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ARE MARRIED WOMEN SECONDARY WORKERS? THE EVOLUTION OF MARRIED WOMEN'S LABOR SUPPLY IN THE U.S. FROM 1983 TO 2000

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Abstract

Applying several estimation procedures to the Panel Study of Income Dynamics, we find that labor supply elasticities with respect to own wages and to other household members' income for married white women have decreased significantly in absolute terms during the 1983-2000 period. The elasticities with respect to after-tax wages are statistically either not different from zero or negative, while the elasticities with respect to other household members' income are negative, significant, and relatively stable for much of the period. Our results are robust and consistent across models and specifications. These findings suggest an important change in the labor supply behavior of married women, revealing that younger females today are not behaving like younger females in the past. We informally explore several possible explanations to this phenomenon: changes in the intrahousehold resource allocation and in turnover rates for younger cohorts. These institutional adjustments, together with the increasing portion of younger females in the labor force pool, might explain the empirical findings of our study.

1. Introduction[1]

A conventional view of labor supply in the United States highlights the differences between men and women. However, women have changed their labor market behavior over time, prompting Heckman's (1993) empirical question: "Has the consensus view of the 1960s of high labor supply elasticities for married women and low labor supply elasticities for married men held up?"

Many early papers (Heckman (1974), Mroz (1987), Cogan (1980)) as well as relatively recent ones (Zabel (1993), Blundell, et al. (1998), Angrist (1991), Eissa (1995)) found relatively high labor supply elasticities with respect to wages for married women, in contrast to those for their partners. For instance, Eissa (1995) estimates an uncompensated elasticity of 0.6 using a difference-in-difference approach with data from the 1986 to 1988 and 1990 to 1992 March Current Population Surveys (CPS). Zabel (1993) reports an estimate of 0.197 using data from the 1987 Panel Study of Income Dynamics (PSID) and a Tobit-type model. The widely accepted conclusion of these studies is that secondary workers are, in comparison with primary workers, significantly more responsive to wage and income variations.[2]

To analyze the evolution of the behavior of married women's labor supply, we estimate labor-supply elasticities with respect to their own wages and to all other household income ("non-labor income" from now on) with data from the PSID for the period from 1983 to 2000. We check the

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[2] Possible explanations for the difference include the responsibility for child care and cultural elements. In this paper, married women are classified as "secondary workers" when their husbands are working and receiving a paycheck.

robustness of our estimates by using the simultaneous equations method and the two-step estimation method of Vella (1993), both with two models from Zabel (1993), and the difference-in-differences (DID) approach with instrumental variables used by Blundell, et al. (1998).

Our main findings from all three approaches are that the wage elasticity has trended down over time and is now zero or even negative, while the non-labor income elasticities are always significantly negative and fairly stable for much of the period. Compensated wage elasticities under different hypotheses of intra-family resource allocation also are not significantly different from zero in recent years. Our results are similar to those of Heim (2004), who found that the uncompensated wage elasticity of married women has shrunk dramatically over time using the CPS data from 1979 to 2003, a decrease mainly caused by a drop in the estimated wage and income coefficients of the labor supply regressions.

The remainder of the paper is organized in four sections. Section 2 explains the estimation methods we use. Data analysis and estimation results are presented in Section 3. Section 4 suggests possible explanations on what we found in this study. We conclude in Section 5.

2. Estimation Methods

Several econometric methods have been used to estimate workers' wage and non-labor income elasticities. Some of them focus on controlling for the endogeneity caused by the nonlinear budget set resulting from the tax system (see Triest (1990) and Heim and Meyer (2003)). Others, including Mroz's (1987) seminal paper, deal with other sources of endogeneity such as wage rates, non-labor incomes, the presence of children in the household, labor market experience, and self-selection into the labor force. Among these potential sources of endogeneity, this study mainly considers wage rates and labor force participation for both the cross-sectional and the repeated cross-section analyses, although we also address potential simultaneity problems caused by other types of income and children in the household.

For the cross-section data, we adopt two models used by Zabel (1993). Zabel studies four models: 1) a simplified Tobit-type version of the Heckman (1974) model, 2) the fixed cost model, 3) the minimum hours constraint model, and 4) the generalized labor supply model. However, we only use two--the Heckman model and the generalized Tobit-type labor supply model–because Zabel's findings show that estimated labor supply elasticities are quite similar in their magnitudes and signs for all of the models except Heckman's. We estimate the two models using the maximum likelihood (ML) simultaneous-equations approach. We also use the two-step estimation procedure of Vella (1993) to check the robustness of our ML estimates because ML estimates can be numerically inaccurate for high dimensional density functions (see Mroz (1997)).

For the repeated cross-section study, we use the DID approach proposed by Blundell, et al. (1998), which includes a "control function" method to eliminate the potential biases induced by the wage rate, other income, participation to the labor force, and data selection away from the kink in the after-tax budget constraint. However, we do not consider the endogeneity from the kink in the budget set for two reasons. First, it is unlikely that there are significant kinks in the U.S. tax system for many people given its complicated structure.[3] Second, even for the case of a

[3]Blundell, et al. (1998) did not find strong arguments to support bunching around the kink in the UK, a country where the tax system is far less complicated (only two well identified brackets) than the US tax system in terms of number of brackets, and

significant kink in the U.K., Blundell, et al. (1998) conclude that the kink has very little effect on the estimated elasticities. Therefore, we only control for the possible endogeneity from the wage rate, other income, and participation in the labor force.[4]

2.1. The Simultaneous Equations Approach

The simplified Heckman model and the generalized labor supply model used by Zabel (1993) consist of two equations: one characterizing desired hours of work, and another for latent wages. The main difference between the two models is that the generalized labor supply model allows for separate equations for labor force participation (LFP) and hours of work.

Zabel (1993) specifies the hours-of-work and wage equations as:

$$H_i^* = \beta_1 \ln W_i^* + \beta_2 NI_i + X_i^{'}\beta_3 + u_{1i} \qquad (1)$$

and

$$\ln W_i^* = Y_i^{'}\alpha + u_{2i}, \qquad (2)$$

where H_i^* is the latent value for desired hours of work, $\ln W_i^*$ is the latent value for the natural logarithm of hourly wages, NI_i is income other than the wife's labor income, X_i and Y_i are vectors of individual characteristics, and u_{1i} and u_{2i} are jointly normal errors with zero mean and covariance matrix $\Sigma_{12} = \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ & \sigma_2^2 \end{pmatrix}$.

thus, number of kinks. Moreover, the U.S. tax system has been subject recently to multiple changes in a relatively short period of time; a fact that we believe can deter individuals from deciding their hours of work based on current tax rates.

[4]In an earlier version of this paper, we also treated children variables as endogenous.

2.1.1. Tobit-type Model

Individuals participate in the labor force when desired hours of work are greater than zero, while they do not work otherwise. That is:

$$\text{work if} \quad H_i^* > 0 ,$$

$$\text{do not work if } H_i^* \le 0 \rightarrow \frac{u_{1i} + \beta_1 u_{2i}}{\sigma} \le -t_i ,$$

where

$$t_i = \frac{\beta_1 Y_i \alpha + \beta_2 NI_i + X_i^{'} \beta_3}{\sigma}$$

and

$$\sigma = std\ dev(u_{1i} + \beta_1 u_{2i}) = (\sigma_1^2 + \beta_1^2 \sigma_2^2 + 2\beta_1 \sigma_{12})^{1/2} .$$

Thus, the corresponding log-likelihood function for this model is written as:

$$\log L = \sum_0 \log\left[\Phi\left(-t_i\right)\right] + \sum_1 \log\left[b\left(u_{1i}, u_{2i}; \Sigma_{12}\right)\right],$$

where Φ is the standard normal cumulative density function and $b(v, w; \Sigma)$ is the bivariate normal density with the covariance matrix Σ.

2.1.2. Generalized Tobit-type Model

The second labor supply model generalizes the Tobit-type model in two ways. First, the parameters of the LFP equation are not restricted to be proportional to the parameters in the hours-of-work equation. Second, the regressors in the LFP equation are not necessary identical to those in the reduced form hours-of-work equation. We characterize the LFP as:

$$\text{work if} \quad LFP_i^* > 0 ,$$

$$\text{do not work if } LFP_i^* \le 0 \rightarrow u_{3gi} \le -Z_i'\pi ,$$

where $LFP_i^* = Z_i'\pi + u_{3gi}$ is a latent tendency to work. Again, we assume that the three error terms follow a joint normal distribution with zero mean and covariance matrix as:

$$\Sigma_{123g} = \begin{pmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{13g} \\ & \sigma_2^2 & \sigma_{23g} \\ & & 1 \end{pmatrix}.$$

We perform the ML estimation based on the log-likelihood function:

$$\begin{aligned} &\log L = \sum_0 \log\left[\Phi\left(-Z_i'\pi\right)\right] + \\ &\sum_1 \left\{\log\left[\Phi\left(Z_i'\pi \middle| u_{1i}, u_{2i}\right)\right] + \log\left[b\left(u_{1i}, u_{2i}; \Sigma_{12}\right)\right]\right\} \end{aligned} \tag{3}$$

The first term in (3) is the probability of not working. The second term is the probability of working conditional on the error terms from the wage and hours of work equations. This term would be zero under the restrictions made in the simple Tobit-type model. The last expression is the density associated with the hours-of-work decision.

We estimate both the Tobit-type model and the generalized labor supply model using the PSID data for every available year in the 1983 to 2000 period.[5] The logarithm of wages, non-labor income, age, education, and variables related to the number of children and health status of the household head are included in the hours-of-work equation. The wage equation contains age and education variables up to cubic terms, health, a variable indicating residence in a SMSA (standard metropolitan statistical area), parents' education, regional dummies, and the local labor

[5] We estimate the two models using both before- and after-tax wages and incomes. It turns out that accounting for taxes makes little difference to the estimates.

market variables. Finally, the union of the variables in the hours-of-work and wage equations are used for the LFP equation in the generalized labor supply model. The estimation results are discussed in Section 3.

We encountered several problems using maximum likelihood. For some years, we had difficulty obtaining convergence of the estimates because the likelihood surface was relatively flat, a common problem of estimating labor supply models. The sign of the wage elasticity was counterintuitive (i.e., negative). In addition, the wage parameters were not often significant. We overcame the first problem by using different initial values for certain years, which gave us consistent estimates across years.[6] Nevertheless, given the counterintuitive signs and lack of significance of the ML estimates, we decided to use a more robust two-step method in hopes of obtaining better estimates.

2.2. Two-Step Approach

The two-step approach, widely used in the labor economics literature among other fields, has several virtues. Most importantly, it can deal with selection bias and other simultaneity problems in a rather simple manner as suggested by Vella (1993), and its results are numerically robust. Moreover, it relaxes some of the strong distributional assumptions and tends to impose fewer computational burdens than ML estimation. The main drawbacks of this approach are a loss of efficiency as compared with ML and a lack of flexibility. Nevertheless, we used this two-step methodology in order to overcome potential problems as mentioned in Mroz (1997) of numerically inaccurate estimates in our ML estimations.

[6] We used both OLS and IV estimates for each year as initial values following Mroz (1987).

In the first step, we estimate two reduced-form equations using the probit estimator: one for labor force participation and the other for wages. In the second step, we use ordinary least squares (OLS) on the hours-of-work equation with the inverse Mill's ratio constructed from the first-stage probit estimation and the residuals from the estimated wage equation as additional regressors. To be more precise, we estimate the following bias-corrected, hours-of-work equation using OLS:

$$H_i = \alpha + \beta_1 \ln W_i + \beta_2 NI_i + X_i^{'}\beta_3 + \delta_w \hat{\upsilon}_i^w + \delta_P \hat{\upsilon}_i^P + \varepsilon_i ,$$

where X_{it} includes age, education, children variables, and health, $\ln W_i$ and NI_i stand for the logarithm of wage and other income, respectively. $\hat{\upsilon}_i^w$ denotes the estimated residual from the wage equation estimation and $\hat{\upsilon}_i^P$ is the inverse Mill's ratio obtained from the first-stage probit estimation. In the first-stage, reduced-form estimations, the wage equation contains age and education variables up to cubic terms, health, a SMSA dummy, parents' education, regional dummies, and the local market variables. The union of the variables in the hours-of-work and wage equations are used for the probit estimation. A detailed description of the variables used and the estimation results will be presented in Section 3.

Our findings from the generalized Tobit-type estimation and the 2-step estimation suggest that our ML estimates have the wrong sign and are not very precise for certain years. The former suggests a possible misspecification of the model and the later might reflect the numerical inaccuracy of the ML estimates. Consequently, we implement the DID approach of Blundell, et al. (1998), which may produce more reasonable estimates.

2.3. Difference-in-Differences Approach

A DID approach is commonly used to measure the effect of a certain treatment on a group by comparing the behaviors of the treated group and the untreated group before and after the treatment. The difference in behavior (before and after the treatment) of the treated group will contain two factors: the effect of the treatment and a common shock (macro shock or time effect). The difference in behavior of the untreated group will contain only the common shock. Subtracting the two differences in behavior (difference in differences) eliminates the common shock, leaving the true effect of the treatment.

In our DID approach, we treat tax reforms natural experiments. The idea is that if two different cohort groups are affected differently by tax reforms, the difference of the responses by two different groups to the tax reforms will identify the labor supply responses. The main advantage of this DID approach is that we can use exogenous experiments (tax reforms) and can combine several years of data. We used the four major tax reforms in 1986, 1990, 1993, and 1997 during the 1983-2000 period. Our main identification assumption is that these exogenous changes had different effects on different groups of individuals, namely birth cohort and education level. We used those groups because they are likely to be affected differently by the tax reforms. Cohort/experience effects on wage and non-labor income as well as changes in returns to education across time suggest that wage and other income distributions are different across these groups. Moreover, birth cohort and educational attainment are exogenous to the labor supply decision at the time these women were analyzed, making them reasonable instrumental variables.

Although one might be tempted to split the sample up into groups based on tax status, that approach is invalid for the purposes of this paper. In contrast with the U.K. system studied by Blundell, et al., there is no salient kink or discontinuity in the United States tax system. All individuals in the U.K. have a tax allowance on earnings, regardless of the total level of household income or consumption. About 30 percent of working married women are exempt from tax under this allowance, which enables researchers to divide them into two groups as 'non-taxpayers' and 'taxpayers'. Another factor that creates a discontinuity in the budget constraint under the U.K. tax system is the national insurance system (NI). Contributions to the system are paid on the entire income between the lower earning limit and upper earnings limit. Interestingly, the NI kink (in the lower limit) and the tax kink are very close each other, creating a unique salient kink in the budget set in practice. By contrast, the U.S. tax system has several tax credits and tax brackets, but the after-tax budget set is relatively linear. A second reason for not using tax status as a grouping criterion is that even if there is one salient kink in the budget set, the composition of the groups defined by tax status will change over time in a nonrandom way, as argued in Blundell, et al. (1998).

Average federal tax rates across cohorts and education levels do not show any unusual patterns over the period (see Table 1). The tax rates are calculated for every married woman in the PSID using the NBER's TAXSIM tax calculator. On average, income tax rates faced by one cohort (or education level) differ consistently from those faced by any other cohort (or educational level). The income tax rates of people born in 1940s, for example, were always higher than those of people born in 1930s for comparable years on average. The same is true for the 1950s cohort as compared with the 1960s cohort for comparable years. Finally, higher education groups always

Table 1. Marginal Federal Tax Rates by Cohort and Education Level							
	1920s	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**Weighted Average**
			All Individuals				
1983	26.35	24.66	26.63	25.11	-	-	25.75
1984	24.10	25.44	25.95	24.88	-	-	25.30
1985	24.46	24.94	25.53	25.03	-	-	25.13
1986	22.79	23.10	26.19	24.14	-	-	24.54
1987	25.70	23.35	25.63	23.58	-	-	24.30
1988	21.85	21.16	23.10	21.65	-	-	22.04
1989	21.00	21.50	23.64	22.26	-	-	22.56
1990	-	19.09	21.11	20.94	18.79	-	20.58
1991	-	16.66	21.29	20.97	19.45	-	20.31
1992	-	19.45	22.35	21.44	19.69	-	21.20
1993	-	-	24.04	23.09	21.62	-	22.94
1994	-	-	24.44	22.98	21.45	-	22.85
1995	-	-	23.12	23.46	22.30	-	22.95
1996	-	-	23.05	24.09	22.89	-	23.33
1998	-	-	24.52	23.59	22.11	-	23.15
2000	-	-	24.10	24.72	23.40	21.97	23.98
Weighted Average	24.43	21.64	23.79	22.85	21.84	21.97	
			Up to High School				
1983	25.40	23.38	24.86	23.98	-	-	24.34
1984	22.97	23.68	24.34	23.02	-	-	23.64
1985	23.45	22.73	22.94	23.05	-	-	22.99
1986	21.90	21.00	23.74	22.38	-	-	22.42
1987	25.14	20.77	23.68	21.22	-	-	22.13
1988	19.88	20.04	21.19	20.39	-	-	20.55
1989	20.80	19.48	21.20	20.44	-	-	20.47
1990	-	17.50	19.60	19.11	16.08	-	18.77
1991	-	15.32	19.39	19.76	17.75	-	18.66
1992	-	18.10	20.15	19.86	17.62	-	19.38
1993	-	19.96	22.60	21.60	19.52	-	21.38
1994	-	20.97	23.40	22.21	19.58	-	21.79
1995	-	19.84	21.06	22.15	20.58	-	21.33
1996	-	18.17	21.11	22.65	21.01	-	21.60
1998	-	21.50	23.03	22.45	20.10	-	21.66
2000	-	-	22.45	23.16	21.83	20.15	22.43
Weighted Average	23.40	19.97	21.85	21.29	19.86	20.15	
			More Than High School				
1983	29.02	28.86	28.87	26.20	-	-	27.98
1984	27.94	30.57	28.39	26.86	-	-	28.08
1985	27.71	29.79	28.31	26.85	-	-	27.87
1986	24.90	28.31	28.82	25.67	-	-	27.08
1987	26.79	29.17	27.85	25.58	-	-	26.80
1988	28.53	23.69	25.17	22.71	-	-	23.71
1989	21.50	27.15	25.92	23.68	-	-	24.63
1990	-	23.85	23.38	23.01	22.46	-	23.16
1991	-	20.73	23.88	22.23	21.08	-	22.41
1992	-	23.28	25.43	23.12	21.77	-	23.47
1993	-	25.81	25.64	24.48	23.17	-	24.48
1994	-	22.79	25.59	23.69	23.03	-	23.89
1995	-	26.73	25.47	24.72	23.69	-	24.57
1996	-	23.53	25.12	25.50	24.34	-	24.96
1998	-	-	25.80	24.46	23.66	-	24.32
2000	-	-	25.19	25.89	24.57	22.63	25.06
Weighted Average	27.37	26.20	26.06	24.32	23.47	22.63	

Source: Authors using PSID and NBER's TAXSIM tax calculator.

face higher income tax rates than lower education groups for all cohorts and comparable years on average. Table 1 highlights the non-randomness of tax rates as well as the power of the cohort instrumental variable as an identification tool.

