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Single Women's Labor Supply Elasticities: Trends and Policy Implications

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Abstract
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Keywords
Single Women, Labor Supply Elasticities, Trends, Policy

SINGLE WOMEN'S LABOR SUPPLY ELASTICITIES: TRENDS AND POLICY IMPLICATIONS

KELLY BISHOP, BRADLEY HEIM , and KATA MIHALY*

This paper uses CPS data to examine changes in single women's labor supply elasticities in recent decades. Specifically, the authors investigate trends in how single women's hours of work and labor force participation rates responded to both wages and income over the years 1979–2003. Results from the base specification suggest that over the observation period, hours wage elasticities decreased by 82%, participation wage elasticities by 36%, and participation income elasticities by 57%. These results imply that changes in tax policy had a much larger effect on the labor supply and labor force participation behavior of women in this subpopulation in the early 1980s than in recent years.

It is well documented that, over the past few decades, female labor force behavior has undergone substantial changes. Women's labor force participation rates have increased markedly, as have their annual hours of work. At the same time, the marital composition of women has undergone a substantial change as well, with the proportion of married women falling steadily over time. As a result, single women comprise a greater share of the labor force than in earlier years, and hence their behavioral responses to changes in wages and incomes carry even greater importance for the effects of changes in tax and transfer policies.

Despite the large increase in the number of single women over the past decades, single women's labor supply behavior has received relatively little attention, especially when compared to the vast literature on the labor supply of married women. Single mothers have received greater coverage, but this literature has typically been focused on the effects of the Earned Income Tax Credit (EITC) or welfare programs such as Aid to Families with Dependent Children (AFDC) and Temporary Assistance to Needy Families (TANF) on the labor supply of these women. However, single women with children comprise only about 40% of all single women.

Studying the labor supply behavior of single women is of importance for at least three reasons. First, since there have been relatively few efforts to estimate labor supply elasticities for single women, such results will add to our limited understanding of single women's labor supply behavior. Second, two recent papers (Heim 2007; Blau and Kahn

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Data and estimation programs will be made available, on request, to interested researchers. Contact Bradley Heim, Office of Tax Analysis, U.S. Department of the Treasury, Room 4036B, 1500 Pennsylvania Ave, Washington, DC 20220; (202) 622-1316; Bradley.Heim@do.treas.gov.

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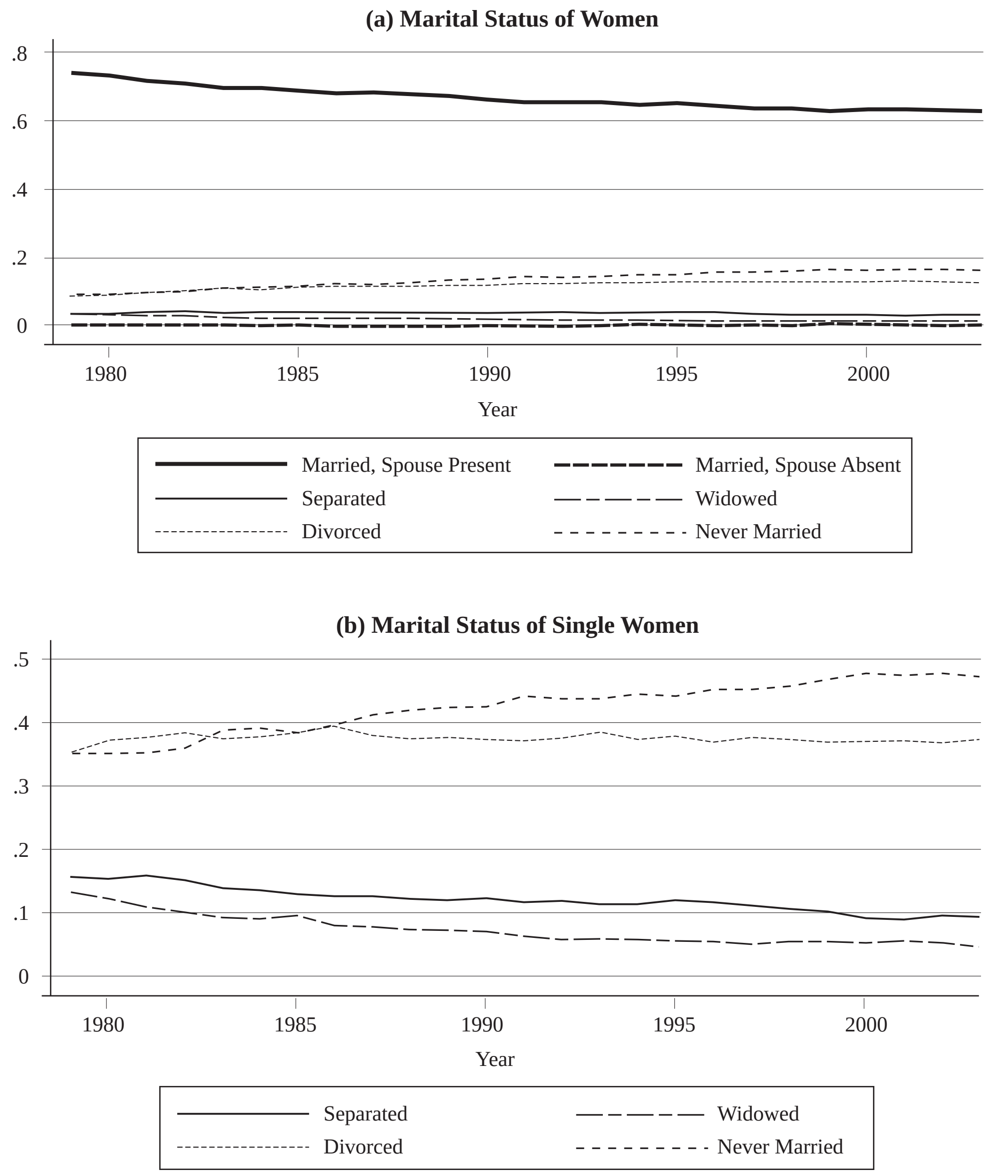
Figure 1. The Composition of Women by Marital Status.



2007) have found that married women's labor supply elasticities have declined by considerable amounts over the past 25 years, and a possible rationale for these findings is that there has been a shift of high-elasticity women from being married to being single. Studying single women provides a way to test this hypothesis. Third, a recent aim of tax and transfer policy has been to encourage labor market participation by single women, particularly single women with children. If single women's labor supply elasticities have shifted since the last time policy parameters changed, these trends need to be taken into account in evaluations of further possible changes in tax and transfer policy.

This paper examines both the direction and extent of change in single women's labor supply and labor force participation elasticities over recent decades. Using CPS data for the 25-year period from 1979 through 2003, we estimate labor supply elasticities for single women separately for each year of data, on both the intensive and extensive margins. As a result, we can examine not only elasticity levels but also any change in these levels that may have occurred over this period.

The Changing Composition of Women

The past few decades have seen a marked transformation in the composition of women by marital status, in their labor force participation and labor supply behavior, and in variables that affect women's labor force participation and labor supply behavior.

In Figure 1, we present information on the marital status of women over the years 1979–2003 using data from the March Current Population Survey (CPS). In the CPS, women report their marital status as being in one of six categories: married with spouse present, married with spouse absent, separated, divorced, widowed, or never married. For this figure, we cut the sample to include all women between the ages of 25 and 55, inclusive.

Panel (a) of Figure 1 demonstrates that the proportion of single women aged 25–55 has been growing in recent decades: in 1979, it was 25%; in 2003, 40%. One possible explanation for this trend is the reported increase in the divorce rate, which would imply an increase in divorced women and a decrease in married women. Interestingly, however, divorced women as a percentage of the population only increased from 9.1% to 13.5% over this period. Two factors help explain the modest size of this increase. First, the actual divorce rate peaked in 1979 at 5.3 per 1,000 in the population, and had fallen to 4.0 per 1,000 by 2001.[1] Second, since the CPS asks only for the current marital status of the women being interviewed and 75% of women remarry within ten years of their first divorce,[2] many formerly divorced women would be coded as married in these figures.

Interestingly, a larger change in the marital composition of women was driven by an increase in women who had never been married, which increased from 9% to 17% of the population over this time period, surpassing the proportion of divorced women in 1983. This trend is consistent with the increasing age at first marriage over this period, which was 22.1 in 1979 and 25.3 by 2003.[3] As a result, conditional on being single, the percentage of divorced women surveyed by the CPS stayed constant at just under 40%, while the percentage of women who never married increased from 35% to 48%. This trend can be seen in Panel (b) of Figure 1.[4]

As previously discussed, the literature that has addressed the labor supply of single women has typically focused on those who have children. However, over 60% of single women in 2003 did not have children, as can be seen in Panel (a) of Figure 2. In addition, over this period the composition of single women by number of children stayed fairly constant, with a slight increase in the number of women with no children and a slight drop in the number of single women with three or more children.

Panels (b) and (c) of Figure 2 demonstrate that the age and educational composition of single women changed as well. In Panel (b), it is apparent that there was a decline in the proportion of single women between the ages of 25 and 35, an increase in the proportion aged 36 to 45, and a decline and then increase in the proportion aged 46 to 55. Panel (c) demonstrates that single women became more educated over the sample period, with a declining proportion of women who were high school dropouts or graduates, and a larger proportion of women with at least some college.

