Declining Female Labor Supply Elasticities in the U.S. and Implications for Tax Policy: Evidence from Panel Data

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Abstract

Recent work has provided compelling evidence of a long-term decline in US female labor supply elasticities with respect to wages and to income. While previous work used cross-sectional data from the Current Population Surevy (CPS), we reexamine the trend for married women using panel data from the Panel Study of Income Dynamics (PSID) from 1980 to 2006. We find evidence in support of a long-term decline in married females' labor supply elasticities on the participation margin, but less so on the hours margin. We also extend the analysis to investigating the implications of these results on welfare effects of tax reforms. Policy simulations indicate that shrinking elasticities, mostly concentrated on the participation margin, have contributed to a dramatic decline in welfare gains from actual and potential tax reforms since the 1980's.

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1. Introduction

Labor supply elasticity is critical to evaluating the impact of tax and transfer policies, estimating the excess burden of taxation, and analyzing the response of labor force participation over the business cycle. In an era when fundamental tax reform plans reemerge amid questions about the long-term sustainability of the US national debt, precise elasticity measures will be needed to evaluate the impact of potential tax policy changes. Long-term projections by the Bureau of Labor Statistics (BLS) and the Congressional Budget Office (CBO) indicate that the U.S. labor force growth is expected to slow considerably as baby boomers age and labor force participation among key demographic groups either stagnates or declines (Toosi (2012), Congressional Budget Office (2011)). If so, then updated estimates of labor supply elasticities will aid the design of effective policies to boost labor supply. Married females, whose participation rate recently declined after impressive growth from 1980 to 2000, is a demographic group crucial to the future U.S. labor force.

There has long existed a broad consensus among researchers that the female labor supply is more elastic than that of males. This belief has been challenged in a provocative set of recent papers that found female labor supply elasticities—both with respect to wage and income—have been in a remarkable decline since the 1980's (Goldin (1990), Blau and Kahn (2007), Bishop et al. (2009), Heim (2007), Macunovich and Pegula (2010), (Bradbury and Katz, 2008), Hotchkiss (2005), Juhn and Murphy(1997)). With male labor supply elasticity believed to be already close to zero, the finding that female elasticties have converged toward those of males has significant implications for tax policy and optimal tax rates. Inelastic male and female labor supplies mean that distortions from higher taxes, work disincentives from welfare programs, and incentives from tax credits could now be significantly smaller than previously thought.

Evidence in support of a long-term decline in married women's labor supply elasticity, while strong and compelling, is based almost entirely on cross-sectional data from the Current Population Survey (CPS). Given the significant policy implications of the decline, reexamination of this evidence based on a different data source—preferably, panel data—is desirable. In addition, use of panel data can help address concerns regarding unobserved heterogeneity in female labor supply behavior that, if correlated with wages and income as well as labor supply, may bias estimated elasticities.

While the literature has focused primarily on the long-term decline in elasticities and its likely explanations, precise welfare effects incorporating the declining elasticities remain unknown.[1] Heim (2009) calculated the welfare effects of Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA01) and Jobs And Growth Tax Relief Reconciliation Act of 2003 (JGTRRA03) on married female labor supply and found that welfare calculations for these reforms based on constant or dated elasticity estimates from 1986 can be seriously misleading. Additionally, most existing estimates of welfare effects of major tax reforms for married women have so far been based on traditional formulas, from Harberger (1964) and Hausman (1981), that did not distinguish between tax wedges on the extensive (participation) and intensive (hours) margins.[2]

In recent work, Saez (2002) and Eissa, Kleven, and Kreiner (2008) have shown that, not only the magnitude but also the composition of elasticities between the hours and participation margins matter for optimal taxes and their excess burden. Precise welfare simulations using this new insight have been conducted only for single women in the context of EITC (Eissa, Kleven, and Kreiner (2008)). Tax policy implications based on single females' labor supply elasticities may not apply to married females because the two groups' labor market behavior significantly differs.

This paper extends existing research documenting a downward trend in labor supply of married women in two ways. First, the paper uses panel data on married women from the Panel Study of Income Dynamics (PSID) covering almost three decades (from 1980–2006) to mitigate concerns regarding unobserved heterogeneity and to reexamine recent cross-sectional evidence that female labor supply elasticities have declined. Second, based on estimates of time-varying elasticities and employing a method proposed in Eissa, Kleven,

[1] Likely explanations include increasing labor market attachment, rising career orientation due to higher divorce rates, with the result that married women have increasingly become more like men in their labor supply behavior (Goldin (1990)). Alternatively, the long-term elasticities decline could simply reflect a changing temporal pattern of selection biases in estimated elasticities or changes in sample composition that favors women with lower elasticities (e.g., older, more educated, less white, and with more white collar jobs). Heim (2007) and Blau and Kahn (2007) conducted a number of robustness tests and ruled out most statistical or compositional explanations.

[2] Also see Hausman (1981), Hausman (1981), Hausman and Poterba (1987) .

and Kreiner (2008), the paper simulates the welfare effects on married females of tax policy changes, from six major tax reforms since 1980 by explicitly accounting for both the participation and the hours margin responses.

We have three primary findings. First, we find strong evidence of a downward trend in the participation wage elasticity, as it declined from 0.8 in mid-1980's to 0.4 in the early 2000's. Although, we are unable to detect a clear long-term trend in the hours wage elasticity, we find a weak evidence of a decline since mid-1990's. Driven primarily by responses on the participation margin, the overall compensated labor supply elasticity of married women declined sharply between 1980 and 2006.

Second, we use estimated elasticities to simulate the welfare gains of six major tax reforms since 1980 and find that Economic Recovery Tax Act of 1981 (ERTA81) and Tax Reform Act of 1986 (TRA86) led to the largest welfare gains, of 2 percent and 2.6 percent of earnings on average, respectively. Wives with high household earnings contributed mostly to these welfare gains. On the other hand, later tax reforms (EGTRRA01, JGTRRA03) had more modest welfare effects not only because the tax rate changes were smaller, but also because estimated elasticities declined.

And finally, we find that traditional calculations of welfare gains, that do not distinguish between differing tax wedges on the participation and hours margins, are generally upward biased and that bias is particularly large for married females in the top quartile of the household earnings distribution—54 percent for ERTA81 and 19 percent for TRA86.

This paper is organized as follows: Section 2 outlines the static labor supply model of Eissa, Kleven, and Kreiner (2008). Section 3 discusses the econometric specification and identification. Section 4 provides a brief description of the data and construction of key variables: wages, income, and taxes. Section 5 reports estimated labor supply elasticities. Section 6 presents welfare implications for tax reforms. There is a brief conclusion.

2. Theoretical Framework

We adopt the theoretical framework from Eissa, Kleven, and Kreiner (2008) that augments the standard static labor supply model with taxes, to account for fixed costs of work. Fixed costs may be monetary (e.g. commuting cost) or emotional (e.g. stress due to work responsibilities) and may explain excess bunching at zero hours or full time work and that few individuals have very low working hours. Importantly, including such costs have nontrivial implications for identifying the tax wedges relevant for the labor supply participation and hour decisions and for evaluation of welfare effects.

In this framework, the wife chooses consumption c and hours of work h to maximize the utility function:

$$u(c, h; \boldsymbol{x}) - qD(h > 0), \tag{1}$$

subject to a static budget constraint,

$$c = wh + y - T(wh). \tag{2}$$

q is the utility fixed cost of working which is continuously distributed and $D(.)$ is an indicator function denoting labor force participation. $\boldsymbol{x}$ are other exogenous variables affecting preferences for work and w is the hourly wage rate. y is unearned (or nonlabor) income and includes the husband's income and other unearned income such as asset income. We adopt a secondary earner model (e.g. Eissa and Hoynes (2004), Heim (2007)), where the wife chooses her labor supply conditional on her husband's labor supply decision and we assume that y is exogenous. $T(.)$ is a nonlinear tax function that depends on the wife's earnings and is assumed to be piece-wise linear and convex.

With the addition of fixed costs to the standard model, the maximization problem could be solved in two stages. First, solve for optimal hours of work conditional on labor force participation, and second, solve for whether to enter the labor force at the optimal working hours. The first-stage problem is identical to the standard model without fixed costs. At the optimum, the first order-condition holds. Solving for optimal hours yields,

$$h^* = h | h > 0 = f_1(w(1 - \tau^m), r, \boldsymbol{x}), \tag{3}$$

where τ^m is the marginal tax rate at optimal hours and r is virtual income, which is the intercept obtained from linearizing the budget set at optimal hours.[3]

In the second stage, the wife chooses to work if $u(c(h = h^*), h = h^*; \boldsymbol{x}) - q > u(c(h = 0), h = 0; \boldsymbol{x})$. Because $c(h = h^*) = y + wh(1 - \tau^a)$, where τ^a is the average tax rate on the wife's earnings at optimal working hours conditional on participation, we get

[3] More specifically, $r = y + \{(\tau^m wh) - T(wh)\}$.

$$D^* = D(h > 0) = f_2(w(1-\tau^a), y, \boldsymbol{x}). \tag{4}$$

Note that while the relevant tax wedge for hours conditional on participation is the marginal tax rate, the relevant tax wedge for participation is the average tax rate which equals the additional tax liability (due to wife's participation) as a percent of wife's earnings.[4] For the income effect, the relevant income for participation is the unearned income.

We can now define the extensive margin (participation) and the intensive margin (hours) uncompensated wage and income elasticities as:

$$e^{D,wage} = \frac{\partial D}{\partial w(1-\tau^a)} \frac{w(1-\tau^a)}{D}, e^{D,income} = \frac{\partial D}{\partial y} \frac{y}{D}. \tag{5}$$

$$e^{h,wage} = \frac{\partial h}{\partial w(1-\tau^m)} \frac{w(1-\tau^m)}{h}, e^{h,income} = \frac{\partial h}{\partial r} \frac{r}{h}. \tag{6}$$

After recovering the compensated hours and participation elasticities, e_c^h and e_c^D, from the uncompensated wage and income elasticities using the Slutsky equation, Eissa, Kleven, and Kreiner (2008) showed that the excess burden of a tax reform, EB, as a percent of pre-reform earning is:

$$\frac{\Delta EB}{wh} = \frac{\tau^m}{1-\tau^m} \Delta\tau^m e_c^h + \frac{\tau^a}{1-\tau^a} \Delta\tau^a e_c^D. \tag{7}$$

wh, τ^m, τ^a are at the pre-reform levels, and Δ refers to the change due to the reform. Note, once again, that the right tax wedge to use with the hours elasticity is the marginal tax rate, while with the participation elasticity it is the average tax rate. Once we have the elasticity estimates, the excess burden could be obtained through simulations.[5]

In comparison, the traditional (marginal) excess burden formula, that clumps together both margins of labor supply, is:

$$\frac{\Delta EB^{traditional}}{wh} = \frac{\tau^m}{1-\tau^m} \Delta\tau^m (e_c^h + e_c^D). \tag{8}$$

[4] More specifically the average tax rate, $\tau^a = \left(T(wh + Y^H + Y^A) - T(Y^H + Y^A)\right)/(wh)$, where Y^H and Y^A are husband's and assets income, respectively.

[5] A limitation of this method pointed out in Eissa, Kleven, and Kreiner (2008) is that the formula, like the traditional marginal excess burden formula, is only correct for small tax reforms.

The more general formula in equation (7) reduces to the traditional formula in (8) only when the tax system is of the linear negative income tax type and the reform changes the parameters of this tax system. In this case, the marginal tax rate coincides with the average tax rate. The traditional calculations are biased upwards (downwards) if average tax rates are lower (higher) than the marginal tax rates.

3. Econometric specification and identification

The previous literature has proposed diverse methods to estimate the labor supply elasticity of married women. To maintain comparability with previous studies, we closely follow the strategies used in Heim (2007) and Blau and Kahn (2007) while remaining consistent with the theoretical model in Eissa, Kleven, and Kreiner (2008). An important complication in the context of female labor supply is that wages of labor force nonparticipants are not observed and need to be imputed. Following Heim (2007), we estimate a two-step Heckman-type selection-corrected wage equation (Heckman (1979)) for each cross section separately.

$$D_{it}^{*} = \beta_0^d + \beta_y^d y_{it} + \beta_x^d \boldsymbol{x}_{it}^d + \varepsilon_{it}^d, \tag{9}$$

$$\ln w_{it} = \beta_0^w + \beta_\psi^w \psi\left(\widehat{D}_{it}^{*}\right) + \beta_x^w \boldsymbol{x}_{it}^w + \varepsilon_{it}^w. \tag{10}$$

We use the i and t indices to denote individuals and years respectively in our panel data. First, we estimate the standard reduced-form selection equation (9) using a Probit model of labor force participation with $D_{it} = 1$ if $D_{it}^{*} > 0$ and $D_{it} = 0$ otherwise. y_{it} is unearned income. In basic specifications without taxes, we use gross unearned income. In specifications with taxes, we use net unearned income. $\boldsymbol{x}_{it}^d$ consists of a cubic in age and education, a dummy for poor health, dummies for race, state-level unemployment rate, dummies for census divisions, number of children in the household, and a dummy for the presence of children under seven years. ε_{it} are error terms.