We use 8 groups in all. We used 4 birth cohorts and and 2 levels of education, both interacted with the tax year. The four birth cohorts are: (i) those who were born before-1940; (ii) those born from 1940 to 1949; (iii) those born from 1950 to 1959; and (iv) those born in 1960 and thereafter. The 2 education groups are high school or less, and more than high school.[7] Our main identifying assumption is the same as that of Blundell, et al. (1998) -- average differences in labor supply between groups are constant over time, after conditioning on the wage, other income, and demographic characteristics. In practical terms, that assumption means that while the full set of time and group effects are included in the hours-of-work equation, the time-group interactions can be ignored. That enables us to identify the parameters in the labor supply equation.

Suppose that we are interested in estimating the following labor supply equation (assuming, for simplicity, that there is no covariate and the logarithm of wage is exogenous):

$$h_{it} = a + b \ln w_{it} + u_{it} \,,$$

where individual i can be categorized in one of several demographic groups $g = \{g_1, g_2, \ldots g_G\}$, each sampled for a least two time periods. Define for a variable x:

$$D_x^{gt} = E(x_{it} \mid P_{it}, g, t) - E(x_{it} \mid P_{it}, g) - E(x_{it} \mid P_{it}, t) \,,$$

[7]This is a standard cut-off, although alternatives could be used. Given the importance of a college degree in the labor market, this cut-off is useful for identifying differences in individuals' labor supply behavior.

where P_{it} is an indicator for an individual's working status at time t. Blundell, et al. (1998) assume that:

Assumption A1: $E(u_{it} \mid P_{it}, g, t) = a_g + m_t$

Assumption A2: $E[(D_w^{gt})^2] \neq 0$.

Assumption A1 implies that the unobserved differences in average labor supply across groups can be explained by a group effect (a_g) plus an additive time effect (m_t) without interaction terms, which creates exclusion restrictions for identification. Another implicit restriction of Assumption A1 is that we do not allow $E(u_{it} \mid P_{it}, g, t)$ to vary over time. More specifically, that restriction implies that labor participation (P_{it}) is completely explained by time and group effects without interaction terms, which is too restrictive (athough the data might show this is the case). Assumption A2 requires that after taking away time and group effects, wages still have some variation, excluding the possible multicollinearity of the wage variable with time and group dummies. In that sense, it is a usual rank condition for identification. Blundell, et al. (1998) relax the two assumptions presented above, but still allow exclusion restrictions for the interacting dummies:

Assumption B1: $E(u_{it} \mid P_{it}, g, t) = a_g + m_t + \rho\lambda_{gt}$

Assumption B2: $E[(D_w^{gt} - \rho_w \lambda_{gt})^2] \neq 0$ and $E[(D_\lambda^{gt})^2] \neq 0$,

where λ_{gt} is the inverse Mill's ratio evaluated at $\Phi^{-1}(L_{gt})$ with Φ^{-1} being the inverse function of the standard normal distribution, and L_{gt} being the proportion of group g working in period *t*. ρ_w is naturally defined as the population partial regression coefficient $\rho_w = E[D_w^{gt} D_\lambda^{gt}] / E[(D_\lambda^{gt})^2]$. Assumption B2 is the same rank condition with Assumption A2. If indeed $E[(D_{\lambda}^{gt})^2]=0$, we can disregard the selection bias caused by $\rho\lambda_{gt}$ in the estimation of the wage coefficient.

2.3.1. Implementation of the DID Estimator

We implement the difference-in-differences estimator using a regression approach, controlling for several endogeneities using the control functions, similar to the two-step method. The potential endogenous variables are the wage rate, other income, participation in the labor market, and children variables. However, we ignore the potential endogeneity of the children variables for several reasons. First, we could not find any significant differences between treating children variables as endogenous or exogenous. Secondly, most of the studies, including Zabel (1993), Triest (1990), and Blundell, et al. (1998), that estimate intensive margins in married women labor supply treat children variables as exogenous. The last reason is a technical one regarding difficulties raised when treating dummy endogenous variables in the estimation.[8]

We first estimate the reduced-form equations for each of endogenous regressors. Right-hand side variables include a complete set of group and time dummies and their interactions along with several other demographic variables including regional variables, health, and parents' education. The equation for the logarithm of wages was estimated using data for those employed; the other income equation and the participation probit were estimated with the entire sample.

In the second step, we estimate the hours-of-work equation using ordinary least squares. The

[8] We could estimate reduced-form equations for the children dummy variables using a probability index model such as a probit. However, the treatment of dummy endogenous variables in a censored equation is beyond the scope of this paper. See Heckman (1978) and Kim (2004) for a discussion of the issue.

basic equation without the children dummy variable interactions is:

$$H_{it} = a_g + m_t + \beta_1 \ln W_{it} + \beta_2 NI_{it} + X_{it}^{'}\beta_3 + \delta_w \hat{\upsilon}_{it}^{w} + \delta_{NI} \hat{\upsilon}_{it}^{NI} + \delta_P \hat{\upsilon}_{it}^{P} + \varepsilon_{it}\,, \qquad (4)$$

where a_g are the group dummies, m_t are time dummies, X_{it} are the children dummy variables and the health variable, $\ln W_{it}$ and NI_{it} are the logarithm of the individual *i*'s after-tax wage and her level of other income, respectively. Children dummy variables include a dummy for no children under seventeen in the household, a dummy for the youngest child under six years old, and a dummy indicating the youngest child between six to seventeen years old. The $\hat{\upsilon}$'s variables are the residuals from the reduced-form estimations that control for the endogeneity of wages ($\hat{\upsilon}_{it}^{w}$), other income ($\hat{\upsilon}_{it}^{NI}$), and participation ($\hat{\upsilon}_{it}^{P}$, inverse Mill's ratio). One of the virtues of this control function approach is that we can directly test the exogeneity of every possible endogenous variable using *t*-statistics for the δ parameters (Smith and Blundell (1986)). In equation (4), we exclude all interactions of the group and time dummies, which is justified under Assumption A1 or Assumption B1 conditional on the wage, other income, demographic, and health variables. From these exclusions, we can identify this structural equation. Also note that in the reduced-form estimation, we drop the interacting time and group dummies if the cells associated with these interacting dummies have less than 45 observations. In addition, some of the interacting dummies are dropped to avoid multicollinearities, including the exact ones. The asymptotic covariance matrix accounts for the generated regressors used in the second step and heteroskedasticity as noted by Blundell, et al. (1998). A detailed description of the calculation of the standard errors is presented in Appendix F.

Finally, although equation (4) is a cross-sectional, marginal-rate-of-substitution equation with a full set of time dummies, it differs from an intertemporal Euler equation with a common real interest rate because it excludes the average group interest rate which is assumed to vary over time and across groups. Such variation in the interest rate could arise from the tax system or liquidity constraints.

3. Empirical Results

3.1. The Data

The raw data used for this analysis are the annual interviews from the PSID longitudinal data set for the period 1983 to 2001. Data from two consecutive years were merged to create a consistent data set. The data for interview year *t* includes actual information on wages, income, and hours of work for year *t-1*, while data from the interview year *t-1* contains the actual individual and family information for *t-1*. Thus, individual and family data from interview year *t-1* were merged with labor supply and income related information of the interview year *t*, for every possible *t* and *t-1*, for those individuals who are present in both samples. We did not perform this merge for the last two interview years (1999 and 2001), because the PSID is produced every other year from 1997 on. Consequently, we decided to use labor and income data from the 1999 and 2001 interview years directly. We ended up with 16 cross-section data sets, which are named according to the date of the labor and income information they contain: yearly from 1983 to 1996; 1998, and 2000.

Our analysis is limited to white, married women with the following characteristics: (i) they are 30-60 years of age whose husbands earned labor income that year; (ii) they do not belong to the low-income sample in the PSID; (iii) their spouses are present and there was no change in household status for head and spouse; and (iv) they were neither retired nor students at the time of the survey. We also dropped those individuals who met one or more of the following conditions: (i) the unemployment rate in their county of residence was above 50%; (ii) they belonged to the top 2.5% of the non-labor income distribution and such income was more than $150,000 in 1990 dollars;[9] (iii) their reported annual hours of work were greater than 4,000 hours;[10] (iv) their computed marginal tax rate was negative; and (v) there was missing information for any variable used in the estimations.[11] The resulting data set contains a total of 16,385 observations (see Table 2).

Table 2. Sample Sizes by Year

Year	Observations (Women)	Working	Not Working	Percent Working
1983	620	449	171	72%
1984	856	627	229	73%
1985	858	632	226	74%
1986	852	654	198	77%
1987	923	719	204	78%
1988	810	643	167	79%
1989	842	686	156	81%
1990	1,428	1,104	324	77%
1991	1,506	1,218	288	81%
1992	1,518	1,168	350	77%
1993	927	747	180	81%
1994	908	759	149	84%
1995	1,179	957	222	81%
1996	1,188	966	222	81%
1998	952	814	138	86%
2000	1,018	853	165	84%
Total	16,385	12,996	3,389	79%

Source: Authors.
Note: The analysis could not be done in 1997 and 1999.

[9] This limit makes the nonlabor income distribution in our 1986 sample more similar to that in Zabel's (1993) sample.

[10] This upper bound is the total number of hours for a person who works two 8-hour jobs per day, 5 days a week with no vacations.

[11] The number of individuals deleted for the first four criteria never exceeded 5% of observations for any criterion in any year.

Exogenous methodological variations in the PSID sampling process account for the differences in sample size across years.[12] We assume that the changes in sample size are on average neutral across all types of individuals. This assumption is supported by the lack of sudden jumps in the female labor force participation rate shown in Table 2 and in the descriptive statistics for each year shown in Appendix C and by the findings of other studies using the PSID data set, such as Gouskova and Schoeni (2002).

3.1.1. Construction of the Hours, Wage, and Income Variables

Hours of work are defined as "aggregated hours of work in all jobs." "Wage rate" is used for the years where this variable is available (1993 to 2000). In the years where pre-tax wage rates are not explicitly asked in the questionnaire, we constructed them by dividing "yearly income from work" by "aggregated hours in all jobs." Non-labor income is constructed by summing the taxable income of all other family members.

After-tax wages were calculated by using liabilities and tax rates of "secondary earners" in the TAXSIM (Internet TAXSIM version 5.1) software provided by the NBER. We used those imputed liabilities and tax rates because we wanted to get an overall effective tax rate and thus minimize possible measurement errors in the data caused by individuals' imprecise answers

[12] For instance, (i) there was a change from pencil and paper to computer-assisted telephone interview in 1994; (ii) after 1996, about 2,000 low-income families were dropped from the sample; (iii) a sample of families who immigrated to the U.S. since 1968 was added in 1997; and (iv) the length of the interview was doubled from 1995 to 1999. See Gouskova and Schoeni (2002) for more details on the reliability of income data from the PSID and their remarkable similarity to the March Current Population Survey.

about their tax burden and status.[13] We were able to compute federal, state, and FICA tax rates accurately because the PSID has most of the necessary information (i.e., disaggregation by incomes and expenditures) to compute them via TAXSIM.[14]

3.1.2. Hours, Wages, and Participation in the PSID

From 1983 to 2000, the sample of married women in the PSID has increased its labor force participation and hours of work, and has earned greater after-tax wages. Figure 1 shows that both average yearly hours of work and the participation rate have trended up over time. Figure 2 indicates that real, after-tax wages for married women and their non-labor income also have trended up. Both income variables fell significantly at the beginning of the 1990s, however, possibly due in part to the rise in tax rates in the 1990 tax reform and the economic downturn of 1990-1991.

Although Figures 1 and 2 suggest a positive relationship between hours of work and real wages, that inference is not necessarily valid because we still have to control for the possible endogeneity problems and potential cohort/education effects.

Figures 3 and 4 show participation rates and average yearly hours by cohort for certain years. Those figures illustrate the marked differences in labor-market behavior across cohorts, consistent with their positions in their life cycles.

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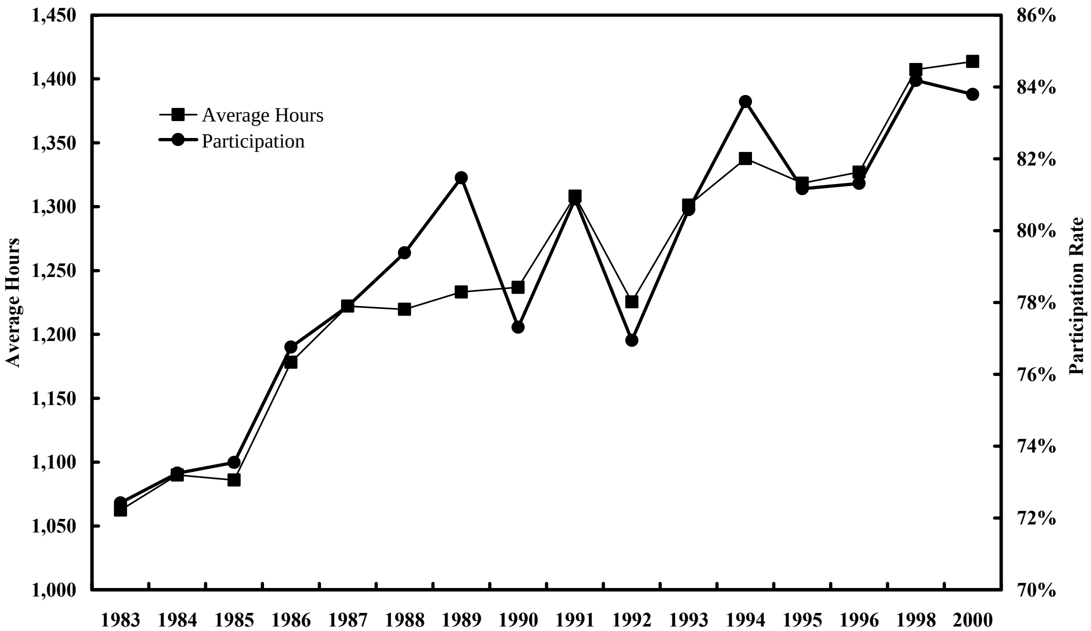
[13]The overall tax rate includes federal, state and FICA taxes. City tax rates cannot be computed because individuals' city of residency is unavailable.

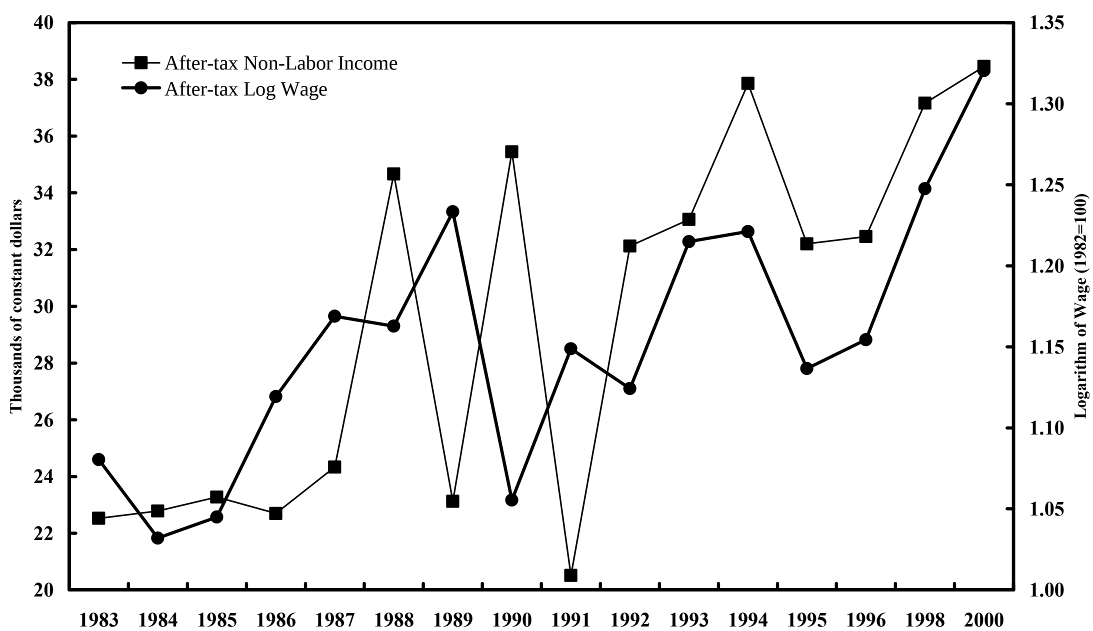
[14]We compared the tax data returned by this software with tax data reported by individuals in the survey for comparable years and we did not find significant differences. Nevertheless, we used TAXSIM data because we think it provides a relevant overall effective tax rate.