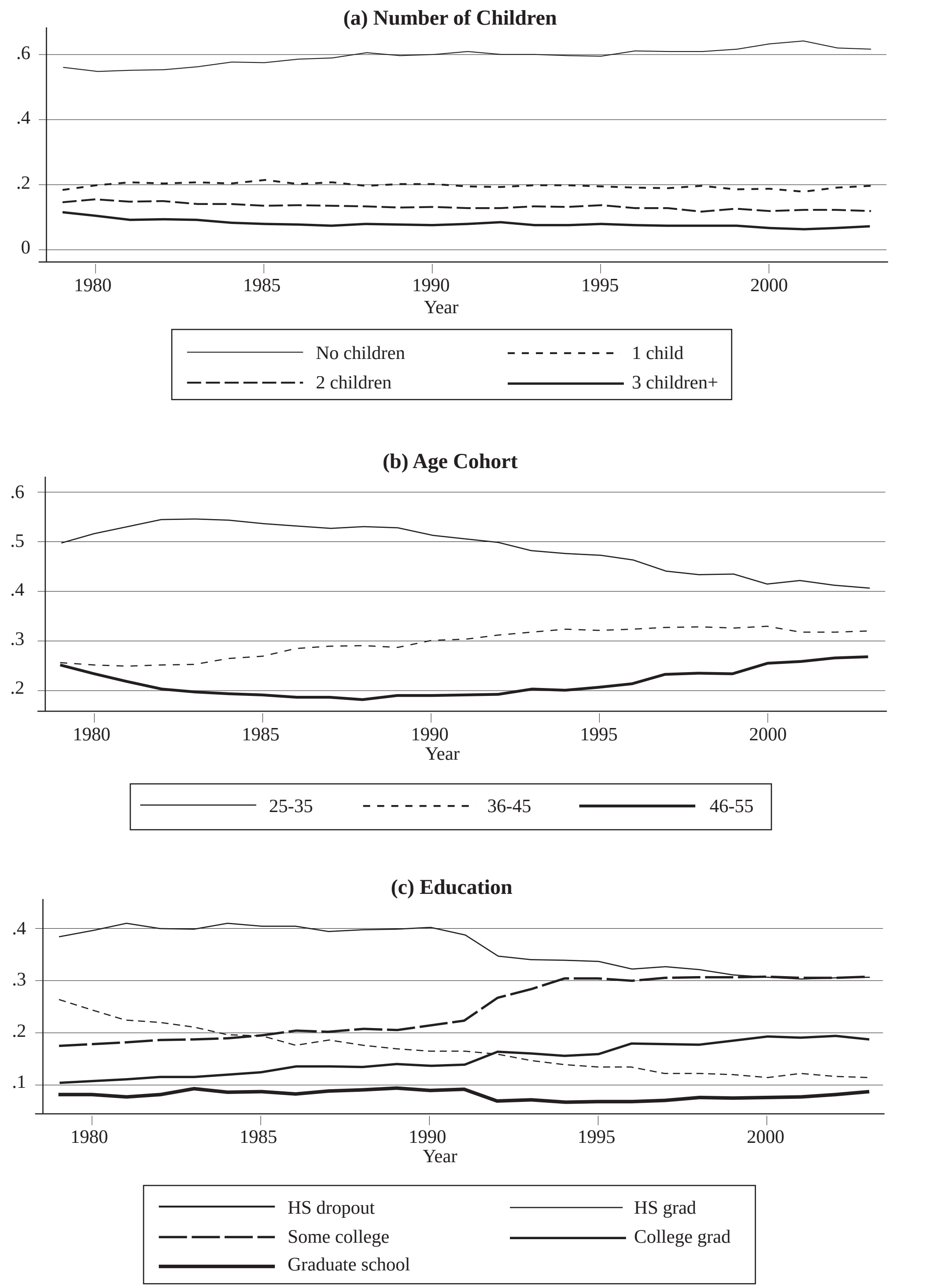
[1]http://www.census.gov/prod/2004pubs/03statab/vitstat.pdf.

[2]http://www.cdc.gov/nchs/data/series/sr_23/sr23_022.pdf.

[3]http://www.census.gov/population/socdemo/hh-fam/ms2.pdf.

[4]Similar trends are also apparent when the sample is cut to include only women who are reported as heads of households.

Figure 2. Demographic Characteristics of Single Women.



In addition to changes in marital status and demographics, there were substantial changes in the labor market characteristics of single women. In Panels (a) and (b) of Figure 3, labor force participation rates and average hours of work conditional on working are presented for all of the years in our sample. As can be seen from Panel (a), the single female labor force participation rate increased from 84% in 1979 to 92% in 2003. These labor force participation rates were significantly higher than those of married women. For example, Heim (2007) found an increase from 63% to 79% for married women over the same time period. While the increase was not quite as dramatic for single women, it was still substantial, and by 2003 the vast majority of single women were in the labor force. As shown in Panel (b), single women who worked in 1979 worked an average of 1,770 hours a year, whereas by 2003 they worked just less than 1,900 hours, on average. In comparison, married women's annual hours worked increased from 1,450 to just over 1,750 hours during this period.

These findings of substantial increases in labor force participation rates and labor supplies set the stage for an examination of time trends in wages and nonlabor incomes. Panels (c) and (d) of Figure 3 present the time trends in average real wages and nonlabor income (in 2000 dollars) among women in the sample. In Panel (c), wages are calculated by dividing labor income (in 2000 dollars) by hours worked. As can be seen in this figure, real hourly wages of single women rose significantly over the 25-year period, from $11 in 1979 to over $14 in 2003. Nonlabor income, on the other hand (Panel d), displays a procyclical trend.

Given the greatly increased proportion of single women in the population and the substantial changes in single women's labor force behavior and wages, it is clearly important for policy analysis to ascertain the extent to which this group's labor supply and labor force participation respond to changes in wages and incomes. In addition, if such responsiveness has changed over the past few decades, estimates gleaned from earlier data or using earlier policy changes to identify wage and income effects may give a misleading picture of how single women will respond to contemporaneous policy changes.

Data and Estimation Method

Sample Preparation

Data for this study come from 25 years of the March Annual Demographic Survey of the Current Population Survey, covering the years 1979–2003. The Current Population Survey consists of short rotating panels in which households are interviewed for four months, not interviewed for the subsequent eight months, interviewed for an additional four months, and then dropped from the survey. Interviews administered in the fourth and eighth months of the survey make up the Outgoing Rotation Group (ORG).

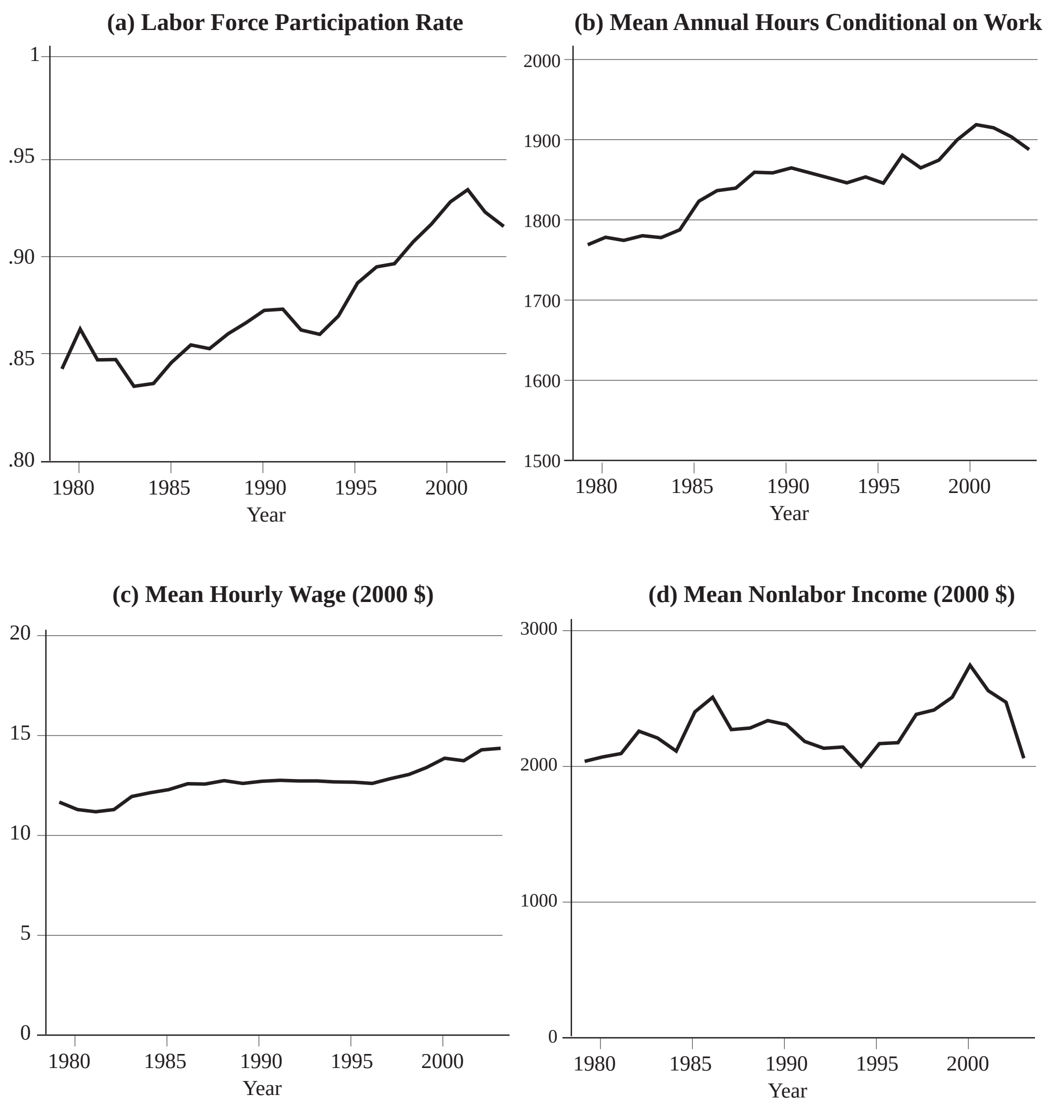
To create the sample, we include single women between the ages of 25 to 55, inclusive, in order to focus on labor supply behavior in the prime working years.[5] Single women are classified as those who are never-married and those who are currently divorced, separated, or widowed. We also create separate cohorts for the never-married and the divorced, as they make up the vast majority of single women.