In the logarithmic gross wage equation (10), $\psi(\widehat{D}_{it}^{*})$ is the inverse Mills ratio from (9); $\boldsymbol{x}_{it}^w$ consists of all variables in $\boldsymbol{x}_{it}^D$ except number of children, a dummy for presence of children in the household between 0–7 years old, and unearned income. These excluded variables serve as exclusion restrictions. We use predicted wages, $\widehat{w}_{it}$, using equation (10), to estimate the structural hours and participation equations. This helps address the twin concerns of the wage rate being unobserved for nonparticipants and observed wages being endogenous. We estimate the structural labor supply equations by pooling data from multiple years. Writing the labor force participation equation as,

$$D_{it}^{*} = \beta_0^D + \beta_w^D \widehat{w}_{it}(1-\tau_{it}^a) + \beta_y^D y_{it} + \beta_x^D \boldsymbol{x}_{it}^D + d_t^D + \alpha_i^D + \varepsilon_{it}^D, \qquad (11)$$

we estimate a Probit model with a similar set of covariates as in the reduced-form equation (9). The only difference is that, following Heim (2007), we exclude the nonlinear terms of age and education from $\boldsymbol{x}_{it}^D$ to help identify the coefficient on $\widehat{w}_{it}$.[6]

In the basic specifications without taxes, we set τ_{it}^a to zero and use gross unearned income for y_{it}. In the specifications with taxes, we use the average tax rate and net unearned income, which are the relevant budget set variables for the participation margin. Besides being consistent with our theoretical framework based on Eissa, Kleven, and Kreiner (2008), including taxes also provides additional variation that helps identification. Treatment of taxes here is similar to Blau and Kahn (2007) and consistent with, but somewhat different from Heim (2007) who used the first-dollar tax rate (of the wife). Our results, however, are largely insensitive to the exact tax rate variable used.

A natural candidate for the average tax rate measure is the average tax rate at observed earnings. Using this rate, however, is problematic because it is not clear what tax rate to use for nonparticipants, as their earnings are unobserved. Furthermore, average rate based on observed hours and earnings, for labor force participants, are endogenous. We, therefore, use the average tax rate at a predicted earnings level, $\widehat{wh}_{it}$, which is the predicted earnings based on a selection-corrected earnings regression analogous to equation (10), except that the dependent variable is the logarithm of annual earnings.[7]

In equation (11), d_t are year dummies to account for unobserved year fixed effects. α_i represents unobserved individual fixed effects. In our baseline specifications, we assume that α_i is uncorrelated with other regressors and use simple pooled Probit to estimate

[6] Note that this helps in identification because the set of covariates, $\boldsymbol{x}_{it}^w$, in wage prediction equation (10) includes the nonlinear terms of age and education.

[7] More specifically, $\hat{\tau}_{it}^a = \left(T(\widehat{wh} + Y^H + Y^A) - T(Y^H + Y^A)\right)/(\widehat{wh})$, where $\widehat{wh}$ is wife's predicted earnings, Y^H and Y^A are husband's and assets income, respectively. Following the previous literature (e.g. Blau and Kahn (2007)) we also used an exogenously fixed level of 2000 hours in constructing an the average tax rate measure, $\tau_{it}^{a,2000} = \left(T(\widehat{W} \times 2000 + Y^H + Y^A) - T(Y^H + Y^A)\right)/(\widehat{W} \times 2000)$. The results were very similar.

equation (11). In additional specifications, we exploit the panel structure and attempt to address the likely correlation of α_i with the other regressors. Because simple fixed effects (FE) models lead to incidental parameters problems in nonlinear models (Neyman and Scott (1948)), we use correlated random effect (CRE) models.[8] As proposed in a series of recent papers, e.g., Papke and Wooldridge (2008), Wooldridge (2009), and Semykina and Wooldridge (2010), we implement CRE by including individual-specific means over time of all regressors.[9] CRE is more restrictive than FE in assuming a functional form for the relationship between the individual heterogeneity α_i and other covariates. We find that our results are qualitatively similar using pooled Probit models or CRE specifications. Therefore, while CRE models serve as useful robustness checks, unobserved heterogeneity does not appear to be an important concern.

For hours of work conditional on participation, we estimate a selection-corrected hours equation on just the subsample of workers:

$$h_{it}|h_{it} > 0 = \beta_0^h + \beta_w^h \widehat{w}_{it}(1-\tau^m) + \beta_r^h r_{it} + \beta_\psi^h \psi(\widehat{D}_{it}^*) + \beta_x^h \boldsymbol{x}_{it}^h + d_t^h + \alpha_i^h + \varepsilon_{it}^h. \quad (12)$$

In the basic specification without taxes, we set τ^m to zero and use gross unearned income for virtual income r_{it} (virtual income reduces to gross unearned income when there are no taxes). In specification with taxes, we use the marginal tax rate at observed earnings (of the wife given unearned income) and the virtual income measured at the observed budget segment (see equation (3)). This way to account for taxes is similar to Heim (2007) except that Heim evaluates the marginal tax rate at 2000 hours to obtain an exogenous measure correlated with the tax rate. Strictly speaking, he obtains a reduced-form wage effect rather than a structural wage effect.

We address the endogeneity of the marginal tax rate in (12) using an instrumental variables approach. Instruments could, e.g., be based on the first-dollar tax rate or the marginal tax rate at fixed hours of work (such as Heim's reduced-form tax rate variable). To stay close to the specification for the labor force participation in equation (11), we base our

[8] Note that CRE models and fixed effects yield identical estimates in linear panel data models, but they can differ in nonlinear panel data specifications.

[9] Letting $(x_{1it} \dots x_{Kit})$ be the set of all regressors and $\bar{x}_{ki}$ be the mean of x_{kit} over time for individual i, the underlying assumption in the CRE framework of Papke and Wooldridge (2008) is that $\alpha_i = \sum_k \lambda_k \bar{x}_{ki}$ adequately capture the correlation between α_i and the other regressors. We include only individual-specific time means that had sufficient explanatory power and dropped the ones that were collinear.

instruments on the average tax rate evaluated at the predicted earnings ($\hat{\tau}_{it}^{a}$). We note that $\hat{\tau}_{it}^{a}$ is reasonably exogenous and also has the advantage of containing more variation than the other suggested options (e.g., the first dollar tax rate or tax rates at 2000 hours). We construct a virtual income instrument, $\widehat{r_{it}^{a}}$, in a similar way and use it as an instrument to account for endogeneity of r_{it}.[10] Because average tax rates are highly correlated with marginal rates, the instruments have sufficient explanatory power in the first stage.

As for the remaining variables in equation (11), $\psi(\widehat{D}_{it}^{*})$ is the inverse Mills ratio from equation (9); $\boldsymbol{x}_{it}^{h}$ contains the same set of variables as $\boldsymbol{x}_{it}^{D}$ but without the nonlinear terms in age and education which serve as exclusion restrictions; d_t are year dummies and α_i represent individual heterogeneity that we assume is either uncorrelated with the regressors or account for it using CRE as proposed in Semykina and Wooldridge (2010).

In summary our estimation and tax policy simulation framework proceeds as follows. We first estimate labor supply elasticities presented in equations (5) and (6) using our labor supply specifications (11) and (12). We evaluate the elasticities at the sample mean. All standard errors are clustered at the individual level and obtained based on 50 bootstrap replications of estimation, including all intermediate estimation steps, so that standard errors are unaffected by the generated regressors problem. Finally, we use our estimated elasticities for simulations of the excess burden using equations (7) and (8). We report the sample average of excess burden as a share of wife's earnings, i.e., $\sum \Delta EB / \sum wh$.

4. Data

Started in 1968, the PSID is a longitudinal data set of a representative sample of U.S. individuals and their family units. The sample consists of an unbalanced panel of 4428 married women surveyed in the PSID between 1981 and 2007 with a total of 32108 observations (person years).[11] PSID collects most labor market information for the year before the survey year, so data from 1981 to 2007 waves of the PSID pertain to years 1980

[10] More specifically, we calculate $\widehat{r_{it}^{a}}$ by replacing τ^{m} with $\hat{\tau}_{it}^{a}$ in r_{it}, i.e., $\widehat{r_{it}^{a}} = y_{it} + \{(\hat{\tau}_{it}^{a}\widehat{wh}) - T(\widehat{wh})\}$.

[11] The main sample of PSID, i.e. excluding an oversample of low-income families, has 60280 observations on wives from 1981 to 2007. Restricting the age to 22-60 years olds resulted in 49029 observations. Dropping households in which wife or head was self-employed, head was a farmer, or household had own business, left an unbalanced sample of 34822 observations on 4971 married females. Dropping observations with missing values for the dependent variable or other covariates resulted in an unbalanced sample of 32108 person-years on 4428 wives to be used for estimation.

to 2006. In addition to the PSID data directly available from the Survey Research Center, University of Michigan, the Cross-National Equivalent File for PSID (PSID-CNEF) available from the Department of Policy Analysis and Management at Cornell University are used to construct the key variables used in the paper (Burkhauser et al. (2001)). Measurement of key variables follows an approach almost identical to Kumar (2013), who also used the PSID.

Measurement of Key Variables

Wages and Nonlabor Income

The PSID contains more than a single measure of the wage rate. One measure can be formed by dividing annual real earnings by the annual hours worked. This method is known to induce division bias in labor supply estimates, yielding parameter estimates inconsistent with theory (Ziliak and Kniesner (1999), Eklof and Sacklen (2000), Engelhardt and Kumar (2007)). Following Ziliak and Kniesner (1999) and Heim (2009), we use a self-reported measure of wage from the PSID that does not require dividing annual labor income with annual hours and is free of division bias. In doing so, we use a self-reported measure of hourly wage for hourly workers. For salaried workers, the PSID asked the dollar amount received in salary and the pay period i.e. once a month, twice a month, or weekly. Assuming that the salaried individual worked 40 hours a week, the dollar amount was divided by the respective number of hours worked during the pay period. Throughout the paper, we convert nominal numbers to real 2002 dollars by adjusting with the CPI (U). Unearned income is calculated as the sum of the husband's earnings and the household's asset income obtained from PSID-CNEF data.

Taxes

Our measure of adjusted gross income equals the sum of a household's pre-government income and government transfer income, both available from the PSID-CNEF data. The pre-government income in PSID-CNEF is the sum of total family income from labor earnings, asset income, private transfers (such as child support and alimony received), and private pensions. Given the itemization status of the household from PSID, the dollar amount of itemized deductions was imputed as the average of itemized deductions for different categories of adjusted gross income from the NBER tax public use files obtained from IRS Statistics of Income. Information on year, filing status, number of dependents, number of age exemptions, household labor income, itemized deductions, and state was used to calculate the federal, state, and payroll tax rates and tax liabilities using the NBER-TAXSIM (Feenberg and Coutts (1993)). Federal, state and payroll tax rates were then added to calculate the overall marginal tax rates for each individual, for each year.

We report summary statistics for key variables for select years in Table 1, which shows that both labor supply participation rate and hours of work conditional on participation increased during the sample period, although the participation rate decelerated since 1995. Real gross wage rates and unearned income also increased over time. Both marginal and average tax rates declined sharply in the 1980's due to the two major tax reforms.

5. Results on estimated elasticities

5.1 Baseline models without taxes

Before estimating models accounting for unobserved heterogeneity, we first obtain our baseline estimates without accounting for taxes. We estimate standard static labor supply specifications presented in equations (11) and (12), but ignoring taxes. Our baseline estimates are comparable to those obtained using cross-sectional data from the CPS in Heim (2007) and Blau and Kahn (2007). Although, we estimated wage and income elasticities separately for each year to examine whether they show a declining trend when estimated using PSID, the results turned out to be noisy. Therefore, we focus on 5-year rolling pooled panels starting with the 1980–1984 panel and ending with the 1998–2006 panel.[12] Figure 1 plots elasticities with respect to gross wages and income for 5-year rolling pooled panels from the PSID, both on the participation and the hours margins; Table 2 presents estimated elasticities for select 5-year pooled panels.[13]

Figures 1 shows that participation wage elasticities exhibit a declining trend, similar to that seen in the previous literature. Although there is no clear trend in hours wage

[12] We estimate rolling 5-year panel data models using years t to $t + 4$ from the PSID for each panel, where t varies from 1980 to 1998. Noting that PSID is available only every two years since 1996, we end up with 18 sets of 5-year panels, e.g., 1980–1984, 1981–1985, 1982–1986 … 1996-2004, 1998-2006. Doing so allows us to detect a trend in labor supply elasticities over time.

