faces. The degree to which the 1990's family is worse off (in terms of the changes in the real wage package) is roughly equivalent to an hour of leisure per week.

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# RUNNING HARD AND FALLING BEHIND: A WELFARE ANALYSIS OF TWO-EARNER FAMILIES

Julie L. Hotchkiss, Mary Mathewes Kassis, and Robert E. Moore

## Introduction

The 1980s and early 1990s have seen tremendous progress in the equalization of wages of males and females. Although married women in 1993 still only earned about 76 cents for every dollar earned by married men, this figure represents a 15 percent increase in the female/male wage ratio between 1983 and 1993 (see Figure 1).[1] Analyses in the economics literature on the size of and changes in the wage differential between men and women typically either focus on the issue of equity (i.e., equally productive men and women *should* receive equal compensation), or on the economic concern that an important factor of production (the human capital of women) is being mis-allocated as a result of non-economic barriers to certain (high-paying) occupations.[2] Based on both an equity and efficiency criterion, then, one could easily argue that the rise in the female/male wage ratio is a good thing.

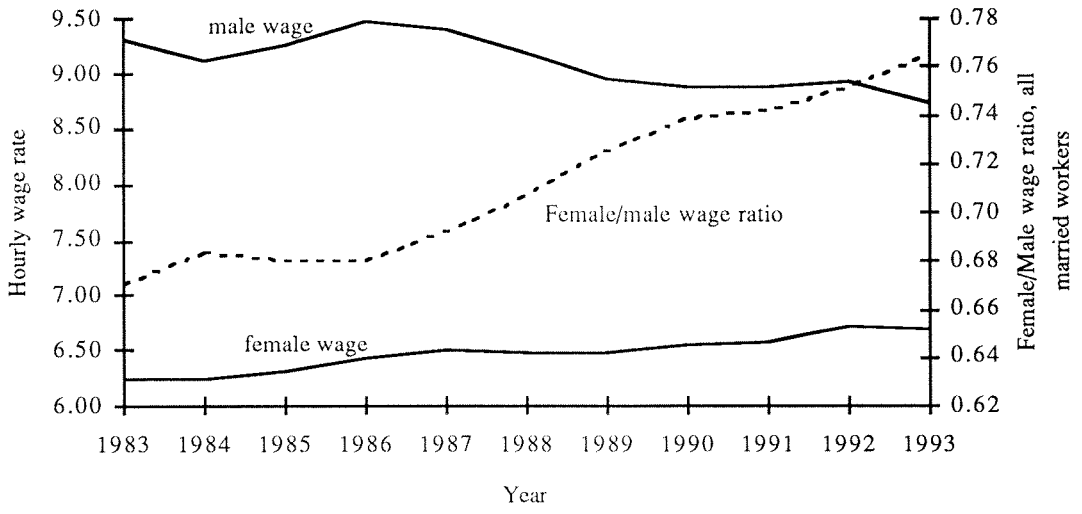


Figure 1. Average hourly real wage for married males and females (1982-84 dollars) and the married female/male wage ratio.

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[1]Note that the wage ratio had remained roughly constant for decades prior 1980 (see Gunderson, 1989). Average wages were computed using annual national averages reported in Employment and Earnings and correspond to husbands and wives whose spouses are working.

[2]See, for example, Gunderson (1989) and Bound and Johnson (1992).

What has not been addressed before now is how the rise in the wage ratio has impacted the welfare of the two-earner family, given that the rise is partly driven by a decline in the male real wage.[3] The analysis in this paper is directed at determining how the changes in the real wages of married men and women, taken together, have affected the two-earner family.[4] Specifically we ask, within a family utility framework, whether the average two-earner family of the 1990s would prefer the real wage package it currently faces, or the real wage package that prevailed during the previous decade. Although the 1990s family is experiencing a greater average level of real consumption than the 1980s family, such a simple comparison fails to take into account the relative value the family places on the leisure that has been sacrificed to attain the higher level of consumption. We find convincing evidence that the 1990s two-earner family would prefer the 1980s wage package and therefore can be said to be worse off than an equivalent two-earner 1980s family. The degree to which the family is worse off is roughly equivalent to the (marginal) value of an hour of leisure *per week*, or the consumption that could be earned with a week's pay per year. Our results are consistent with popular press reports that today's family faces an ever-increasing burden in trying to maintain a middle-class standard of consumption.[5]

Method

Within the framework of the neoclassical family labor supply model, a family maximizes a utility function that is a function of the husband's leisure, the wife's leisure, and their joint consumption, subject to a single budget constraint:

[3]Kaestner (1993) explores how labor supply of married couples is affected by wage changes and the addition of children and how those labor supply responses have changed over time, but he does not explore how these changes have affected family welfare.