We use two wage variables. The first is created by dividing annual labor income by annual hours of work. However, labor supply equations estimated using such a wage rate are well known to suffer from division bias, biasing wage elasticities downward in absolute value.[6] As a result, in a specification check in which the wage is assumed to be exogenous, we use a second wage measure that is derived from a series of questions asked of ORG

[5]Several other sample cuts are made. We exclude the self-employed, as well as those who are students, retired, or disabled. We exclude those for whom a valid wage measure was not available, due either to nonresponse or to topcoding. In addition, we exclude a handful of observations who reported extreme wages above $200 per hour or extreme transfer payments of over $25,000 per month.

[6]See, for example, Eklof and Sacklen (2000). Instrumenting for the wage should ameliorate this concern in the base specification, but not in the specification check when wages are assumed to be exogenous.

Figure 3. Labor Market Characteristics of Single Women.



respondents.[7] Because these questions ask directly for each individual's typical hourly or weekly wage, the direct report wage variable is equal to the typical hourly wage (if avail-

[7]Unfortunately, due to some peculiarities in the sampling frame of the March CPS in some years, not all individuals who were in the ORG received the hourly earnings questions, and these individuals are not identified in any particular way in the dataset. The major cause of this in recent years is the increase in the March sample used to evaluate the SCHIP program, but several other reasons exist for other years. This is a problem for those who are nonworkers, as it is impossible to tell whether or not a nonworker was part of the ORG who would have received the earnings questions had she worked. As a result, if only those who were working and had a nonresponse to the ORG questions are cut, the labor force participation rate for the resulting sample is much below the labor force participation rate of the overall sample. As such, we include in our sample all

able) or is calculated by dividing the usual weekly wage by 40 hours.

Both of these wage variables, as well as the non-wage income, are inflated (or deflated) to real dollars from the year 2000 using the CPI Urban Price Index.

Additional variables used in the estimation are the woman's age, education, and race, the number of children, and the presence of children under six, as well as some geographic variables and the unemployment rate in the state of the woman's residence.

Estimation Method

In a study of this kind, the ideal would be to use an estimation methodology that is considered the standard for estimating single women's labor supply. However, due to the paucity of studies on single women's labor supply, no single methodology has emerged with such standing. Further, many of the recent advances in this literature either have been in the estimation of structural labor supply models (for example, Keane and Moffitt 1998; Meyer and Rosenbaum 2001), the computational intensity of which would make them unsuitable for an analysis of 25 years of labor supply elasticities, or have relied on natural experiment variation (Blundell et al. 1998), which would have to take the form of yearly policy changes in order for us to exploit it to estimate labor supply elasticities for each year under analysis.

Fortunately, estimating single women's labor supply is considerably simplified by the fact that, unlike in estimating married women's labor supply, one does not need to take into account the joint labor supply decision between the husband and wife. Still, any methodology chosen in the absence of a standard one has the chance of being at least somewhat controversial.

That said, the estimation method we employ in this study is an adaptation of the "second-generation" methods described in Killingsworth (1983) and Mroz (1987), with an added fourth step that allows for the estimation of extensive-margin labor supply elasticities. This method has the advantage that it allows for separate estimation on each year of data. In addition, the variation that is used to identify labor supply parameters is clear. However, such a method uses only cross-sectional variation to identify labor supply parameters and relies on the assumption that marital status and childbearing are exogenous.

In order to explicitly account for tax policy changes over the relevant period, we use the NBER's TAXSIM model to calculate both the tax rate and tax burden for each woman in each year at both zero and 40 hours of work per week. For this calculation we use the mean of wages and nonlabor income (excluding transfer payments) in the state in which the woman resides. Variation in the tax rates comes from state-to-state variation in tax laws, and the rates are not endogenous to the observed wage rate or nonlabor income. In calculating the tax rates and amounts, we include taxes and EITC benefits at both the state and federal levels and include the woman's share of the payroll tax. Finally, we assume that all women take the standard deduction.

If we did not account for taxes, the estimated elasticities would confound behavioral parameters with tax parameters. As such, changes in the estimated elasticities could simply be driven by changes in tax rates. By controlling for tax rates in the estimation, we eliminate this possibility. However, changes in welfare policy could still affect estimated parameters. We return to this issue below (in the section "Possible Explanations").

Estimation proceeds in four stages. Coefficients are subscripted with t to emphasize that separate systems of equations were estimated for each year of data.

In the first stage, a reduced form probit of the form

$$(1) \qquad P^*_{it} = \alpha_{0t} + \alpha_{1t}\ln(1-\tau^0_{it}) + \alpha_{2t}Y^0_{it} + \alpha_{3t}Z^P_{it} + \varepsilon^P_{it}$$

$$P_{it} = \begin{cases} 1 \text{ if } P^*_{it} > 0 \\ 0 \text{ otherwise} \end{cases}$$

those with positive hours who gave valid responses to the hourly earnings questions, and a random sample of nonworkers, so that the labor force participation rate in the resulting sample equals the labor force participation rate in the overall sample.

is estimated, where $P_{it} = 1$ denotes participation. In the above, τ^0_{it} denotes the marginal tax rate that individual i would face on her first hour of work, Y^0_{it} denotes her after-tax nonlabor income at zero hours of work (defined as the sum of interest, dividends, and rent received, plus transfers from other individuals, minus calculated taxes at zero hours of work, plus the maximum AFDC benefits the woman would qualify for given her state of residence and number of children), and Z^P_{it} contains other variables that affect the participation decision. Included in Z^P_{it} are cubics in age and years of education, race dummies, the number of children, the presence of children under age six, the unemployment rate in the state of residence, and geographic variables including a regional dummy, a dummy for residence in a center city, and the size of the MSA of residence.

In the second stage, a selection-corrected wage regression of the form

(2) $$\ln W_{it} = \beta_{0t} + \beta_{1t} Z^W_{it} + \varepsilon^W_{it}$$

is estimated for women observed to be working positive hours and who have a direct wage report. Included in Z^W_{it} are cubics in age and years of education, race dummies, the geographic variables noted above, and the inverse Mills ratio calculated from the first stage. The method up to this point is simply the Heckman two-step method, described in Heckman (1980). The exclusion of nonlabor income and children variables in this equation provides identification of the inverse Mills ratio term other than that which would come from functional form assumptions alone.

In the third stage, a selection-corrected labor supply equation of the form

(3) $$h_{it} = \gamma_{0t} + \gamma_{1t} \ln \hat{W}^{FT}_{it} + \gamma_{2t} Y^{FT}_{it} + \gamma_{3t} Z^h_{it} + \varepsilon^h_{it}$$

is estimated on women observed to be working positive hours, where $\hat{W}^{FT}_{it}$ denotes the woman's after-tax wage and is calculated as her imputed second-stage wage multiplied by her net-of-tax share if she were to work full-time, Y^{FT}_{it} denotes virtual nonlabor income[8] given full-time work (defined as the sum of interest, dividends, and rent received, plus transfers from other individuals, minus calculated taxes at full-time hours of work), and Z^h_{it} are variables other than wage and income that affect hours of work. Specifically, Z^h_{it} includes the woman's age, her years of education, the number of children, the presence of children under six, unemployment and geographic variables, and the inverse Mills ratio calculated from the first stage. Identification of the wage coefficient comes from the exclusion of higher order terms in age and education. Using the estimates from this stage, hours elasticities are calculated as

(4) $$\varepsilon^h_{wt} = \frac{\hat{\gamma}_{1t}}{\bar{h}_t}$$

$$\varepsilon^h_{yt} = \frac{\hat{\gamma}_{2t}}{\bar{h}_t} \bar{Y}_t,$$

where $\hat{\gamma}_{1t}$ and $\hat{\gamma}_{2t}$ denote the estimated coefficients on log wages and nonlabor income, respectively, $\bar{h}_t$ denotes mean annual hours of work conditional on working, and Y_t denotes mean nonlabor income.

In the fourth stage, a structural participation equation of the form

(5) $$P^*_{it} = \delta_{0t} + \delta_{1t} \ln \hat{W}^0_{it} + \delta_{2t} Y^0_{it} + \delta_{3t} Z^P_{it} + \varepsilon^P_{it},$$

$$P_{it} = \left\{ \begin{array}{l} 1 \text{ if } P^*_{it} > 0 \\ 0 \text{ otherwise} \end{array} \right\}$$

is estimated. Identification of this equation follows the same strategy as described above for the hours equation. Participation elasticities are calculated as

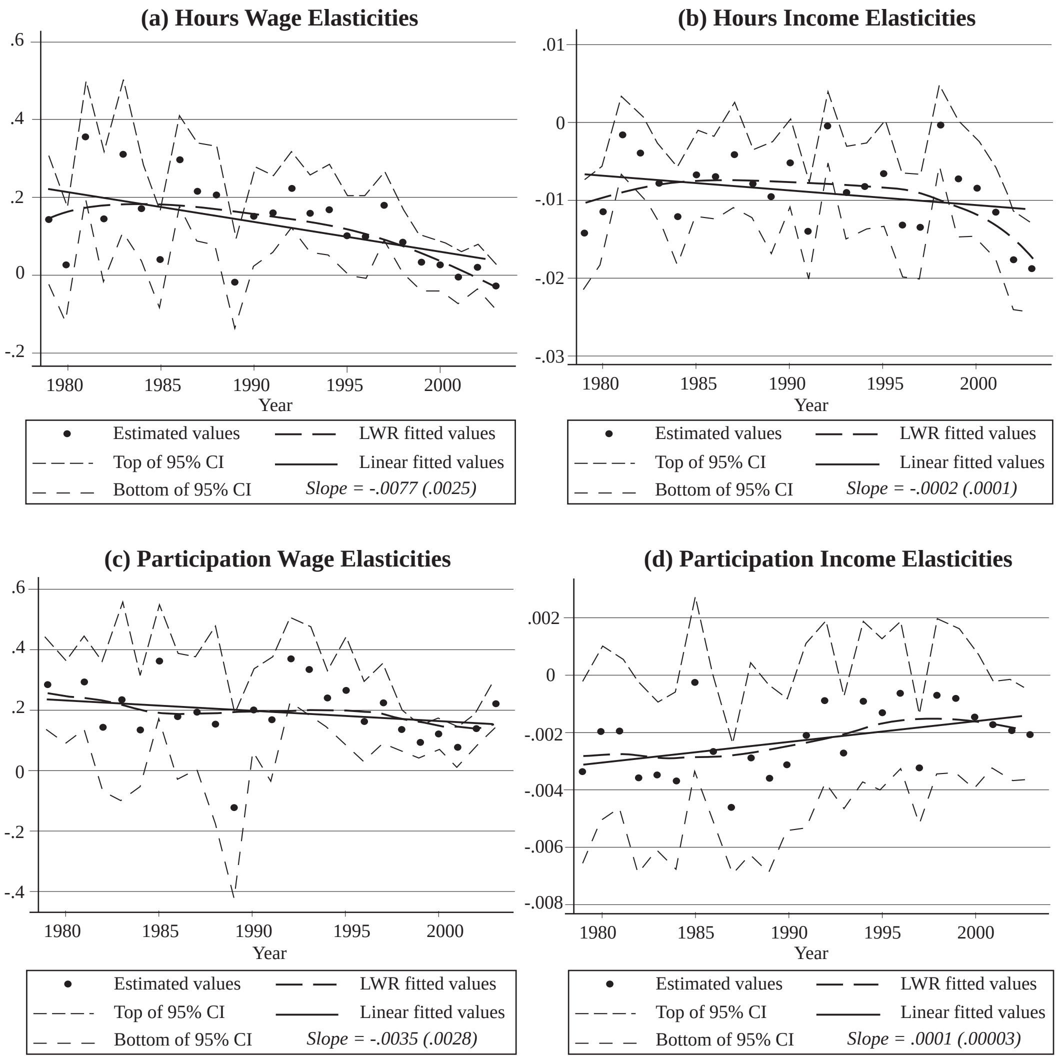
(6) $$\varepsilon^p_{wt} = \frac{\frac{\partial \hat{\Phi}}{\partial \ln W}}{lfp_t}$$