[13] The full set of results for each year and for all 5-year rolling panels are omitted due to space constraints, but are available from the authors on request.

elasticities, it appears to have fallen in the late 1990's. Moreover, the 95 percent confidence interval always includes zero. Figure 1 also shows that both participation and hours income elasticities declined in magnitude (towards zero) between 1980 and 2006. Estimated elasticities using baseline CRE specifications were similar to pooled models and, therefore, are omitted.

Table 2, presenting a full set of results for select 5-year pooled panels, suggests that most estimates—with the exception of hours wage elasticities—remained significantly different from zero. The participation wage elasticity plunged from 0.84 in 1980–1984 to 0.30 in 1998–2006 panel—a 64 percent decline. There is a similar, but smaller decline for the participation income elasticity from -0.13 to -0.07. Identification remains a concern in baseline models without taxes, as it ignores variation in wages from tax reforms.

5.2 Models with taxes

We account for taxes, using labor supply specifications presented in equation (11) for participation elasticities and equation (12) for hours elasticities. Estimated elasticities for 5-year rolling panels using pooled panel specifications along with their 95 percent confidence intervals are plotted in Figure 2. Table 3 presents a full set of results for select 5-year pooled panel model with taxes and, with regard to wage elasticities, confirms a pattern broadly similar to Table 2 for the baseline specification without taxes. We get precise estimates of the income elasticity, but they remain small in magnitude reflecting similarity with a vast majority of estimates in the previous literature. Both Figure 2 and Table 3 suggest that, while the participation wage elasticity registered a remarkable decline, such a secular trend is not apparent in case of hours wage elasticities.[14]

The pattern from CRE models with taxes also is qualitatively similar and can be gauged by comparing select 5-year panel results in Table 3 (pooled panel) with those in Table 4, which presents results from the CRE models. We plot elasticities along with their 95 percent confidence intervals from the CRE specification with taxes in Figure 3. The figure strongly confirms the pattern we found earlier, the participation wage elasticities

[14] The partial F-statistic on average tax rate-based instruments in the first stage of the selection-corrected hours regression exceeded 38 in various 5-year panels for net wage in CRE models and 46 in pooled panel models. The partial F-stat for virtual income was even higher and the p-Value on instruments in both net wage and virtual income equations were smaller than 0.01 in all 5-year panels.

show a strong secular decline since early 1980's.[15] Meanwhile, hours wage elasticities do not exhibit a clear pattern and the estimates are imprecise. The estimates of participation income elasticities are highly imprecise. The hours income elasticities are small in magnitude, but negative throughout and, therefore, are consistent with the long-held belief that leisure is a normal good.

Figure 4 plots compensated elasticities from pooled panel and CRE specifications with taxes, with 95 percent confidence intervals, and shows that both pooled and CRE models exhibit a pattern of unmistakably declining participation compensated elasticities. The hours compensated elasticities not only are substantially smaller but also are very imprecisely estimated, as their 95 percent confidence intervals include zero in multiple years. Since compensated elasticities from pooled and CRE models with taxes are similar, we plot overall compensated elasticities—the sum of the participation and hours margins—from the CRE model in Figure 5. Given the dominance of the participation wage elasticities and the fact that they have declined sharply, the overall elasticities mirror that trend and, are significantly different from zero.

A sharp decline in some components of fixed costs of work, e.g. commuting time, explains some of the differing patterns of participation and hours wage elasticities (Black at al. (2014)). While fixed costs are key to the participation decision in the theoretical framework that we adopt from Eissa, Kleven, and Kreiner (2008), they have a rather limited role in the choice of hours conditional on participation. The intuition is that once a married female has decided to enter the labor force, fixed costs should matter less for hours conditional on working. It is well-documented that a dramatic run-up in married females' labor force participation contributed to the decline in their labor supply elasticities (Goldin (1990)). A long-term decline in fixed costs is, therefore, broadly consistent with the sharp increase in married females' labor force participation as well as an associated decline in sensitivity of participation to wages. Fixed costs' impact on hours is more subdued and the influence on hours elasticities, therefore, more limited. While the previous literature focused

[15]The overall wage elasticity calculated as the sum of participation and hours margin elasticities reported in Figures 2 and 3 and Tables 3 and 4 are close to the median estimate of 0.7-0.8 in two major survey papers by Killingsworth and Heckman (1986) and Blundell and MaCurdy (1999). Our estimated overall labor supply elasticities in the 1980's are close to other papers using the PSID e.g. Hausman (1981), Hausman and Ruud (1984), and Triest (1990), who reported wage elasticities of 0.9, 0.76, and 1, respectively.

on the overall trend and other likely explanations of declining elasticities, what these trends precisely mean for welfare impact of taxation was left largely unanswered. We now proceed to answer this question.

6. Implications for tax policy

6.1 Simulated welfare effects of potential tax cuts

The long-term decline in the labor supply elasticities, although concentrated mainly on the participation margin, would suggest that the excess burden from taxation may have declined significantly between 1980 and 2006. We simulate marginal excess burden of tax reforms using both, the formula in equation (7)–which accounts for different tax wedges between the participation and hours margins—as well as the traditional formula in equation (8).

To assess the extent to which using (7) rather than the traditional formula (8) really matters, Figure 6 plots the simulated sample average marginal excess burden from a 10 percent cut in both the current marginal tax rate and the average tax rate for each individual in each year of our estimation sample from the PSID and compares it with the excess burden obtained using the traditional formula. Marginal and average tax rates include federal, state and employee portions of payroll taxes. Because estimated elasticities from both pooled and CRE models with taxes are qualitatively similar, for calculations in Figure 6, we focus on our estimates of time-varying elasticities from the CRE specification with taxes, presented in Table 4 and Figure 3. Comparing the two solid lines in Figure 6 suggests that, because average tax rates tend to be lower, the traditional formula overestimates the marginal excess burden from the 10 percent tax cut.[16]

The two dashed lines show marginal tax burdens calculated using constant elasticities, which were set to the average compensated elasticity from 1980 to 2006. Comparing the solid and the dashed lines indicates the bias from use of time-constant elasticities rather than time-varying ones. Overall, Figure 6 shows the combined effect of the long-term decline in compensated elasticities and lower tax rates and suggests that welfare gains from tax reforms for married females have declined sharply between 1980 and 2006.

[16] The reason is that the traditional formula applies a weight of $\tau^m/(1-\tau^m)\,\Delta\tau^m$ to the compensated participation elasticity (e_c^D). The formula based on Eissa, Kleven, and Kreiner (2008) uses the appropriate weight of $\tau^a/(1-\tau^a)\,\Delta\tau^a$.

We now turn to calculation of the welfare gains from the six major tax reforms since 1980, incorporating the new estimated elasticities and accounting for the differing tax wedges on the two margins of labor supply.

6.2 Welfare effects of six major tax reforms[17]

During the sample period, there were several major tax reforms. We investigate the welfare effects for ERTA81, TRA86, OBRA90, OBRA93, EGTRRA01, and JBTRRA03. Using NBER-TAXSIM, Figure 7 presents federal marginal tax rates at different levels of real earnings (2002 dollars) before and after these major tax reforms, for a married and joint tax filer with two children starting at zero earnings for the couple. A clear implication from Figure 7 is that marginal as well as average tax rates have declined significantly from 1980 to 2006.

Figure 8 shows the change in marginal tax rates (upper panel) and average tax rates (lower panel) calculated using NBER-TAXSIM for each major tax reform since 1980 for married females in our estimation sample from the PSID. To isolate the impact of the change in federal tax laws on tax rates (and not those due to associated behavioral changes), we calculate the post-reform change in federal tax rates for the same inflation-adjusted predicted earnings as before the tax reform. The two figures show that federal tax rates decreased drastically in ERTA81 and TRA86, particularly for the upper income quartiles, while the changes in later tax reforms were relatively modest.[18]

Following Eissa, Kleven, and Kreiner (2008), we base our tax simulations for the major tax reforms on marginal and average tax rates and tax liabilities calculated on the husband's earnings *plus* the wife's predicted earnings based on a Heckman-type selection-corrected earnings regression similar to the one used to predict hourly wages using equation

[17]In addition to, ERTA81, TRA86, EGTRRA01, and JGTRRA03, mentioned earlier in the text, we also simulate the effects of Omnibus Budget Reconciliation Act of 1990 (OBRA90) and Omnibus Budget Reconciliation Act of 1993 (OBRA93).

[18] NBER-TAXSIM includes EITC in its federal tax calculations but does not incorporate changes in effective marginal tax rates due to phase-out of cash or in-kind transfer programs, e.g., AFDC, TANF, Medicaid, Food Stamps etc. Since we ignore cash and in-kind benefits in tax rate calculations, we likely underestimate changes in effective marginal and average tax rates for low-income households in our sample. Relative to single women, however, this should be a much smaller concern for our sample of married women.

(10).[19] Table 5 presents the sample average of all the components of the excess burden formula (7), along with sample average marginal excess burdens calculations for each major tax reform. TRA86 resulted in the largest welfare gain for married females, on average, because the reform led to the largest decline in marginal tax rates (6.4 percent) as well as in average tax rates (5.9 percent).[20]

Figure 9 plots the marginal excess burden of taxation (welfare gain/loss) from the six major tax reforms. The top panel shows that ERTA81 and TRA86 produced the largest welfare gains. Most of the welfare gains from the two reforms are concentrated on the participation margin due to large elasticities on that margin. Small welfare gains from subsequent reforms reflect lower elasticities as well as smaller tax cuts, relative to ERTA81 and TRA86. The bottom panel shows welfare gains by quartiles of husband's earnings *plus* the wife's predicted earnings. Not surprisingly, married females in the top quartile had the biggest gains as a percent of their earnings from both major tax reforms in the 1980s. Because of reduced size and scope, reflecting significantly lower compensated elasticities, subsequent tax reforms produced relatively modest welfare gains. It will be interesting to study how much the marginal excess burden would differ if calculations used the traditional formula that does not distinguish between the tax wedges of the two margins.

Figure 10 compares the marginal excess burden using the new and the traditional calculations for the two tax reforms that produced the most significant welfare gains. The comparison suggests that the traditional calculation, which does not account for the differing tax wedge on the participation and the hours margin, would generally overestimate the welfare gain, particularly for wives belonging to the top quartile of the household earnings distribution. But for the third quartile, the traditional measure of welfare gain from TRA86 is downward-biased because cuts in effective average rates, for this quartile, were larger than marginal rates, as Figure showed. Finally, Figure 11 presents welfare gain calculations for the two methods—accounting for both margins using (7) and the traditional calculation from (8)—for the remaining four major tax reforms and points to important differences for

[19] The marginal tax rate of the wife is simply the tax rate on the last dollar of husband's earnings *plus* the wife's predicted earnings. The average tax rates is the change in tax liability from the addition of the wife's predicted earnings to husband's earnings expressed as a percent of the wife's predicted earnings.

[20] In marginal excess burden calculations for six major tax reforms we only consider federal tax rate changes.

wives belonging to different quartiles in the household earnings distribution. Most notably, the traditional formula significantly overestimates the welfare gains from JGTRRA03 for the third quartile and the upward bias amounts to 78 percent.

7. Conclusion

The primary objectives of this paper were (1) to reexamine recent cross-sectional evidence that female labor supply elasticities have declined using almost three decades of data from the PSID and (2) to simulate the welfare effects of tax policy on married females by explicitly accounting for both the participation and the hours margin responses.

Using data from PSID from 1980–2006, we find a discernible trend toward smaller labor supply elasticities with respect to wages and nonlabor income on the participation margin; wage elasticity declined from 0.8 in early 1980's to 0.4 in early 2000's. Our estimates of income elasticities are small and much of the decline happened after 1990. Unlike previous research, we are unable to detect a clear trend in hours wage elasticities. More subdued sensitivity of hours to wage changes—relative to participation—could be due to a long-term fixed costs decline that primarily affected participation rather than hours. Nevertheless, because a bulk of the labor supply response due to wage changes was concentrated on the participation margin, we find evidence of a dramatic 50 percent decline in overall compensated elasticities (from 0.8 to 0.4) and significant reduction in associated welfare costs of taxation between 1980 and 2006.

We simulate the welfare gains (as a percent of earnings) of six major tax reforms since 1980 and find that ERTA81 and TRA86 led to the largest gains of 2 percent and 2.6 percent of earnings on average, respectively. On the other hand, welfare gains from EGTRRA01 (0.1 percent) and JGTRRA03 (0.5 percent) were substantially lower, because tax rate changes from the tax reforms as well as compensated elasticities were significantly smaller than in the 1980's.

We also find that using time-varying elasticities and accounting for both participation and hours margins responses are important for simulating the impact of tax policy. In particular, use of older elasticity estimates or a traditional (Harberger-type) formula of estimating welfare costs of recent tax policy changes would overstate welfare gains from tax cuts. Moreover, the bias from ignoring differing tax wedges for the two margins of labor supply and relying instead on traditional calculations varies widely by quartiles of household earnings distribution; the bias is generally upward but in some cases also downward. The upward bias from traditional calculations is particularly large for the top quartile—54 percent for ERTA81 and 19 percent for TRA86.