[4]We constrain the problem to consider only the case of two-earner families since the welfare effect of decreasing male real wages on male single-earner families is obvious, as is the effect of the rising female real wage on the well-being of female single-earner families.

[5]For example, see Hewlett (1990), Otten (1994), and Uchitelle (1994).

$$\underset{\{L_1\,L_2\,X\}}{\text{Max}}\; U = U(T-h_1, T-h_2, X) \tag{1}$$

Subject to $X = w_1h_1 + w_2h_2 + Y$.[6]

T is total time available for an individual, $L_1=T-h_1$ is the husband's leisure, $L_2=T-h_2$ is the wife's leisure, $h_1$ is the labor supply of the husband, $h_2$ is the labor supply of the wife, X is total money income (or consumption with price equal to one), Y is non-labor income, $w_1$ is the husband's market wage and $w_2$ is the wife's market wage.[7] Since we are limiting the discussion to families where both spouses work, $h_1$ and $h_2$ are also constrained to be positive.

The solution to the above maximization problem can be expressed in terms of the indirect utility function, which is solely a function of the wages of the husband and wife and non-labor income of the family:

$$V(w_1,w_2,Y)=U\left\{\left[T-h_1^*(w_1,w_2,Y)\right],\left[T-h_2^*(w_1,w_2,Y)\right],\right.$$
$$\left.\left[w_1h_1^*(w_1,w_2,Y)+w_2h_2^*(w_1,w_2,Y)+Y\right]\right\}, \tag{2}$$

where $h_1^*(w_1,w_2,Y)$ and $h_2^*(w_1,w_2,Y)$ correspond to the optimal labor supply equations for the husband and wife, respectively. In order to capture the total effect of the wage changes observed during the 1980s on family utility at each member's optimal leisure choice, we totally differentiate the indirect utility function:

$$dV = -U_1dh_1 - U_2dh_2 + U_3dX, \tag{3}$$

where $U_1$ is the family's marginal utility of the husband's leisure, $U_2$ is the family's marginal utility of the wife's leisure, and $U_3$ is the family's marginal utility of consumption. Expressed in terms of changes in non-labor income and wages, the total derivative becomes:

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[6]We choose the neoclassical framework in order to obtain a clear-cut specification of family welfare. Although a household bargaining model might tell us more about how the behaviors of individual household members respond to wage changes, it does not readily lend itself to evaluation of the welfare of the *family* unit.

[7]Although we refer to $L_1$ and $L_2$ as the "leisure" of the husband and wife, respectively, they actually correspond to all uses of non-market time, including home production activities.

$$dV = \left\{-U_1\frac{\partial h_1}{\partial w_1} - U_2\frac{\partial h_2}{\partial w_1} + U_3\left[w_1\frac{\partial h_1}{\partial w_1} + h_1 + w_2\frac{\partial h_2}{\partial w_1}\right]\right\}dw_1$$

$$+\left\{-U_1\frac{\partial h_1}{\partial w_2} - U_2\frac{\partial h_2}{\partial w_2} + U_3\left[w_1\frac{\partial h_1}{\partial w_2} + h_2 + w_2\frac{\partial h_2}{\partial w_2}\right]\right\}dw_2$$

$$+\left\{-U_1\frac{\partial h_1}{\partial Y} - U_2\frac{\partial h_2}{\partial Y} + U_3\left[w_1\frac{\partial h_1}{\partial Y} + 1 + w_2\frac{\partial h_2}{\partial Y}\right]\right\}dY \qquad (4)$$

The direction (sign) of the change in utility at the optimal leisure choices that results from changes in the husband's and wife's wage and changes in non-labor income cannot be determined analytically; it depends on the relative size of labor supply responses of the husband and wife to own and to spouse wage changes, as well as on the relative size of the additional utility the family attains from an additional unit of leisure enjoyed by the husband and wife. Consequently, in order to obtain estimates of the pieces of the total derivative in equation (4) a family labor supply model is estimated empirically.

The impact of the wage changes on family utility is isolated from changes in non-labor income by calculating the change in family utility that occurs when the wages change, but non-labor income does not. This is accomplished by evaluating equation (4) when dY=0.

