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Impact of the 2017 Tax Cuts and Jobs Act on Labor Supply and Welfare of Married Households

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Abstract: This paper calculates the change in optimal labor supply and total family welfare resulting from the Tax Cuts and Jobs Act of 2017 (TCJA). We estimate labor supply elasticities for married families in the Current Population Survey from 2015 to 2017, using a joint family utility model. These elasticities are then used to simulate changes in optimal labor supply and resulting change in welfare among families with different characteristics under the new TCJA tax code. We find that optimal hours are lower post-TCJA, relative to before. However, there are differences across family members and family types. Both men's and women's optimal hours decline with income starting in the second quintile, but the decline is more dramatic for men. Overall, all families' welfare increased post-TCJA, with the gains in welfare disproportionately benefiting the wealthy; families with any self-employment income; families with children; and families renting, versus owning, their home.

JEL classification: I30, J22, D19

Key words: family welfare, joint labor supply, microsimulation, TCJA

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1 Introduction and Backgrounds

On December 31, 2017, the Tax Cuts and Jobs Act (TCJA) became the most sweeping reform of the U.S. tax code since the Economic Growth and Tax Relief Reconciliation Act took effect in 2001 and 2003. The centerpiece of the TCJA affecting all taxpayers was a reduction in marginal tax rates for taxable income. The top tax rate was reduced from 39.6 percent to 37 percent.[1] Personal and dependent exemptions were replaced by a larger standard deduction and expanded child tax credit. New limits to itemized deductions were introduced (e.g., on state and local taxes and mortgage interest) and the phase-down of allowable deductions was removed. The Alternative Minimum Tax (AMT) rules were relaxed making it binding on fewer taxpayers overall. Additionally, personal income earned by small business owners, which was previously taxed at higher personal income tax rates, now qualifies as "pass-through" income (up to certain limits) and is, thus, partially deductible, lowering the effective marginal tax rate for the self-employed.

The purpose of this paper is to take these tax changes into account in order to assess their impact on the welfare of families across the income distribution. For now, we are focused on married families only with either earned or self-employment income. Our analysis goes beyond merely estimating the impact on net income of these tax changes. We estimate a family utility model that allows for joint labor supply decisions of the husband and wife, as well as for adjustments in optimal labor supply in response to changes in net earnings which are affected by the tax reform. Focusing on simulated changes in optimal behavior allows us to isolate changes

[1] Further details of the changes enacted through the TCJA can be found in Gale et al. (2018).

that would be predicted from the tax reform alone, unconfounded by other economic environmental changes.

Most of the analysis to date on the expected impact of the TCJA relates to the impact on aggregate domestic economic output or growth. While Gale et al. (2018) estimates that the TCJA will stimulate the economy in the short-run, he concludes it will have very little effect in the long-run. Kumar (2020) links a one percentage point higher growth in GDP growth and 0.3 percentage point faster job growth in 2018 to the implementation of the TCJA. Lieberknecht and Wieland (2019) contend that the long-run impact on GDP of about 2.5 percent will exceed the short-run impact of two percent. However, Barro and Furman (2018) report a much smaller estimate of the long-run impact of just 0.4 percent increase in GDP, which has been borne out by more recent evidence (see Furman 2019).

A second strand of the literature is devoted to how the TCJA might affect individual and firm behavior. Gaertner, Lynch, and Vernon (2020) find that the reduction in corporate tax rates from 35 percent in 2017 to 21 percent in 2018 resulted in a shifting (as opposed to a permanent increase) in defined benefit contributions by employers in 2017, presumably designed to take advantage of pension-related deferred taxes at higher taxes before TCJA went into effect. In contrast, Hanlon, Hoopes, and Slemrod (2018) find that firms reported (before the TCJA took effect) that they intended to share some of the spoils of the tax cut they were expected to receive with their workers and to increase investments. However, Cohen and Viswanathan (2020) find that these plans did not come to fruition, concluding that, "corporations have not significantly reinvested their tax savings in their employees, property, plants, or equipment." They theorize that the incidence of corporate taxes falls primarily on investors whose behavior is inelastic with respect to tax changes.

The analysis in this paper is focused on the impact of the TCJA on expected changes in optimal family behavior and welfare. It was highly anticipated that the tax cuts from the policy change would disproportionately benefit the top end of the income distribution (Li and Pomerleau 2018). Bhattarai et al. (2019) show that in addition to the unequal treatment of income by the TCJA, the reduction in capital tax rates have the effect with increasing the skill premium, compounding TCJA's effect on increasing inequality. This effect is exacerbated by the expected declines in individual charitable contributions resulting from reduced incentives for such contributions from the new tax rules (Brill and Choe 2018). This paper contributes to the existing literature by exploring the expected impact on optimal hours of work and family welfare across the income distribution. We not only account for changes in expected net income, but also changes in optimal consumption on non-market time.

2 Methodology

Microsimulation is a popular methodology often applied to assess the impact of a specific policy on welfare (for example, see Fiorio 2008; Blundell et al. 2000; Bahl et al. 1993; Blundell 1992; Gustman 1983; Hotchkiss, Moore, and Rios-Avila 2012). Here, we simulate the impact of changes in the tax law under the Tax Cuts and Jobs Act (TCJA). The advantage of the theoretical framework employed for this exercise is that it is constructed from a standard joint family utility model, allowing for joint estimation of labor supply of family members. By specifying a specific form of the utility function, we can estimate changes in utility from changes in net wages and non-labor income, resulting in labor supply changes, and ultimately, changes in family welfare.

2.1 Family Utility Framework

The model described in this section nests the simpler case of single households, which will be investigated at a later time. Family labor supply decisions are modeled in a neoclassical joint utility framework often referred to as the "unitary" model. This model can be thought of as a reduced-form specification of family decision-making. The model yields a clear-cut expression of family welfare that allows for cross wage effects on each member's labor supply decision. Assumptions of the unitary model are often rejected in favor of a bargaining structure, or, more generally, the collective model, for modeling intra-familial decisions making (for example, see Apps and Rees 2009; McElroy 1990). However, a collective model framework provides no concept of measurable household welfare, which is what we are after in this analysis. What matters from the perspective of this paper is how a policy outcome impacts a family's welfare, providing less emphasis on the implications in terms of decision-making structure within the household. Additionally, there is evidence that the choice of structure for household decision making has very little implication for conclusions in microsimulation exercises (see Moreau and Bargain 2005). Further, Blundell et al. (2007) find that both collective and unitary models are consistent with their household labor supply model estimated in the U.K. We do not argue here that the unitary model is generally "better" than the collective model, but rather that it is more appropriate for the research questions in this article. The question posed in this paper requires differentiability of the utility function in order to make use of the indirect utility function to draw conclusions about changes in family welfare.[2]

Within the framework of the neoclassical family labor supply model, a family maximizes a utility function that represents household welfare. Assuming, for simplicity, that there are only two working members of the household (husband and wife), the family chooses levels of non-