$$\varepsilon^p_{yt} = \frac{\frac{\partial \hat{\Phi}}{\partial Y}}{lfp_t} \bar{Y}_t$$

where $\frac{\partial \hat{\Phi}}{\partial \ln W}$ denotes the estimated average derivative of participation with respect

[8]Defined as the intersection of the budget segment at full-time work, when extended, with the origin.

Figure 4. Estimated Single Female Labor Supply Elasticities, 1979-2003.



Notes: Linear fitted values come from a regression of the elasticities against a time trend. The coefficient on the time trend is presented in the legend for each panel (along with the standard error). LWR fitted values come from a locally weighted regression of the elasticity estimates against a time (see Cleveland 1979).

to log wages and $\frac{\partial\hat{\Phi}}{\partial Y}$ denotes the estimated average derivative with respect to non-labor income.

Results

Overall Trends in Elasticities

In the figures that follow, estimated wage and income elasticities are presented, both on the extensive and intensive margin.

In Figure 4, we present elasticities estimated from the base specification described above.[9] The points in the figure represent

[9]As a specification check, Appendix Table 1 presents results from tests for weak instruments, by year, includ-

Table 1. Changes in Single Women's Elasticities between 1979 and 2003.

Elasticity	*1979*	*2003*	|Δ|
Hours Wage	0.143*	–0.031	0.173*
	(0.085)	(0.030)	(0.090)
Hours Income	–0.014***	–0.019***	0.004
	(0.004)	(0.003)	(0.005)
Participation Wage	0.283***	0.219***	0.064
	(0.077)	(0.042)	(0.087)
Participation Income	–0.003**	–0.002***	0.001
	(0.002)	(0.001)	(0.002)

Note: Authors' calculations from the Current Population Survey. Bootstrapped standard errors in parentheses.

*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level.

the actual elasticity estimates. The results are presented two additional ways to smooth out the trends in elasticities: the solid line presents the results from a linear regression of the elasticity estimates on a time trend, and the dashed line represents the results from a locally weighted regression of the elasticity estimates on a time trend.

Two observations of note jump out from these figures. First, the estimated elasticities are small, especially compared to typical estimates of married women's labor supply elasticities. For example, the estimates of the hours wage elasticity tends to range between –0.03 and 0.35, and estimates of the hours income elasticity tend to fall between –0.019 and –0.004. Participation wage elasticities tend to range from –0.121 to 0.368, and participation income elasticities range from –0.0046 to –0.0002.

Second, the hours wage, participation wage, and income elasticities appear to have decreased in absolute value over the time period under analysis. The linear time trend suggests that single women's hours wage elasticity decreased by 82% (from 0.22 to 0.04), their participation wage elasticity declined by 36% (from 0.23 to 0.15), and their participation income elasticity decreased by 57% (from –0.0031 to –0.0014). The hours income elasticity, on the other hand, exhibits an increase in absolute value (from –0.007 to –0.011).[10]

These results are further summarized in Table 1, which presents the difference in elasticities from the beginning to the end of the period. Comparing 1979 to 2003, there was a 100% decrease in the hours wage elasticity, a 23% decrease in the participation wage elasticity, and a 33% absolute value decrease in the participation income elasticity. Again, the hours income elasticity increased slightly. However, only the decline in the hours wage elasticity is statistically significant.

Overall, from these results it appears that a change in the composition of married women cannot explain the findings in Heim (2007) and Blau and Kahn (2007) that married women's labor supply elasticities had fallen by substantial margins. Had each of the elasticities among single women increased substantially, this would have provided a sample selection story to explain why married women's elasticities fell: women with high elasticities tended to be married earlier in the early years of the sample, but these women tended to be single later in the period. However, most of the elasticities were found to be decreasing over this time period, and the increase in the hours income elasticity was not statistically significant.

Robustness Checks

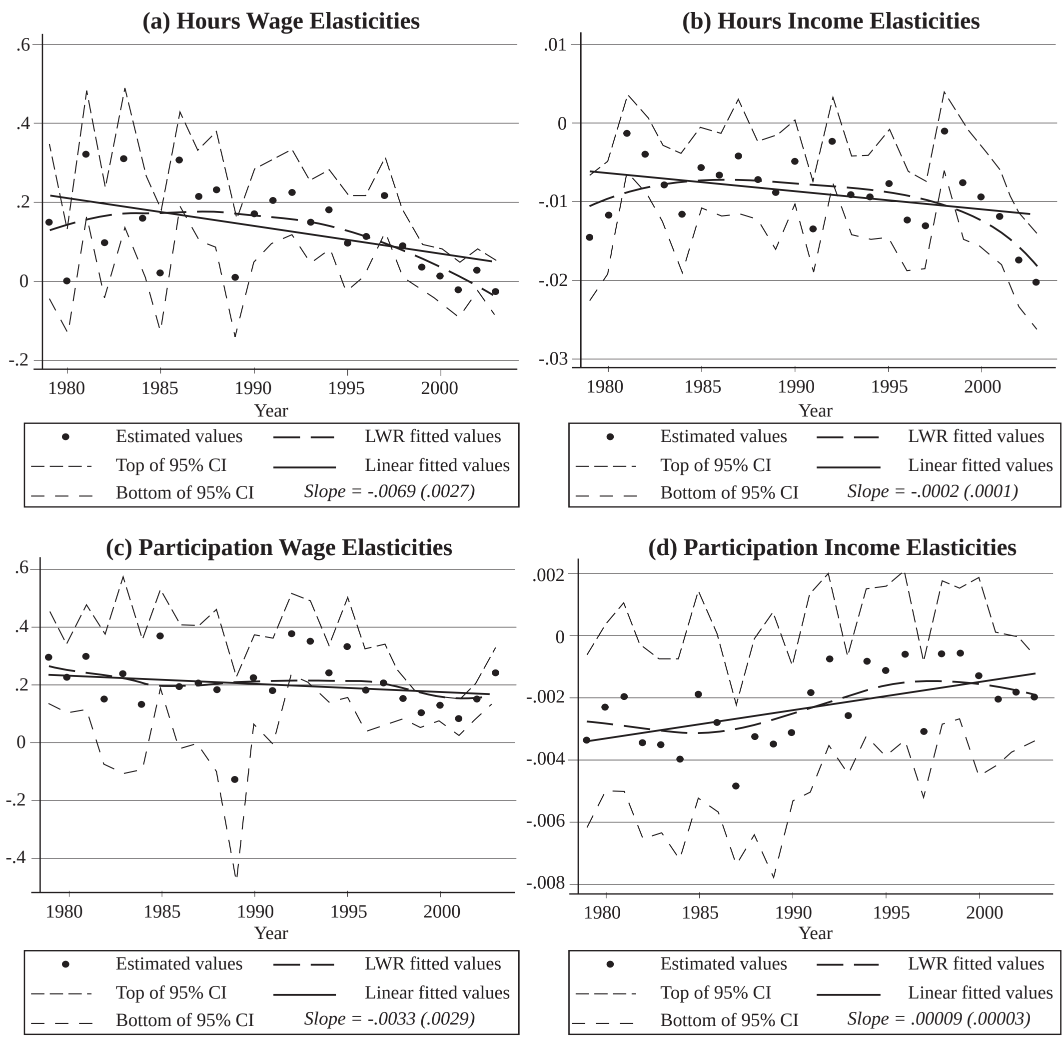
Figures 5 and 6 examine the robustness of these findings to alternative identification strategies.[11]

ing the partial R-squared of the instruments in the first stage regression, and the F test statistic and the related p-value from a test that the coefficients on all instruments are zero. As noted in Staiger and Stock (1997), F test statistics above 10 are preferable to avoid weak instrument concerns, but unfortunately only in six years is the F test statistic above 10 for the sample used here. However, when some alternative instrument sets were tried (using higher order age and education terms and geographic variables as instruments, and using all age and education terms as instruments) the results were qualitatively similar, suggesting that the particular choice of instruments is not driving the general finding that there were declines in these elasticities.

[10]In a study focusing on married women, Blau and Kahn (2007) reported declines in own wage elasticities for single women from between .43 and .59 in 1980 to between .15 and .28 in 2000.