Empirical Estimation

To obtain estimates to use in evaluating equation (4), we appeal to the family utility framework presented by Ransom (1987). He specifies a quadratic form of the utility function:

$$U(Z) = \alpha(Z) - (1/2)Z'\beta Z, \qquad (5)$$

where Z is a vector with elements $Z_1 = T - h_1$, $Z_2 = T - h_2$ and $Z_3 = w_1h_1 + w_2h_2 + Y$; $\alpha$ is a vector of parameters and $\beta$ is a matrix of parameters. This utility function belongs to the class of flexible functional forms in the sense that it can be thought of as a second order approximation to an arbitrary utility function when $\beta$ is positive definite.[8]

[8]The estimation performed resulted in a positive definite $\beta$ matrix.

The first order conditions, the labor supply equations, and the likelihood function estimated to obtain structural parameter estimates are found in Ransom (1987: 467-8).[9] The specification of the likelihood function allows for simultaneous labor supply decisions of the husband and wife. The March 1993 Current Population Survey (CPS) was used to construct the sample for which the family labor supply model was estimated. Table 1 contains the means and standard deviations of the variables for the sample. The responses correspond to work behavior during March 1993. The wage and non-labor income are reported in real (1982-84) dollar values. On average, husbands (wives) work about 43 (about 36) hours per week and earn $10.00 ($7.52) per hour. Families receive about $45 of non-labor income per week. Husbands are slightly older than wives and both have about the same level of education.

The parameter estimates are reported in Table 2. Unlike Ransom (1987) we include children regressors in the labor supply equation of the husband, as well as the wife. (Excluding these regressors from the husband's labor supply equation did not alter the conclusions of the paper.) Estimates of the marginal utilities of leisure and consumption, as well as the own and cross wage elasticities are also reported in Table 2.[10] The coefficients on the variables included in the labor supply equation are all of the expected sign and, for the most part, highly significant. Children have more of an impact on the labor supply decisions of the wife than the husband. The marginal utilities are all positive and significantly different from zero. Both the husband's and wife's own wage elasticities are positive and, although small, significantly different from zero. The cross-wage elasticities are insignificant and so is the wife's income elasticity. The husband's income elasticity is of the appropriate sign and significantly different from zero.[11]

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[9]These are repeated in Appendix A for the convenience of the reader. Appendix A also contains details on obtaining estimates for equation (4).

[10]95% confidence intervals for all functions of the estimated parameters were generated using standard bootstrapping techniques. 200 repetitions were performed and the results are reported in Appendix B. Details of bootstrapping techniques can be found in Efron (1982).

[11]If the *source* of non-labor income matters in the labor supply response of the husband and wife, as suggested by Schultz (1990), the positive effect of non-labor income on the husband's labor supply and the corresponding absence of an income effect on the wife's labor supply could be suggesting that the bulk of non-labor income is generated by the husband.

Inserting the parameter estimates and the mean values for $h_1$, $h_2$, $w_1$, $w_2$, and Y into equation (4), we have:

$$dV = (4.98)dw_1 + (4.22)dw_2 + (0.12)dY.^{12} \quad (6)$$

The evaluation of equation (6), tells us how the 1990s family utility is affected by any changes in wage and non-labor income experienced through $dw_1$, $dw_2$, and dY. To determine how wage changes over the last 10 years affect the utility of the 1990s family, $dw_1$ ($dw_2$) was calculated as the difference between the average real wage of husbands (wives) who have a working spouse in 1983 and 1993.[13] The average wages were calculated using hours and earnings information from the Employment and Earnings publication. $dw_1$ was calculated as -0.63 per hour and $dw_2$ was calculated as 0.52 per hour. The change in non-labor income (dY) was calculated using the (weighted) average non-labor income reported by families in the 1983 and 1993 Current Population Surveys and is $3.24 per week (in 1982-84 dollars).

Interpretation of Results

*Isolating the Change in Wages*

Setting dY=0 in equation (6) yields a picture of the actual impact on utility resulting solely from the trade-off of wives' for husbands' earnings through changes in their respective wages. The simulated decline in the husband's wage along with the simulated increase in the wife's wage alone result in a decline of total utility of 0.94.[14] This -0.94 change in utility is equivalent (given the estimated marginal utilities of the husband's and wife's leisure) to a loss of 0.93 hours of leisure per week for the husband or a loss of 1.39 hours of leisure per week for the wife (which translates into 48.4 hours per year for the husband and 72.3 hours per year for the wife).[15]

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[12]Each of these numerical pieces is significantly different from zero at the 95% confidence level.