Figure 1. Women's Average Hours of Work per Year and Labor Force Participation, 1983-2000



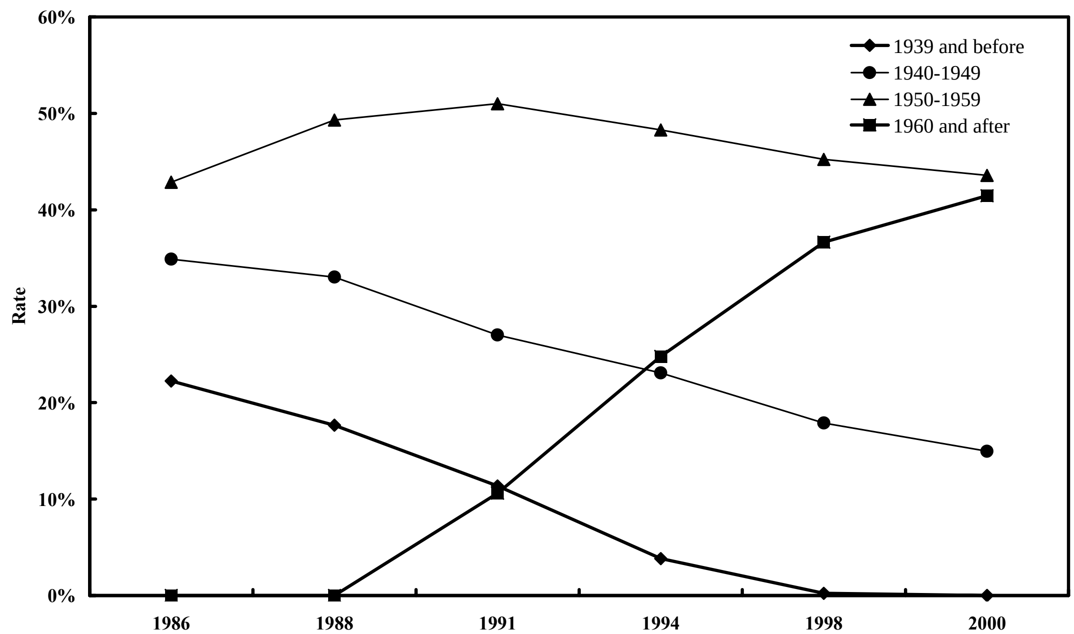
Source: Authors using the PSID.

Figure 2. Average After-Tax, Non-Labor Incomes and Wages of Married Women in Real Terms, 1983-2000



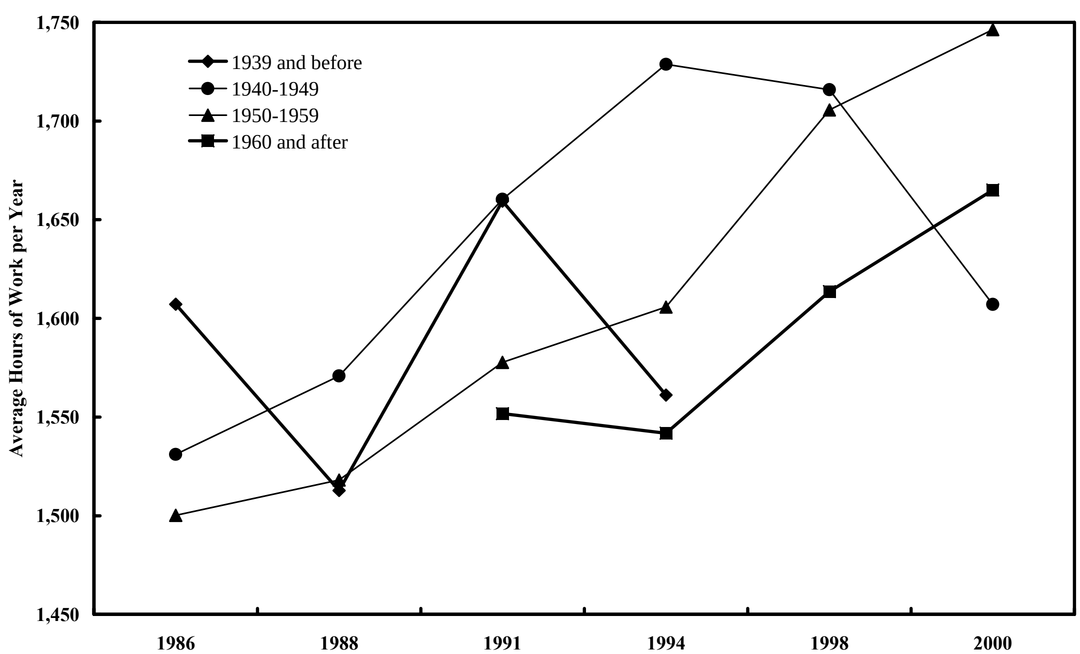
Source: Authors using the PSID.

Figure 3. Participation by Cohort



Source: Authors using the PSID.

Figure 4. Hours-of-Work by Cohort



Source: Authors using the PSID.

3.2. Estimation Results

3.2.1. Simultaneous Equation Approach

The estimation results using the after-tax variables are presented in Tables 3 and 4, where we report coefficients and elasticities from the hours-of-work equations. [15] (Figures 5 and 6 show the elasticities over time.)

Table 3. Cross-Section Elasticities by Tobit-Type Model

	After-tax log wage			After-tax non-labor income		
Year	**Parameter**		**Elasticticty**	**Parameter**		**Elasticticty**
1983	668.64	***	0.63	-25.57	*	-0.57
1984	617.39		0.57	-24.88	*	-0.57
1985	1406.57	*	1.29	-22.91	*	-0.54
1986	436.23		0.37	-21.58	*	-0.48
1987	952.49	**	0.78	-19.84	*	-0.47
1988	-947.21	**	-0.81	-6.50	*	-0.23
1989	-308.85		-0.25	-13.31	*	-0.33
1990	-491.17	**	-0.40	-8.18	*	-0.26
1991	-449.34	**	-0.35	-15.29	*	-0.35
1992	-730.76	*	-0.60	-7.32	*	-0.26
1993	-2138.98	*	-1.63	-8.88	*	-0.30
1994	-1122.27	*	-0.70	-11.60	*	-0.31
1995	-2607.21	*	-1.99	-9.31	*	-0.33
1996	-2267.39	*	-1.72	-10.80	*	-0.38
1998	-2744.35	*	-1.96	-6.15	*	-0.25
2000	-1550.71	*	-1.11	-6.13	*	-0.27

Source: Authors.
* Significant at 90% of confidence or more.
** Significant at 85% of confidence.
*** Significant at 80% of confidence.

[15] Additional estimation results are in Appendix A. Appendix B shows that the estimation results from the generalized Tobit-type model using before-tax variables are very similar to those using after-tax wage and income.

Table 4. Cross-section Elasticities by Generalized Tobit-type Model						
	After-tax log wage			After-tax non-labor income		
Year	Parameter		Elasticity	Parameter		Elasticity
1983	-1658.44		-1.56	-11.89	*	-0.26
1984	n.d.		n.d.	n.d.		n.d.
1985	494.19	*	0.45	-6.88	*	-0.16
1986	209.13		0.18	-6.15	*	-0.14
1987	-148.80		-0.12	-8.51	*	-0.20
1988	-146.57		-0.12	-3.35	*	-0.12
1989	-1072.43	*	-0.87	-6.09	*	-0.15
1990	-444.96	***	-0.36	-4.42	*	-0.14
1991	-58.12		-0.05	-5.97	*	-0.13
1992	-269.50	***	-0.22	-1.21	***	-0.04
1993	-802.23	*	-0.61	-2.12	*	-0.07
1994	-1142.91	*	-0.71	-4.91	*	-0.13
1995	n.d.		n.d.	n.d.		n.d.
1996	-1408.95	*	-1.07	-5.98	*	-0.21
1998	-1337.33	*	-0.95	-3.02	*	-0.12
2000	-809.40	*	-0.58	-4.45	*	-0.20

Source: Authors.

* Significant at 90% of confidence or more.

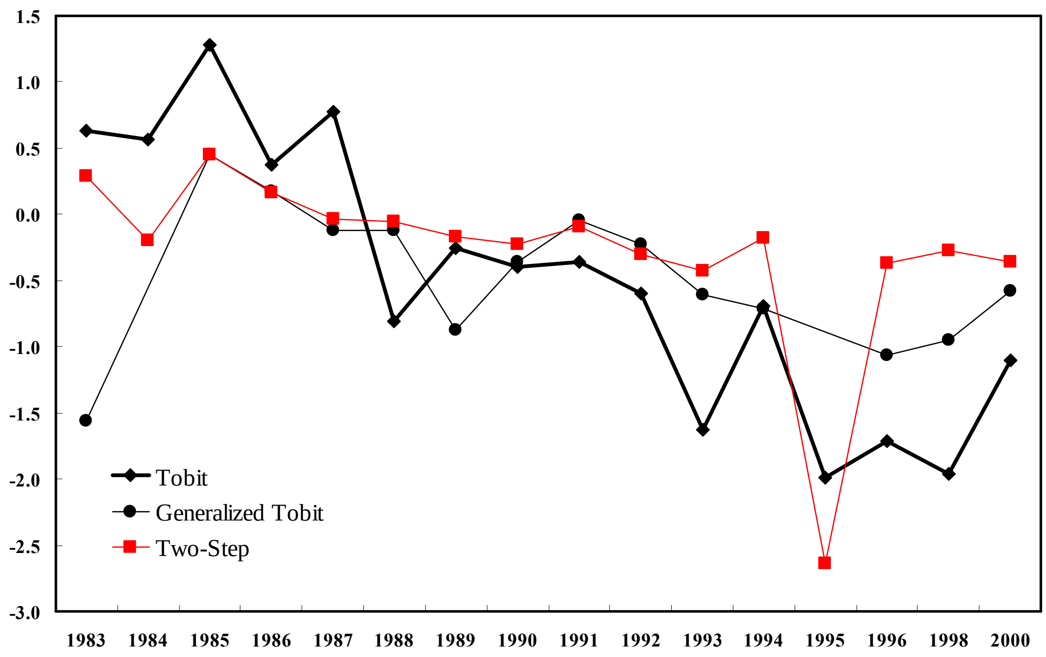
** Significant at 85% of confidence.

*** Significant at 80% of confidence.

n.d. We do not report estimates given convergence problems.

The wage elasticities are quite surprising: they are all negative after 1987 in both models and generally significant in the later years. Moreover, the elasticities appear to fall over time for much of the sample period, particularly for the Tobit-type estimates. The elasticities with respect to after-tax non-labor income are negative as expected and mostly significant in both models; the estimates show much less variation over time than the wage elasticities, particularly after 1987. The elasticities from the Tobit-type model are usually larger in absolute value than those from the generalized Tobit-type model, also noted by Zabel (1993), because the standard labor supply elasticities for the Tobit-type model compound both the intensive margin and the extensive margin (participation effect). Given that the income elasticities are smaller in absolute value than the wage elasticities, the compensated wage elasticities are negative in both models, contrary to expectations.[16]

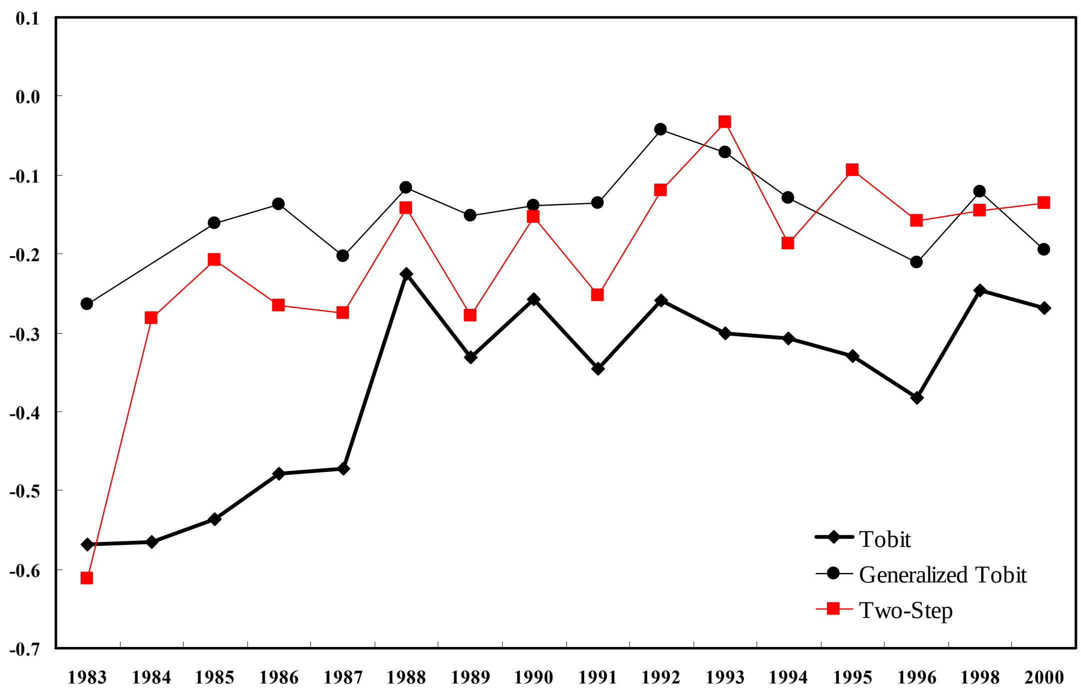
Figure 5. Trends in Wage Elasticities over Time



To confirm that our estimation procedure was correct, we estimated before-tax elasticities for the year 1986 using both the Tobit-type and the generalized models in order to compare our results to those of Zabel (1993). For the Tobit-type model, Zabel reported 0.554 for the before-tax wage elasticity and -0.322 for the before-tax non-labor income elasticity, and our results are very close: 0.426 and -0.333, respectively. In the case of the generalized Tobit-type model, we have 0.186 for the before-tax wage elasticity and -0.102 for before-tax non-labor income elasticity, also close to Zabel's estimates of 0.197 and -0.115, respectively.

[16] The upper bound of compensated wage elasticities can be obtained by subtracting the income elasticities (adjusted by a factor smaller or equal to one) from the uncompensated wage elasticities.

Figure 6. Trends in Non-Labor Income Elasticities over Time



The initial values for those ML estimations were obtained from OLS and instrumental variable (IV) approaches employed by Mroz (1987). After 1986, the IV estimates of the wage coefficients are negative, though they are smaller in absolute value than the ML estimates in many cases. The signs of the wage coefficients in the OLS hours-of-work equations after 1986 have positive signs, which are exactly opposite signs of the IV and the ML estimates for those years. Previous studies have shown that OLS produces negative signs for the wage coefficients, while IV estimates are positive. We observe exactly the opposite switch of signs, suggesting that endogeneity of wage is still a driving force of the sign switch of these parameter estimates.

The surprising values of the wage parameters obtained and their low significance in some years when using the simultaneous equations methods (Tobit-type and generalized Tobit), altogether with the similarity of the maximum log-likelihood values across models, suggests that we might have an identification problem caused by either a misspecification of the model or poor fitness of the data.[17] As mentioned in an earlier version of this paper, our model specification has been widely used in the labor economics literature for estimating women's labor supply.[18] So, in the first hand, we do not believe the misspecification is the source of the problem but we rather think

Table 5. Cross-Section Elasticities by Two-Step Model

	After-tax lnwage			After-tax non-labor income		
Year	**Parameter**		**Elasticticty**	**Parameter**		**Elasticticty**
1983	302.95		0.29	-27.49	*	-0.61
1984	-211.44		-0.19	-12.39	*	-0.28
1985	489.03	*	0.45	-8.91	*	-0.21
1986	189.81	*	0.16	-11.93	*	-0.26
1987	-47.53		-0.04	-11.57	*	-0.28
1988	-65.99		-0.06	-4.09	*	-0.14
1989	-212.68	***	-0.17	-11.20	*	-0.28
1990	-281.70	*	-0.23	-4.90	*	-0.15
1991	-119.28		-0.09	-11.17	*	-0.25
1992	-371.61	*	-0.30	-3.37	*	-0.12
1993	-560.97	*	-0.43	-0.98	*	-0.03
1994	-288.38	**	-0.18	-7.09	*	-0.19
1995	-81.10		-2.64	-2.64	*	-0.09
1996	-489.81	*	-0.37	-4.45	*	-0.16
1998	-384.66	***	-0.27	-3.64	*	-0.15
2000	-500.38	*	-0.36	-3.10	*	-0.14

Source: Authors.

* Significant at 90% of confidence or more.

** Significant at 85% of confidence.

*** Significant at 80% of confidence.

[17] See Appendix A.

[18] Kim and Rodríguez-Pueblita (2004).

the estimation method we use creates the problem. Thus, we rely on a more robust method such as the two-step estimation proposed by Vella (1993) to investigate if our belief is correct.

3.2.2. Two-Step Method with Correction of Wage Endogeneity

The two-step method estimation correcting for wage endogeneity produces estimates that are similar to the ML estimations in sign, magnitude, and significance (see Figures 5 and 6 and Tables 5 and 6). The wage elasticities are still negative after 1986, but they are smaller in magnitude than the ML estimates. The income elasticities are the same order of magnitude as the ML estimates and appear to trend up over time.

We take three conclusions from these cross-section results. First, the driving force of our results is not the methodology but the specified model, which was used by others for estimating married women's labor behavior. Second, estimates of the wage elasticity for married women appear to have fallen over time, while estimates of the non-labor income elasticity from the Tobit model and the 2-step estimation have fallen in absolute terms. Third, the estimation results by Zabel (1993) appear to be very particular to the year 1986, and may not be applicable to later years. The following section attempts to solve for the model specification problem with a difference-in-differences approach used by Blundell et al (1998).