[11]We ran several other robustness checks, including estimations that excluded all age and education vari-

Figure 5. Estimated Single Female Labor Supply Elasticities, 1979-2003: Including Self-Employed.



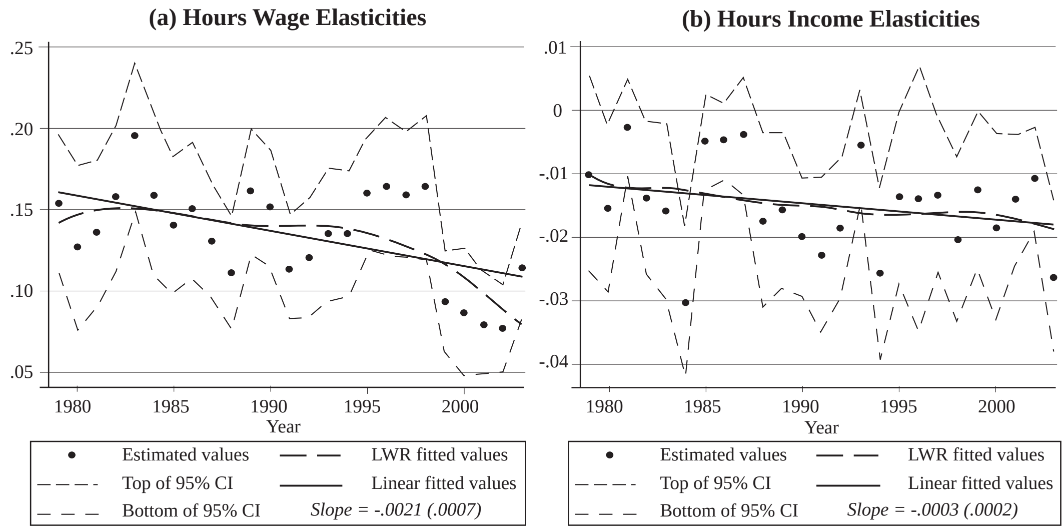
Notes: Linear fitted values come from a regression of the elasticities against a time trend. The coefficient on the time trend is presented in the legend for each panel (along with the standard error). LWR fitted values come from a locally weighted regression of the elasticity estimates against a time (see Cleveland 1979).

ables from the hours and participation equations, and others that omitted geographic variables in addition to the higher order education and age terms from the hours and participation equations. We also estimated the base specification using only the ORG subsample of the CPS, with the wage variable coming from a direct report of the wage. The results from all of these were qualitatively similar to those in the base specification.

In Figure 5, the self-employed are included in the estimation sample.[12] Although the

[12]Analogous to the case of wage and salaried workers, we calculate hourly wages for self-employed women by dividing reported labor income by reported annual hours of work.

Figure 6. Estimated Single Female Labor Supply Elasticities, 1979-2003: ORG Sample, Wages Assumed Exogenous.



Notes: Linear fitted values come from a regression of the elasticities against a time trend. The coefficient on the time trend is presented in the legend for each panel (along with the standard error). LWR fitted values come from a locally weighted regression of the elasticity estimates against a time (see Cleveland 1979).

self-employed are customarily excluded from studies of labor supply, their exclusion from the sample could be driving the declining elasticities if single women with higher elasticities were more likely to be self-employed in later years. Figure 5, however, suggests that this is not the case, with declines again apparent for hours wage, participation wage, and participation income elasticities.

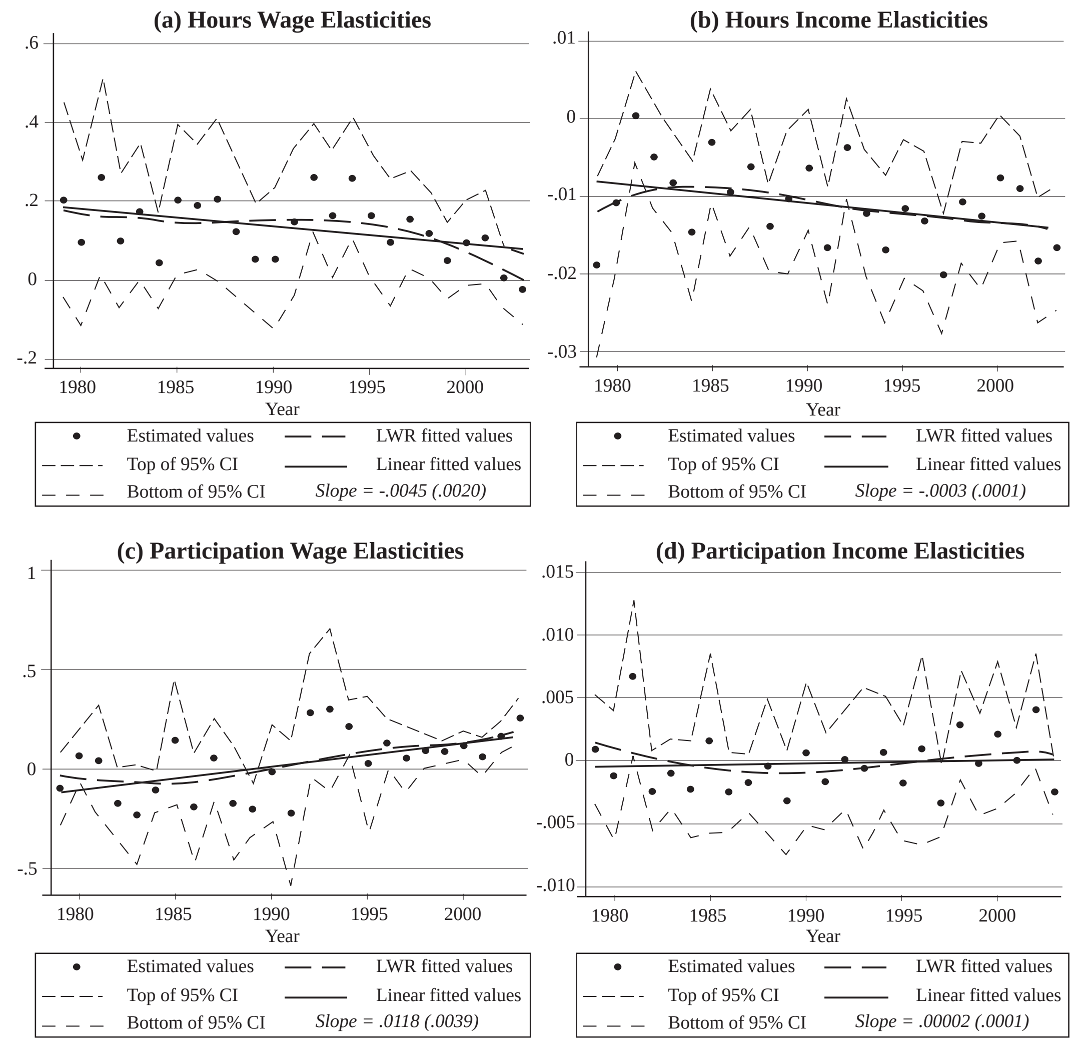
Many structural labor supply models maintain the assumption that wages are exogenous. To examine whether the elasticities exhibit declines when wages are assumed to be exogenous, we estimate a selection-corrected labor supply function without instrumenting for the wage using the ORG subsample with the direct report of the wage. The results are presented in Figure 6. Again, a decline in the hours wage elasticity is present, with the linear trend suggesting a decline from 0.16 to 0.11. Thus, the results are robust to the assumption that wages are exogenous.

Does the Change Differ for Different Groups?

Since there may be substantial heterogeneity in labor supply elasticities of single women based on marital history and number of children, we consider these groups separately. For example, because divorced women have been married before, their labor supply behavior may differ substantially from that of women who have never been married, and the trends for the two groups may move differently. Similar differences may exist between women with and without children. As a result, pooling such groups together may mask interesting trends that occur at the subsample level.

Therefore, we now consider whether the changes in elasticities differ depending on marital status and presence of children. In doing so, we can identify whether changes in elasticities among a particular subset of the population are driving the drop in the overall elasticity estimates.

Figure 7. Estimated Single Female Labor Supply Elasticities, 1979-2003: Never Married Women.



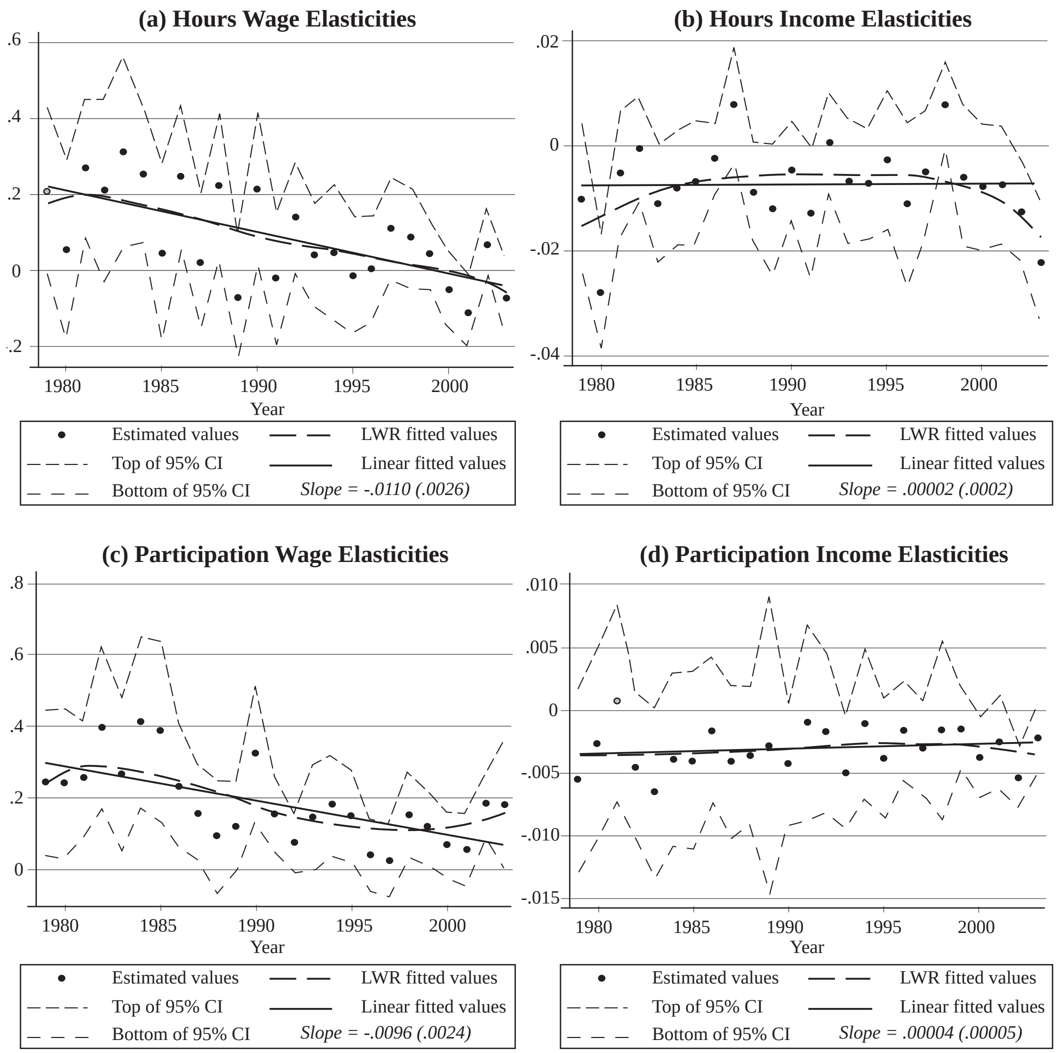
Notes: Linear fitted values come from a regression of the elasticities against a time trend. The coefficient on the time trend is presented in the legend for each panel (along with the standard error). LWR fitted values come from a locally weighted regression of the elasticity estimates against a time (see Cleveland 1979).