[2] Also see Browning, Chiappori, and Lechene (2006), who show that the unitary model, unlike the collective model, is well behaved and satisfies the Slutsky condition.

market time (e.g., leisure, household production) for each member and a joint consumption level in order to solve the following problem:

$$\max_{(L_1,L_2,C)} U = U(L_1, L_2, C)$$
$$subject\ to\ C = w_1 h_1 + w_2 h_2 + Y\ . \tag{1}$$

Define T as total time available for an individual; $L_1 = T - h_1$ will be referred to as the husband's non-market time, and $L_2 = T - h_2$ will be referred to as the wife's non-market time; h_1 is the labor supply of the husband; h_2 is the labor supply of the wife; *C* is total money income (or consumption with price equal to one); w_1 and w_2 are the husband's and wife's after-tax market wage, respectively; and *Y* is non-labor income. L_1 and L_2 correspond to *all uses of non-market time*, including home production activities.[3]

The solution to the maximization problem in equation (1) can be expressed in terms of the indirect utility function, which is solely a function of the wages of the husband and wife and non-labor income of the family:

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

where $h_1^*(w_1, w_2, Y)$ and $h_2^*(w_1, w_2, Y)$ correspond to the optimal labor supply equations (desired hours) for the husband and wife, respectively. By totally differentiating the indirect utility function, we can simulate the change in welfare that results from changes in optimal hours of work and consumption in response to changes in wages and non-labor income (also see Apps and Rees 2009, 263):

$$dV = -U_1 dh_1^* - U_2 dh_2^* + U_3 dC^*\ , \tag{3}$$

[3] Apps and Rees (2009) are highly critical of family utility models that do not include measures of household production, but even they acknowledge that not much can be done without the availability of richer data (p. 108). Since the focus of the analysis in this paper is utility at the household level, the absence of home production activities is not crucial.

where U_1 and U_2 are the family's marginal utility of the husband's and wife's non-market time, respectively, and U_3 is the family's marginal utility of consumption. It is this equation that gives us the change in family welfare that will result from a change in marginal tax rates. It is clear from equation (3) that the change in welfare not only depends on the individual labor supply responses, but also on the family's marginal evaluation of a change in non-market time and income. The simulation exercise answers the following question: How much better (or worse) off are families that we observe in 2015-2017 under the new TCJA tax regime, compared to the pre-TCJA tax regime? In other words, if we hold everything else about a family constant (in terms of age, education, children, pre-tax wages and non-labor income, etc), how is their welfare impacted by the TCJA?

2.2 Estimation of Utility Function Parameters and Labor Supply Elasticities

Simulating the impact on family welfare of a change in the tax code requires the estimation of labor supply elasticities of each family member with respect to changes in their own and each other's (in the case of married-couple families) wages, elasticities with respect to non-labor family income, as well as the changes in the probability of employment (extensive margin elasticities); i.e., the probability of being at an interior solution on the budget constraint. Research on joint labor supply, starting with Ransom (1987), and others, has approached the modeling of the probability of an interior solution using modifications of censored type regressions (Tobit), which necessarily restricts the parameters that determine participation and quantity of hours worked to be the same. In this paper, we implement an extension of this model by estimating a nonlinear bivariate Tobit model which accommodates jointly-determined household labor supply. Using this model, we obtain unbiased labor supply elasticities and utility function parameters that allow us to simulate changes in utility for families optimizing under a different tax regime.

There are many divergent empirical issues raised in the literature related to estimating labor supply elasticities. While the focus of this paper is on the simulation exercise itself, the simulation does require labor supply elasticities and it is, therefore, worthwhile to address some of the empirical issues; most of these issues, including the potential for endogeneity of wages and non-labor income, are addressed in detail in Appendix A. The goal here is to produce reasonable labor supply elasticities that are consistent with the literature. Toward that end, the methodology adopted takes the simplest approach possible while maintaining basic theoretical and empirical integrity. We also illustrate that most of the estimated labor supply elasticities fall well within the range of the existing literature, which contains significant variation in modeling assumptions.

The requirement of simplicity here primarily derives from the goal of quantifying the family-level utility changes. In order to obtain estimates of the pieces of the change in utility in equation (3), a specific functional form of utility must be specified. Following previous work (e.g., Ransom 1987; Hotchkiss, Kassis, and Moore 1997; Heim 2009; Hotchkiss, Moore, and Rios-Avila 2012), we estimate a quadratic form of the utility function:

$$U(Z) = \alpha(Z) - (1/2)Z'\mathrm{B}Z \; , \qquad (4)$$

where Z is a vector with elements $Z_1 = T - h_1$, $Z_2 = T - h_2$, and $Z_3 = w_1h_1 + w_2h_2 + Y$; α is a vector of parameters and B is a symmetric matrix of parameters. This functional form has the advantage of being a flexible functional form in the sense that it can be thought of as a second order approximation to an arbitrary utility function (and when the second order conditions with respect to non-market time comply with $U_{11} < 0, U_{22} < 0$ & $U_{11} * U_{22} > U_{12}^2$ it is well-behaved). In addition, it is possible to produce analytical closed-form solutions for both the husband's and wife's labor supply functions. Obtaining the first order conditions of this unconstrained maximization problem results in a system of equations linear in h:

$$\frac{\partial U}{\partial h_1} = \Omega_1 h_1 + \Omega_2 h_2 + \Omega_3 = 0 \tag{5}$$

$$\frac{\partial U}{\partial h_2} = \Omega_2 h_1 + \Omega_4 h_2 + \Omega_5 = 0 \tag{6}$$

This system can be solved simultaneously, and the desired hours become $h_1^* = f(w_1, w_2, Y)$ and $h_2^* = g(w_1, w_2, Y)$, which represent the desired number of hours the members of a household would like to work, given the parameters that define their household utility function, given wages and non-labor income. Details of this derivation are reported in Appendix B.

Observed hours ($\tilde{h}$), however, might differ from the optimum hours due to stochastic errors, such that:

$$\tilde{h}_1 = \begin{cases} h_1^* + e_1 & if\ observed\ to\ be\ working \\ 0 & otherwise\ (not\ working) \end{cases}$$

$$\tilde{h}_2 = \begin{cases} h_2^* + e_2 & if\ (observed\ to\ be\ working) \\ 0 & otherwise\ (not\ working) \end{cases}, \tag{7}$$

where we assume that (e_1, e_2) follows a bivariate Normal distribution with mean zero and covariance matrix $\sum$. The presence of non-working members of the household poses a special problem since wages are not observed for non-workers. To impute unobserved wages for non-workers, we follow methodology known as predictive mean matching (pmm) (see Little 1988; Morris, White, and Royston 2014). For the implementation, we first estimate Heckman selection models to predict selectivity-corrected pre-tax wages for all workers and non-workers in our sample. Next, we use these predicted wages to randomly assign to each non-worker the observed after-tax wage (both before and after the TCJA) from the worker that is closest based on the

Heckman predicted wage.[4] Separate models are estimated to impute wages for non-working wives and husbands.