Our findings have both positive and negative implications for the effectiveness of tax policy to achieve desired objectives. Since we find that taxes are now significantly less distortionary than in the 1980's and the 1990's, the government can raise taxes to reduce the fiscal deficit at a significantly lower welfare cost. On the other hand, consistent with previous research on declining elasticities, our findings also imply that tax policy can no longer be counted upon to strongly induce married females to enter the workforce to prop up the labor force participation rate, as was possible several years ago.

The models we estimate share a number of simplifications with the previous literature on declining elasticities and, therefore, are subject to similar biases. First, we estimate a secondary earner's model of female labor supply in a unitary rather than collective framework. Second, we have abstracted from assortative mating and endogenous fertility. Third, we linearize the budget set and employ an instrumental variables approach that relies on strong identification assumptions (Heim and Meyer (2003). An alternative is to estimate a labor supply function incorporating the entire budget set (Burtless and Hausman (1978), Blomquist and Newey (2002), Kumar (2008), Liang (2011), Kumar (2012)).We also do not model fixed costs and associated non-convexities. Nevertheless, our tax policy implications are relatively unaffected by omission of work costs (Heim and Meyer (2004). Fourth, we use panel data but ignore intertemporal considerations such as human capital accumulation that are known to induce downward bias in estimated elasticities (Imai and Keane (2004)). If this condition prevails, then lower estimated elasticities may simply be a consequence of growing importance of human capital accumulation. Our model also does not incorporate optimization frictions causing observed elasticities to deviate from structural estimates (Chetty (2009)). Our tax policy simulations abstract from the realities of a general equilibrium framework. Addressing one or more of these shortcomings in examining the long-term trend in labor supply elasticities is a fruitful avenue for future research.

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Table 1: Summary Statistics

	1980-84	1985-89	1990-94	1995-98	2000-06
LF Participation Rate	0.710	0.759	0.784	0.794	0.782
Hours*	1002.1	1164.8	1255.4	1309.4	1325.6
	(871.3)	(887.9)	(893.4)	(912.1)	(936.6)
Real Wage	11.86	12.79	13.15	13.69	16.00
	(5.213)	(6.887)	(7.984)	(8.434)	(9.725)
Predicted Real Wage	11.28	12.09	11.93	12.10	13.30
	(2.266)	(3.088)	(3.595)	(3.970)	(4.021)
Real After-tax Wage	7.238	8.423	8.705	8.862	10.40
	(2.359)	(3.673)	(4.437)	(4.627)	(5.459)
Real Nonlabor Income (000)	45.48	47.39	47.18	49.55	51.31
	(30.64)	(33.80)	(35.00)	(38.35)	(42.73)
Real Virtual Income (000)	45.04	46.96	47.23	50.07	51.47
	(30.59)	(33.66)	(34.91)	(38.25)	(42.56)
Marginal Tax Rate	0.357	0.309	0.296	0.307	0.284
	(0.111)	(0.0862)	(0.0888)	(0.102)	(0.123)
Head's Last Dollar Tax Rate	0.313	0.267	0.261	0.271	0.243
	(0.113)	(0.0932)	(0.108)	(0.133)	(0.144)
Average Tax Rate (Predicted)	0.358	0.303	0.294	0.303	0.281
	(0.0846)	(0.0624)	(0.0603)	(0.0650)	(0.0857)
Age	40.17	40.01	39.94	41.06	41.92
	(11.16)	(10.83)	(10.13)	(9.613)	(10.14)
Education	12.35	12.80	13.02	13.15	13.18
Have Children < 7 Years	0.329	0.334	0.327	0.317	0.320
Number Children	1.164	1.106	1.095	1.076	1.086
	(1.203)	(1.177)	(1.145)	(1.119)	(1.183)
Poor Health	0.0828	0.140	0.136	0.139	0.122
White	0.909	0.912	0.914	0.912	0.866
State Unemployment Rate	8.492	6.174	6.418	4.985	4.971

Note: Hours are averaged over workers (with actual hours) as well as non-workers (with zero hours). All real variables are deflated to 2002 dollar using the CPI (U).

Table 2: Estimated Elasticities from Pooled Baseline Models Without Taxes

	(1) 1980-1984	(2) 1984-1989	(3) 1990-1994	(4) 1995-2002	(5) 1998-2006
Panel A: Participation					
Wage Elasticity	0.839**	0.454**	0.279**	0.307**	0.304**
	(0.261)	(0.194)	(0.126)	(0.101)	(0.097)
Income Elasticity	-0.134**	-0.091**	-0.089**	-0.088**	-0.074**
	(0.019)	(0.017)	(0.015)	(0.015)	(0.012)
Comp Elasticity	0.873**	0.481**	0.307**	0.335**	0.329**
	(0.262)	(0.195)	(0.127)	(0.102)	(0.098)
Panel B: Hours					
Wage Elasticity	0.010	-0.031	0.075	-0.027	-0.082
	(0.220)	(0.111)	(0.133)	(0.069)	(0.110)
Income Elasticity	-0.063**	-0.072**	-0.062**	-0.039**	-0.041**
	(0.023)	(0.020)	(0.016)	(0.013)	(0.015)
Comp Elasticity	0.033	-0.002	0.100	-0.010	-0.064
	(0.224)	(0.113)	(0.135)	(0.070)	(0.111)
Observations	7371	7338	7525	8442	9321
LF Participation Rate	0.71	0.77	0.80	0.79	0.79
Mean Wage (All)	10.98	11.64	11.65	12.07	12.80
Mean Income (All)	43.28	46.44	47.21	50.48	51.80
Mean Hours(Workers)	1410.16	1546.85	1605.72	1680.66	1707.02
Mean Wage (Workers)	11.13	11.81	11.89	12.26	13.05
Mean Income (Workers)	41.99	45.56	46.02	49.13	50.53

Note: Standard errors are in parenthesis. **Significant at 5 percent level; *Significant at 10 percent level. Panel A presents elasticities from a Probit model of labor force participation on predicted real wage, real nonlabor income, age, education, dummy for presence of children less than 7 years, number of children, dummy for poor health, dummy for white, state unemployment rate, census division dummies, and year dummies. Participation elasticities calculated by multiplying marginal effects of wage (nonlabor income) with the ratio of mean wage (nonlabor income) to sample participation rate. Predicted wages obtained from year-specific selection-corrected log wage equation. The selection equation includes real nonlabor income, dummy for presence of children less than 7 years, number of children, cubic in age and education, dummy for poor health, dummy for white, state unemployment rate, , and census division dummies. Log wage equation includes variables in selection equation minus real nonlabor income, dummy for presence of children less than 7 years, number of children. Panel B presents elasticities from a selection corrected regression of annual hours on real wage, real nonlabor income, age, education, dummy for presence of children less than 7 years, number of children, dummy for poor health, dummy for white, state unemployment rate, census division dummies, and year dummies. Hours elasticities were calculated by multiplying coefficients on wage (non labor income) with the ratio of mean wage (nonlabor income) to sample mean of hours. Pooled models were estimated for each rolling 5- year panel from 1980 to 2006, e.g., 1980-1984 … 1998-2006. Estimates presented are for select 5-year panels. All standard errors are clustered at the individual level and obtained based on 50 bootstrap replications of estimation, including all intermediate estimation steps, so that standard errors are unaffected by the generated regressors problem.

Table 3: Estimated Elasticities from Pooled Panel Models with Taxes

	(1) 1980-1984	(2) 1984-1989	(3) 1990-1994	(4) 1995-2002	(5) 1998-2006
Panel A: Participation					
Wage Elasticity	0.794**	0.823**	0.436**	0.364**	0.357**
	(0.132)	(0.218)	(0.111)	(0.071)	(0.067)
Income Elasticity	-0.015	-0.032**	-0.067**	-0.067**	-0.052**
	(0.025)	(0.015)	(0.016)	(0.014)	(0.011)
Comp Elasticity	0.797**	0.832**	0.454**	0.383**	0.372**
	(0.129)	(0.216)	(0.110)	(0.071)	(0.066)
Panel B: Hours					
Wage Elasticity	0.037	0.191	0.253**	0.054	0.036
	(0.165)	(0.120)	(0.106)	(0.046)	(0.046)
Income Elasticity	-0.040*	-0.065**	-0.081**	-0.037**	-0.038**
	(0.021)	(0.019)	(0.019)	(0.017)	(0.013)
Comp Elasticity	0.047	0.210	0.278**	0.066	0.049
	(0.165)	(0.124)	(0.109)	(0.047)	(0.047)
Observations	7371	7338	7525	8442	9321
LF Participation Rate	0.71	0.77	0.80	0.79	0.79
Mean Wage (All)	7.10	8.15	8.23	8.46	9.08
Mean Income (All)	33.35	37.50	38.06	40.99	42.38
Mean Hours (Workers)	1410.16	1546.82	1605.84	1680.48	1706.75
Mean Wage (Workers)	7.19	8.48	9.01	9.39	10.22
Mean Income (Workers)	42.12	45.56	46.36	49.67	51.04

Note: Standard errors are in parenthesis. **Significant at 5 percent level; *Significant at 10 percent level. Panel A presents elasticities from a Probit model of Labor force participation on after-tax predicted real wage, $\hat{w}_{it}(1-\hat{\tau}_{it}^{a})$, where $\hat{\tau}_{it}^{a}$ is average tax rate based on predicted earnings, tax-adjusted nonlabor income, age, education, dummy for presence of children less than 7 years, number of children, dummy for poor health, dummy for white, state unemployment rate, census division dummies, and year dummies. Participation elasticities calculated by multiplying marginal effects of wage (nonlabor income) with the ratio of mean wage (nonlabor income) to sample participation rate. Predicted wages obtained from year-specific selection-corrected log wage equation (See notes to Table 2 or 3). Panel B presents elasticities from a selection corrected instrumental variables regression of annual hours on endogenous variables—after-tax real wage and virtual income—and other exogenous covariates: age, education, dummy for presence of children less than 7 years, number of children, dummy for poor health, dummy for white, state unemployment rate, census division dummies, and year dummies. Instruments used were after-tax predicted wages, $\hat{w}_{it}(1-\hat{\tau}_{it}^{a})$, where $\hat{\tau}_{it}^{a}$ is average tax rate based on predicted earnings, and virtual income based on $\hat{\tau}_{it}^{a}$. Hours elasticities were calculated by multiplying coefficients on wage (nonlabor income) with the ratio of mean wage (nonlabor income) to sample mean of hours. Pooled models were estimated for each rolling 5- year panel from 1980 to 2006, e.g., 1980-1984 … 1998-2006. Estimates presented are for select 5-year panels. All standard errors are clustered at the individual level and obtained based on 50 bootstrap replications of estimation, including all intermediate estimation steps, so that standard errors are unaffected by the generated regressors problem.