[13]Our focus on the most recent decade incorporates the majority of the time period over which the rise in the female/male real wage ratio has been the most dramatic. See footnote 1.

[14]This estimate is significantly different from zero at the 95% confidence level. The confidence interval is reported in Appendix B.

[15]$dL_1 \approx (dV/U_1)$ and $dL_2 \approx (dV/U_2)$.

*Total Change in Utility*

This reduction in utility holds even when we account for the estimated increase in non-labor income. Total family utility decreased by a magnitude of 0.56.[16] This is equivalent to 0.55 of an hour of husband's leisure per week and 0.83 of an hour of wife's leisure per week (this translates into 28.6 hours per year for the husband and 43.2 hours per year for the wife).

*Implication for Adjustments in Consumption*

Since non-labor income appears to have increased over the last 10 years, the decline in total utility clearly stems from the changes in wages and the resulting adjustments in leisure. Changes in both the wages and non-labor income, however, have an implication for total money income, or consumption of the family. Given our family utility function parameter estimates, we calculated that the 1990's family would have received more total money income with the 1980's wage package than with the 1990's wage package, suggesting that we should have seen a decline in total money income over the last decade. We calculated the predicted change in total money income from the wage and non-labor income changes over the last decade by inserting our estimated parameters into:

$$dX = \left[ w_1 \frac{\partial h_1}{\partial w_1} + h_1 + w_2 \frac{\partial h_2}{\partial w_1} \right] dw_1 + \left[ w_1 \frac{\partial h_1}{\partial w_2} + h_2 + w_2 \frac{\partial h_2}{\partial w_2} \right] dw_2 + \left[ w_1 \frac{\partial h_1}{\partial Y} + 1 + w_2 \frac{\partial h_2}{\partial Y} \right] dY, \quad (7)$$

and predicted a total money income decline of approximately 0.6%.[17] However, we have not seen a decrease in consumption over this time period. Real median family income has actually increased at an average annual rate of approximately 3%.[18] Though the predicted and the observed changes are both small in magnitude, they are different in direction. Part of the problem may be our

[16]This estimate is also significantly different from zero at the 95% confidence level. The confidence interval is reported in Appendix B.

[17]The estimate of dX is significantly different from zero at the 95% confidence level. See Appendix B.

[18](Statistical Abstract for the United States, 1993). This figure is for all families, not just two-earner families. A comparable figure for two-earner families is not available.

inability to obtain a perfect match between our "predicting" and "observed" groups. In addition to the fact that the 3% increase in family income is observed for all families, not just two-earner families, another important difference between the "predicting" and "observed" group is that the "observed" group includes demographic changes. In the presence of demographic changes, such as the increasing average age of the population, the presence of long-term consumption contracts (such as home mortgages and whole life insurance policies) may tend to constrain the average consumption of families, not allowing them to easily adjust consumption downward.

## Conclusion

For several years now the popular media has been lamenting the financial plight of the family. Anecdotes abound of the difficulty families have in making ends meet.[19] Our study is the first to empirically document the financial squeeze on the two-earner family and to estimate its magnitude. We find that the average two-earner family has suffered a loss roughly equivalent to one hour of leisure per week when accounting for the changes, over the last decade, in real average male and female wages alone. While adding in the effect of the change in non-labor income reduces the loss, it is still equivalent to greater than a half hour of leisure per week.

This research may be extended in a number of ways. For example, exploration of why consumption seems to have increased when the theoretical model predicts a decline and making use of longitudinal data would contribute to even greater understanding of the welfare response of families who face changes in their non-labor income and prices of leisure.

Possible limitations of this study include our inability to control for changes in non-wage benefits and taxes over the decade examined. The rise in benefits as a proportion of total compensation may dampen our results, however if the benefits offered a two-earner family are redundant, the impact of not being able to measure benefit receipt is lowered. In addition, we expect that being able to incorporate the generally rising taxes over the decade (e.g., social security, property, and sales taxes) would magnify our results.

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[19]For example, see Hewlett (1990), Otten (1994), and Uchitelle (1994).