The maximum likelihood function corresponding to the joint labor supply optimization problem can be written as follows:

$$L = \prod_{i=1}^{N} \left[\left(\frac{1}{\sigma_1 \sigma_2} \right) \psi \left(\frac{\tilde{h}_1 - h_1^*}{\sigma_1}, \frac{\tilde{h}_2 - h_2^*}{\sigma_2}, \rho \right) \right]^{(H=1,W=1)}$$

$$* \left[\frac{1}{\sigma_1} \varphi \left(\frac{\tilde{h}_1 - h_1^*}{\sigma_1} \right) \left\{ 1 - \Phi \left(\frac{\sigma_1 h_2^* - \rho \sigma_2 (\tilde{h}_1 - h_1^*)}{\sigma_2 \sigma_1 \sqrt{1 - \rho^2}} \right) \right\} \right]^{(H=1,W=0)}$$

$$* \left[\frac{1}{\sigma_2} \varphi \left(\frac{\tilde{h}_2 - h_2^*}{\sigma_2} \right) \left\{ 1 - \Phi \left(\frac{\sigma_2 h_1^* - \rho \sigma_1 (\tilde{h}_2 - h_2^*)}{\sigma_2 \sigma_1 \sqrt{1-\rho^2}} \right) \right\} \right]^{(H=0,W=1)} * \Psi \left(\frac{-h_1^*}{\sigma_1}, \frac{-h_2^*}{\sigma_2}, \rho \right)^{(H=0,W=0)} , \quad (8)$$

where φ and Φ correspond to the probability density and cumulative distribution functions of a univariate normal distribution, and ψ and Ψ represent the probability density and cumulative distribution functions of the bivariate normal distribution. For singles, this likelihood function reduces to the univariate case. Also, H=1 if the husband is working and W=1 if the wife is working (0 otherwise), σ_i (*i*=1,2) represents the standard deviations of (e_1, e_2) and ρ is the correlation between the stochastic errors.

With the expectation of heterogeneity in preferences across families of different income levels (see Keane and Wasi 2016; and Deaton 2018), we estimate different sets of parameters for families for overlapping quintiles of the income distribution. Specifically, we estimate household labor supply models for each overlapping quintile of households. For example, the first set of parameters, for the first quintile, are estimated using households whose predicted income is

[4] To investigate the robustness of the matching process, we generated alternative wage predictions by adding some randomness using the variance of the prediction error (see Morris, White, and Royston 2014); there was no appreciable difference in the estimated parameters.

between the 1st and 20th centiles of the income distribution. For the next estimate, we use data for households between the 2nd and 21st centiles of income, so on and so forth, ending with estimates for families in the 81st to 100th quintile group. This results in 81 samples for which changes in hours, consumption, and welfare are estimated. Families are assigned to a quintile group based on their predicted income from a non-parametric model.

Since where a family falls along the income distribution is likely endogenous to a family's labor supply decisions, we use potential income quintiles, which are exogenously determined as follows. We estimate a fully non-parametric model using total income per week as the dependent variable as a function of the husband's and wife's age, their education, race of the household, metropolitan city status, and region of household residence.[5] Predicted household income from this model is used to classify families into quintile groups for which we estimate separate parameters for household labor supply model. Further details of predicting family income quintile are found in Appendix C.

3. Data

The Current Population Survey (CPS) is administered by the U.S. Bureau of Labor Statistics each month to roughly 60,000 households.[6] The survey has a limited longitudinal aspect in that households are interviewed for four consecutive months, not interviewed for eight months, then interviewed again for four months. Households, families, and individuals can be matched across these survey months if they remain in the same physical location. In survey months four and eight, the household is said to be in the "outgoing rotation" group and members

[5] Race of the household is defined as white, if both husband and wife are white, and other if any of them indicates other race. Since education may be endogenous to income, we have repeated the analysis here excluding education as a predictor without any appreciable difference in results.
[6] We obtained the CPS data set from IPUMS. See Flood et al. (2015).

of the household are asked more detailed questions about their labor market experience, such as wages and hours of work.

We make use of the CPS outgoing rotation groups in March, April, May, and June from 2015-2017, prior to the implementation of the TCJA, in order to construct the samples for which the family labor supply model is estimated. We combine as many months as possible across three years in order to construct a data set as large as possible to meet the demands of the challenging estimation problem. Detailed non-labor income is obtained by matching each family to their March supplement survey, which is when this information is collected. Households that couldn't be matched to the March data are excluded from the analysis.

We restrict the sample further for two reasons. The first is for structural reasons to make the observations conform better to the theoretical model. These restrictions involve including only households with members between 25-64 years of age and excluding households with unmarried couples, or same-sex adults/partners couples, households with children older than 18 or extended adult family members, and households with employed children.[7] We also exclude households in which the main activity of both members is being a student being retired or if either is in the military. We expect that those younger than 25, older than 64, students and retired individuals have additional constraints on their optimization problem not considered here.

Because the simultaneous estimation of nonlinear labor supply functions is challenging, we also "trim" the data to eliminate outliers that cause difficulties in the estimation process.

[7] In same-sex partnered households, it's unclear how to assign the "husband" and "wife" labels; we plan to explore the feasibility of including same-sex couple households in the future. We estimate these comprise roughly 0.8 percent of all household in the U.S. in 2018. Some households have children under 18 earning a significant share of the household total income, which distorts estimation of husband's and wife's elasticities. And the model doesn't allow for potential additional adult labor supply of extended family members.

About ten percent of the sample is eliminated based on the following restrictions: non-positive after-tax weekly household income, negative non-labor income, negative earnings, or an estimated marginal tax rate that is negative or 75 percent or higher. A comparison of means for the trimmed and un-trimmed samples are available in Appendix C. There are very few characteristics for which the two samples differ in their means at a statistically significant level.

3.1 Calculating Tax Rates using TaxSim

Information on family demographics, number of children, earnings, and detailed sources of non-labor income, available from the CPS, are used to calculate the marginal tax rate on earnings (wages), whether as self-employed or as an employee, and the total tax liability (in any year of interest) using the National Bureau of Economic Research (NBER) TaxSim tax calculator. Table 1 lists the data elements accepted by the calculator and what we are able to include along with sources. For some of the information used by the calculator for which we do not have information from the CPS, we use estimates, by quintile and region of the country from the Consumer Expenditure Survey.[8]

[Table 1 about here]

3.2 Sample Means by Quintiles

Table 2 contains means across families in each (predicted) quintile, along with their average estimated marginal tax rates before and after the TCJA. The sample includes roughly 37,000 families, split evenly across quintiles. The employment rate is increasing by quintile for both men and women. Education, wages, and non-labor income are also increasing for both men

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[8] http:// www.nber.org/~ taxsim/; see also Feenberg and Coutts (1993). In addition to the detailed income source information from the CPS data, we also include information on property tax, CPS imputed capital gains and capital losses. All married households are classified as if they were declaring taxes jointly and the main earner is identified as that with the highest total earned income. The tax simulation was implemented using the Stata taxsim interface.

and women across the quintiles. The effect on the TCJA on wages can be seen with higher real net wages for both men and women within each quintile post-TCJA relative to pre-TCJA.[9] The smaller within-quintile virtual non-labor income also reflects smaller tax rates (or, rather, steeper budget constraints in the consumption/leisure plane). On average, federal marginal tax rates declined by 3.9 percentage points, with a larger decline, on average, going to families in the higher quintiles (4.8 percentage points in the highest quintile vs. 3.3 percentage points in the lowest quintile).