Table 4: Estimated Elasticities from CRE Models With Taxes

	(1) 1980-1984	(2) 1984-1989	(3) 1990-1994	(4) 1995-2002	(5) 1998-2006
Panel A: Participation					
Wage Elasticity	0.528**	0.825**	0.363**	0.373**	0.352**
	(0.162)	(0.208)	(0.156)	(0.071)	(0.065)
Income Elasticity	-0.031	0.056**	-0.068**	-0.014	0.021
	(0.025)	(0.025)	(0.016)	(0.017)	(0.019)
Comp Elasticity	0.534**	0.810**	0.382**	0.377**	0.346**
	(0.158)	(0.207)	(0.156)	(0.071)	(0.064)
Panel B: Hours					
Wage Elasticity	0.178	0.134	0.232*	0.057	0.052
	(0.165)	(0.124)	(0.108)	(0.046)	(0.041)
Income Elasticity	-0.042**	-0.058**	-0.041*	-0.013	-0.044**
	(0.019)	(0.018)	(0.022)	(0.019)	(0.012)
Comp Elasticity	0.188	0.151	0.244**	0.061	0.067
	(0.164)	(0.128)	(0.108)	(0.045)	(0.041)
Observations	7371	7338	7525	8442	9321
LF Participation Rate	0.71	0.77	0.80	0.79	0.79
Mean Wage (All)	7.10	8.15	8.23	8.46	9.08
Mean Income (All)	33.35	37.50	38.06	40.99	42.38
Mean Hours (Workers)	1410.16	1546.82	1605.84	1680.48	1706.75
Mean Wage (Workers)	7.19	8.48	9.01	9.39	10.22
Mean Income (Workers)	42.12	45.56	46.36	49.67	51.04

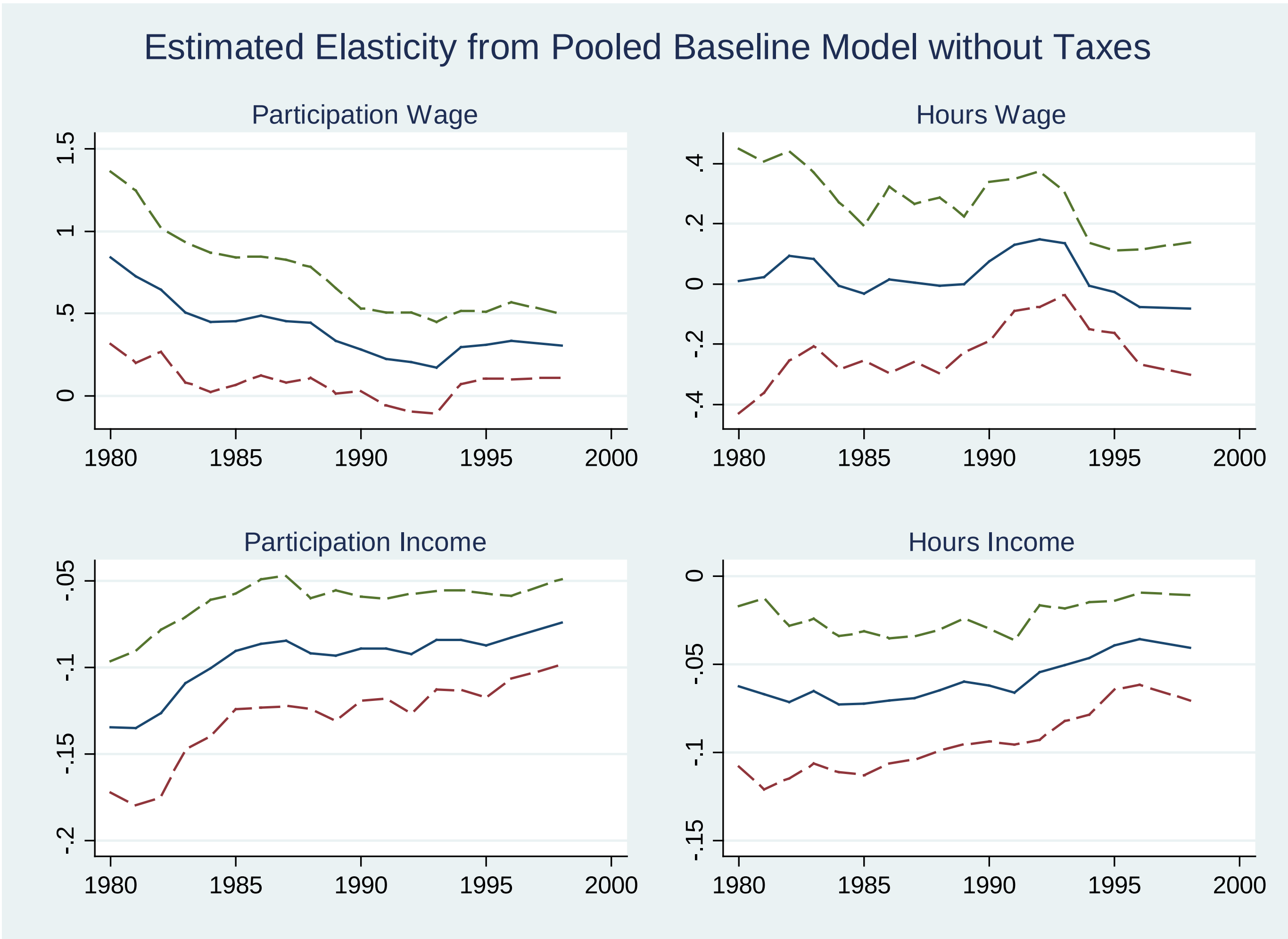
Note: Standard errors are in parenthesis. **Significant at 5 percent level; *Significant at 10 percent level. Panel A presents elasticities from a Probit model of Labor force participation on after-tax predicted real wage, $\hat{w}_{it}(1-\hat{\tau}_{it}^{a})$, where $\hat{\tau}_{it}^{a}$ is average tax rate based on predicted earnings, tax-adjusted nonlabor income, age, education, dummy for presence of children less than 7 years, number of children, dummy for poor health, dummy for white, state unemployment rate, census division dummies, and year dummies. Participation elasticities calculated by multiplying marginal effects of wage (nonlabor income) with the ratio of mean wage (nonlabor income) to sample participation rate. Predicted wages obtained from year-specific selection-corrected log wage equation (See notes to Table 2 or 3). Panel B presents elasticities from a selection corrected instrumental variables regression of annual hours on endogenous variables—after-tax real wage and virtual income—and other exogenous covariates: age, education, dummy for presence of children less than 7 years, number of children, dummy for poor health, dummy for white, state unemployment rate, census division dummies, and year dummies. Instruments used were after-tax predicted wages, $\hat{w}_{it}(1-\hat{\tau}_{it}^{a})$, where $\hat{\tau}_{it}^{a}$ is average tax rate based on predicted earnings, and virtual income based on $\hat{\tau}_{it}^{a}$. Hours elasticities were calculated by multiplying coefficients on wage (nonlabor income) with the ratio of mean wage (nonlabor income) to sample mean of hours. CRE models were estimated for each rolling 5- year panel from 1980 to 2006, e.g., 1980-1984 … 1998-2006. Correlated random effects (CRE) models used means of variables with enough within variation included as additional regressors. Estimates presented are for select 5-year panels. All standard errors are clustered at the individual level and obtained based on 50 bootstrap replications of estimation, including all intermediate estimation steps, so that standard errors are unaffected by the generated regressors problem.

Table 5: Summary Statistics and Marginal Excess Burden Calculations from CRE Models with Taxes

	ERTA81	TRA86	OBRA90	OBRA93	EGTRRA01	JGTRRA03
Predicted Nominal Earnings (Wife)	15055.48	18498.93	21697.23	24046.07	30872.81	31926.44
	(5224.30)	(6309.75)	(6946.47)	(8327.00)	(8735.93)	(10914.81)
Pre-Reform MTR/Net of Tax ($\tau^m/(1-\tau^m)$)	66.14	60.29	46.47	48.85	55.84	53.50
	(21.87)	(15.77)	(10.63)	(11.68)	(17.31)	(15.74)
Change in Federal MTR ($\Delta\tau^m$)	-2.36	-6.43	0.03	0.37	-0.46	-2.30
	(2.90)	(5.58)	(1.20)	(3.05)	(2.78)	(4.28)
Compensated Hours Elasticity (e_c^h)	0.32	0.14	0.30	0.08	0.07	0.07
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Pre-Reform ATR/Net of Tax ($\tau^a/(1-\tau^a)$)	56.13	53.82	42.38	44.45	47.61	45.86
	(20.14)	(17.03)	(10.63)	(11.55)	(14.65)	(16.21)
Change in Federal ATR ($\Delta\tau^a$)	-1.79	-5.94	0.11	0.38	-0.55	-2.23
	(1.51)	(3.87)	(0.64)	(1.81)	(1.14)	(1.85)
Compensated LFP Elasticity (e_c^D)	1.19	0.55	0.34	0.37	0.35	0.35
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Marginal Excess Burden (Hours Margin)*	0.61	0.63	0.00	-0.01	0.03	0.10
	(0.87)	(0.50)	(0.16)	(0.13)	(0.10)	(0.19)
Marginal Excess Burden (Participation)*	1.45	1.96	-0.01	-0.07	0.07	0.36
	(1.69)	(1.45)	(0.10)	(0.28)	(0.15)	(0.37)
Marginal Excess Burden (Both Margins)*	2.07	2.60	-0.01	-0.09	0.10	0.46
	(2.33)	(1.78)	(0.23)	(0.32)	(0.19)	(0.44)
Marginal Excess Burden (Traditional)*	2.88	3.07	0.00	-0.06	0.16	0.61
	(4.10)	(2.44)	(0.34)	(0.69)	(0.63)	(1.18)

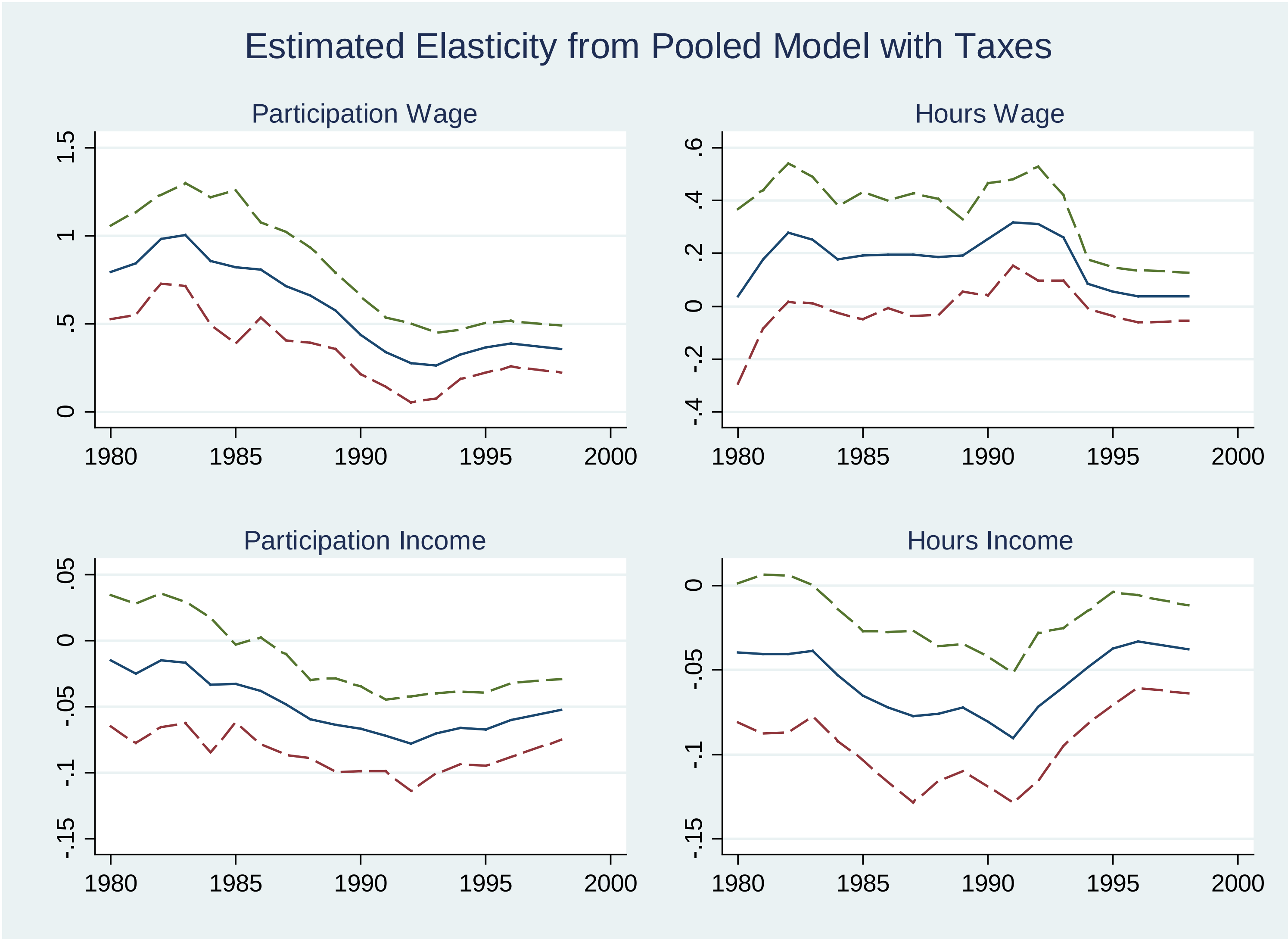
* Marginal excess burden as percent of wife's earnings. Standard deviations are in parenthesis. Calculations are based on equation (7): Marginal Excess Burden (Both Margins) $= \Delta EB/wh = \tau^m/(1-\tau^m)\,\Delta\tau^m\ e_c^h + \tau^a/(1-\tau^a)\,\Delta\tau^a\ e_c^D$. Marginal Excess Burden (Traditional) $= \tau^m/(1-\tau^m)\,\Delta\tau^m\,(e_c^h + e_c^D)$. Marginal excess burden presented are averages of individual estimates in the estimation sample from the PSID.