Table 1. Means and standard deviations of variables for sample used in estimation, N = 2,910 families.

| Variable | Mean | Standard Deviation |
|---|---|---|
| $h_1$ | 42.71 | (8.58) |
| $h_2$ | 35.78 | (10.07) |
| $w_1$ | $10.00 | (5.20) |
| $w_2$ | $7.52 | (4.84) |
| Y | $45.02 | (107.07) |
| $Black_1 = 1$ | 0.07 | (0.25) |
| $Black_2 = 1$ | 0.06 | (0.24) |
| $Age_1$ | 40.96 | (10.19) |
| $Age_2$ | 38.76 | (9.69) |
| $HS_1 = 1$ | 0.91 | (0.28) |
| $HS_2 = 1$ | 0.93 | (0.26) |
| $COL_1 = 1$ | 0.30 | (0.46) |
| $COL_2 = 1$ | 0.27 | (0.45) |
| NKIDS | 2.12 | (2.24) |
| PRESCHL = 1 | 0.27 | (1.07) |

Notes: Wages and non-labor income are in real terms (1982-84 CPI=1.445). $h_1$ and $h_2$ are in terms of hours per week. Y is in terms of dollars per week.

Table 2. Estimated parameter values for quadratic family utility function; two specifications.

| Parameter | Coefficient (s.e.) |
|---|---|
| Elements of $\alpha_1^*$ | |
| Intercept | 53.913* (2.963) |
| $Black_1 = 1$ | -1.710* (0.672) |
| $HS_1 = 1$ | 1.911* (0.533) |
| $COL_1 = 1$ | 1.930* (0.316) |
| $AGE_1$ | -0.059* (0.014) |
| NKIDS | -0.154 (0.117) |
| PRESCHL = 1 | -0.631 (0.496) |
| Elements of $\alpha_2^*$ | |
| Intercept | 30.627* (7.261) |
| $Black_2 = 1$ | 0.328 (0.422) |
| $HS_2 = 1$ | -0.175 (0.264) |
| $COL_2 = 1$ | 0.578* (0.191) |
| $AGE_2$ | -0.054* (0.015) |
| NKIDS | -0.353* (0.112) |
| PRESCHL = 1 | -0.616* (0.297) |
| $\alpha_3^*$ | 0.187* (0.038) |
| $\beta_{11}$ | 1.000 |
| $\beta_{22}$ | 0.440* (0.118) |
| $\beta_{33}$ | 0.0001* (0.00003) |
| $\beta_{12}$ | 0.305* (0.070) |
| $\beta_{13}$ | -0.0005 (0.0003) |
| $\beta_{23}$ | 0.0007* (0.0003) |

Table 2., cont.

| Parameter | Coefficient (s.e.) |
|---|---|
| $\sigma_1$ | 9.400* (0.286) |
| $\sigma_2$ | 5.161* (1.258) |
| $\rho$ | 0.807* (0.063) |
| Log likelihood | -10,359.6 |
| $U_1$ | 1.012@ |
| $U_2$ | 0.675@ |
| $U_3$ | 0.117@ |
| Husband's own wage elasticity | 0.017@ |
| Wife's own wage elasticity | 0.083@ |
| Husband's cross wage elasticity | -0.031 |
| Wife's cross wage elasticity | -0.016 |
| Husband's income elasticity | -0.0019@ |
| Wife's income elasticity | 0.0015 |

Notes: Standard errors are in parentheses. * => significant at the 95 percent level (two-tail test).
@ => significant at the 95 percent level based on bootstrapping techniques.
$\beta_{11}$ is assumed to equal 1 for identification purposes (see Ransom, 1987: 469).
$\rho$ is the correlation between the error terms in the husband's and wife's labor supply equations

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## APPENDIX A

First order conditions of utility maximization problem, labor supply equations, and likelihood function estimated.

As presented by Ransom (1987), the first order conditions set equal to zero that result from maximizing the utility function in equation (5) in the text are:

$$m_1 = \alpha_1^* + \alpha_3^* * w_1 - \beta_{11}h_1 - \beta_{33}w_1(w_1h_1 + w_2h_2 + Y) - \beta_{12}h_2 + \beta_{13}(2w_1h_1 + w_2h_2 + Y) + \beta_{23}w_1h_2 \quad (A1)$$

$$m_2 = \alpha_2^* + \alpha_3^* * w_2 - \beta_{22}h_2 - \beta_{33}w_2(w_1h_1 + w_2h_2 + Y) - \beta_{12}h_1 + \beta_{23}(w_1h_1 + 2w_2h_2 + Y) + \beta_{13}w_2h_1 \, . \quad (A2)$$