[Table 2 about here]

Table 3 illustrates the distribution of families for each quintile across earning type classification. Overall, neither spouse is self-employed in 82 percent of households, and at least one spouse is self-employed in 18 percent of households. Both spouses are self-employed in just three percent of households.

[Table 3 about here]

Sample means by family self-employed status and for those with and without children are found in Table 4. 75 percent of husbands are self-employed whereas only 41 percent of wives are. And as we would expect, families with at least one spouse self-employed or with children enjoyed an even larger tax rate reduction than families with no self-employment or with no children.

[Table 4 about here]

[9] Post-TCJA values for wages and non-labor income are not actual, but merely the observed values in the sample period (2015-2017) evaluated at post-TCJA tax rates.

4. Results

4.1 Utility Function Parameter Estimates and Labor Supply Elasticities

Parameter estimates from estimating the likelihood function in equation (8) are found in Appendix C. The parameter estimates are consistent with expectations regarding the determinants of labor supply. For example, whereas the presence of (especially young) children significantly decrease women's labor supply across all quintiles, the presence of children is either insignificant (young children) or positively influence men's hours of work. Additionally, both men and women, across quintiles, are likely to work fewer hours if they have a disability. Whereas seeing black women working more hours and Hispanic women working fewer hours than white women is not unexpected (for example, see Neal 2004; Stettner and Novello 2017), we might have expected Hispanic men to supply more hours than white men (Stettner and Novello 2017).

These parameter estimates are used to construct labor supply elasticities and marginal utilities with which to perform the simulation of tax changes. Table 5 reports these elasticities and marginal utilities, along with the estimated change in hours and consumption coming from the TCJA tax regime change. Equation (3) is then used to calculate the change in welfare resulting from these changes in hours and consumption. Dividing the change in welfare by the marginal utility of income, we obtain a dollar equivalent value of the change in welfare. The elasticities reported in Table 5 account for both the intensive and extensive changes in hours of work.

[Table 5 about here]

The simulated change in welfare is only as reliable as are our estimates of labor supply elasticities. Figure 1 puts our estimated labor supply elasticities into the context of the existing literature of estimated labor supply elasticities. It is well known that varying assumptions can produce a wide array of labor supply elasticities (see Mroz 1987); our estimates generally fall within the range of those found in the literature.

[Figure 1 about here]

Note that married women's own wage elasticities are positive and higher (in absolute value) than married men's elasticities, indicating that women's labor supply is more responsive and in a positive direction to increases in her own wages. Consequently, the estimated negative cross-wage elasticity for husbands indicate that husbands view their non-market time as a substitute for their wives' non-market time. However, the wives' negative cross-elasticity, along with the husband's negative own-wage elasticity, indicates that wives view their non-market time as complementary with their husband's. Cross wage elasticities for husbands and wives correspond to families in which both members are working. Both men and women present the expected negative income elasticity. The bottom line from these estimates is that the simulation will be based on behavior reflected through labor supply elasticities consistent with those estimated by others, using different data, empirical models, and for different purposes.

The estimation of a Tobit type model means that the total elasticities are essentially the sum of the intensive and extensive margin elasticities. Figure 2 shows that the extensive margin elasticity plays a larger role in the total labor supply response estimated for wives than for husbands. On average, across the income distribution, the extensive margin accounts for thirty percent of the total own-wage elasticity for wives and only five percent of the total own-wage elasticity for husbands.

[Figure 2 about here]

4.2 The Welfare Impact of the TCJA Across the Income Distribution

4.2.a All Families

Figure 3 illustrates the estimated changes in hours (panel a), consumption (panel b), and welfare (panel c) resulting from the TCJA tax reform for the average family in each rolling quintile. Again, these figures tell us how much better (or worse) off families observed in 2015-2017 are under the TCJA at different points in the income distribution. Panel (a) illustrates the impact of higher net wages on hours of work under the TCJA. As net wages rise, the price of non-market time increases, and each hour of work also generates more income, producing a conflicting substitution and income effect. Declining hours (increasing non-market time) indicates that the income effect is dominating the substitution effect from an increase in wages. While Panel (a) illustrates that the impact of the tax reform on hours of work is small (among the highest quintile, average hours declines by about 12 minutes per week for husbands and eight minutes for wives), the disparity in increased non-market time disproportionately favors the wealthy. While some anticipated that the TCJA would increase labor supply, primarily as a result of entrance into the labor market at the low end of the income distribution (Page et al. 2017), Kopytov, Roussanov, and Taschereau-Dumouchel (2020) document a longer-run trend in hours decline resulting from the declining price of leisure goods.

[Figure 3 about here]

Panel (b) illustrates the implications of the lower taxes on total after-tax income. The implication from this panel is that the small decline in hours (lost earnings) was not enough to offset the higher income generated by lower tax rates for both wages and non-labor income. The higher total after-tax income is nearly monotonically rising across the income distribution. Combining the increase in non-market time with the rise in income produces the average total dollar-equivalent change in welfare illustrated in Panel (c).[10] Not surprisingly, with the increase in non-market time and the increase in total income, the TCJA produced higher average welfare for all families across the income distribution. However, higher income families benefited more than lower income families. Dividing the total welfare gain by after-tax, pre-TCJA income flattens the relative welfare gains considerably. While all families are still better off under the new tax regime, there is notable larger relative welfare gains in the top half of the income distribution.

4.2.b Differential Impacts across Family Types

Certain provisions of the TCJA were particularly beneficial to families with certain characteristics. Under the new tax code, qualifying self-employment income became taxed at a lower rate, benefiting families with at least some types of self-employment income. Additionally, families with children received expanded tax credits. On the other hand, many home owners found their deductions for state and local property taxes and mortgage interest payments significantly limited under the new tax regime. The differential impact of these provisions across families can be seen in Figure 4 through the comparison of relative welfare changes for families of different characteristics.

[Figure 4 about here]

Panel (a) of Figure 4 illustrates the larger gains experienced by families with some self-employment income as a result of the larger tax rate cuts these families experienced, relative to families in which neither spouse is self-employed. The greatest difference in gains is

[10] Dollar equivalent welfare change is calculated by dividing total change in welfare by the marginal utility of income. The blip at bottom of the distribution (in centiles 1-3) is the result of sample outliers that have very small average marginal utilities of income, especially among the self-employed -- see Figure 3, panel (b).

concentrated in the upper half of the income distribution where there is a higher incidence of self-employment.