3.2.3. Difference-in-Differences Results

Like our previous models, our DID approach with interaction terms on the children dummy variables produces a significant decline in the after-tax wage elasticity over time.[19] The

[19]Appendix E presents reduced-form estimates of the wage, non-labor income, and participation equations.

elasticities are shown in Table 7, and the underlying parameters in Table 8. The estimated wage elasticities are negative using the whole sample, but positive when using just years 1983 to 1989. Older cohorts (born before 1950) show positive wage elasticities, while younger cohorts (born in 1950 or later) exhibit negative wage elasticities. Noting that the data from the years 1983 to 1989 do not include individuals born after 1960 and that the estimation with years 1990 to 2000 includes a greater percentage of younger cohorts, those results suggest that the younger cohorts of married women behave differently than the older cohorts. The elasticities on other income, however, are significant and negative in all cases.

Table 6. Cross-Section Elasticities by Different Models

	Tobit		Generalized Tobit		Two-step	
Year	After-tax log wage	After-tax non-labor income	After-tax log wage	After-tax non-labor income	After-tax log wage	After-tax non-labor income
1983	0.63 ***	-0.57 *	-1.56	-0.26 *	0.29	-0.61 *
1984	0.57	-0.57 *	n.d.	n.d.	-0.19	-0.28 *
1985	1.29 *	-0.54 *	0.45 *	-0.16 *	0.45 *	-0.21 *
1986	0.37	-0.48 *	0.18	-0.14 *	0.16 *	-0.26 *
1987	0.78 **	-0.47 *	-0.12	-0.20 *	-0.04	-0.28 *
1988	-0.81 **	-0.23 *	-0.12	-0.12 *	-0.06	-0.14 *
1989	-0.25	-0.33 *	-0.87 *	-0.15 *	-0.17 ***	-0.28 *
1990	-0.40 **	-0.26 *	-0.36 ***	-0.14 *	-0.23 *	-0.15 *
1991	-0.35 **	-0.35 *	-0.05	-0.13 *	-0.09	-0.25 *
1992	-0.60 *	-0.26 *	-0.22 ***	-0.04 ***	-0.30 *	-0.12 *
1993	-1.63 *	-0.30 *	-0.61 *	-0.07 *	-0.43 *	-0.03 *
1994	-0.70 *	-0.31 *	-0.71 *	-0.13 *	-0.18 **	-0.19 *
1995	-1.99 *	-0.33 *	n.d.	n.d.	-0.06	-0.09 *
1996	-1.72 *	-0.38 *	-1.07 *	-0.21 *	-0.37 *	-0.16 *
1998	-1.96 *	-0.25 *	-0.95 *	-0.12 *	-0.27 ***	-0.15 *
2000	-1.11 *	-0.27 *	-0.58 *	-0.20 *	-0.36 *	-0.14 *

Source: Authors.
* Significant at 90% of confidence.
** Significant at 85% of confidence.
*** Significant at 80% of confidence.

Table 7 also reports compensated wage elasticities. In the column labeled ‘compensated wage(a)’, we use the income share of wives (Share1 = Wage/(Wage+Nonlabor income)), and in the column labeled ‘compensated wage(b)’ we use an income share of one, Share2=Wage/Wage=1. In other words, Share1 stands for the families where their members share their resources fully (i.e., they pool their resources), while Share2 is applicable to families where each member lives on only their own income (i.e., purely individualistic resource allocation). Thus, we informally suggest that 'compensated wage(a)' is the lower bound of the compensated wage elasticity and 'compensated wage(b)' is the upper bound of the elasticity. We will revisit the issue of intrahousehold allocation in section 4.

The estimation using only data of the younger cohorts shows that the upper bounds of the compensated wage elasticities is negative for all three groups defined by children dummy variables, which contradicts economic theory. For the other cases, the upper bounds of the compensated wage elasticities are positive except for the "no children under seventeen years old" groups for the 1983-2000 and 1990-2000 panels. It is worthwhile mentioning that, even for negative values, we cannot reject the hypothesis that the compensated wage elasticity is zero for a moderate range of standard errors.[20]

[20] Assuming the covariance between the wage elasticity and the income elasticity is positive, the range of standard errors is 0.074 to 0.104 for the 'no children' case in the 1983-2000 panel and 0.098 to 0.138 for the 'no children' case in the 1990-2000 panel.

Table 7. Wage and Income Elasticities with the Chldren Interactions

	Elasticities				Group Means		
	Wage	Compensated Wage (a)	Compensated Wage (b)	Other Income	Hours	Wage	Income
			1983-2000				
No Children	-0.119	-0.096	-0.005	-0.114	1722	1.85	42.95
	0.051			*0.043*			
Youngest Child 0-6	-0.156	-0.115	0.081	-0.237	1375	1.87	42.23
	0.065			*0.053*			
Youngest Child 6-17	-0.108	-0.077	0.069	-0.178	1594	1.76	43.01
	0.056			*0.046*			
			1983-1989				
No Children	0.084	0.134	0.315	-0.231	1645	1.64	30.34
	0.105			*0.083*			
Youngest Child 0-6	0.101	0.185	0.552	-0.451	1243	1.68	29.29
	0.141			*0.107*			
Youngest Child 6-17	0.077	0.135	0.363	-0.286	1553	1.53	28.52
	0.113			*0.081*			
			1990-2000				
No Children	-0.168	-0.142	-0.042	-0.126	1759	1.96	49.40
	0.064			*0.057*			
Youngest Child 0-6	-0.227	-0.180	0.043	-0.269	1440	1.96	49.17
	0.079			*0.071*			
Youngest Child 6-17	-0.147	-0.113	0.050	-0.197	1615	1.87	50.35
	0.070			*0.063*			
			Older Cohorts (30s, 40s)				
No Children	0.120	0.150	0.275	-0.155	1654	1.77	41.08
	0.076			*0.064*			
Youngest Child 0-6	0.166	0.215	0.424	-0.258	1378	1.77	33.97
	0.100			*0.073*			
Youngest Child 6-17	0.157	0.197	0.381	-0.224	1544	1.69	39.04
	0.083			*0.065*			
			Younger Cohorts (50s, 60s)				
No Children	-0.206	-0.183	-0.106	-0.100	1844	2.01	46.93
	0.063			*0.057*			
Youngest Child 0-6	-0.277	-0.238	-0.053	-0.223	1375	1.88	43.22
	0.083			*0.071*			
Youngest Child 6-17	-0.210	-0.182	-0.051	-0.159	1620	1.79	45.23
	0.071			*0.062*			

Source: Authors.

Notes: Asymptotic standard errors in italics.

Compensated Wage (a) is the lower-bound estimate and Compensated Wage (b) is the upper-bound estimate.

All wages and incomes are after-tax.

Table 8. Parameter Estimates for Hours-of-Work Equation With the Children Interactions					
	1983 to 1989	**1990 to 2000**	**1983 to 2000**	**Older Cohorts (30s, 40s)**	**Younger Cohorts (50s, 60s)**
Constant	1775.562	2475.879	2132.065	1204.487	2341.079
	251.937	*155.008*	*135.465*	*189.233*	*180.481*
Youngest Child 0-6	-163.212	-73.202	-161.608	-272.150	-264.322
	136.534	*85.713*	*70.664*	*183.272*	*94.864*
Youngest Child 6-17	-8.864	-205.468	-139.720	-73.802	-245.868
	94.637	*70.955*	*53.889*	*73.662*	*85.032*
Health	-121.163	-137.373	-118.118	-219.407	-175.524
	180.280	*129.135*	*98.004*	*136.992*	*126.246*
			Wage Effects		
No Children	138.297	-294.739	-205.731	198.578	-379.690
	180.280	*129.135*	*98.004*	*136.992*	*126.246*
Youngest Child 0-6	124.998	-326.347	-214.750	228.338	-380.196
	182.122	*129.254*	*98.737*	*153.275*	*125.414*
Youngest Child 6-17	120.311	-237.192	-172.915	243.122	-340.817
	181.263	*129.500*	*98.620*	*137.922*	*126.464*
			Other Income Effects		
No Children	-12.525	-4.477	-4.585	-6.232	-3.923
	4.608	*2.298*	*1.880*	*2.725*	*2.470*
Youngest Child 0-6	-19.141	-7.882	-7.720	-10.482	-7.106
	4.712	*2.361*	*1.923*	*3.152*	*2.490*
Youngest Child 6-17	-15.575	-6.307	-6.590	-8.847	-5.695
	4.583	*2.298*	*1.872*	*2.685*	*2.459*
			Residuals		
Wage	-62.417	374.373	283.825	-132.768	449.801
	179.230	*127.943*	*97.246*	*135.938*	*124.107*
Other Income	7.425	3.261	2.387	3.936	1.937
	4.555	*2.287*	*1.868*	*2.723*	*2.448*
Participation	-253.594	-340.706	-397.135	306.341	-232.828
	226.613	*134.061*	*122.306*	*212.558*	*152.518*

Source: Authors.

Notes: Asymptotic standard errors in italics.
All wages and incomes are after-tax.

In Tables 9 and 10, we report the same set of experiments but excluding the children dummy variable interactions. The overall results are quite similar to those using interaction terms as shown in Tables 7 and 8.

Table 9. Wage and Income Elasticities Without the Children Interactions							
	Elasticities				Group Means		
	Wage	Compensated Wage (a)	Compensated Wage (b)	Other Income	Hours	Wage	Income
1983-2000	-0.126	-0.095	0.041	-0.167	1588	1.82	42.80
	0.062			*0.052*			
1983-1989	0.111	0.176	0.428	-0.317	1513	1.60	29.34
	0.118			*0.088*			
1990-2000	-0.188	-0.155	-0.008	-0.180	1625	1.92	49.73
	0.079			*0.070*			
Older Cohorts (30s, 40s)	0.153	0.191	0.357	-0.204	1597	1.74	39.89
	0.085			*0.067*			
Younger Cohorts (50s, 60s)	-0.249	-0.220	-0.094	-0.155	1583	1.87	44.80
	0.079			*0.069*			

Source: Authors.

Notes: Asymptotic standard errors in italics.

All wages and incomes are after-tax.

Table 10. Parameter Estimates for Hours-of-Work Equation Without the Children Interactions					
	1983 to 1989	1990 to 2000	1983 to 2000	Older Cohorts (30s, 40s)	Younger Cohorts (50s, 60s)
Constant	1778.239	2530.792	2150.677	1220.095	2434.088
	249.951	*153.142*	*131.289*	*187.800*	*173.081*
Youngest Child 0-6	-394.357	-302.786	-320.429	-366.097	-412.947
	74.037	*36.392*	*33.966*	*63.382*	*46.151*
Youngest Child 6-17	-124.751	-193.626	-172.412	-101.129	-262.887
	35.820	*25.238*	*19.618*	*23.933*	*31.555*
Health	-132.688	-142.806	-127.581	-210.861	-184.932
	178.519	*128.475*	*98.350*	*135.609*	*124.600*
Log Wage	168.419	-305.328	-200.578	243.820	-394.692
	178.519	*128.475*	*98.350*	*135.609*	*124.600*
Other Income	-16.326	-5.868	-6.205	-8.165	-5.489
	4.527	*2.288*	*1.948*	*2.663*	*2.448*
			Residuals		
Wage	-101.664	398.313	288.899	-155.642	480.068
	179.232	*128.867*	*98.678*	*136.082*	*124.686*
Other Income	8.552	3.197	2.546	4.744	1.712
	4.547	*2.300*	*1.961*	*2.709*	*2.463*
Participation	-153.193	-324.715	-351.655	276.029	-199.734
	223.690	*134.916*	*120.123*	*210.700*	*153.126*

Source: Authors.

Notes: Asymptotic standard errors in italics.

All wages and incomes are after-tax.

Table 11. Various Specifications of the Model for the 1983 to 2000 Period					
	(1)	(2)	(3)	(4)	(5)
Constant	2132.065	1862.607	2169.103	1919.643	1477.919
	120.754	*87.204*	*117.861*	*105.500*	*44.226*
Youngest Child 0-6	-161.608	-137.532	-179.174	-262.994	-255.158
	58.819	*58.365*	*57.484*	*51.707*	*51.634*
Youngest Child 6-17	-139.720	-110.983	-151.069	-157.451	-131.840
	45.575	*44.712*	*44.859*	*45.331*	*44.592*
Health	-118.118	-96.246	-127.220	-191.623	-160.255
	87.992	*17.227*	*63.379*	*87.055*	*17.203*
Wage Effects					
No Children	-205.731	72.526	-291.712	-252.970	65.881
	87.992	*17.227*	*63.379*	*87.055*	*17.203*
Youngest Child 0-6	-214.750	64.869	-300.586	-259.213	62.865
	88.787	*19.085*	*64.575*	*87.970*	*19.088*
Youngest Child 6-17	-172.915	108.589	-259.630	-219.754	103.720
	88.673	*15.562*	*63.821*	*87.760*	*15.550*
Other Income Effects					
No Children	-4.585	-8.384	-2.241	-2.590	-2.384
	1.709	*1.239*	*0.390*	*1.618*	*0.390*
Youngest Child 0-6	-7.720	-11.534	-5.392	-5.577	-5.509
	1.730	*1.264*	*0.513*	*1.626*	*0.509*
Youngest Child 6-17	-6.590	-10.373	-4.272	-4.570	-4.439
	1.689	*1.216*	*0.380*	*1.594*	*0.379*
Residuals					
Wage	283.825	-	370.260	330.051	-
	88.017	-	*63.101*	*87.122*	-
Other Income	2.387	6.197	-	0.348	-
	1.695	*1.215*	-	*1.598*	-
Participation	-397.135	-448.734	-345.510	-	-
	109.999	*108.869*	*103.717*	-	-

Source: Authors.

Notes: Asymptotic standard errors in italics.

All wages and incomes are after-tax.

Table 11 presents the parameter estimates for a number of different specifications using the data for all the years. In column (1), we correct for the endogeneity of the wage rate, non-labor income, and labor force participation. In columns (3) and (4), we drop the corrections for non-labor income and for participation, respectively. As in Blundell, et al. (1998), the results in these three columns are quite similar because the changes in those endogenous variables can be controlled by the group and time effects without the correction terms. In column (2), we do not include the correction term for the wage rate, observing an important difference from the corrected model of column (1), suggesting that what really matters is the correction for the endogeneity of the wage rate. Moreover, column (2) provides quite similar estimates to the OLS results of column (5), which has a positive sign for the wage coefficient. The positive signs of the OLS estimate for the wage rate (expected from the relationship between the hours of work

Table 12. Variations in Job Stability and Job Security, 1975 versus 2000
(as a percentage of 1975 transition rates)

	Men		**Women**	
	Job Stability	**Job Variation**	**Job Stability**	**Job Variation**
All	45.22%	-28.50%	58.47%	-20.30%
Age				
19-24	25.44%	-25.73%	30.33%	-16.89%
25-34	23.23%	-43.78%	54.53%	-29.70%
35-44	78.67%	-8.55%	52.18%	-8.85%
45-54	144.08%	13.57%	190.11%	-19.10%
Education				
High School Dropouts	23.40%	-18.40%	69.39%	-5.28%
High School	59.50%	-28.00%	67.71%	-21.72%
Some College	47.21%	-40.55%	47.59%	-26.71%
College Graduates	35.52%	-21.42%	41.83%	-34.57%
Race				
White	43.62%	-29.48%	48.41%	-22.28%
Nonwhite	61.71%	-22.38%	146.64%	-12.53%
Martial Status				
Married-Spouse Present	50.56%	-25.50%	61.01%	-26.98%
Other	34.82%	-23.52%	52.52%	-14.12%

Source: Table 2, Stewart (2002).

and the wage rate depicted in Figures 1 and 2) and the estimate in column 2 confirms the idea that wages are the main source of endogeneity in this model.

4. Possible Explanation of Our Findings

Our empirical analysis shows that the wage elasticity for married women has been decreasing across time regardless of methodology and model specification. There are two compelling arguments for that result. One, there have been important changes in the intrahousehold resource allocation that have affected women's labor supply behavior. Two, women have raised their turnover rates that in turn generates the negative wage estimates.

Support for the first potential explanation comes from Browning, et al. (1994) who study a sample of Canadian couples with no children and find that relative incomes between partners are one of the main factors determining the final allocations of expenditures on each partner. If this is a current driving factor of labor behavior, then a married woman cannot be treated as a 'secondary worker' anymore, because informally speaking, she lives on her own income, which implies she is a separate "primary worker." Thus, when younger cohorts make up a higher percentage of working women, aggregate behavior changes.

Our second probable explanation relies on the fact that younger generations change their careers and jobs more often than do older cohorts. This phenomenon might have become more important as women had gained more access to the labor market, allowing them to switch jobs more easily than before. According to empirical evidence, it is indeed unlikely for a woman of a younger generation to stay in a single firm during her whole career. Evidence of this trend can be found in Stewart (2002), who reports that job stability has fallen for married couples, while job security has increased in the March CPS data over the period from 1975-76 to 2000-2001. Stewart notes that there has been a dramatic increase in employment-to-employment transitions for those job changes with two or fewer weeks of unemployment (58.47% for all women and 61.01% for married women as a percentage of 1975 as shown in Table 13), indicating that it has become easier to change employers than before. These trends are consistent with findings from the PSID (see Rose (1995) and Marcotte (1996)).[21]

One of the reasons why women move to a new job may be that they can earn more total income than in their previous job with the same or fewer hours of work. If so, that creates a selection problem in the estimation, or at least makes statistical inference difficult if movements from job to job are frequent enough. This phenomenon, if it is significant, can make the estimated wage elasticities negative. Therefore, the higher portion of younger cohorts we have in our sample, the more salient negative wage elasticities will result from the estimation.