Figure 1



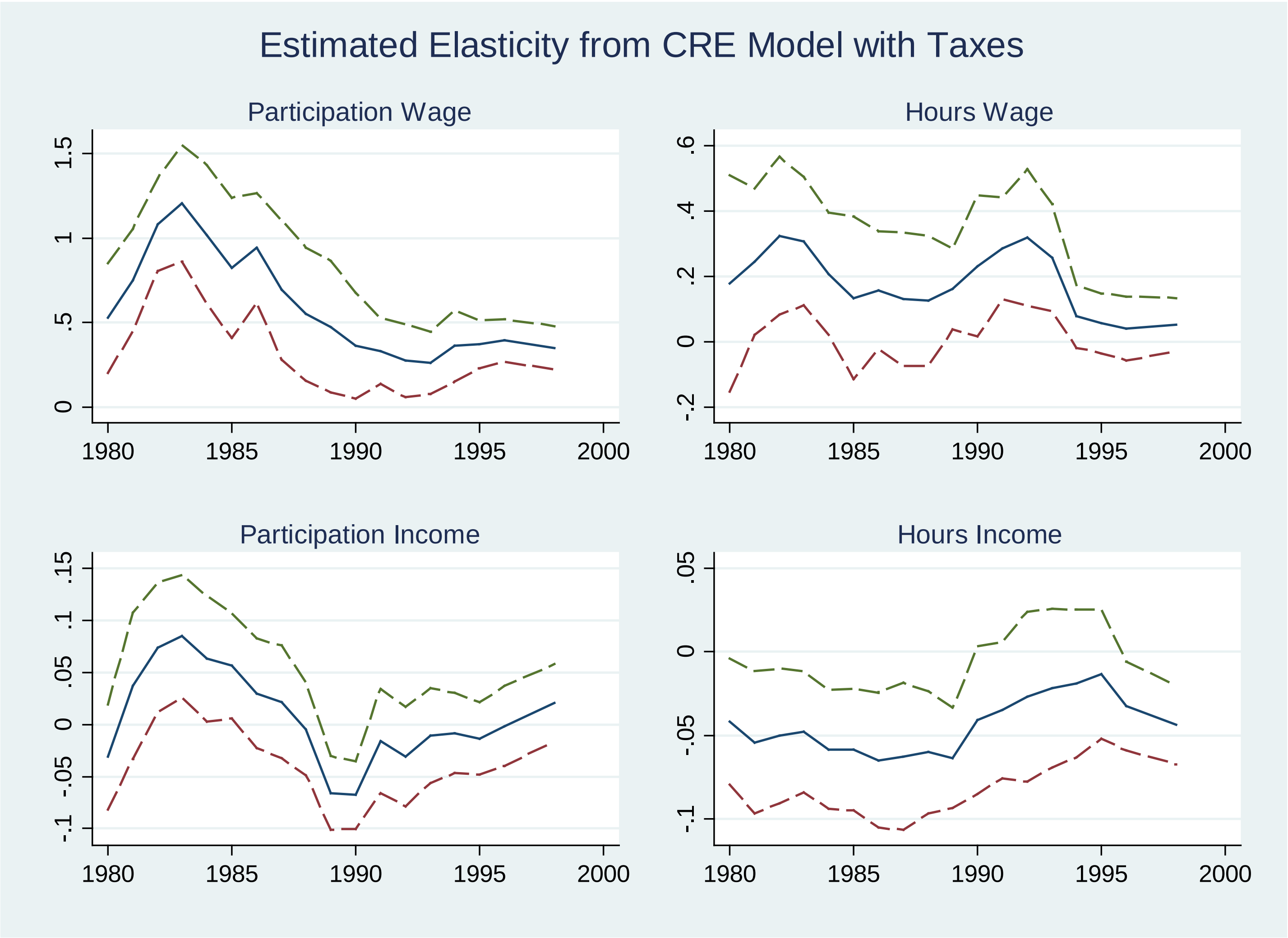
Notes: See Table 2 for regression and other estimation details. Dashed lines represent 95 percent confidence interval.

Figure 2



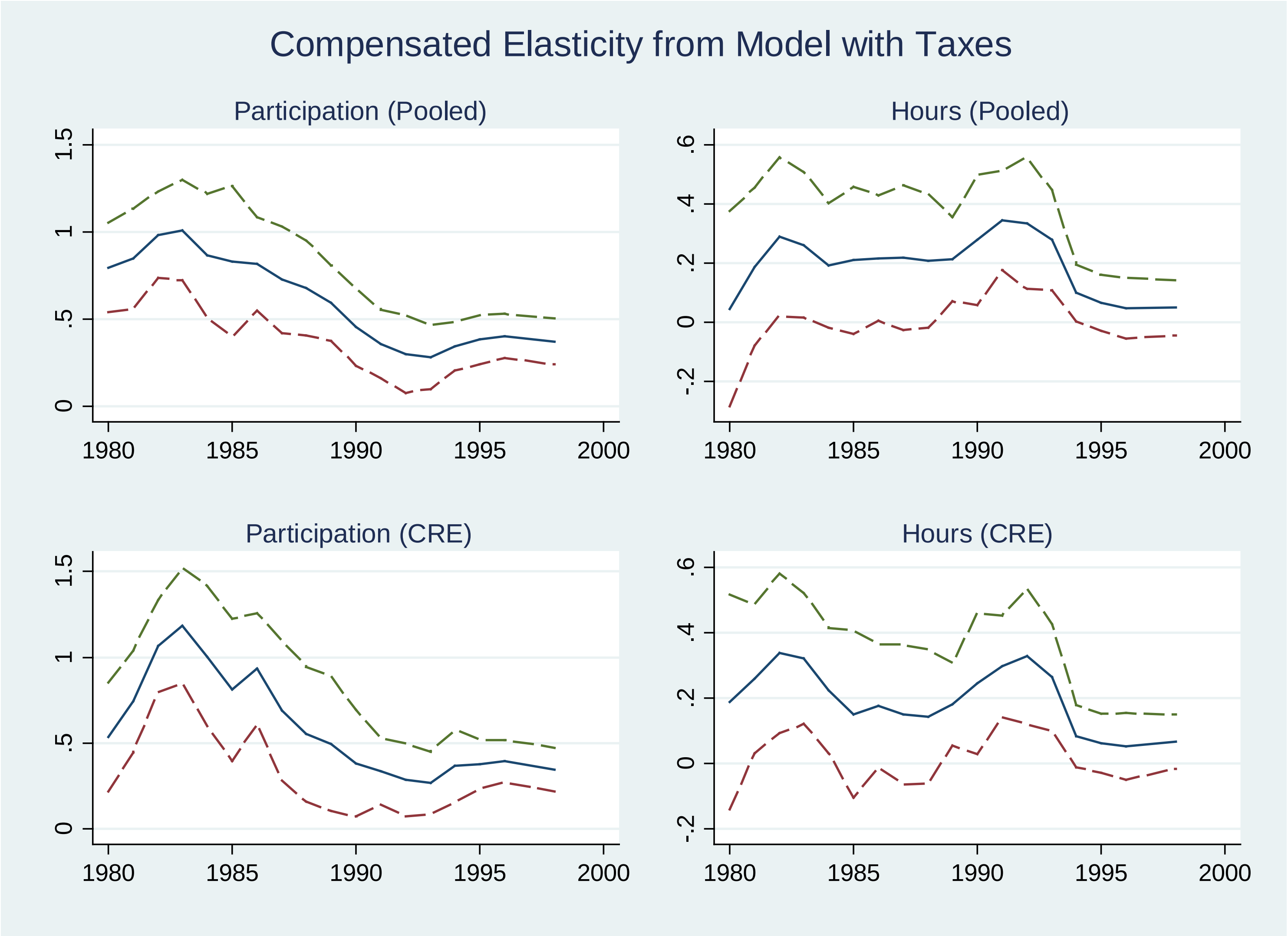
Notes: See Table 3 for regression and other estimation details. Dashed lines represent 95 percent confidence interval.

Figure 3



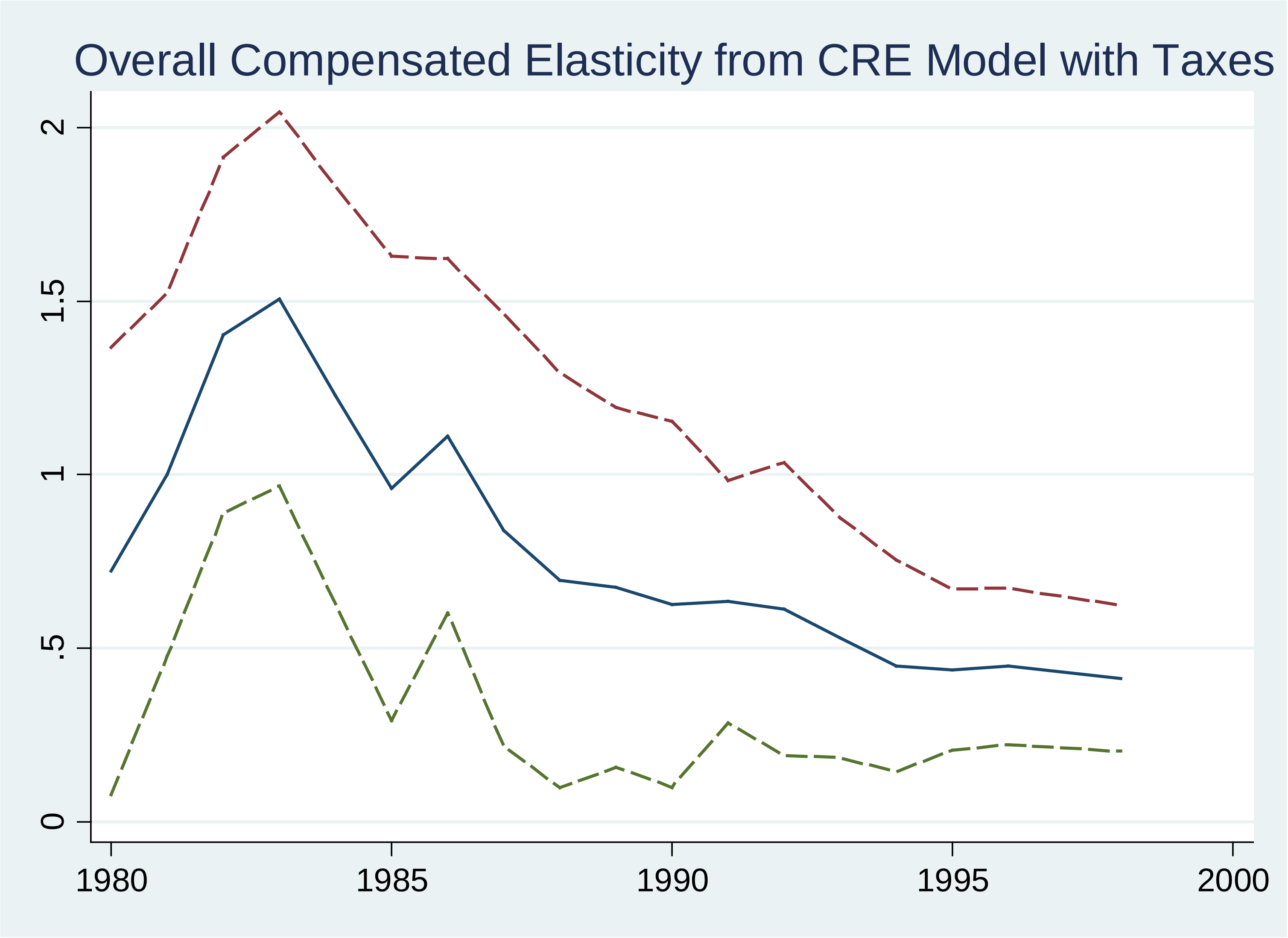
Notes: See Table 4 for regression and other estimation details. Dashed lines represent 95 percent confidence interval.