The benefit of the expanded child tax credit of the TCJA is clear when comparing the relative welfare gains among families with children with their childless counterparts in panel (b) of Figure 4. Note that the additional benefit to families with children is more uniformly distributed across the income distribution because, unlike the presence of self-employment income, there is more similarity in numbers of children across income.

Because homeowners typically have higher incomes than families who rent their home, we would expect the larger TCJA cuts in marginal tax rates at the high end of the income distribution to benefit families who own their home relative to families who do not. However, since homeowners faced additional limits on their deductions for state and local property taxes and mortgage interest payments as a result of the TCJA, we see in Panel (c) of Figure 4, that, all else equal, renters enjoyed a slightly larger relative welfare gain than home owners -- but only in the top half of the income distribution. This result is consistent with Altig et al. (2019) who estimate a larger increase in life-time consumption as a result of the TCJA among residents of states with lower state and local property taxes.

5. Conclusions and Policy Implications

The analysis in this paper of the welfare impact of the Tax Cuts and Jobs Act (TCJA) of 2017 finds that families, on average along the income distribution, are better off under the tax environment post-TCJA than before. The dollar equivalent of family welfare increased by an average of $37 per week among the lowest percentile of families to an average of $119 per week among the top percentile. These welfare gains translate into three percent and four percent, respectively, of total income (before taxes). The bottom line is that the welfare gains resulting from the TCJA are increasing in absolute value with income, and the gains are flat as a share of total income.

The welfare gains of the TCJA accruing to families with self-employment income or with children are higher than for other families with similar incomes. Families with self-employment income enjoyed a 64 percent higher gain in dollar equivalent welfare than families with no self-employment income, and families with children enjoyed a 24 percent higher welfare gain compared to their childless counterparts. Importantly, much of this higher welfare gain can be traced to greater reductions in optimal labor supply, especially at the high end of the income distribution -- a significant outcome of the TCJA was to buy leisure for the wealthy. Additionally, given the new limits on deductions for state and local property taxes and mortgage interest deductions, we show that renters, all else equal (most notably, income), experience a greater gain in welfare than home owners in the upper half of the income distribution.

Overall, optimal labor supply is lower post-TCJA, relative to before, implying that the income effect from rising net wages (through lower tax rates) dominates the substitution effect. However, while this is the case for both men and women, the decline in husband's optimal hours is more dramatic than the decline in wives' hours. Note, however, that the impact on hours for both men and women are quite small -- an average of five minutes per week for men and an average of three minutes per week for women. The largest decline in optimal hours was identified for men in the top quintile of households, amounting to 12 minutes per week.

While it is clear that the welfare gains from the 2017 Tax Cuts and Jobs Act were not distributed equally across family types, all families, on average, gained from lower tax rates and other provisions of the tax change that resulted in greater consumption. It's important to point out, however, that most of the provisions of the TCJA benefiting individual tax payers are set to expire in 2025 (Joint Committee on Taxation 2018), which is expected to claw back the welfare gains estimated in this paper. Those provisions most relevant to the results presented in this paper include marginal tax rates, the higher child tax credit, phase-out of the alternative minimum tax, higher standard deductions, and the qualified business income deduction (pass-through provision).The expiration of those individual tax provisions, combined with the retention of most of the corporate tax provisions, will result in greater inequality (Nallareddy, Rouen, and Serrato 2018).

And, lastly, it's important to note, that with the gain in welfare among families due to lower tax rates came at a loss in revenue for the federal, and to a lesser degree, state, coffers. A natural question is whether the gains in welfare were at least as great as the tax revenue lost. This paper does not claim to offer a generalized accounting of the efficiency of aggregate welfare gains, but we can, again using the TaxSim software, offer a back-of-the-envelope comparison of welfare gains to the change in total tax paid by each family as a result of the TCJA. On average, the total welfare gain (annual dollar equivalent per family) is calculated to be $3,522, whereas the Federal revenue lost, on average, per family, is $3,634 (with an additional loss of an average of $66 state revenue per family).[11] This result that one dollar of lost revenue generates less than one dollar of welfare gain, on average, derives from two sources: (1) the bulk of the revenue loss comes from the larger tax rate cuts at the high end of the income distribution, and (2) the marginal utility of an additional dollar of income declines with income. In other words, a dollar's worth of welfare gained is more expensive (in terms of lost tax revenue) at the high end of the income distribution than at the low end of the income distribution.

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[11] A graph of the difference between Federal revenue lost and welfare gained by income quintile is found in Appendix C.

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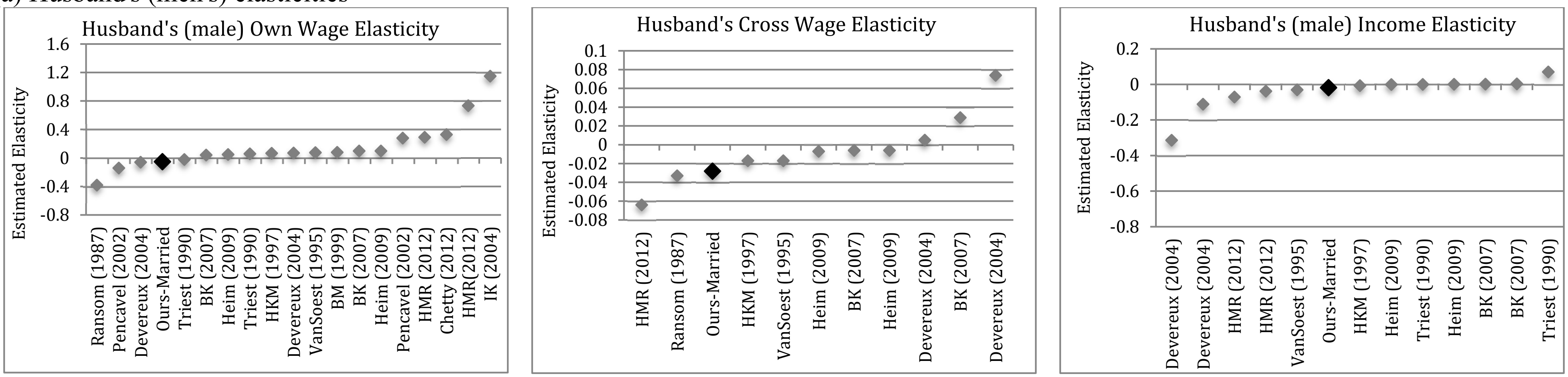
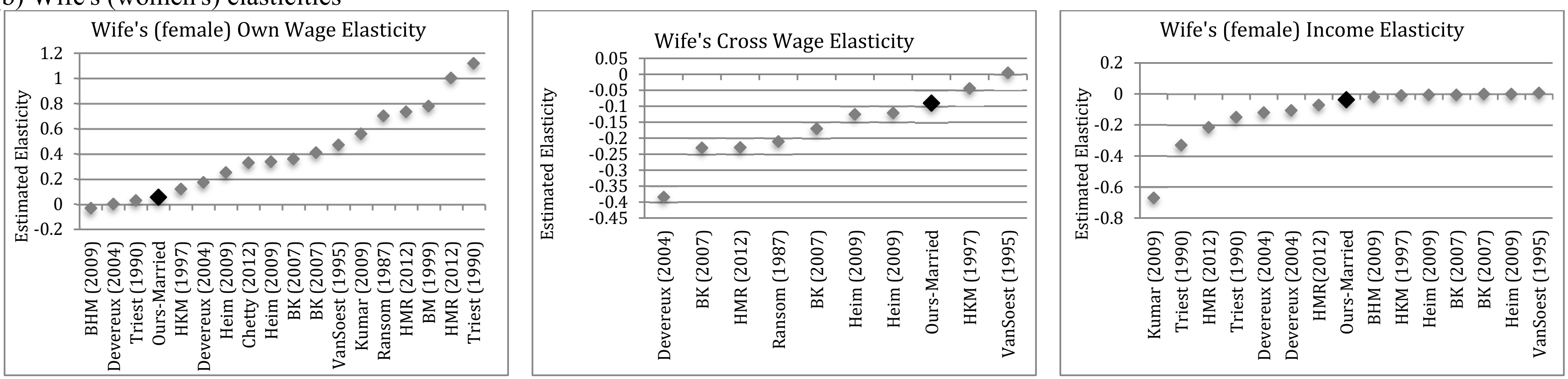
Figure 1 Comparison of labor supply elasticity estimates with the literature.