5. Conclusion

The aim of this paper was to estimate the responsiveness of secondary workers to changes in their wages and other income in a world where average hours-of-work of these individuals, as well as their participation rates, have increased substantially over the last two decades. Implementing several econometric methodologies and using PSID for the period of 1983-2000, we found that the wage elasticity for white, married women has decreased significantly in magnitude, while their elasticity with respect to other income has remained relatively constant for much of the period. In particular, the secondary workers' labor supply elasticities with respect to their after-tax wages are either not different from zero or negative across methodologies and several specifications, while their elasticities with respect to non-labor

[21] We should note that there are several other papers reporting little or no changes in job stability including Farber (1998), Diebold, Neumark, and Polsky (1997), and Jaeger and Stevens (1999).

income are negative, statistically significant and stable or shrinking in absolute value over the years depending on the estimation approach. These findings might imply that our conventional models of married women labor behavior are not powerful anymore. Another possible important implication is that married women's elasticity is not a good reference any more when talking about the most sensitive group of individuals to changes in wage rates. Therefore, younger cohorts of married women do not fit the "secondary worker" definition anymore compared to several decades ago, confirming the saying that the labor supply behavior gap between women and men is indeed shrinking. In that sense, our study partially answers the original question raised by Heckman (1993): "Has the consensus view of the 1960s of high labor supply elasticities for married women and low labor supply elasticities for married men held up?" Our answer is "no." Our results are robust and consistent across models and specifications in the sense that all of them show declining wage elasticities over the time span studied.

Interestingly, when we use the difference-in-differences approach, the only case where our IV estimates of wage coefficients show a significant difference between the bias-corrected and uncorrected models is when the endogeneity of the wage rate is addressed. Moreover, when we do not control for this endogeneity bias, our estimates are quite similar to the OLS results, suggesting that the wage is the main source of endogeneity in our model.

Finally, the cross-section results suggest that in recent years the non-labor income elasticities are smaller in magnitude than the wage elasticities, resulting in negative compensated wage elasticities, contradicting theory. One way to reconcile our empirical findings with theory is by arguing changes in the intrahousehold resource allocation pattern for younger cohorts, a phenomenon with interesting social implications that has not been taken into account explicitly in the labor model of secondary workers. Additionally, changing patterns in younger cohorts on turnover rates, together with their increasing portion in the pool of the labor force, can help us to understand our results. Future research in these hypotheses is required in order to find a solution to this puzzle.

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Appendix A

Estimations using After-Tax Wages and Non-Labor Income

Table A1. Estimates from Unrestricted Tobit-Type Model

Year	After-tax lnwage	After-tax non-labor income	Age	Education	Number of kids 0 to 6 years old	Number of kids 6 to 17 years old	Number of kids 0 to 17 years old	Whether kids younger than 6 years old	Health	Constant	σ_1	σ_2	ρ_{12}	Log likelihood
1983	668.64	-25.57	-8.14	36.37	-556.00	-60.57	-	-	-672.64	640.36	1091.71	0.54	-0.35	-4265.56
	534.21	*2.96*	*7.08*	*43.26*	*87.46*	*50.17*	-	-	*265.35*	*597.22*	*110.93*	*0.02*	*0.47*	-
1984	617.39	-24.88	-13.13	18.37	-462.66	-56.15	-	-	-244.58	1196.04	1043.02	0.51	-0.21	-5917.46
	*	*2.50*	*5.57*	*18.25*	*68.51*	*40.31*	-	-	*163.71*	*369.44*	*35.07*	*0.01*	*0.24*	-
1985	1406.57	-22.91	-17.20	-22.55	-560.36	-104.69	-	-	-545.09	749.62	1176.29	0.48	-0.55	-5889.93
	458.64	*2.44*	*6.25*	*43.52*	*66.98*	*39.62*	-	-	*198.68*	*463.60*	*131.49*	*0.01*	*0.32*	-
1986	436.23	-21.58	-26.76	33.51	-550.90	-132.51	-	-	38.00	1882.70	995.64	0.48	-0.17	-6255.35
	806.89	*2.41*	*5.51*	*67.49*	*62.56*	*36.97*	-	-	*126.62*	*444.99*	*69.36*	*0.01*	*0.62*	-
1987	952.49	-19.84	-29.46	-8.68	-631.77	-122.45	-	-	-232.74	1771.67	1117.45	0.52	-0.52	-6708.41
	649.15	*2.06*	*6.02*	*59.37*	*60.18*	*36.35*	-	-	*128.63*	*450.37*	*179.26*	*0.01*	*0.41*	-
1988	-947.21	-6.50	-26.68	150.12	-608.35	-132.06	-	-	-505.06	2368.82	1150.70	0.56	0.48	-6434.16
	641.32	*1.41*	*6.67*	*66.87*	*63.92*	*38.13*	-	-	*183.37*	*404.43*	*177.71*	*0.02*	*0.44*	-
1989	-308.85	-13.31	-16.52	95.24	-442.33	-70.87	-	-	-429.37	1746.10	942.53	0.54	0.20	-6380.96
	369.48	*1.86*	*5.64*	*45.63*	*60.18*	*34.26*	-	-	*119.80*	*336.58*	*49.17*	*0.01*	*0.46*	-
1990	-491.17	-8.18	-23.20	96.37	-365.18	-64.08	-	-	-596.02	2218.90	1130.38	0.52	0.42	-10427.07
	318.98	*1.23*	*4.60*	*26.99*	*50.32*	*28.04*	-	-	*119.52*	*324.68*	*75.67*	*0.01*	*0.33*	-
1991	-449.34	-15.29	-14.41	119.01	-378.84	-107.80	-	-	-122.62	1689.63	1049.60	0.53	0.30	-11680.71
	306.25	*1.41*	*4.23*	*32.04*	*46.65*	*26.23*	-	-	*88.76*	*266.94*	*54.97*	*0.01*	*0.37*	-
1992	-730.76	-7.32	-18.50	116.63	-421.55	-128.47	-	-	-697.99	2415.06	1083.75	0.60	0.26	-11342.08
	247.22	*1.13*	*4.77*	*19.29*	*50.89*	*28.12*	-	-	*99.21*	*346.94*	*47.99*	*0.01*	*0.36*	-
1993	-2138.98	-8.88	0.04	275.97	-	-	-101.23	-169.37	-572.07	2414.06	1448.45	0.53	0.74	-7074.11
	777.62	*1.40*	*8.60*	*84.99*	-	-	*94.40*	*34.25*	*201.13*	*602.91*	*308.56*	*0.01*	*0.25*	-
1994	-1122.27	-11.60	3.21	195.67	-	-	-286.72	-59.11	-143.83	1287.19	1181.72	0.58	0.59	-7183.40
	574.31	*1.70*	*7.59*	*64.96*	-	-	*89.07*	*32.53*	*140.16*	*410.50*	*202.11*	*0.02*	*0.35*	-
1995	-2607.21	-9.31	-12.09	405.63	-	-	-388.89	-1.78	-749.20	1756.93	1895.76	0.55	0.87	-9041.93
	1520.54	*1.11*	*9.34*	*192.87*	-	-	*79.81*	*29.10*	*222.49*	*687.93*	*729.12*	*0.01*	*0.16*	-
1996	-2267.39	-10.80	-24.02	338.85	-	-	-429.56	-25.32	-750.13	2719.95	1763.45	0.56	0.85	-9121.31
	959.56	*1.13*	*8.23*	*111.12*	-	-	*79.81*	*29.56*	*188.70*	*671.38*	*463.58*	*0.01*	*0.16*	-
1998	-2744.35	-6.15	-5.86	354.66	-	-	-607.78	-111.04	-1031.12	3021.66	1892.88	0.55	0.88	-7767.41
	1738.02	*1.00*	*10.03*	*200.48*	-	-	*89.42*	*32.52*	*292.19*	*974.45*	*848.25*	*0.01*	*0.16*	-
2000	-1550.71	-6.13	-10.04	218.96	-	-	-498.70	-150.08	-751.46	2762.13	1361.36	0.56	0.72	-8347.07
	594.93	*0.84*	*7.52*	*68.51*	-	-	*94.95*	*32.54*	*149.61*	*494.35*	*242.82*	*0.01*	*0.24*	-

Source: Authors.

Notes: Estimates were computed both with and without initial values. The estimates shown in this table are those with the smallest standard errors.

Standard errors are in italics.

No restrictions were imposed on the wage parameter. When it was restricted to be nonnegative, convergence was achieved with values very close to zero in those years where the unrestricted parameter was negative.

* There are no standard errors for the wage estimate in 1984 given convergence problems.

Table A2. Estimates from the Generalized Tobit-Type Model

Year	After-tax lnwage	After-tax non-labor income	Age	Education	Number of kids 0 to 6 years old	Number of kids 6 to 17 years old	Number of kids 0 to 17 years old	Whether kids younger than 6 years old	Health	Constant	σ1	σ2	ρ12	ρ13	ρ23	Log likelihood
1983	-1658.44	-11.89	-8.99	119.81	-309.90	-56.78	-	-	-893.73	3073.16	1129.20	0.55	0.82	0.18	0.07	-4218.4
	1511.92	*3.01*	*7.35*	*104.71*	*80.42*	*36.91*	-	-	489.86	*1121.37*	*681.08*	*1.04*	*0.28*	*0.43*	*0.41*	-
1984*	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	-	-	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	n.d.	*n.d.*	*n.d.*	*n.d.*	*n.d.*	*n.d.*	-	-	*n.d.*	*n.d.*	*n.d.*	*n.d.*	*n.d.*	*n.d.*	*n.d.*	-
1985	494.19	-6.88	-4.20	-51.20	-179.94	-90.11	-	-	-156.24	2000.07	711.15	0.51	-0.22	-0.36	-0.55	-5857.3
	252.52	*2.45*	*4.33*	*21.91*	*59.73*	*30.15*	-	-	141.58	*329.13*	*36.10*	*1.04*	*0.44*	*0.40*	*0.31*	-
1986	209.13	-6.15	-1.96	-36.26	-208.73	-68.69	-	-	-90.75	2189.97	696.92	0.54	0.08	-0.57	-0.80	-6173.8
	297.15	*1.91*	*4.48*	*23.24*	*49.99*	*28.10*	-	-	94.05	*299.14*	*27.88*	*1.04*	*0.49*	*0.36*	*0.12*	-
1987	-148.80	-8.51	-5.73	3.69	-258.27	-76.44	-	-	-161.98	2475.00	655.11	0.54	0.15	-0.33	-0.49	-6629.9
	283.39	*2.19*	*4.59*	*25.06*	*63.65*	*27.07*	-	-	79.24	*283.19*	*37.04*	*1.04*	*0.50*	*0.51*	*0.35*	-
1988	-146.57	-3.35	-13.91	18.73	-361.36	-111.19	-	-	-104.96	2417.13	677.25	0.56	0.12	0.09	-0.22	-6375.8
	450.63	*1.20*	*4.91*	*47.76*	*64.67*	*27.67*	-	-	124.18	*266.23*	*36.92*	*1.03*	*0.62*	*0.55*	*0.48*	-
1989	-1072.43	-6.09	4.84	93.34	-268.47	-109.51	-	-	13.72	2584.91	1006.44	0.63	0.77	-0.81	-0.75	-6337.2
	460.38	*1.44*	*7.18*	*53.15*	*46.49*	*25.90*	-	-	151.59	*352.07*	*223.94*	*1.04*	*0.22*	*0.16*	*0.16*	-
1990	-444.96	-4.42	-16.60	31.10	-303.24	-115.18	-	-	-369.99	2973.22	743.28	0.56	0.38	0.28	-0.19	-10901.6
	192.86	*0.98*	*3.57*	*17.63*	*39.33*	*20.00*	-	-	86.75	*233.22*	*48.06*	*1.02*	*0.34*	*0.40*	*0.40*	-
1991	-58.12	-5.97	0.24	-12.41	-135.89	-80.73	-	-	-12.21	2305.32	714.07	0.59	0.26	-0.63	-0.74	-11713.2
	156.39	*1.12*	*3.20*	*13.51*	*36.67*	*19.18*	-	-	64.16	*207.87*	*30.72*	*1.03*	*0.34*	*0.24*	*0.13*	-
1992	-269.50	-1.21	-0.37	-3.70	-141.33	-93.16	-	-	-24.08	2588.69	768.74	0.67	0.34	-0.78	-0.65	-11320.8
	151.19	*0.90*	*3.57*	*11.98*	*39.20*	*20.80*	-	-	75.82	*252.85*	*39.95*	*1.03*	*0.33*	*0.16*	*0.16*	-
1993	-802.23	-2.12	2.71	60.08	-	-	-86.83	-47.68	78.41	2716.92	884.00	0.61	0.62	-0.81	-0.72	-7168.5
	243.70	*1.11*	*5.17*	*27.55*	-	-	*25.37*	*67.21*	*107.45*	*345.10*	*94.21*	*1.03*	*0.26*	*0.13*	*0.15*	-
1994	-1142.91	-4.91	13.56	108.22	-	-	-51.32	40.52	13.99	2348.50	1060.64	0.63	0.77	-0.83	-0.77	-7065.7
	552.82	*1.36*	*7.01*	*53.92*	-	-	*24.97*	*67.34*	*127.65*	*466.64*	*269.58*	*1.03*	*0.24*	*0.13*	*0.13*	-
1995*	n.d.	n.d.	n.d.	n.d.	-	-	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	n.d.	*n.d.*	*n.d.*	*n.d.*	-	-	*n.d.*	*n.d.*	*n.d.*	*n.d.*	*n.d.*	*n.d.*	*n.d.*	*n.d.*	*n.d.*	-
1996	-1408.95	-5.98	-7.14	168.59	-	-	-38.12	-223.91	-308.12	2733.57	1112.09	0.56	0.80	0.22	0.00	-9099.6
	518.40	*1.38*	*5.97*	*60.50*	-	-	*22.26*	*76.58*	*142.36*	*441.88*	*239.21*	*1.02*	*0.19*	*0.46*	*0.33*	-
1998	-1337.33	-3.02	-7.63	160.12	-	-	-79.07	-370.40	-398.34	2892.12	1030.30	0.55	0.79	0.12	0.08	-7700.0
	755.32	*0.87*	*5.87*	*86.34*	-	-	*25.39*	*75.84*	*147.06*	*525.22*	*332.18*	*1.03*	*0.24*	*0.37*	*0.42*	-
2000	-809.40	-4.45	-9.77	98.29	-	-	-117.37	-335.14	-286.24	3017.30	841.86	0.60	0.57	-0.17	-0.69	-8325.4
	259.29	*0.80*	*4.82*	*32.40*	-	-	*27.22*	*78.19*	*109.19*	*321.11*	*87.45*	*1.04*	*0.28*	*0.51*	*0.25*	-

Source: Authors.

Notes: Estimates were computed both with and without initial values. The estimates shown in this table are those with the smallest standard errors.

Standard errors are in italics.

No restrictions were imposed on the wage parameter. When it was restricted to be nonnegative, convergence was achieved with values very close to zero in those years where the unrestricted parameter was negative.

* There were convergence problems in 1984 and 1995.

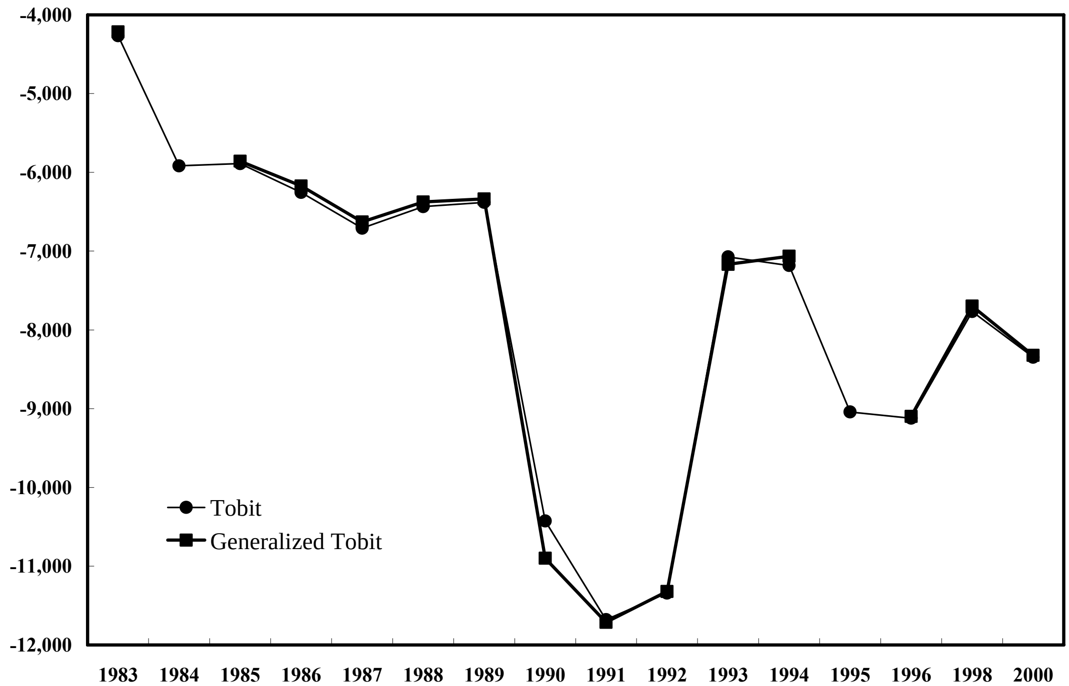
Table A3. Estimates from the Two-Step Method