There is no need to specify a time endowment in order to estimate the labor supply functions because $\alpha_1^*$, $\alpha_2^*$, and $\alpha_3^*$ are re-parameterized functions of T, $\alpha$s, and $\beta$s. This re-parameterization is necessary for identification of the labor supply equations. It is through these starred parameters that differences in tastes across families are allowed to enter. Specifically,

$$\alpha_1^* = X_1\Gamma_1 + \varepsilon_1, \quad (A3)$$

and

$$\alpha_2^* = X_2\Gamma_2 + \varepsilon_2, \quad (A4)$$

where $X_1$ and $X_2$ are vectors of individual and family characteristics, $\Gamma_1$ and $\Gamma_2$ are parameters to be estimated, and $\varepsilon_1$ and $\varepsilon_2$ are normally distributed error terms with means zero and covariance matrix $\Sigma$.

The likelihood function estimated, then, is

$$L = \prod f^*(h_1,h_2), \quad (A5)$$

where $f^*(.,.)$ is obtained through the transformation of $\varepsilon_1$ and $\varepsilon_2$:

$$f^*(h_1,h_2) = abs(J)f(\varepsilon_1,\varepsilon_2),$$

where

$$\varepsilon_1 = X_1\Gamma_1 + \alpha_3^* * w_1 - \beta_{11}h_1 - \beta_{33}w_1(w_1h_1 + w_2h_2 + Y) - \beta_{12}h_2 + \beta_{13}(2w_1h_1 + w_2h_2 + Y) + \beta_{23}w_1h_2 \, , \quad (A6)$$

and

$$\varepsilon_2 = X_2\Gamma_2 + \alpha_3^{*}{}^{*}w_2 - \beta_{22}h_2 - \beta_{33}w_2(w_1h_1 + w_2h_2 + Y) - \beta_{12}h_1$$
$$+ \beta_{23}(w_1h_1 + 2w_2h_2 + Y) + \beta_{13}w_2h_1 , \qquad \text{(A7)}$$

and the Jacobian, J, has the form:

$$J = (-\beta_{11} - \beta_{33}w_1^2 + 2\beta_{13}w_1)(-\beta_{22} - \beta_{33}w_2^2 + 2\beta_{23}w_2)$$
$$- (-\beta_{33}w_1w_2 - \beta_{12} + \beta_{13}w_2 + \beta_{23}w_1)^2 . \qquad \text{(A8)}$$

The Jacobian is restricted to be positive for internal consistency to ensure that a unique solution exists. Further details can be found in Ransom (1987: 467-8).

In order to obtain estimates for dV (equation 4 in text), we require expressions for the partial derivatives of the labor supply equations ($h_1$ and $h_2$) with respect to $w_1$, $w_2$, and Y. This is accomplished by setting equations A1 and A2 equal to zero and solving the equations simultaneously for explicit expressions for $h_1$ and $h_2$, respectively. These explicit functions are then differentiated accordingly. These manipulations were performed with the help of Mathematica® (Wolfram Research, version 2.2) for the Macintosh. The derivatives are then evaluated at the sample means and the estimated coefficients.

## APPENDIX B

Functions of estimated parameters and their 95% confidence intervals generated by standard bootstrapping techniques.

| Calculated Variable | Estimate | 95% Confidence Interval |
|---|---|---|
| $U_1$ | 1.012 | (0.0495, 1.7913) |
| $U_2$ | 0.675 | (0.0987, 1.3334) |
| $U_3$ | 0.117 | (0.0118, 0.1936) |
| Husband's own wage elasticity | 0.017 | (0.0160, 0.1262) |
| Wife's own wage elasticity | 0.083 | (0.0087, 0.2123) |
| Husband's cross wage elasticity | -0.031 | (-0.0775, 0.0616) |
| Wife's cross wage elasticity | -0.016 | (-0.0253, 0.1000) |
| Husband's income elasticity | -0.0019 | (-0.0034, -0.0004) |
| Wife's income elasticity | 0.0015 | (-0.0044, 0.0027) |
| dX | -4.64 | (-0.8197, -10.838) |
| $dV\|_{dY=0}$ | -0.94 | (-1.6129, -0.1364) |
| dV | -0.56 | (-0.9981, -0.1059) |

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