(a) Husband's (men's) elasticities



(b) Wife's (women's) elasticities



Notes: Sources of literature estimates are (Devereux 2004; Hotchkiss, Moore, and Rios-Avila 2012; Hotchkiss, Kassis, and Moore 1997; Heim 2009; Blau and Kahn 2007; Triest 1990; Pencavel 2002; Ransom 1987; Blundell and Macurdy 1999; Kumar 2009; Bishop, Heim, and Mihaly 2009; Imai and Keane May2004; Chetty 2012; van Soest 1995). Also see Keane (2011) and McClelland and Mok (2012).

Figure 2 Extensive margin own-wage elasticities for husbands and wives.

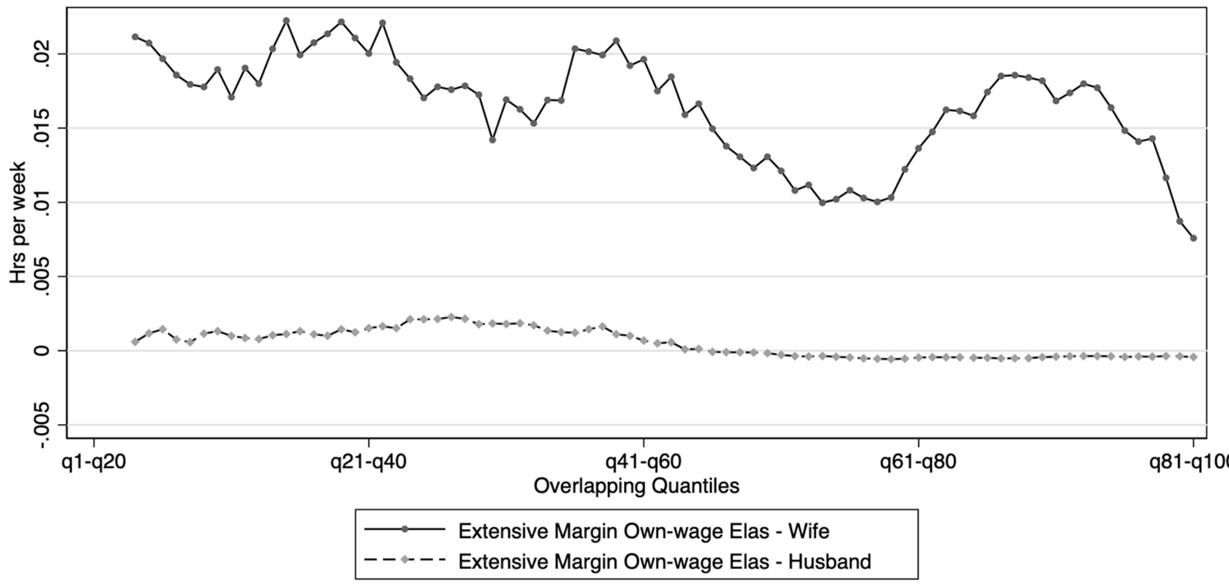
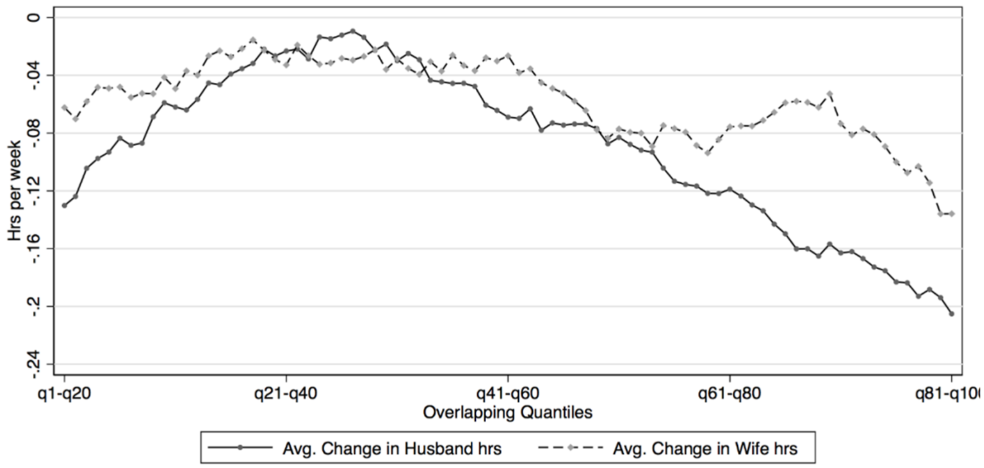
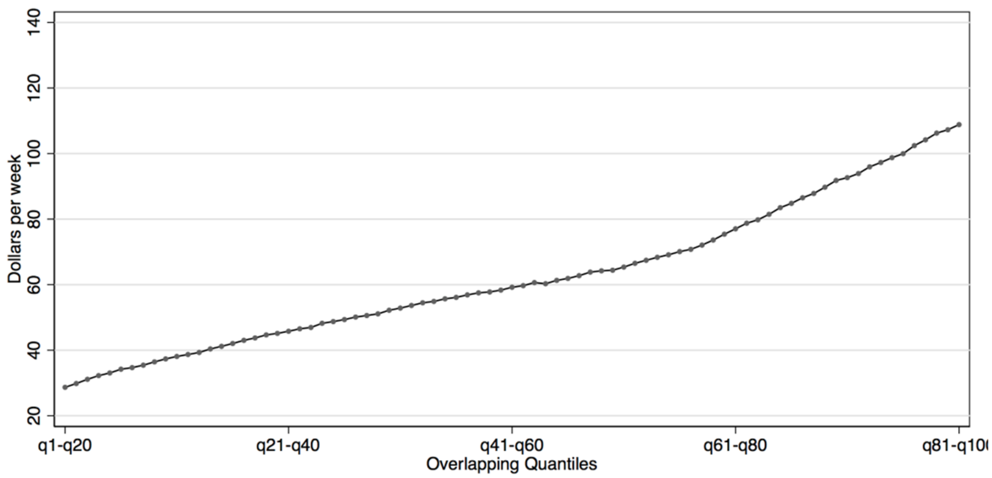