Year	After-tax lnwage	After-tax non-labor income	Age	Education	Number of kids 0 to 6 years old	Number of kids 6 to 17 years old	Number of kids 0 to 17 years old	Whether kids younger than 6 years old	Health	Residuals	Mills Ratio	Constant
1983	302.95	-27.49	-8.71	60.24	-614.39	-65.25	-	-	-871.47	-327.74	1378.48	895.74
	264.20	*5.01*	*4.73*	*29.43*	*109.65*	*35.77*	-	-	231.82	272.87	*391.68*	*485.25*
1984	-211.44	-12.39	-0.69	20.66	-234.77	-90.26	-	-	-3.95	301.04	-65.10	2020.23
	356.68	*3.40*	*4.03*	*28.27*	*68.27*	*28.44*	-	-	127.48	362.00	*268.31*	*419.58*
1985	489.03	-8.91	-4.92	-45.06	-214.65	-98.48	-	-	-190.67	-459.52	-243.68	2001.40
	210.27	*2.94*	*4.46*	*23.09*	*75.43*	*29.25*	-	-	139.82	218.64	*232.52*	*318.99*
1986	189.81	-11.93	-9.09	-10.16	-334.13	-100.56	-	-	-64.69	-123.89	81.55	2179.87
	221.13	*2.52*	*5.14*	*24.34*	*71.06*	*29.98*	-	-	88.18	227.53	*260.34*	*263.84*
1987	-47.53	-11.57	-10.89	13.03	-350.45	-92.78	-	-	-205.08	10.34	174.74	2395.49
	219.45	*2.37*	*4.93*	*22.41*	*73.57*	*27.73*	-	-	80.43	224.48	*231.46*	*261.06*
1988	-65.99	-4.09	-17.14	18.94	-419.74	-116.41	-	-	-136.55	71.42	333.54	2374.70
	199.76	*1.25*	*4.87*	*25.47*	*72.90*	*27.58*	-	-	102.34	204.47	*244.02*	*254.49*
1989	-212.68	-11.20	-10.74	48.11	-403.19	-93.80	-	-	-270.13	244.62	578.35	2102.87
	161.76	*1.93*	*4.58*	*26.74*	*56.51*	*24.79*	-	-	98.03	167.75	*268.17*	*277.36*
1990	-281.70	-4.90	-19.13	25.61	-332.04	-131.54	-	-	-346.44	369.38	550.82	2838.51
	132.68	*0.99*	*3.82*	*16.32*	*44.29*	*20.76*	-	-	79.85	137.35	*234.92*	*206.95*
1991	-119.28	-11.17	-6.72	32.98	-267.38	-107.64	-	-	-55.42	192.50	459.91	2039.88
	129.71	*1.43*	*3.26*	*16.40*	*43.56*	*19.29*	-	-	61.25	134.17	*196.91*	*194.13*
1992	-371.61	-3.37	-6.71	32.89	-258.60	-122.22	-	-	-252.54	281.84	129.68	2477.26
	134.55	*0.97*	*3.62*	*15.92*	*47.54*	*20.36*	-	-	92.11	138.54	*197.74*	*212.87*
1993	-560.97	-0.98	3.53	27.36	-	-	-72.25	-32.07	111.35	462.86	-764.13	2604.08
	206.49	*1.45*	*4.39*	*28.83*	-	-	*27.99*	*67.92*	*107.51*	*210.81*	*270.43*	*281.79*
1994	-288.38	-7.09	5.69	53.12	-	-	-68.22	-47.86	-20.75	288.40	150.44	1610.38
	180.90	*1.70*	*4.40*	*25.50*	-	-	*24.49*	*75.87*	*87.27*	*186.68*	*254.55*	*275.69*
1995	-81.10	-2.64	3.50	11.03	-	-	-55.49	-62.46	-178.95	179.23	-549.95	1902.23
	219.68	*1.37*	*3.85*	*29.93*	-	-	*21.26*	*86.96*	*99.02*	*222.73*	*272.21*	*258.49*
1996	-489.81	-4.45	-2.88	52.69	-	-	-28.11	-175.17	-199.33	651.05	-138.95	2338.96
	204.81	*1.50*	*4.49*	*30.06*	-	-	*21.34*	*85.08*	*101.79*	*208.42*	*269.85*	*249.96*
1998	-384.66	-3.64	-7.47	59.09	-	-	-89.75	-418.77	-383.04	502.51	258.92	2318.12
	297.60	*0.98*	*4.09*	*35.80*	-	-	*25.16*	*92.76*	*117.07*	*300.42*	*249.05*	*282.44*
2000	-500.38	-3.10	-7.89	46.56	-	-	-74.62	-284.83	-115.97	568.90	-458.79	3000.85
	177.74	*0.85*	*4.34*	*25.40*	-	-	*30.91*	*75.46*	*104.60*	*182.09*	*321.06*	*269.42*

Source: Authors.

Note: Standard errors are in italics.

Figure A1. Maximum Log-likelihood Values with Tobit-type and Generalized Tobit-type Models



Appendix B

Variable Definitions

Variable	Definition
age	Age at the time of the interview.
atnonlinc	(husband's total taxable income + other family members' taxable income - wife's labor income - household's total tax)/1000
basiceduc	1 if elementary school degree
educ	Years of education.
fedrate	Federal income tax marginal rate
fedtax	Federal income tax payable
feduccol	1 if father attended to college
feduchs	1 if father attended to college
fica	Contribution to federal insurance
ficarate	Contribution marginal rate to federal insurance
h	Annual hours of work
lfp	Labor force participation
lkaw	1 if there was a health condition that limited working (a lot, somewhat or just a little).
lnatwageaftax	ln(labor income/h)*(1-mgtotal)) or lnatwage = ln(wage rate(1-mgtotal))
lnunskll	ln(Unskilled worker wage rate).
lnwage	Logarithm of wage
matj	1 if negative local labor market situation (more applicants than jobs and many more applicants than jobs)
meduccol	1 if mother attended to college.
meduchs	1 if mother attended to high school.
mgtotal	(Federal marginal rate+State marginal rate+(FICA marginal rate)/2)/100
nkid0t17	Number of children 17 years old or younger present in the household.
nkid6t17	Number of children 7 to 17 years old present in the household.
nkidlt6	Number of children 6 years old and younger present in the household.
nonlinc	Income from other family members
northcen	1 if region is North Central.
northest	1 if region is Northwest.
smsa	1 if standard metropolitan statistical area.
south	1 if region South.
unemprate	County’s unemployment rate
west	1 if region West.
whkidt6	Whether there are children 6 years old or younger present in the household.

Appendix C

Estimations using Before-tax Wages and Non-Labor Incomes

Table C1. Estimates of the Generalized Labor Supply Model for Selected Years

	1986	1988	1991	1994	1999	2001
lnwage	280.37	-249.79	-74.57	-522.90	-1175.63	-716.00
	223.71	258.00	160.08	257.25	658.94	239.65
nonlinc	-4.05	-2.35	-4.01	-4.35	-1.81	-2.84
	1.43	0.97	1.02	1.25	0.73	0.63
age	-3.96	-12.52	0.22	5.33	-3.99	-6.58
	4.49	4.61	3.37	4.41	6.06	4.49
educ	-41.59	33.00	-7.10	88.21	158.45	87.38
	17.77	31.63	14.55	38.67	86.83	32.15
nkid1t6	-225.06	-360.60	-125.83	-	-	-
	50.10	61.03	37.84	-	-	-
nkid6t17	-65.21	-109.61	-76.08	-	-	-
	27.69	27.41	19.27	-	-	-
nkid0t17	-	-	-	-79.60	-76.53	-97.59
	-	-	-	21.30	25.00	24.26
whkidt6	-	-	-	-69.36	-362.41	-300.36
	-	-	-	-	74.55	71.36
lkaw	-81.45	-134.13	8.15	-13.61	-432.81	-301.37
	89.11	110.57	65.99	93.07	159.14	102.23
cons	2074.83	2412.38	2267.08	1743.31	2892.38	3035.95
	276.85	284.70	238.54	261.03	515.41	323.12
sigma1	687.38	697.85	729.65	771.73	1011.30	834.69
	134.98	180.81	175.55	254.46	558.00	262.35
sigma2	0.68	0.59	0.69	0.62	0.59	0.57
	0.13	0.11	0.11	0.11	0.10	0.09
rho12	0.10	0.27	0.34	0.49	0.78	0.59
	0.18	0.20	0.12	0.13	0.06	0.07
rho13	-0.47	0.11	-0.59	0.11	0.19	-0.09
	0.14	0.27	0.08	0.25	0.13	0.20
rho23	-0.88	-0.18	-0.86	0.17	0.27	-0.04
	0.01	0.27	0.01	0.36	0.14	0.24

Source: Authors.

Variable definitions are in Appendix B.

Table C2. Estimated Wage and Nonlabor Income Elasticities

Year	Wage Coefficient	Wage Elasticity	Nonlabor Income Coefficient	Nonlabor Income Elasticity
1986	280.367	0.186	-4.045	-0.102
1988	-249.788	-0.164	-2.347	-0.067
1991	-74.575	-0.046	-4.008	-0.094
1994	-522.902	-0.324	-4.348	-0.122
1999	-1175.626	-0.703	-1.813	-0.065
2001	-716.000	-0.425	-2.163	-0.084

Source: Authors.

Appendix D

Descriptive Statistics for the Whole Sample and for Each Year

Table D1. Summary Statistics: Aggregate Data 1983 to 2000

Variable	Mean	Std. Dev.	Min	Max
age	40.99	7.88	30	60
atnonlinc*	42.81	26.61	-42	188
basiceduc	0.53	0.50	0	1
educ	13.21	2.43	1	21
fedrate**	22.85	8.17	-40	52
fedtax*	8.49	8.12	-4	102
feduccol	0.12	0.33	0	1
fica*	7.26	3.84	0	29
ficarate**	14.70	2.01	0	15
h	1258.59	878.10	0	4000
lfp	0.79	0.41	0	1
lkaw	0.11	0.31	0	1
lnatwage	1.44	0.92	-2	5
lnwage	1.90	1.11	-1	5
meduccol	0.08	0.27	0	1
meduchs	0.46	0.50	0	1
nkid1t6	0.34	0.65	0	4
nkid6t17	0.97	1.07	0	6
nonlinc*	47.07	27.07	0	150
northcen	0.30	0.46	0	1
northest	0.22	0.41	0	1
south	0.30	0.46	0	1
unemprate (%)	5.82	2.30	1	31
west	0.18	0.38	0	1
1920s	0.04	0.20	0	1
1930s	0.12	0.32	0	1
1940s	0.27	0.45	0	1
1950s	0.44	0.50	0	1
1960s	0.23	0.42	0	1
1970s	0.06	0.23	0	1

Source: Authors.
* Thousands of dollars.
** Effective imputed rate.

Variable definitions are in Appendix B.

Table D2. Summary Statistics by Year

1983				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.724	0.447	0.0	1.0
h	1062.365	879.284	0.0	3606.0
lnatwage	1.076	0.827	0.0	4.3
atnonlinc	23.632	15.911	0.1	107.0
age	40.994	8.715	30.0	60.0
educ	12.955	2.151	3.0	17.0
lkaw	0.052	0.221	0.0	1.0
nkid1t6	0.340	0.627	0.0	3.0
nkid6t17	0.927	1.001	0.0	4.0
northest	0.198	0.399	0.0	1.0
northcen	0.294	0.456	0.0	1.0
south	0.260	0.439	0.0	1.0
west	0.245	0.431	0.0	1.0
meduchs	0.469	0.499	0.0	1.0
educ	12.955	2.15128	3.0	17.0
meduccol	0.071	0.257	0.0	1.0
feduccol	0.118	0.323	0.0	1.0
fedtax	7298.255	7818.725	-500.0	89379.0
fica	4249.053	1979.896	0.0	9567.0
fedrate	25.725	9.373	0.0	44.0
ficarate	13.314	1.074	0.0	13.4

1984				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.732	0.443	0.0	1.0
h	1089.875	874.848	0.0	3232.0
lnatwage	1.070	0.796	0.0	3.4
atnonlinc	24.719	15.551	0.1	105.8
age	40.991	8.866	30.0	60.0
educ	12.937	2.215	3.0	17.0
lkaw	0.062	0.241	0.0	1.0
nkid1t6	0.353	0.659	0.0	3.0
nkid6t17	0.937	1.053	0.0	5.0
northest	0.246	0.431	0.0	1.0
northcen	0.304	0.460	0.0	1.0
south	0.318	0.466	0.0	1.0
west	0.129	0.335	0.0	1.0
meduchs	0.479	0.500	0.0	1.0
educ	12.937	2.215468	3.0	17.0
meduccol	0.070	0.255	0.0	1.0
feduccol	0.105	0.307	0.0	1.0
fedtax	7360.409	6847.630	-500.0	69550.0
fica	4726.790	2108.172	0.0	10584.0
fedrate	25.283	8.447	0.0	45.6
ficarate	13.918	1.067	0.0	14.0

1985				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.735	0.441	0.0	1.0
h	1085.957	872.566	0.0	3430.0
lnatwage	1.118	0.809	0.0	4.3
atnonlinc	25.625	15.924	0.1	103.2
age	40.753	8.764	30.0	60.0
educ	13.111	2.239	3.0	17.0
lkaw	0.068	0.251	0.0	1.0
nkid1t6	0.351	0.664	0.0	4.0
nkid6t17	0.967	1.045	0.0	5.0
northest	0.245	0.430	0.0	1.0
northcen	0.333	0.472	0.0	1.0
south	0.298	0.458	0.0	1.0
west	0.117	0.321	0.0	1.0
meduchs	0.487	0.500	0.0	1.0
educ	13.111	2.239062	3.0	17.0
meduccol	0.080	0.272	0.0	1.0
feduccol	0.106	0.308	0.0	1.0
fedtax	7606.915	7123.363	-512.0	59725.0
fica	4855.936	2306.297	0.0	11167.0
fedrate	24.854	9.113	0.0	45.9
ficarate	14.018	1.074	0.0	14.1

1986				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.768	0.423	0.0	1.0
h	1178.306	879.733	0.0	3568.0
lnatwage	1.211	0.809	0.0	3.3
atnonlinc	26.081	15.948	0.0	98.3
age	40.590	8.464	30.0	60.0
educ	13.336	2.361	5.0	21.0
lkaw	0.094	0.292	0.0	1.0
nkid1t6	0.370	0.695	0.0	4.0
nkid6t17	0.941	1.039	0.0	5.0
northest	0.184	0.388	0.0	1.0
northcen	0.345	0.476	0.0	1.0
south	0.271	0.445	0.0	1.0
west	0.197	0.398	0.0	1.0
meduchs	0.516	0.500	0.0	1.0
educ	13.336	2.361062	5.0	21.0
meduccol	0.092	0.289	0.0	1.0
feduccol	0.137	0.344	0.0	1.0
fedtax	7900.812	7289.652	0.0	66679.0
fica	5274.962	2503.109	0.0	12012.0
fedrate	24.536	9.685	-10.0	46.8
ficarate	14.199	1.196	0.0	14.3

1987				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.779	0.415	0.0	1.0
h	1222.205	878.525	0.0	3556.0
lnatwage	1.296	0.852	0.0	4.1
atnonlinc	29.125	17.366	0.4	108.8
age	40.606	8.159	30.0	60.0
educ	13.271	2.207	5.0	17.0
lkaw	0.143	0.350	0.0	1.0
nkid1t6	0.353	0.668	0.0	3.0
nkid6t17	0.960	1.041	0.0	5.0
northest	0.237	0.426	0.0	1.0
northcen	0.355	0.479	0.0	1.0
south	0.220	0.414	0.0	1.0
west	0.185	0.389	0.0	1.0
meduchs	0.525	0.500	0.0	1.0
educ	13.271	2.207335	5.0	17.0
meduccol	0.093	0.291	0.0	1.0
feduccol	0.132	0.339	0.0	1.0
fedtax	7566.868	7335.532	-820.0	45584.0
fica	5741.359	2522.265	0.0	12526.0
fedrate	24.018	9.323	0.0	39.3
ficarate	14.161	1.406	0.0	14.3

1988				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.794	0.405	0.0	1.0
h	1219.559	873.583	0.0	3710.0
lnatwage	1.331	0.879	0.0	4.0
atnonlinc	43.437	21.652	0.3	138.8
age	40.853	8.145	30.0	60.0
educ	13.391	2.388	5.0	21.0
lkaw	0.136	0.343	0.0	1.0
nkid1t6	0.330	0.634	0.0	3.0
nkid6t17	0.933	1.068	0.0	5.0
northest	0.298	0.457	0.0	1.0
northcen	0.262	0.440	0.0	1.0
south	0.248	0.432	0.0	1.0
west	0.189	0.392	0.0	1.0
meduchs	0.532	0.499	0.0	1.0
educ	13.391	2.388409	5.0	21.0
meduccol	0.095	0.293	0.0	1.0
feduccol	0.131	0.337	0.0	1.0
fedtax	7285.477	6882.240	-874.0	44859.0
fica	6124.515	2809.093	0.0	13517.0
fedrate	22.043	8.031	0.0	33.0
ficarate	14.872	1.486	0.0	15.0

1989				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.815	0.389	0.0	1.0
h	1233.151	846.065	0.0	3840.0
lnatwage	1.448	0.886	0.0	4.0
atnonlinc	30.665	18.906	0.4	106.1
age	40.232	7.821	30.0	60.0
educ	13.378	2.173	5.0	17.0
lkaw	0.100	0.300	0.0	1.0
nkid1t6	0.337	0.643	0.0	3.0
nkid6t17	0.969	1.057	0.0	5.0
northest	0.298	0.458	0.0	1.0
northcen	0.287	0.453	0.0	1.0
south	0.242	0.429	0.0	1.0
west	0.167	0.374	0.0	1.0
meduchs	0.555	0.497	0.0	1.0
educ	13.378	2.17266	5.0	17.0
meduccol	0.097	0.297	0.0	1.0
feduccol	0.135	0.342	0.0	1.0
fedtax	7636.119	7310.315	-910.0	52912.0
fica	6376.342	3005.572	0.0	14419.0
fedrate	22.213	7.994	0.0	33.0
ficarate	11.791	6.174	0.0	15.0

1990				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.773	0.419	0.0	1.0
h	1236.875	896.367	0.0	4000.0
lnatwage	1.323	0.876	0.0	3.8
atnonlinc	48.632	30.283	0.1	188.3
age	41.008	8.147	30.0	60.0
educ	12.552	3.153	1.0	21.0
lkaw	0.122	0.327	0.0	1.0
nkid1t6	0.344	0.645	0.0	3.0
nkid6t17	1.020	1.129	0.0	6.0
northest	0.172	0.378	0.0	1.0
northcen	0.250	0.433	0.0	1.0
south	0.363	0.481	0.0	1.0
west	0.214	0.410	0.0	1.0
meduchs	0.460	0.499	0.0	1.0
educ	12.552	3.152642	1.0	21.0
meduccol	0.078	0.268	0.0	1.0
feduccol	0.119	0.324	0.0	1.0
fedtax	6562.172	6824.522	-953.0	57074.0
fica	6193.675	3238.133	0.0	15697.0
fedrate	20.576	7.964	0.0	33.0
ficarate	15.204	1.211	0.0	15.3