Figure 4



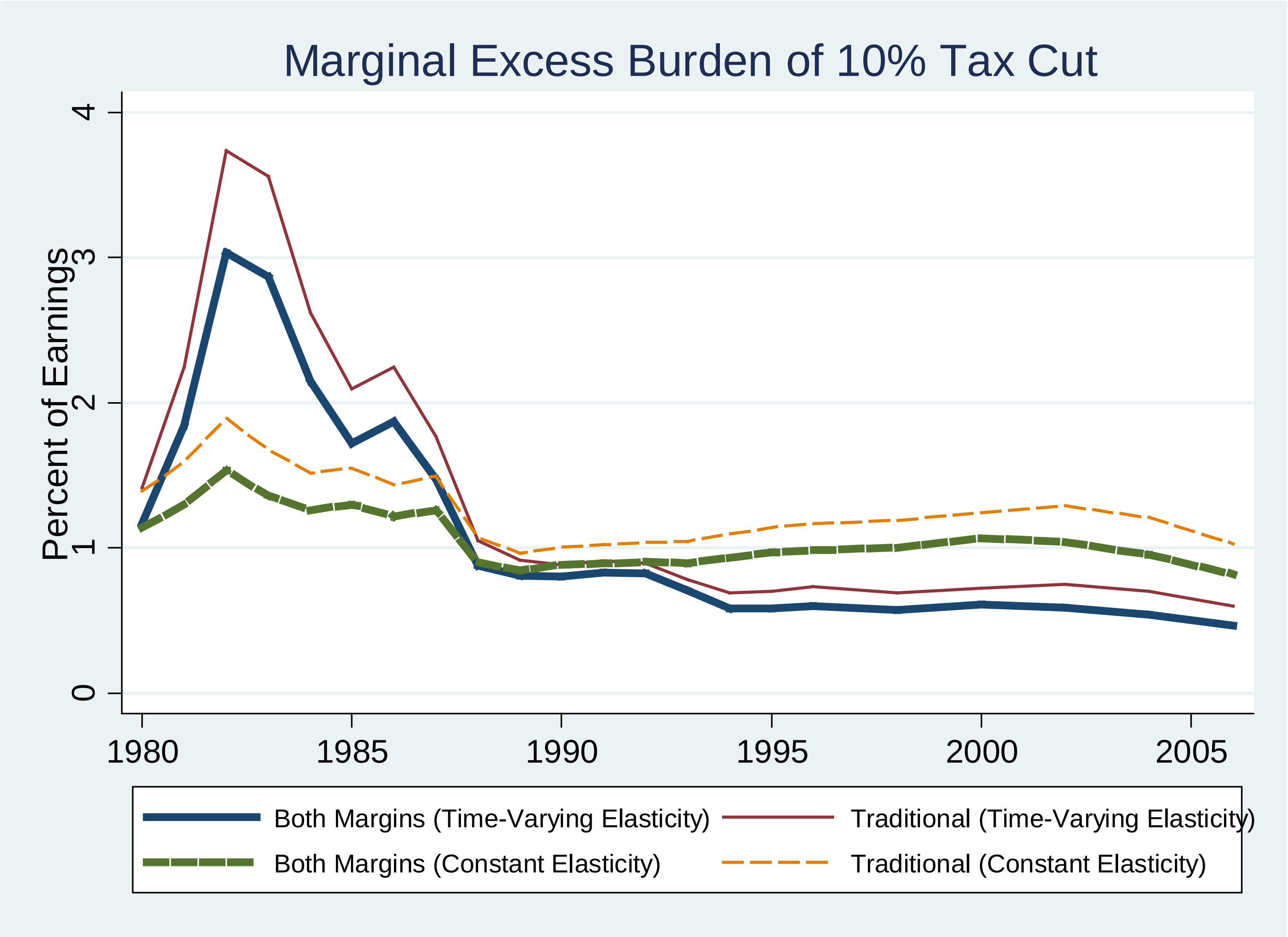
Notes: See Table 3 and 4 for regression and other estimation details. Dashed lines represent 95 percent confidence interval.

Figure 5



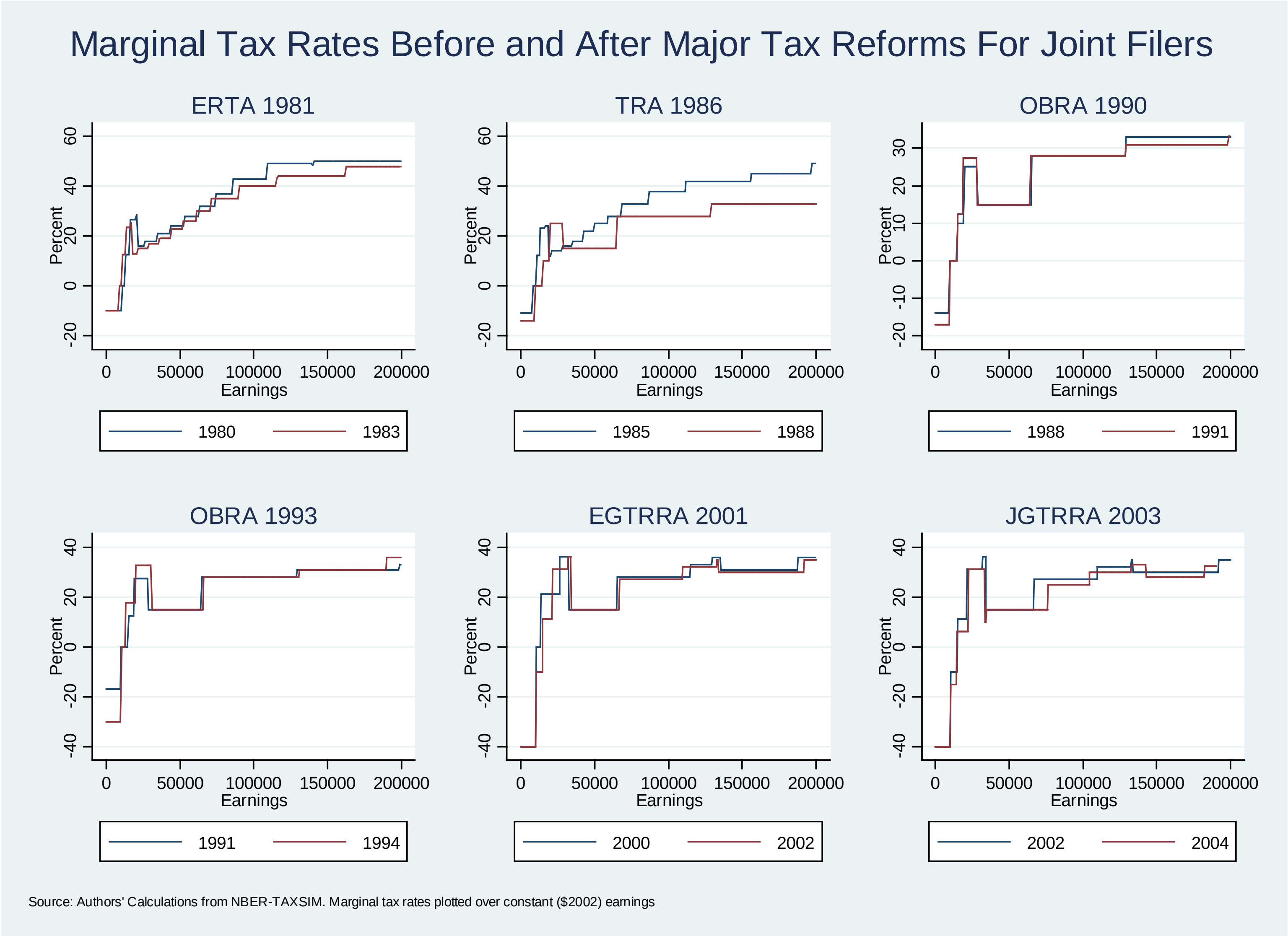
Notes: See Table 3 for regression and other estimation details. Dashed lines represent 95 percent confidence interval.

Figure 6



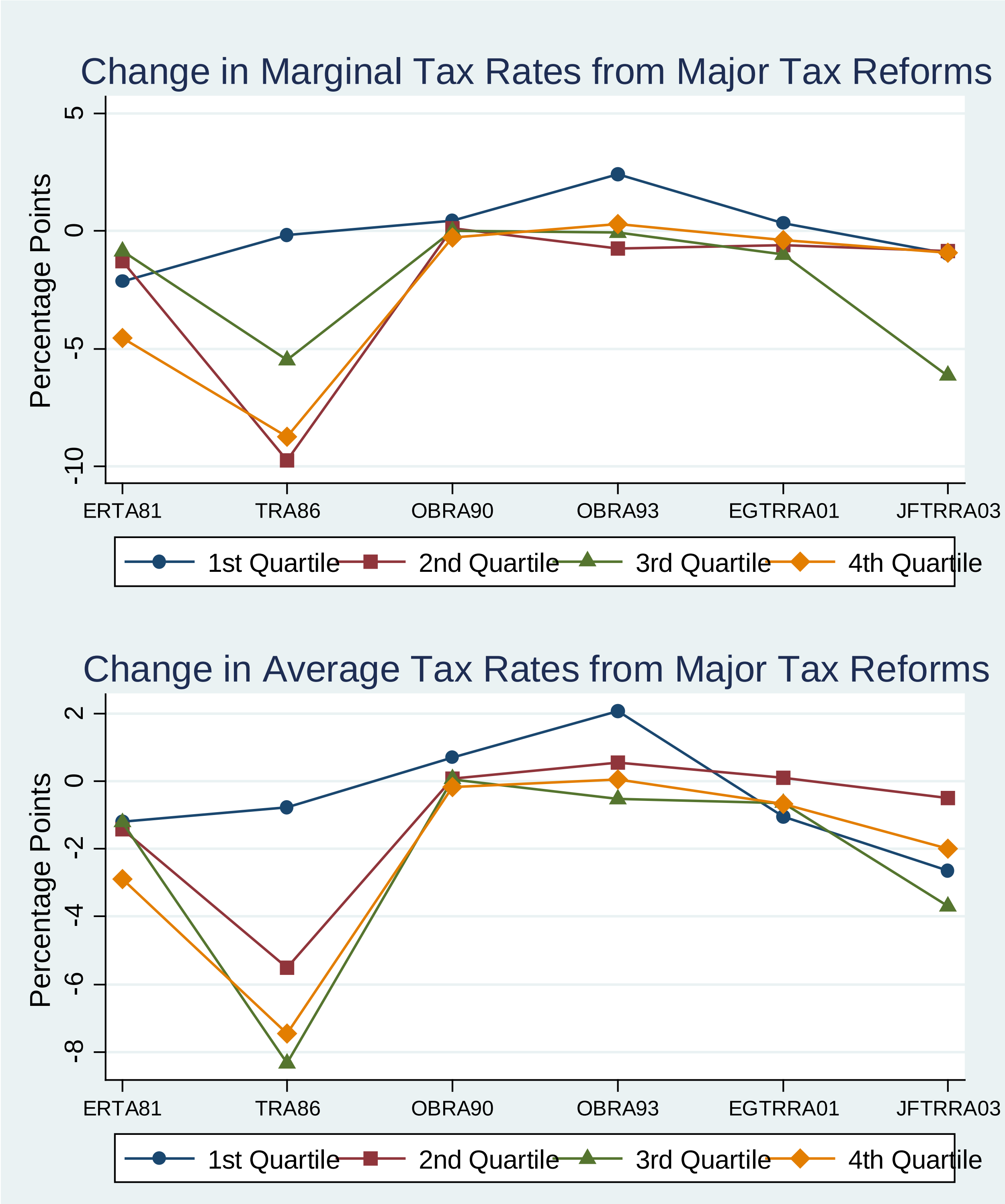
Marginal Excess Burden of 10% Tax Cut
Percent of Earnings
0
1
2
3
4
1980
1985
1990
1995
2000
2005
Both Margins (Time-Varying Elasticity)
Traditional (Time-Varying Elasticity)
Both Margins (Constant Elasticity)
Traditional (Constant Elasticity)

Figure 7



Marginal Tax Rates Before and After Major Tax Reforms For Joint Filers
ERTA 1981
TRA 1986
OBRA 1990
OBRA 1993
EGTRRA 2001
JGTRRA 2003
Percent
Earnings
0
50000
100000
150000
200000
1980
1983
1985
1988
1988
1991
1991
1994
2000
2002
2002
2004
Source: Authors' Calculations from NBER-TAXSIM. Marginal tax rates plotted over constant ($2002) earnings

Figure 8



Source: Authors' calculations from PSID and NBER-TAXSIM. Change in tax rates due to the reform based on pre-reform inflation-adjusted earnings.