Figure 3 Change in hours, consumption, and welfare resulting from the TCJA.
a) Average change in hours



b) Average change in consumption (after-tax income)



c) Average change in family welfare

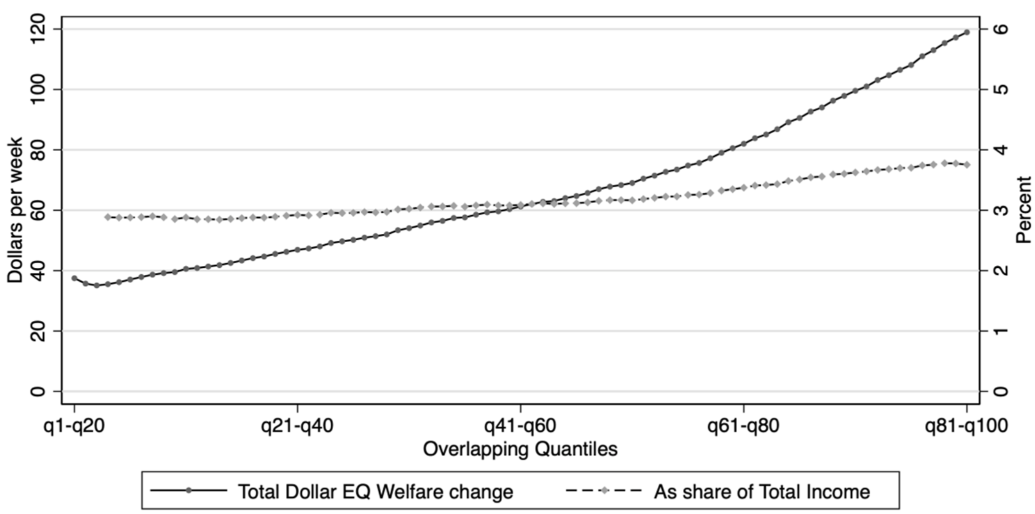
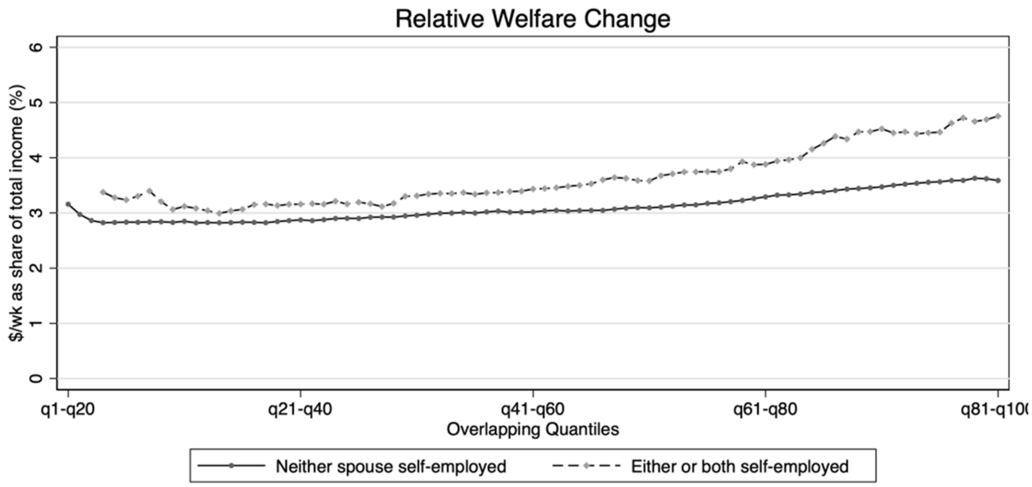
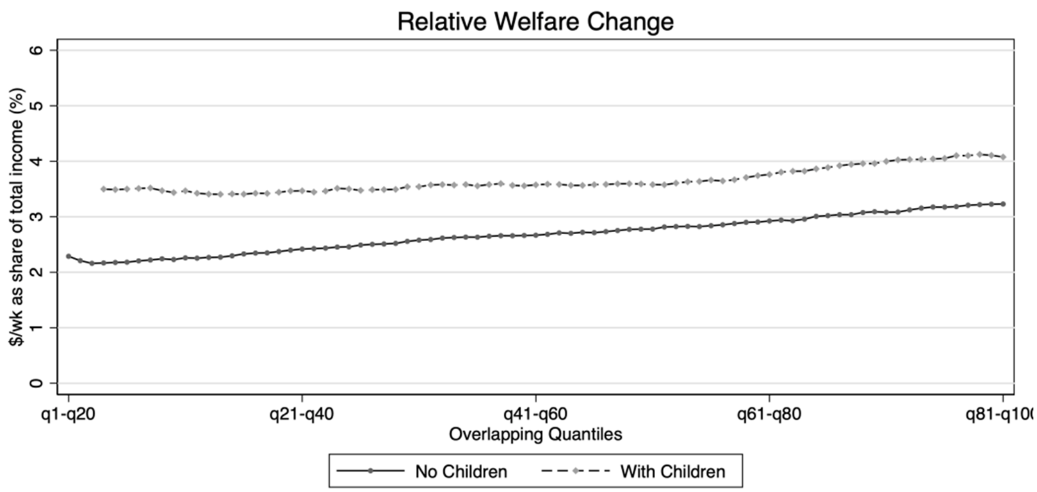


Figure 4 Relative welfare change, comparing families with different characteristics.

a) Families with some self-employment income vs. families with no self-employment income.



b) Families with children vs. families with no children.



c) Families renting their home vs. families owning their home.