Marital History

To examine any effects driven by the changing marital composition of single women, we break our sample into four groups (never-married, divorced, widowed, and separated) and re-run the specifications. We present elasticities for the never-married and divorced cohorts, as these represent the vast majority of the single women in our data.

The results of these estimations, shown in Figures 7 and 8, indicate that the elasticity measures for the never-married and divorced subgroups exhibit trends similar to those for

Figure 8. Estimated Single Female Labor Supply Elasticities, 1979-2003: Divorced Women.



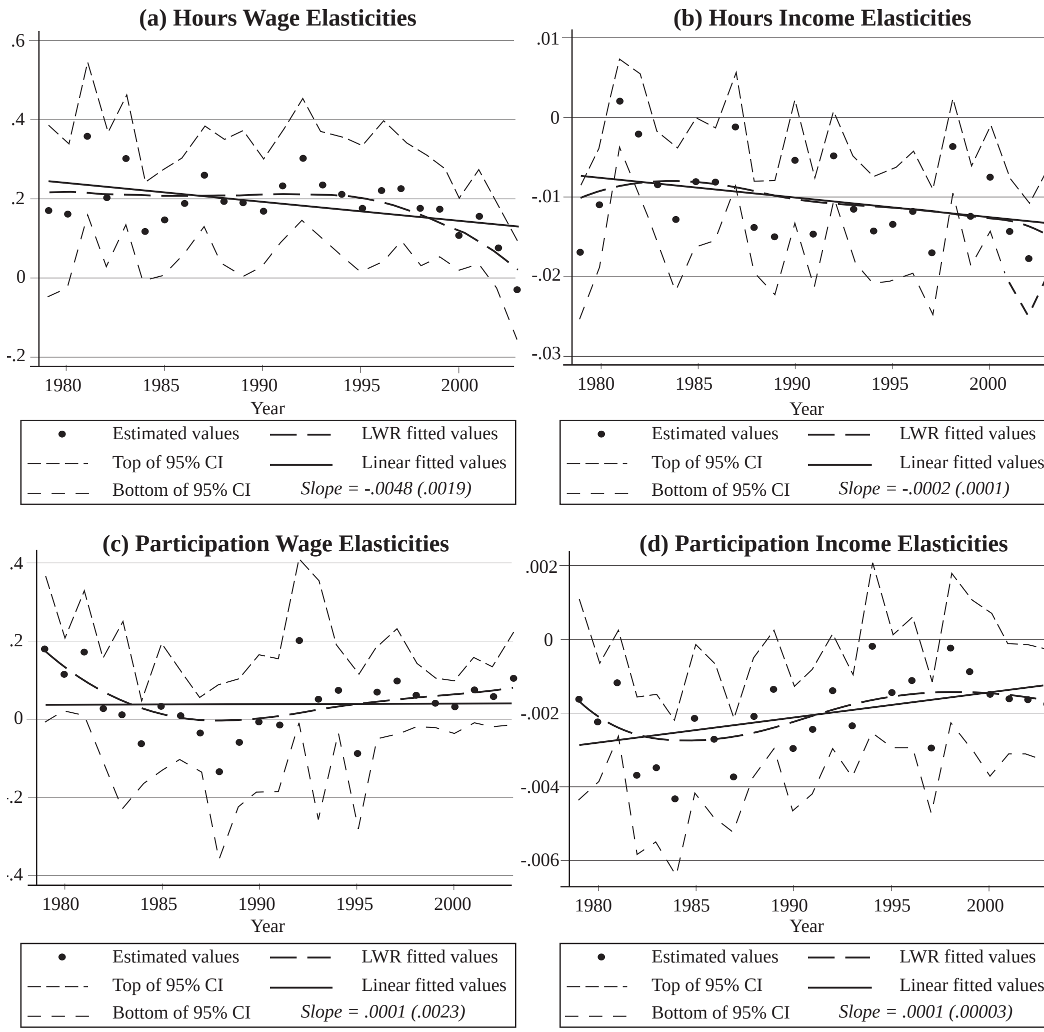
Notes: Linear fitted values come from a regression of the elasticities against a time trend. The coefficient on the time trend is presented in the legend for each panel (along with the standard error). LWR fitted values come from a locally weighted regression of the elasticity estimates against a time (see Cleveland 1979).

the overall sample. An exception to this is the trend in the participation wage elasticities, which were negative in earlier years of the sample and increasing over the sample period for never married women, but were clearly decreasing for divorced women. Therefore, it appears that divorced women were driving much of the overall downward trend in participation wage elasticities.

Presence of Children

We also separately examine the effect of

Figure 9. Estimated Single Female Labor Supply Elasticities, 1979-2003: Women with No Children.

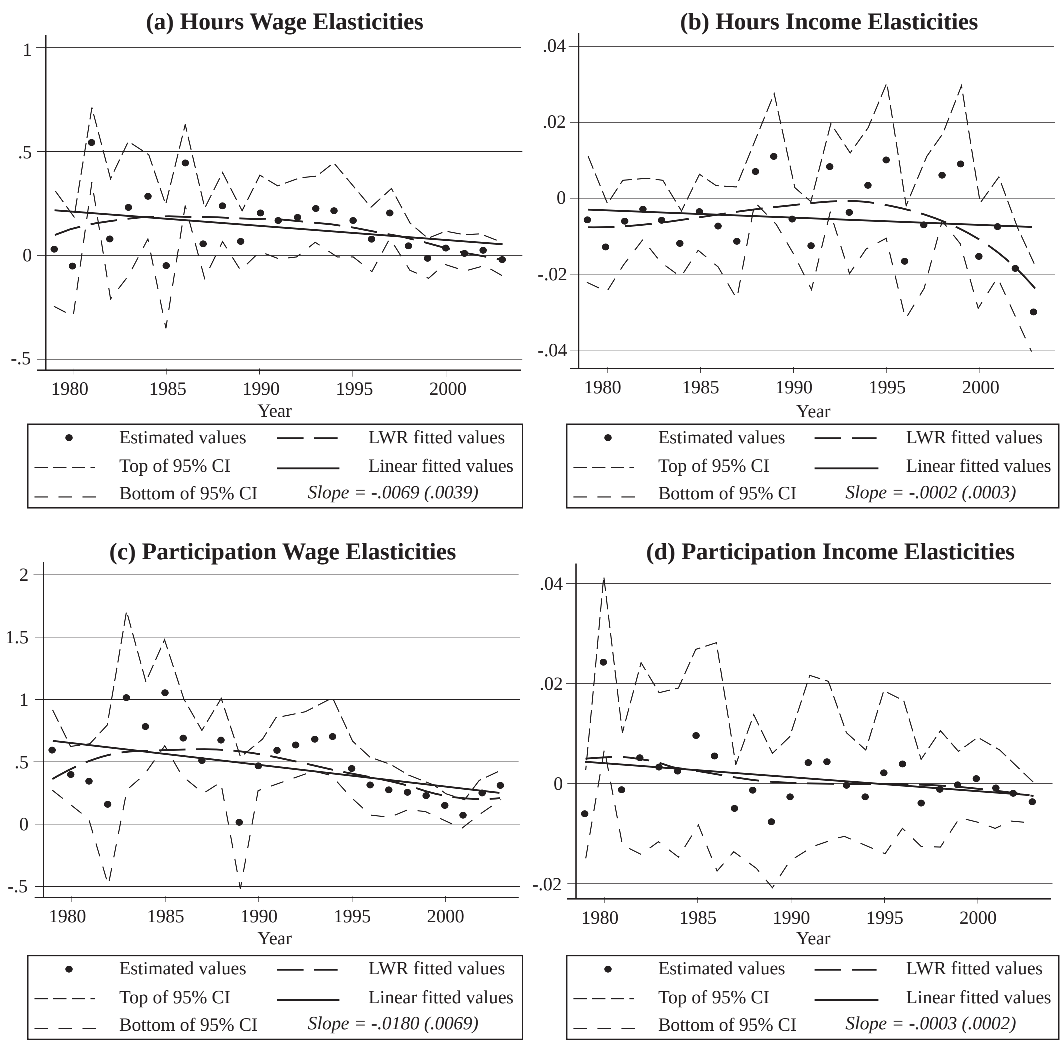


Notes: Linear fitted values come from a regression of the elasticities against a time trend. The coefficient on the time trend is presented in the legend for each panel (along with the standard error). LWR fitted values come from a locally weighted regression of the elasticity estimates against a time (see Cleveland 1979).

children on the change in elasticities. We break down the sample by presence of children and re-estimate elasticities for single women with no children and for those with one child or more. These results are presented in Figures 9 and 10.