1991				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.809	0.393	0.0	1.0
h	1308.296	879.471	0.0	3984.0
lnatwage	1.458	0.888	0.0	4.4
atnonlinc	29.005	19.692	-42.1	108.6
age	40.898	8.045	30.0	60.0
educ	12.964	2.707	5.0	21.0
lkaw	0.107	0.309	0.0	1.0
nkid1t6	0.323	0.638	0.0	4.0
nkid6t17	0.972	1.083	0.0	6.0
northest	0.189	0.392	0.0	1.0
northcen	0.260	0.439	0.0	1.0
south	0.349	0.477	0.0	1.0
west	0.199	0.399	0.0	1.0
meduchs	0.492	0.500	0.0	1.0
educ	12.964	2.707448	5.0	21.0
meduccol	0.086	0.280	0.0	1.0
feduccol	0.131	0.338	0.0	1.0
fedtax	6664.983	6929.807	-1235.0	61549.0
fica	6789.175	3553.104	0.0	19080.0
fedrate	20.303	8.182	0.0	36.7
ficarate	15.193	1.147	2.9	15.3

1992				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.769	0.421	0.0	1.0
h	1225.528	898.435	0.0	3765.0
lnatwage	1.463	0.981	0.0	4.5
atnonlinc	46.672	24.445	0.4	166.4
age	40.901	7.741	30.0	60.0
educ	12.845	2.999	1.0	21.0
lkaw	0.113	0.316	0.0	1.0
nkid1t6	0.360	0.662	0.0	4.0
nkid6t17	1.033	1.112	0.0	6.0
northest	0.190	0.392	0.0	1.0
northcen	0.260	0.439	0.0	1.0
south	0.346	0.476	0.0	1.0
west	0.205	0.404	0.0	1.0
meduchs	0.501	0.500	0.0	1.0
educ	12.845	2.999375	1.0	21.0
meduccol	0.090	0.287	0.0	1.0
feduccol	0.135	0.342	0.0	1.0
fedtax	7901.779	7793.148	-1384.0	72696.0
fica	7476.242	3623.971	15.0	20491.0
fedrate	21.196	7.487	0.0	31.9
ficarate	15.177	1.227	2.9	15.3

1993				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.806	0.396	0.0	1.0
h	1301.162	864.112	0.0	3854.0
lnatwage	1.583	0.940	0.0	4.3
atnonlinc	49.360	23.133	0.7	143.2
age	40.098	6.949	30.0	60.0
educ	13.472	2.171	5.0	21.0
lkaw	0.106	0.308	0.0	1.0
whkidt6	0.268	0.443	0.0	1.0
nkid0t17	1.389	1.180	0.0	5.0
northest	0.200	0.400	0.0	1.0
northcen	0.313	0.464	0.0	1.0
south	0.297	0.457	0.0	1.0
west	0.191	0.393	0.0	1.0
meduchs	0.600	0.490	0.0	1.0
educ	13.472	2.170649	5.0	21.0
meduccol	0.104	0.305	0.0	1.0
feduccol	0.164	0.370	0.0	1.0
fedtax	9660.294	8915.409	-1511.0	60373.0
fica	8310.889	3468.592	76.0	20084.0
fedrate	22.941	7.290	0.0	44.1
ficarate	15.180	1.217	2.9	15.3

1994				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lfp	0.836	0.371	0.0	1.0
h	1337.704	838.554	0.0	3822.0
lnatwage	1.615	0.919	-0.4	4.6
atnonlinc	58.000	27.828	1.3	146.7
age	40.303	7.195	30.0	60.0
educ	13.417	2.083	5.0	18.0
lkaw	0.096	0.294	0.0	1.0
whkidt6	0.256	0.436	0.0	1.0
nkid0t17	1.356	1.194	0.0	6.0
northest	0.193	0.395	0.0	1.0
northcen	0.334	0.472	0.0	1.0
south	0.284	0.451	0.0	1.0
west	0.157	0.364	0.0	1.0
meduchs	0.589	0.492	0.0	1.0
educ	13.417	2.083379	5.0	18.0
meduccol	0.116	0.320	0.0	1.0
feduccol	0.169	0.375	0.0	1.0
fedtax	9378.040	8000.635	-2528.0	59926.0
fica	8575.335	3607.615	687.0	20829.0
fedrate	22.851	6.948	0.0	44.2
ficarate	15.204	1.085	2.9	15.3

1995				
Variable	Mean	Std. Dev.	Min	Max
lfp	0.812	0.391	0.0	1.0
h	1318.374	850.871	0.0	3950.0
lnatwage	1.558	0.922	0.0	4.1
atnonlinc	50.846	24.644	0.6	161.7
age	40.584	7.180	30.0	60.0
educ	13.331	2.052	5.0	17.0
lkaw	0.119	0.324	0.0	1.0
whkidt6	0.255	0.436	0.0	1.0
nkid0t17	1.320	1.182	0.0	6.0
northest	0.209	0.407	0.0	1.0
northcen	0.330	0.470	0.0	1.0
south	0.287	0.452	0.0	1.0
west	0.174	0.379	0.0	1.0
meduchs	0.010	0.100	0.0	1.0
educ	13.331	2.051748	5.0	17.0
meduccol	0.002	0.041	0.0	1.0
feduccol	0.005	0.071	0.0	1.0
fedtax	9755.809	9189.152	-2968.0	62655.0
fica	8573.605	3845.917	260.0	21122.0
fedrate	22.951	7.295	0.0	42.6
ficarate	15.205	1.080	2.9	15.3

1996				
Variable	Mean	Std. Dev.	Min	Max
lfp	0.813	0.390	0.0	1.0
h	1327.015	880.307	0.0	3920.0
lnatwage	1.605	0.944	0.0	4.3
atnonlinc	52.319	24.701	1.5	152.0
age	40.853	7.356	30.0	60.0
educ	13.429	2.118	5.0	17.0
lkaw	0.122	0.327	0.0	1.0
whkidt6	0.246	0.431	0.0	1.0
nkid0t17	1.258	1.161	0.0	6.0
northest	0.210	0.407	0.0	1.0
northcen	0.315	0.465	0.0	1.0
south	0.300	0.458	0.0	1.0
west	0.176	0.381	0.0	1.0
meduchs	0.013	0.115	0.0	1.0
educ	13.429	2.117656	5.0	17.0
meduccol	0.005	0.071	0.0	1.0
feduccol	0.008	0.087	0.0	1.0
fedtax	10238.230	9111.899	-3556.0	58243.0
fica	8909.821	3905.548	91.0	21349.0
fedrate	23.330	7.355	0.0	41.9
ficarate	15.23737	0.8793717	2.9	15.3

1998				
Variable	Mean	Std. Dev.	Min	Max
lfp	0.842	0.365	0.0	1.0
h	1407.417	855.874	0.0	3904.0
lnatwage	1.721	0.923	-0.2	3.6
atnonlinc	60.828	26.847	6.4	164.8
age	42.372	7.035	30.0	60.0
educ	13.634	2.052	5.0	17.0
lkaw	0.135	0.342	0.0	1.0
whkidt6	0.214	0.410	0.0	1.0
nkid0t17	1.204	1.141	0.0	6.0
northest	0.191	0.394	0.0	1.0
northcen	0.359	0.480	0.0	1.0
south	0.283	0.451	0.0	1.0
west	0.164	0.371	0.0	1.0
meduchs	0.690	0.463	0.0	1.0
educ	13.634	2.052219	5.0	17.0
meduccol	0.092	0.289	0.0	1.0
feduccol	0.134	0.341	0.0	1.0
fedtax	10619.130	8498.126	-3756.0	66801.0
fica	10064.530	4083.007	0.0	22473.0
fedrate	23.151	8.041	-40.0	39.2
ficarate	15.210	1.052	2.9	15.3

2000				
Variable	Mean	Std. Dev.	Min	Max
lfp	0.838	0.369	0.0	1.0
h	1413.684	869.846	0.0	4000.0
lnatwage	1.809	0.964	-1.5	4.1
atnonlinc	64.527	28.209	7.5	167.6
age	43.265	7.248	30.0	60.0
educ	13.723	2.051	8.0	17.0
lkaw	0.130	0.336	0.0	1.0
whkidt6	0.184	0.387	0.0	1.0
nkid0t17	1.137	1.144	0.0	7.0
northest	0.195	0.397	0.0	1.0
northcen	0.345	0.476	0.0	1.0
south	0.278	0.448	0.0	1.0
west	0.180	0.384	0.0	1.0
meduchs	0.679	0.467	0.0	1.0
educ	13.723	2.051424	8.0	17.0
meduccol	0.104	0.306	0.0	1.0
feduccol	0.141	0.349	0.0	1.0
fedtax	11969.060	10005.250	-3888.0	101645.0
fica	10946.590	4656.959	918.0	28612.0
fedrate	23.976	6.879	0.0	51.8
ficarate	15.117	1.495	2.9	15.3

Appendix E

Reduced-Form Estimation

This appendix presents reduced-form estimates for the difference-in-differences approach. The first row in each table shows the group effect, defined by cohort and education level, while the first column illustrates the time effect. Each cell represents the interaction effect of the corresponding group and year. Some of cells are empty because of multicollinearity or because the number of observations in those cells is too small (i.e. less than 45). The base year is 1983. Demographic variables such as health, parents' education, regional dummies, children dummy variables, and local unemployment rates are included in each reduced-form estimation. Tables E1 to E3 display results for all years and all cohort groups. Estimation results for subsamples (1983-1989 only, 1990-2000 only, younger cohorts only, and older cohorts only) will be provided upon request.

The strength of the instruments is a relevant question here. The problem of weak instruments has been treated in theoretical and empirical work, including the well-known Angrist and Krueger (1991) study of the returns to schooling using quarter of birth as an instrument (the problem of their instruments was raised by Bound, et al. (1996)). Standard asymptotic theory can be misleading when the instruments are weak as pointed by Nelson and Startz (1990a, b) and Staiger and Stock (1997) among others.

The results presented here suggest that all of the first-stage estimations are statistically valid. All of the regressions show high R^2 values of over 80 percent, much greater than the guideline commonly used, as suggested by Staiger and Stock (1997).

Table E1. Estimates of the Reduced-Form Wage Equation

	Time Effects	Up to High School <1940	Up to High School 1940-1949	Up to High School 1950-1959	Up to High School 1960+	More than High School <1940	More than High School 1940-1949	More than High School 1950-1959	More than High School 1960+
Group Effects		1.439	1.510	1.439	1.340	1.661	1.686	1.676	1.642
		0.054	*0.064*	*0.080*	*0.132*	*0.065*	*0.062*	*0.081*	*0.190*
year=84	0.079	-0.148	-0.140	-	-	-0.143	-0.048	-0.138	-
	0.094	*0.116*	*0.120*	-	-	*0.133*	*0.122*	*0.134*	-
year=85	-0.025	0.004	0.100	0.071	-	-0.023	0.045	-	-
	0.093	*0.119*	*0.123*	*0.132*	-	*0.134*	*0.121*	-	-
year=86	-0.018	0.150	0.066	0.120	-	0.038	0.176	-	-
	0.089	*0.116*	*0.118*	*0.126*	-	*0.133*	*0.117*	-	-
year=87	0.162	0.027	-0.090	0.043	-	-	-0.011	-0.029	-
	0.101	*0.124*	*0.128*	*0.135*	-	-	*0.119*	*0.134*	-
year=88	0.239	-0.130	-0.159	-0.141	-	-	-	-0.078	-
	0.067	*0.102*	*0.104*	*0.110*	-	-	-	*0.110*	-
year=89	0.313	-0.121	-0.180	-0.113	-	-	0.040	-0.055	-
	0.131	*0.155*	*0.155*	*0.158*	-	-	*0.146*	*0.157*	-
year=90	0.110	0.065	0.052	0.090	-	0.106	0.220	0.145	-
	0.161	*0.166*	*0.176*	*0.180*	-	*0.185*	*0.174*	*0.181*	-
year=91	0.514	-0.325	-0.247	-0.247	-0.369	-	-0.112	-0.143	-0.182
	0.105	*0.124*	*0.127*	*0.133*	*0.174*	-	*0.120*	*0.133*	*0.219*
year=92	0.612	-0.335	-0.219	-0.222	-0.191	-	-0.124	-0.205	-0.172
	0.116	*0.137*	*0.136*	*0.142*	*0.177*	-	*0.129*	*0.142*	*0.222*
year=93	0.400	-	0.002	0.047	-	-	0.064	0.093	0.102
	0.109	-	*0.136*	*0.139*	-	-	*0.132*	*0.139*	*0.164*
year=94	0.362	-	0.003	0.087	-0.061	-	0.126	0.096	0.075
	0.114	-	*0.140*	*0.143*	*0.172*	-	*0.137*	*0.142*	*0.218*
year=95	0.395	-	-0.025	0.061	0.033	-	0.109	0.142	0.228
	0.109	-	*0.135*	*0.138*	*0.165*	-	*0.132*	*0.138*	*0.213*
year=96	0.477	-	-0.113	-0.009	0.069	-	0.065	0.115	0.162
	0.132	-	*0.157*	*0.157*	*0.181*	-	*0.150*	*0.157*	*0.225*
year=98	1.172	-	-0.840	-0.663	-0.644	-	-0.696	-0.639	-0.629
	0.560	-	*0.567*	*0.567*	*0.573*	-	*0.566*	*0.566*	*0.589*
year=00	0.583	-	-0.025	-	0.031	-	0.037	0.066	0.031
	0.088	-	*0.133*	-	*0.163*	-	*0.121*	*0.122*	*0.211*
health	-0.093								
	0.017								

Other Coefficients

Regional Dummies		Parents' Education	
northest	0.074	meduchs	0.051
	0.016		*0.014*
northcen	-0.090	feduchs	0.055
	0.015		*0.013*
south	-0.043	meduccol	0.088
	0.015		*0.023*
unemprate	-0.008	feduccol	0.121
	0.003		*0.020*
Youngest Child <6	-0.031		
	0.016		
Youngest Child 6-17	-0.099		
	0.013		

Source: Authors.

Notes: The adjusted R-squared is 0.916.

Missing cells are due to multicollinearity and a small number of observations (< 45).

Table E2. Estimates of the Reduced-Form for Non-Labor Income

		Up to High School				More than High School			
	Time Effects	<1940	1940-1949	1950-1959	1960+	<1940	1940-1949	1950-1959	1960+
Group Effects		26.083	19.804	17.255	14.839	28.087	22.566	16.792	29.713
		1.776	*2.125*	*2.672*	*4.428*	*2.268*	*2.158*	*2.656*	*6.483*
year=84	-0.183	0.204	3.875	-	-	1.009	0.498	1.194	-
	3.138	*3.820*	*4.019*			*4.606*	*4.194*	*4.436*	
year=85	2.691	-0.588	0.996	-2.103	-	-0.522	-2.148	-	-
	3.050	*3.830*	*4.055*	*4.370*		*4.568*	*4.099*		
year=86	3.785	-3.074	-0.083	-2.228	-	-0.783	-2.294	-	-
	2.941	*3.778*	*3.949*	*4.228*		*4.546*	*3.985*		
year=87	5.775	-1.556	3.184	-3.643	-	-	0.600	0.587	-
	3.550	*4.162*	*4.408*	*4.644*			*4.203*	*4.574*	
year=88	23.953	-10.785	-2.656	-9.871	-	-	-	-1.118	-
	2.358	*3.395*	*3.559*	*3.803*				*3.716*	
year=89	8.591	-4.304	1.282	-4.603	-	-	0.720	-1.030	-
	4.519	*5.212*	*5.322*	*5.410*			*5.083*	*5.333*	
year=90	16.202	0.109	12.498	4.443	-	12.882	19.759	18.972	-
	5.308	*5.415*	*5.799*	*5.979*		*6.176*	*5.817*	*5.975*	
year=91	5.917	-1.715	5.477	0.016	-0.164	-	3.938	4.032	-13.957
	3.743	*4.265*	*4.439*	*4.643*	*5.960*		*4.269*	*4.624*	*7.594*
year=92	29.681	-16.238	-2.889	-7.983	-10.579	-	4.300	3.572	-17.214
	3.944	*4.531*	*4.610*	*4.810*	*5.922*		*4.456*	*4.794*	*7.583*
year=93	19.123	-	10.012	5.762	-	-	11.178	15.883	-6.373
	3.579		*4.507*	*4.611*			*4.471*	*4.573*	*5.701*
year=94	27.033	-	11.251	6.590	1.571	-	12.587	14.889	-3.569
	3.647		*4.616*	*4.682*	*5.693*		*4.577*	*4.639*	*7.357*
year=95	16.882	-	13.168	14.240	7.499	-	23.428	25.642	7.043
	3.463		*4.385*	*4.476*	*5.439*		*4.371*	*4.451*	*7.176*
year=96	14.140	-	14.070	19.701	14.562	-	22.795	29.579	13.344
	3.907		*4.759*	*4.838*	*5.704*		*4.704*	*4.817*	*7.375*
year=98	18.861	-	18.890	17.531	7.967	-	23.355	28.082	8.356
	15.514		*15.819*	*15.797*	*16.062*		*15.782*	*15.772*	*16.724*
year=00	38.321	-	0.678	-	-6.739	-	6.560	13.076	-8.319
	3.016		*4.483*		*5.496*		*4.198*	*4.119*	*7.197*
health	-3.798								
	0.558								

Other Coefficients

Regional Dummies		Parents' Education	
northest	5.425	meduchs	2.547
	0.554		*0.484*
northcen	0.298	feduchs	3.638
	0.518		*0.473*
south	-2.122	meduccol	5.126
	0.517		*0.827*
		feduccol	7.109
unemprate	-0.489		*0.703*
	0.087		
Youngest Child <6	1.902		
	0.557		
Youngest Child 6-17	1.789		
	0.457		

Source: Authors.