Figure 9

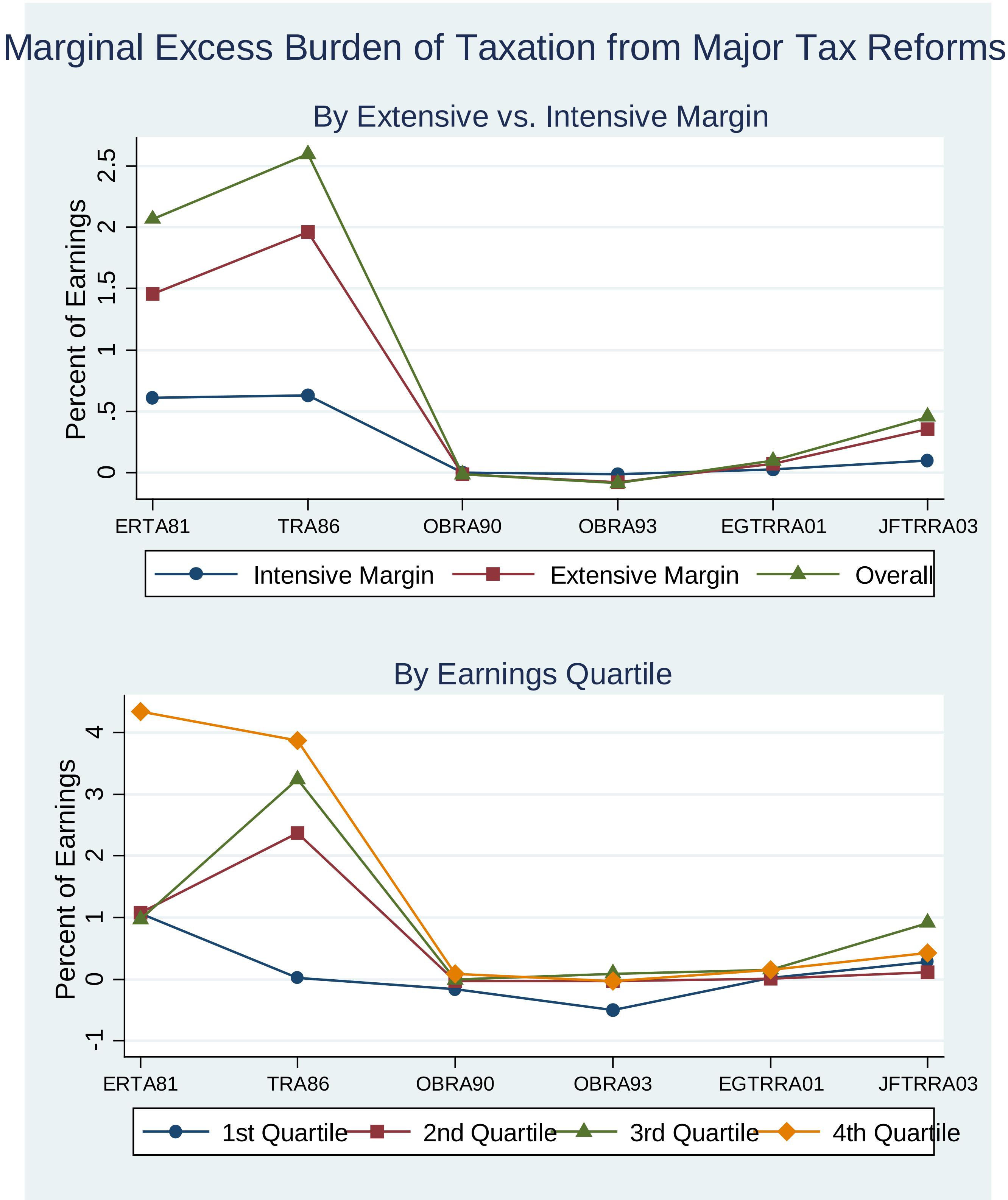
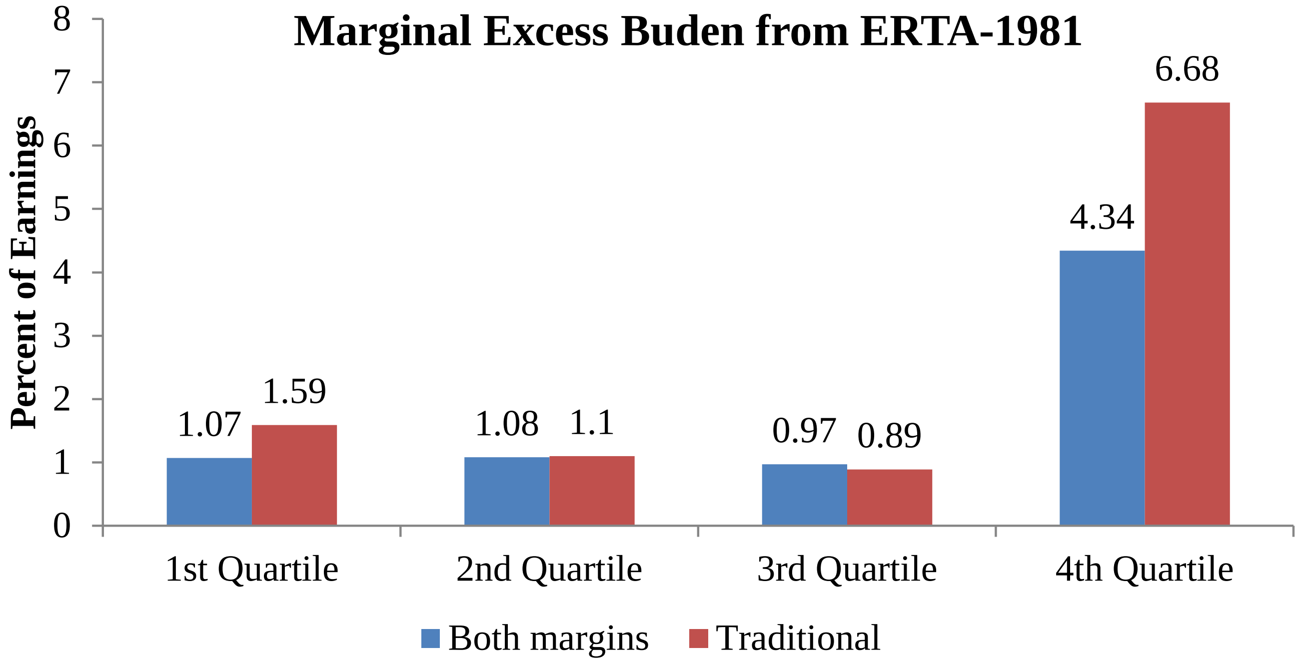
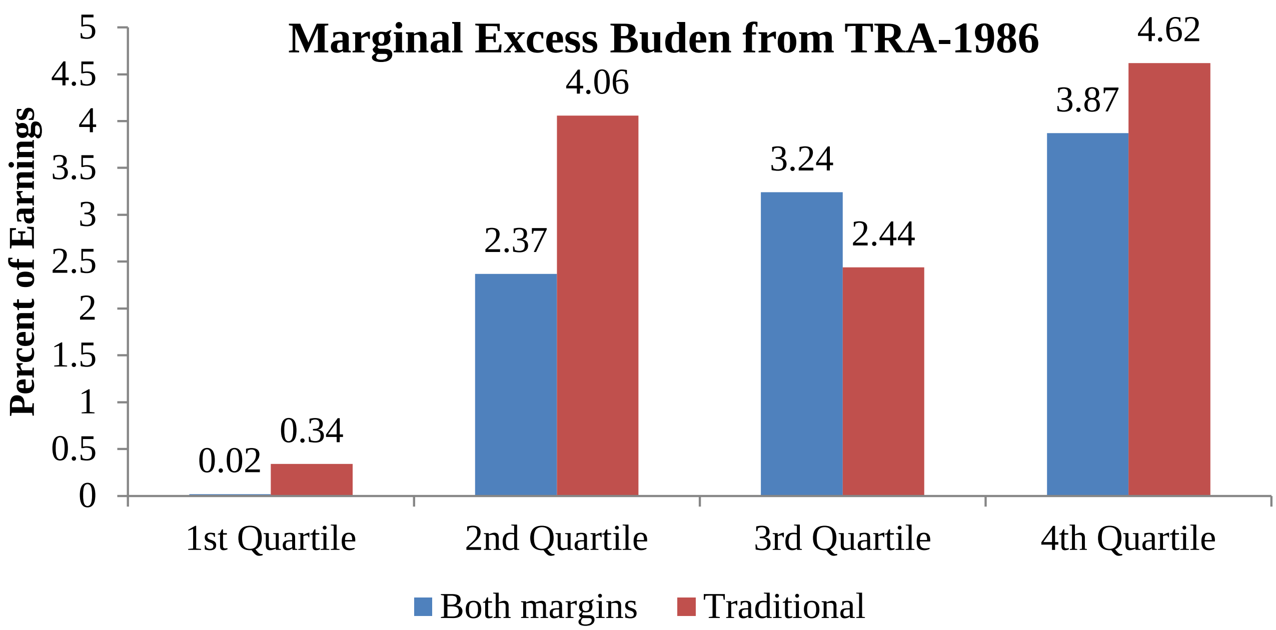

Marginal Excess Burden of Taxation from Major Tax Reforms
By Extensive vs. Intensive Margin
Percent of Earnings
0
.5
1
1.5
2
2.5
ERTA81
TRA86
OBRA90
OBRA93
EGTRRA01
JFTRRA03
Intensive Margin
Extensive Margin
Overall
By Earnings Quartile
Percent of Earnings
-1
0
1
2
3
4
ERTA81
TRA86
OBRA90
OBRA93
EGTRRA01
JFTRRA03
1st Quartile
2nd Quartile
3rd Quartile
4th Quartile

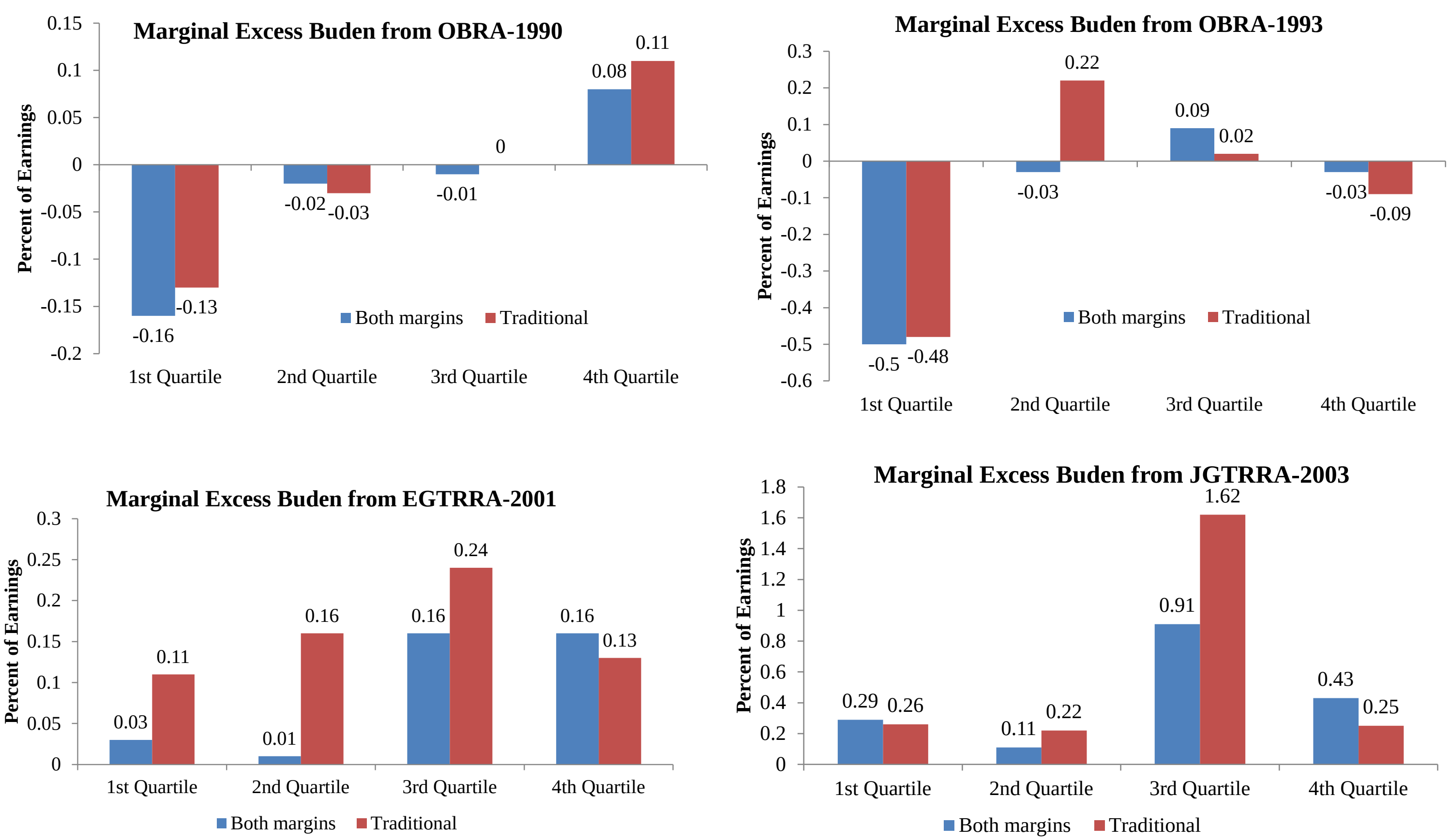
Figure 10





Note: Marginal excess burden are expressed as percent of wife's earnings and are averages of individual estimates in each quartile in the estimation sample from the PSID. Plots labelled "Both Margins" refer to excess burdens calculated using equation (7) by accounting for differing tax wedges on participation and hours margins. Plots labelled "Traditional" refer to excess burdens calculated using equation (8). Pre-reform tax ratio and changes in federal tax rates were calculated using NBER-TAXSIM. Change in tax rates due to the reform based on pre-reform inflation-adjusted earnings.

Figure 11



Note: Marginal excess burden are expressed as percent of wife's earnings and are averages of individual estimates in each quartile in the estimation sample from the PSID. Plots labelled "Both Margins" refer to excess burdens calculated using equation (7) by accounting for differing tax wedges on participation and hours margins. Plots labelled "Traditional" refer to excess burdens calculated using equation (8). Pre-reform tax ratio and changes in federal tax rates were calculated using NBER-TAXSIM. Change in tax rates due to the reform based on pre-reform inflation-adjusted earnings.