There are striking differences in the estimated hours elasticities across these groups. For single women with no children, we again find a decreasing trend in hours wage elasticities, dropping from 0.24 to 0.13. In contrast, for single women with children we

Figure 10. Estimated Single Female Labor Supply Elasticities, 1979-2003: Women with Children.



Notes: Linear fitted values come from a regression of the elasticities against a time trend. The coefficient on the time trend is presented in the legend for each panel (along with the standard error). LWR fitted values come from a locally weighted regression of the elasticity estimates against a time (see Cleveland 1979).

find a 70% drop in the hours wage elasticity, from 0.22 to 0.05. Hours income elasticities, on the other hand, are either constant or increasing for both groups.

Turning to participation elasticities, wage elasticities dropped substantially more for single women with children than for those without children. For example, among women with no children, the fitted linear trend from the participation wage elasticities is constant at approximately 0.04. In contrast, among single women with children, the fitted linear trend from the participation wage elasticities was about 0.68 in 1979 and dropped to 0.25 by the end of the sample period. On the other hand, the participation income elasticities decreased in absolute value for the childless subsample, but did not for women with children, suggesting that women without children were driving the overall decline in participation income elasticities.

Possible Explanations

What could have caused these labor supply elasticities to decrease over this period? One possibility is that the changes in the composition of single women caused the declines in labor supply and labor force participation elasticities. As was seen in Figure 2, at the end of the sample period, single women were less likely to have children, more likely to be in an older cohort, and more likely to be highly educated. If women with these characteristics tend to have lower elasticities, then the change in the composition of the sample could result in lower estimated elasticities over time.

To probe whether this is the case, we divide the sample into three marital states (separated or divorced, widowed, and never married), three education groups (less than high school, high school graduate or some college, and college graduate or more), three age groups (35 or younger, 36 to 45, and 46 and above), and two childbearing states (with or without children). For each year, we calculate the proportion of single women falling into each of the resulting 54 marital status-education-age-children cells, and then reweight each observation in each year by the ratio of the weight of the woman's cell in 1979 to the weight of the cell in that year. Thus, the reweighted sample has the same composition as the 1979 sample along these margins. We then rerun the base specification using these weights. The results from this exercise, presented in Figure 11, are almost identical to those in Figure 4. Thus, it appears that a composition story alone cannot explain these findings.

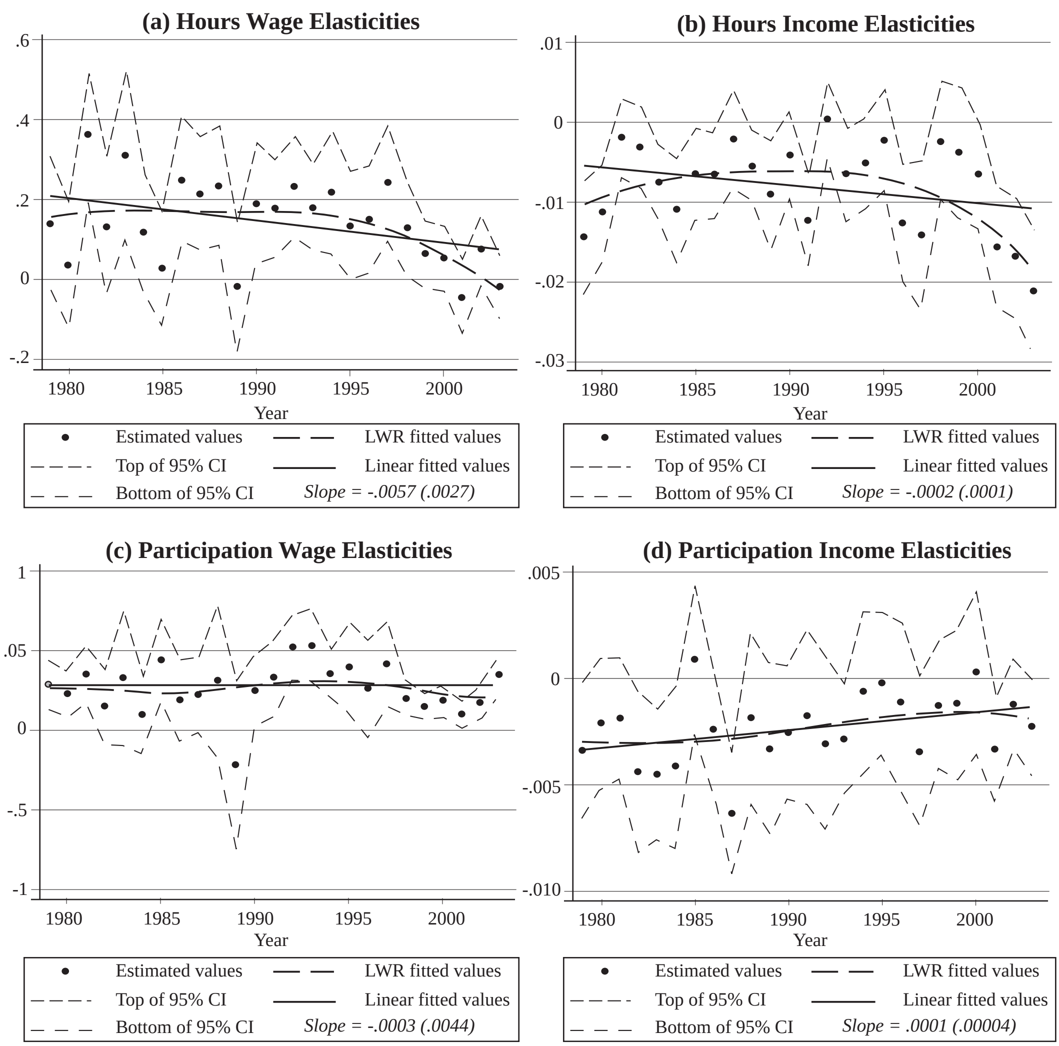
Further, a tendency for higher-elasticity women to marry out of the "single women" group clearly is not the explanation for these declining elasticities, since for this sample selection explanation to hold, elasticities would have had to increase among married women, which is the opposite of the findings reported by Heim (2007) and Blau and Kahn (2007).

For single women with children, a possible reason for the declining wage elasticities, particularly along the participation margin, is the passage of the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA). This act replaced the existing Aid to Families with Dependent Children (AFDC) welfare program and other programs aimed at job training and emergency assistance with the Temporary Assistance to Needy Families Program (TANF). Most importantly for this study, the TANF program includes work requirements for beneficiaries. Recipients must work no later than two years after coming on assistance, with the exact time requirement depending on state law. Single parents are required to work 30 hours per week and two-parent families must work 35 hours per week (55 hours per week if they receive federally funded child care). Failure to meet these requirements results in the reduction or termination of benefits. In addition, certain financial incentives set at the state level are given to families through TANF to encourage work. Some states include earnings disregards and subsidize work expenses such as child care and transportation costs. Certain states also require signing personal responsibility agreements requiring the recipient to take steps toward self-sufficiency, while others require mandatory applicant job search and provide work-related services.

If the constraints placed on TANF recipients required many of the single women with children in this sample to work (or to work more) regardless of their wages, this would cause participation elasticities to decrease, since increases or decreases in wages would not result in any change in their labor force participation.

If this were the case, one would expect elasticities to be roughly constant before 1996 and to shift downward post-1996. Judging by Panels (a) and (c) of Figure 10, such a pattern may have occurred. In addition,

Figure 11. Estimated Single Female Labor Supply Elasticities, 1979-2003: Composition Reweighted Sample.