Notes: The adjusted R-squared is 0.916.

Missing cells are due to multicollinearity and a small number of observations (< 45).

Table E3. Estimates of the Reduced-Form of the Participation Probit

	Time Effects	Up to High School <1940	Up to High School 1940-1949	Up to High School 1950-1959	Up to High School 1960+	More than High School <1940	More than High School 1940-1949	More than High School 1950-1959	More than High School 1960+
Group Effects		0.617	0.851	1.050	1.187	1.114	1.232	0.996	1.904
		0.109	*0.132*	*0.168*	*0.277*	*0.152*	*0.144*	*0.164*	*0.435*
year=84	-0.002	-0.105	0.101	-	-	-0.016	0.005	0.058	-
	0.196	*0.235*	*0.250*			*0.303*	*0.273*	*0.274*	
year=85	0.058	-0.233	-0.042	-0.116	-	-0.140	0.058	-	-
	0.187	*0.233*	*0.250*	*0.271*		*0.295*	*0.268*		
year=86	0.348	-0.409	-0.183	-0.182	-	-0.476	-0.364	-	-
	0.185	*0.233*	*0.249*	*0.268*		*0.295*	*0.261*		
year=87	-0.171	0.011	0.307	0.412	-	-	0.243	0.364	-
	0.232	*0.265*	*0.285*	*0.302*			*0.283*	*0.294*	
year=88	-0.029	-0.023	0.093	0.384	-	-	-	0.295	-
	0.160	*0.216*	*0.231*	*0.253*				*0.241*	
year=89	-0.336	0.210	0.460	0.480	-	-	0.652	0.684	-
	0.289	*0.327*	*0.340*	*0.345*			*0.345*	*0.340*	
year=90	-0.241	0.094	0.194	0.429	-	-0.073	0.140	0.658	-
	0.326	*0.331*	*0.357*	*0.370*		*0.384*	*0.365*	*0.369*	
year=91	0.040	-0.043	0.004	0.276	-0.133	-	0.020	0.416	-0.384
	0.255	*0.281*	*0.295*	*0.309*	*0.384*		*0.293*	*0.307*	*0.518*
year=92	-0.273	0.161	0.278	0.458	-0.062	-	0.273	0.584	-0.209
	0.253	*0.284*	*0.293*	*0.307*	*0.372*		*0.291*	*0.305*	*0.504*
year=93	0.006	-	0.072	0.133	-	-	0.049	0.258	-0.642
	0.218		*0.278*	*0.286*			*0.289*	*0.282*	*0.394*
year=94	-0.130	-	0.392	0.292	0.214	-	0.155	0.651	-0.525
	0.220		*0.288*	*0.290*	*0.355*		*0.296*	*0.290*	*0.484*
year=95	-0.170	-	0.246	0.314	0.246	-	0.248	0.535	-0.342
	0.207		*0.267*	*0.274*	*0.336*		*0.280*	*0.272*	*0.473*
year=96	-0.365	-	0.107	0.482	0.504	-	0.500	0.845	-0.071
	0.237		*0.288*	*0.298*	*0.354*		*0.304*	*0.298*	*0.485*
year=98	-0.390	-	0.365	0.781	0.395	-	0.413	0.897	-0.291
	0.931		*0.951*	*0.953*	*0.968*		*0.954*	*0.950*	*1.022*
year=00	0.144	-	-0.299	-	-0.138	-	-0.297	0.201	-0.883
	0.197		*0.284*		*0.351*		*0.281*	*0.269*	*0.480*
health	-0.442								
	0.035								

Other Coefficients

Regional Dummies		Parents' Education	
northest	0.037	meduchs	0.081
	0.037		*0.032*
northcen	0.105	feduchs	0.029
	0.035		*0.032*
south	0.033	meduccol	0.048
	0.034		*0.057*
unemprate	-0.029	feduccol	0.040
	0.006		*0.048*
Youngest Child <6	-0.526		
	0.038		
Youngest Child 6-17	-0.067		
	0.032		

Source: Authors.

Notes: The adjusted R-squared is 0.916.

Missing cells are due to multicollinearity and a small number of observations (< 45).

Appendix F

Computation of the Standard Errors

The model we consider for the two-step method and difference-in-difference estimation has the form:

$$y_i = x_i'\beta + \sum_{k=1}^{K} \delta_k \hat{z}_i^k + \upsilon_i ,$$

where i denotes individuals (with the sample size n), x_i contains all the regressors of the model including the time and the group dummies for the difference-in-difference estimation, and $\hat{z}_i = (\hat{z}_i^1 \quad \dots \quad \hat{z}_i^K)'$ is the vector of estimated residuals and/or the inverse Mill's ratio used as correction terms. Let the *k*-th estimated correction term be defined as $\hat{z}_i^k = s_k(m_i^k{}'\hat{\gamma}_k)$ for a smooth function of $s_k(\cdot)$ and $\hat{\gamma}_k$ be the $q_k \times 1$ vector of coefficients in the *k*-th reduced form. Finally, denote $\hat{Q}_i = (x_i' \quad \hat{z}_i')'$ and $Q_i = (x_i' \quad z_i')'$, where z_i represents the residuals evaluated at the true parameter estimates, thus we can write $z_i^k = s_k(m_i^k{}'\gamma_k)$.

Here we assume:

Assumption F1: $\dfrac{n}{n_k} \rightarrow p_k$ with $0 < p_k < 1$ as $n_k \rightarrow \infty$ and $n \rightarrow \infty$ for $k = 1, \dots, K$.

Assumption F2:

$$p\lim_{n\to\infty} \frac{1}{n}\sum_{i=1}^{n} \hat{Q}_i\hat{Q}_i' = p\lim_{n\to\infty} \frac{1}{n}\sum_{i=1}^{n} Q_iQ_i' \text{ and } p\lim_{n\to\infty} \frac{1}{n}\sum_{i=1}^{n} \hat{Q}_i\hat{\Gamma}_i^k{}' = p\lim_{n\to\infty} \frac{1}{n}\sum_{i=1}^{n} Q_i\Gamma_i^k{}',\ k = 1, \dots, K .$$

Assumption F3: $p\lim_{n\to\infty} \frac{1}{n}\sum_{i=1}^{n} \hat{\upsilon}_i^2 \hat{Q}_i\hat{Q}_i' = E\left[\upsilon_i^2 Q_iQ_i'\right]$ and $E\left(\left\|\upsilon_i Q_i\right\|^2\right) < \infty$.

Assumption F4: $\sqrt{n_k}(\hat{\gamma}_k - \gamma_k) \xrightarrow{d} N(0, \Omega_k)$ and $\hat{\Omega}_k = \Omega_k + o_p(1)$, where $\hat{\Gamma}_i^k$ (Γ_i^k) denotes the derivative of $s_k(m_i^k{}'\hat{\gamma}_k)$ ($s_k(m_i^k{}'\gamma_k)$) with respect to γ_k , respectively.

Assumption F1 is clearly satisfied in our model. Assumption F2 through F4 can be justified under some regularity conditions as usual. Now let $\hat{Q}$ represent the entire sample for the x and $\hat{z}$ variables and define $\hat{\Gamma}^k$ to be the $n \times q_k$ matrix whose *i*-th row is given by the derivative of $s_k(m_i^k{}'\hat{\gamma}_k)$ with respect to $\gamma_k{}'$. Finally, let $\theta = (\beta' \quad \delta_1 \quad \ldots \quad \delta_K)'$ and then given Assumptions F1-F4, we can estimate the asymptotic covariance of $\hat{\theta}$ as:

$$V(\hat{\theta}) = (\hat{Q}'\hat{Q})^{-1} \left[\sum_{i=1}^{n} \hat{\upsilon}_i^2 \hat{Q}_i \hat{Q}_i{}' + \sum_{k=1}^{K} \hat{\delta}_k^2 \hat{Q}'\hat{\Gamma}^k \frac{\hat{\Omega}_k}{n_k} \hat{\Gamma}^k{}'\hat{Q} \right] (\hat{Q}'\hat{Q})^{-1}, \qquad \text{(FE1)}$$

where $\dfrac{\hat{\Omega}_k}{n_k}$ is the asymptotic variance of $\hat{\gamma}_k$.

Here, we note that the covariance matrix is robust to possible heteroskedasticity and corrects for the effects of estimated correction terms. In this formula, we ignore the covariance of the reduced form coefficients $\hat{\gamma}_k$ across the $k = 1, \ldots, K$ reduced forms, for computational simplicity, as Blundell et al. (1998) did. We also note that if the absolute values of $\hat{\delta}_k$'s are small, then the usual standard errors formula without correction will give us very similar results with the corrected standard errors based on (FE1).

Practically we can decompose (FE1) into two parts:

$$V_1(\hat{\theta}) = (\hat{Q}'\hat{Q})^{-1}\left[\sum_{i=1}^{n}\hat{\upsilon}_i^2\hat{Q}_i\hat{Q}_i'\right](\hat{Q}'\hat{Q})^{-1} \text{ and}$$

$$V_2(\hat{\theta}) = (\hat{Q}'\hat{Q})^{-1}\left[\sum_{k=1}^{K}\hat{\delta}_k^2\hat{Q}'\hat{\Gamma}^k\frac{\hat{\Omega}_k}{n_k}\hat{\Gamma}^k{}'\hat{Q}\right](\hat{Q}'\hat{Q})^{-1}.$$

$V_1(\hat{\theta})$ is the covariance matrix that one will obtain using "robust" option in STATA. $V_2(\hat{\theta})$ requires a separate STATA programming, which could be cumbersome. Thanks to Hardin (2002) we can overcome this computational burden. The authors would like to thank James W. Hardin for providing us a copy of his paper, Hardin (2002).

Table F1 illustrates how much a usual inference without correction for the estimated residuals and estimated inverse Mill's ratio underestimates the standard errors. For comparison, we present three alternative standard errors for the models considered in Table 9; under homoskedasticity assumption (HOM S.E.), heteroskedasticity robust ones (HET S.E.), and two-step estimation robust ones (TSE S.E.) based on (FE1). For example, in the subsample estimation of 1983-1989, standard errors of wage effects are underestimated around 4 percent under the homoskedasticity assumption without correction, if compared to the corrected ones; while in the subsample of 1990-2000, standard errors of wage effects are underestimated around 14 percent.

Table F1. Comparison of Standard Errors

	1983-1989				1990-2000				1983-2000				Older Cohorts (30s, 40s)				Younger Cohorts (50s, 60s)			
	COEF.	HOM S.E.	HET S.E.	TSE S.E.	COEF.	HOM S.E.	HET S.E.	TSE S.E.	COEF.	HOM S.E.	HET S.E.	TSE S.E.	COEF.	HOM S.E.	HET S.E.	TSE S.E.	COEF.	HOM S.E.	HET S.E.	TSE S.E.
Group Dummies																				
1940s and Basic Educ	60.540	60.243	61.376	63.498	121.343	47.663	51.490	55.624	54.905	35.051	35.966	38.724	166.096	48.020	48.368	50.400	-	-	-	-
1950s and Basic Educ	-14.273	92.864	95.379	98.532	138.588	62.458	66.234	71.505	41.578	50.221	51.909	55.670	-	-	-	-	-	-	-	-
1960s+ and Basic Educ	-	-	-	-	-12.547	65.854	70.644	76.209	-88.439	57.364	60.235	64.547	-	-	-	-	-161.987	29.977	30.512	52.942
<1940 and Higher Educ	15.827	72.548	74.200	76.755	185.069	80.634	84.566	91.817	49.235	49.352	50.844	54.784	112.105	68.355	69.173	72.146	-	-	-	-
1940s and Higher Educ	-31.451	100.042	99.749	103.332	161.529	71.248	74.359	80.562	31.273	55.211	55.924	60.229	133.329	86.405	85.663	89.365	-	-	-	-
1950s and Higher Educ	-57.189	103.072	104.091	107.693	183.692	75.997	79.194	85.794	42.252	57.804	59.019	63.482	-	-	-	-	51.134	31.499	30.582	51.718
1960s+ and Higher Educ	-	-	-	-	195.416	79.905	83.936	90.852	82.322	64.869	66.479	71.475	-	-	-	-	74.347	38.543	38.334	57.760
Time Dummies																				
year=84	48.256	41.037	41.040	42.573	-	-	-	-	26.619	40.389	41.166	44.521	47.807	47.190	48.750	50.873	49.585	78.008	78.168	85.286
year=85	49.038	41.982	42.263	43.811	-	-	-	-	29.860	41.049	41.740	45.136	25.606	48.540	49.775	51.957	66.370	76.915	77.610	84.569
year=86	93.105	41.867	41.843	43.379	-	-	-	-	79.958	40.390	41.241	44.543	57.319	49.384	50.301	52.531	144.757	75.353	76.817	83.498
year=87	158.879	46.195	45.379	47.106	-	-	-	-	138.261	41.407	41.765	45.173	120.721	51.322	50.227	52.607	221.736	76.187	78.220	84.866
year=88	357.757	84.628	85.886	88.940	-	-	-	-	197.588	47.121	48.951	52.718	179.669	63.315	65.055	67.879	288.464	80.299	82.393	89.409
year=89	128.995	53.047	52.536	54.517	-	-	-	-	111.329	44.468	44.775	48.404	77.315	59.530	59.751	62.419	211.104	77.588	77.930	84.876
year=90	-	-	-	-	-	-	-	-	317.372	50.273	51.344	55.427	217.501	73.190	74.599	77.828	439.205	81.946	82.439	89.855
year=91	-	-	-	-	-98.543	56.198	57.734	62.786	205.487	41.967	42.419	45.858	125.360	56.453	57.958	60.468	322.787	75.352	75.684	82.366
year=92	-	-	-	-	37.915	34.936	35.909	39.067	342.481	48.075	49.553	53.416	202.281	68.496	71.056	74.064	467.767	79.233	80.670	87.699
year=93	-	-	-	-	80.191	39.847	40.042	43.707	380.766	51.795	52.599	56.812	266.549	73.577	72.733	76.104	521.840	83.447	84.871	92.273
year=94	-	-	-	-	91.215	34.285	34.392	37.556	391.618	58.351	59.633	64.333	314.023	84.671	85.362	89.168	530.595	91.143	92.195	100.363
year=95	-	-	-	-	89.989	34.028	33.103	36.322	393.120	52.328	53.126	57.388	257.614	74.973	74.248	77.697	541.478	84.238	85.248	92.785
year=96	-	-	-	-	110.404	35.794	36.015	39.300	408.986	53.938	54.845	59.214	117.675	78.194	79.506	82.931	593.868	87.132	87.768	95.606
year=98	-	-	-	-	189.639	38.265	37.998	41.513	480.836	61.647	62.617	67.582	359.739	95.666	94.835	99.175	643.581	95.038	96.101	104.536
year=00	-	-	-	-	257.312	42.882	43.152	47.085	541.940	65.638	66.769	72.051	218.169	104.227	107.942	112.479	727.828	98.659	99.690	108.476
Children and Health																				
Youngest Child 0-6	-163.212	115.569	135.008	136.534	-73.202	70.686	84.242	85.713	-161.608	58.819	69.238	70.664	-272.150	137.666	182.110	183.272	-264.322	80.810	92.952	94.864
Youngest Child 6-17	-8.864	80.020	94.015	94.637	-205.468	60.010	70.087	70.955	-139.720	45.575	53.205	53.889	-73.802	61.834	73.199	73.662	-245.868	73.114	84.007	85.032
Health	-121.163	49.063	52.282	53.926	-137.373	34.454	36.239	39.292	-118.118	28.977	30.579	32.811	-219.407	50.146	50.986	53.081	-175.524	37.752	40.026	43.175
Wage Effects																				
No Children	138.297	173.441	174.018	180.280	-294.739	113.207	119.350	129.135	-205.731	87.992	91.269	98.004	198.578	126.072	131.676	136.992	-379.690	115.483	116.440	126.246
Youngest Child 0-6	124.998	175.154	175.899	182.122	-326.347	113.852	119.507	129.254	-214.750	88.787	92.057	98.737	228.338	137.560	148.578	153.275	-380.196	114.190	115.552	125.414
Youngest Child 6-17	120.311	175.048	175.041	181.263	-237.192	113.728	119.766	129.500	-172.915	88.673	91.940	98.620	243.122	128.461	132.645	137.922	-340.817	114.748	116.683	126.464
Other Income Effects																				
No Children	-12.525	4.504	4.449	4.608	-4.477	2.035	2.125	2.298	-4.585	1.709	1.751	1.880	-6.232	2.586	2.616	2.725	-3.923	2.255	2.283	2.470
Youngest Child 0-6	-19.141	4.495	4.555	4.712	-7.882	2.071	2.191	2.361	-7.720	1.730	1.795	1.923	-10.482	2.944	3.056	3.152	-7.106	2.244	2.303	2.490
Youngest Child 6-17	-15.575	4.401	4.423	4.583	-6.307	2.021	2.125	2.298	-6.590	1.689	1.743	1.872	-8.847	2.553	2.574	2.685	-5.695	2.221	2.271	2.459
Residuals																				
Wage	-62.417	173.792	172.928	179.230	374.373	113.024	118.083	127.943	283.825	88.017	90.463	97.246	-132.768	127.051	130.585	135.938	449.801	114.028	114.129	124.107
Other Income	7.425	4.435	4.394	4.555	3.261	2.022	2.112	2.287	2.387	1.695	1.738	1.868	3.936	2.576	2.614	2.723	1.937	2.222	2.259	2.448
Participation	-253.594	210.589	219.780	226.613	-340.706	120.872	123.633	134.061	-397.135	109.999	114.110	122.306	306.341	202.123	204.188	212.558	-232.828	135.196	140.942	152.518
Constant	1775.562	233.383	244.122	251.937	2475.879	138.485	143.158	155.008	2132.065	120.754	126.495	135.465	1204.487	172.907	182.108	189.233	2341.079	164.734	166.729	180.481

Source: Authors.