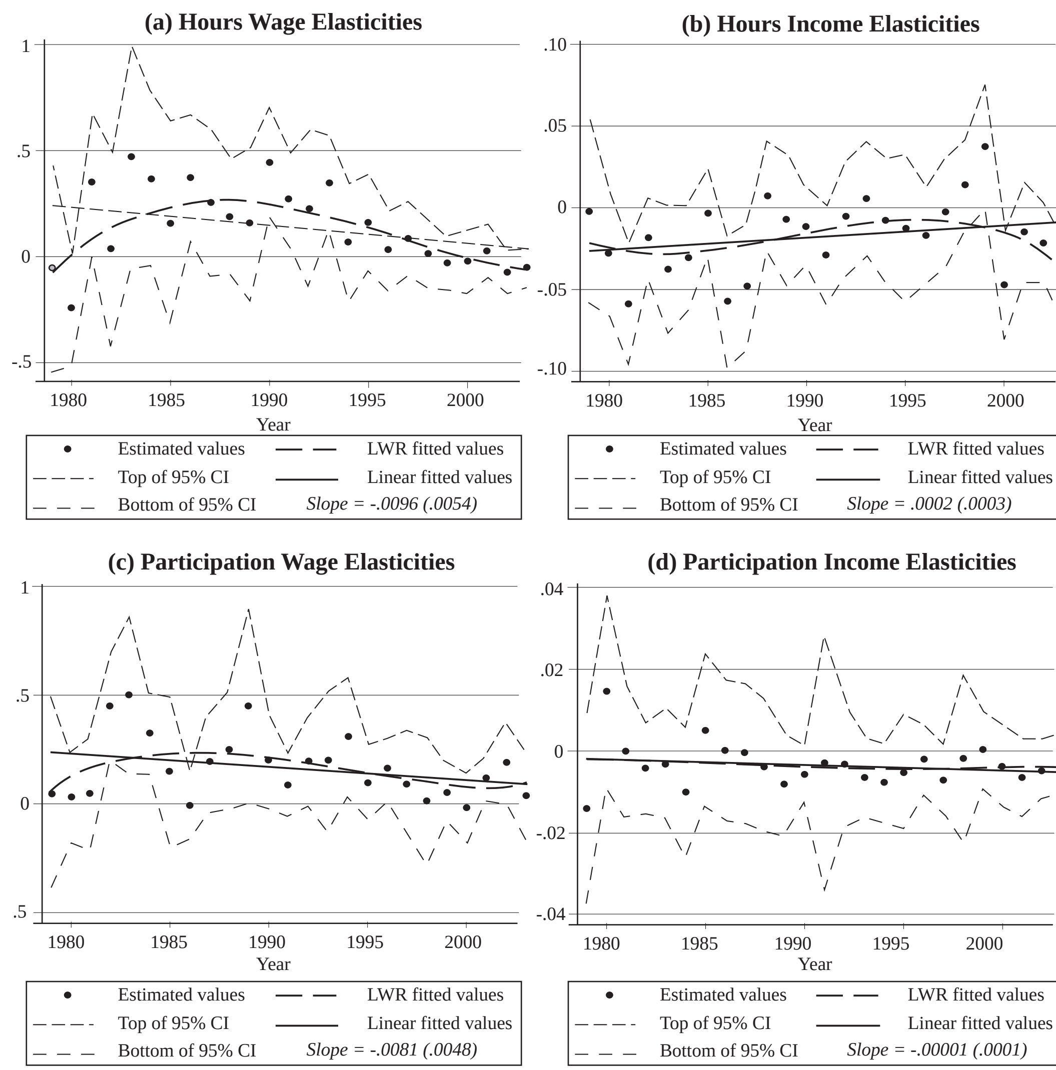


Notes: Linear fitted values come from a regression of the elasticities against a time trend. The coefficient on the time trend is presented in the legend for each panel (along with the standard error). LWR fitted values come from a locally weighted regression of the elasticity estimates against a time (see Cleveland 1979).

although the slope of the linear time trends is negative and statistically significant for both of these panels when the slope and intercept are constrained to be the same pre- and post-1996, when a discontinuity in the linear trend is allowed at 1996, the slopes of both trends are insignificant for both panels, and the estimated slopes are smaller both pre- and post-1996 for the participation wage elasticities. This result provides some suggestive evidence that the work requirements in PRORWA made single women with children less responsive to wages.

However, PRWORA does not appear to

Figure 12. Estimated Single Female Labor Supply Elasticities, 1979-2003: Women with Children and at Least Some College.



Notes: Linear fitted values come from a regression of the elasticities against a time trend. The coefficient on the time trend is presented in the legend for each panel (along with the standard error). LWR fitted values come from a locally weighted regression of the elasticity estimates against a time (see Cleveland 1979).

have been the sole cause of the decline. To demonstrate this, in Figure 12 we present the results from a specification that includes single women with children but excludes from the sample those women with a high school degree or less. As shown in Table 2, the proportion of women with children receiving either AFDC or TANF was higher for those with a high school degree or less. Thus, dropping these women from the sample should have the effect of removing those women who were most likely to be af-

Table 2. Percentage of Women Receiving AFDC/TANF by Education Level.

	Education Level				
Year	*Less Than HS Grad*	*HS Grad*	*Some College*	*College Grad*	*Graduate School*
1979	52.3	27.1	19.9	4.8	2.6
1980	50.0	23.8	18.2	7.5	3.4
1981	49.6	24.3	16.7	8.2	1.7
1982	48.5	25.7	14.7	12.1	1.5
1983	48.9	23.5	14.3	6.1	5.1
1984	51.0	22.8	15.4	6.3	4.3
1985	52.1	22.5	13.8	12.4	5.6
1986	51.7	25.2	15.6	3.8	1.4
1987	50.8	25.3	17.3	4.5	0.6
1988	51.5	25.9	15.2	2.1	4.7
1989	47.9	25.0	18.1	4.9	5.0
1990	44.3	23.5	16.3	5.0	2.6
1991	50.2	25.2	16.9	8.0	4.1
1992	51.9	27.7	17.6	8.6	1.0
1993	52.3	27.1	19.1	5.3	2.5
1994	50.6	29.4	18.9	9.4	1.6
1995	49.1	25.9	19.0	6.9	2.8
1996	45.0	22.5	16.4	5.7	3.8
1997	42.0	19.4	16.0	5.5	3.1
1998	35.3	17.2	13.2	4.7	0.9
1999	28.3	15.5	10.2	4.9	0.9
2000	26.5	11.8	7.3	3.6	0.9
2001	22.9	9.6	7.3	3.8	1.9
2002	16.3	8.0	5.4	2.3	2.5
2003	16.0	8.6	6.3	1.9	0.4

fected by the changes in welfare policy.[13] As can be seen in this figure, the hours wage and participation wage elasticities exhibit declines similar in magnitude to those in Figure 4, and the hours income elasticities are larger than those in Figure 4. Since this subsample was much less likely to be affected by PRWORA than was the sample as a whole, these results suggest that PRWORA was not the sole cause of these decreasing elasticities.

What else might have caused a decline in the elasticities? There are a number of possibilities. For example, a shift in occupational or industrial composition could lead to this result. If more single women in the later years of the observation period worked in occupations where employment and work hours tend to be stable, this could have led to both participation and hours elasticities decreasing over time. Alternatively, there may simply have been changes in societal norms among single women that resulted in their working, and putting in more consistent hours of work, regardless of the wage paid, resulting in declining elasticities. Clearly, determining the source of these declining elasticities is an important avenue for future research.

Implications of These Trends for Tax Policy

The U.S. tax system underwent many significant changes over the period we have examined, 1979–2003. Changes in tax policy altered women's marginal tax rates directly, as in the major tax law changes of 1981, 1986, 1990, 1993, 1997, and 2001, but also indirectly,

[13]We also tried examining only those with a college degree or more, but the sample sizes were too small to say anything definitively.

through the expansion of the Earned Income Tax Credit (EITC) and introduction of the Child Credit.[14]

These tax changes in turn changed incentives to participate in the labor force and supply labor during our sample period. If participation and hours elasticities shifted over the same period, then the expected effects of the tax law changes would depend crucially on the years in which they were implemented. The results above suggest that some labor supply elasticities declined for single women, and since these declines were also found among single women with children who had attended college (who were unlikely to have been affected by PRWORA), it seems likely that the elasticity declines were due at least in part to changes in structural labor supply elasticities, resulting in smaller labor supply effects of tax changes.

To illustrate, consider single women in 1981 whose income placed them in the lowest tax bracket. The estimated hours wage elasticity among these women at the beginning of the observation period was approximately 0.22. The Economic Recovery Tax Act of 1981 (ERTA81) caused the tax rate for these women to decrease from 14% to 12%, resulting in an increase in their after-tax wage of about 2.3%. This, in turn, would be expected to increase hours worked among these women by almost 0.5%.

Now, consider the decrease in the lowest marginal rate that resulted from the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA01). Under this law, the lowest marginal tax rate decreased from 15% to 10%, so that the after-tax wage increased by 5.9%. However, by this time the estimated hours wage elasticity among single women had dropped to about 0.04. Thus, this tax change would be expected to increase hours among these women by only 0.24%, which is less than the effect of ERTA81 even though this tax change was substantially larger than the previous one.

This change in the effect of tax law changes is also apparent when one considers single women with children. For example, the same tax change in ERTA81, given the hours and participation wage elasticities among single women with children of about 0.22 and 0.68, would have caused increases in hours and labor force participation of 0.5% and 1.6%, respectively. However, by 2001, the hours wage elasticity had dropped to 0.05 and the participation wage elasticity to 0.25, implying that EGTRRA01 would have only increased hours by 0.3% and participation by 1.5%.

Thus, the decreases in hours and participation elasticities over this time period suggest that future changes in tax rates should be expected to yield only a fraction of the effect of changes instituted in the 1980s.

Conclusion

We have examined whether single women's labor supply elasticities, like those of married women, have decreased in recent decades. Results from the base specification suggest that hours wage, participation wage, and participation income elasticities declined markedly between 1979 and 2003, with an 82% decrease in hours wage elasticities (from 0.22 to 0.04), a 36% decrease in participation wage elasticities (from 0.23 to 0.15), and a 57% decrease in participation income elasticities (from –0.0031 to –0.0014). These decreases were generally robust to several changes in the sample and estimation specification used.

The decreases in the participation income elasticities appear to have been centered among women without children, while the decreases in the hours wage and participation wage elasticities appear to have been centered among divorced women and women with children. The changing composition of single women does not help to explain the decline, but the passage of PRWORA in 1996 may help to explain the decline for single women with children.

These decreases in elasticities imply that changes in tax policy had a much larger effect on single mothers and divorcees in the early 1980s than they have had in recent years. Therefore, these results reinforce those in Blau and Kahn (2007) and Heim (2007) that suggest that further cuts in marginal

[14]For a detailed description of the history of U.S. income taxation, see Slemrod and Bakija (2004).

tax rates will not yield substantial changes in labor supply. Given the importance of labor supply elasticities in the evaluation of tax reform, identifying other sources of the decrease in these elasticities is clearly an important research question.

Appendix Table 1
Test Statistics

First Stage Test Statistic	*Year*						
	1979	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*
Partial R^2	0.0073	0.0067	0.0083	0.0085	0.0046	0.0100	0.0072
F Test	6.43	6.42	9.19	5.16	4.49	10.44	7.76
p-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1986	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*
Partial R^2	0.0074	0.0068	0.0030	0.0032	0.0065	0.0058	0.0070
F Test	8.61	7.69	4.60	2.94	7.21	7.07	6.34
p-Value	0.000	0.000	0.000	0.004	0.000	0.000	0.000
	1993	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
Partial R^2	0.0063	0.0072	0.0054	0.0070	0.0063	0.0100	0.0143
F Test	6.02	8.55	5.15	6.76	7.40	14.31	17.25
p-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2000	*2001*	*2002*	*2003*			
Partial R^2	0.0104	0.0090	0.0089	0.0076			
F Test	14.71	7.50	10.98	12.87			
p-Value	0.000	0.000	0.000	0.000			

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