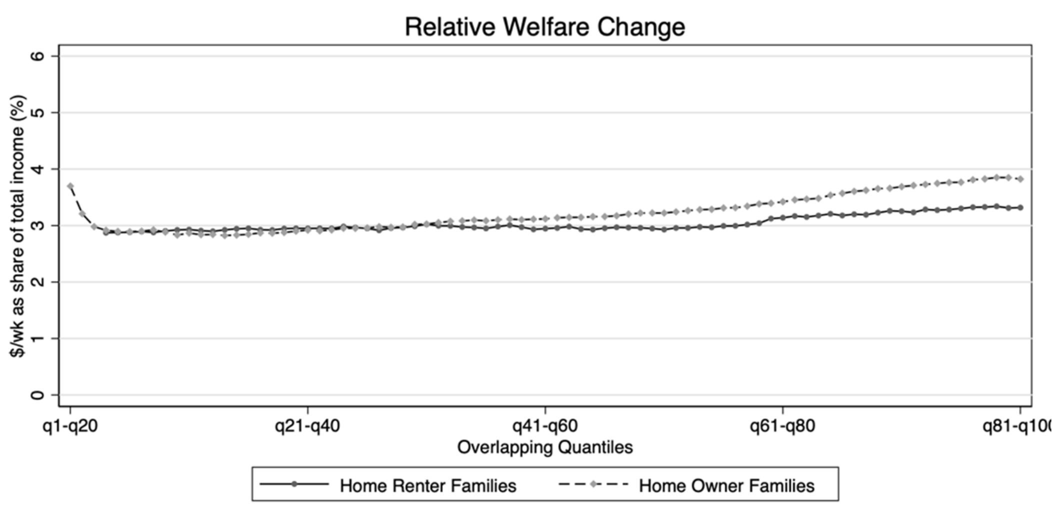


Table 1 Income sources used by TaxSim tax calculator and our treatment of them.

Current	Source	Income Source (TAXSIM item)
included	CPS-ASEC-IPUMS incwage husband	11. **pwages** Wage and salary income of Primary Taxpayer (include self-employment but no QBI).
included	CPS-ASEC-IPUMS incwage wife	12. **swages** Wage and salary income of Spouse (include self-employment but no QBI). Note that this **must be zero** for non-joint returns.
included	CPS-ASEC-IPUMS incdivid household	13. **dividends** Dividend income (qualified dividends only for 2003 on).
included	CPS-ASEC-IPUMS incint household	14. **intrec** Interest Received (+/-)
unavailable	Assume value 0[a]	15. **stcg** Short Term Capital Gains or losses. (+/-)
unavailable	Assume value 0[a]	16. **ltcg** Long Term Capital Gains or losses. (+/-)
included	CPS-ASEC-IPUMS incdivid household	17. **otherprop** Other property income subject to NIIT, including
		unearned or limited partnership and passive S-Corp profits
	incrent	rent not eligible for QBI deduction
		non-qualified dividends
		capital gains distributions on form 1040
		other income or loss not otherwise enumerated here
included	CPS-ASEC-IPUMS Household level	18. **nonprop** Other non-property income not subject to Medicare NIIT such as:
		alimony
	inceduc	nonwage fellowships
		state income tax refunds (itemizers only)
	incother	Other sources of incomes, not reported elsewhere
unavailable	Assume value 0	**Adjustments and items such as**
		alimony paid
		Keogh and IRA contributions
		foreign income exclusion
		NOLs
		can be entered here as negative income.(+/-)
included	CPS-ASEC-IPUMS incretir	19. **pensions** Taxable Pensions and IRA distributions

Current	Source	Income Source (TAXSIM item)
included	CPS-ASEC-IPUMS incss +incssi +incsurv+incdisab	20. **gssi** Gross Social Security Benefits
included	CPS-ASEC-IPUMS incunemp	21. **ui** Unemployment compensation received.
included	CPS-ASEC-IPUMS	22. **transfers** Other non-taxable transfer Income such as
	incwelfr	welfare
	incwkcom	workers comp
	incvet	veterans benefits
	incchild	child support that would affect eligibility for state property tax rebates but would not be taxable at the federal level.
included	CEX – constructed Average Rent paid by marital status, quintile and division. Assigned to non-homeowners	23. **rentpaid** Rent Paid (used only for calculating state property tax rebates)
Included	CPS-ASEC-IPUMS proptax Imputed by Census	24. **proptax** Real Estate taxes paid. This is a preference for the AMT and is is also used to calculate state property tax rebates.
Included	CEX – constructed Average by marital status, quintile and division.	25. **otheritem** Other Itemized deductions that are a preference for the Alternative Minimum Tax. These would include
		Other state and local taxes (line 8 of Schedule A) plus local income tax
		Preference share of medical expenses
		Miscellaneous (line 27)
Included	CEX – constructed Average by marital status, quintile and division. Assigned to Household with Children under 13	26. **childcare** Child care expenses.
unavailable	Assumed as 0	27. **mortgage** Deductions not included in item 25 and not a preference for the AMT, including (on Schedule A for 2009)
		Deductible medical expenses not included in Line 16

Current	Source	Income Source (TAXSIM item)
		Motor Vehicle Taxes paid (line 7)
		Home mortgage interest (Line 15)
		Charitable contributions (Line 19)
		Casulty or Theft Losses (Line 20)
unavailable	Assumed 0 [using average by quintile was producing very high incomes]	28. **scorp** Active S-Corp income (is QBI). (Guaranteed S-corp partner profits and limited partner compensation are taxed as wages, not here).
included	CPS-ASEC-IPUMS incfarm+ incbus Based on occupation[b]	29. **pbusinc** Primary Taxpayer's Qualified Business Income (QBI) subject to a preferential rate without phaseout. Subject to SECA and Medicare additional Earnings Tax.
included	CPS-ASEC-IPUMS incfarm+ incbus Based on occupation[b]	30. **pprofinc** Primary Taxpayer's Specialized Service Trade or Business service (SSTB) with a preferential rate subject to claw-back. Subject to SECA and Medicare Additional Earnings Tax.
included	CPS-ASEC-IPUMS incfarm+ incbus Based on occupation[b]	31. **sbusinc** Spouse's QBI
included	CPS-ASEC-IPUMS incfarm+ incbus Based on occupation[b]	32. **sprofinc** Spouse's SSTB

Notes: All QBI will be treated as earned income before TCJA (2018). Items prior to 11 refer to filing status, number of children, etc. Married couples are all assumed to be filing jointly. More details can be found here: https://users-nber-org.frbakim.idm.oclc.org/~taxsim/taxsim32/

[a] Information for Capital gains and losses, based on Census Bureau's tax model, was discontinued after 2010. Data for the Survey of Consumer Finances is not sufficient to provide an accurate prediction of capital gains/losses. As recommended by TAXSIM, zero is assumed for inputs for which there is no data.

[b] https://www.irs.gov/newsroom/tax-cuts-and-jobs-act-provision-11011-section-199a-qualified-business-income-deduction-faqs

Table 2 Sample means for married families, combined 2015-2017 CPS observations.

	Full Sample	Q1	Q2	Q3	Q4	Q5
Number of Married Families	37,170	7,434	7,434	7,434	7,434	7,434
Husband Average Characteristics						
Working = 1	94.3%	91.4%	93.7%	94.0%	96.0%	96.6%
Self-employed = 1	13.2%	10.3%	13.6%	13.9%	14.2%	14.2%
Net real wage pre-TCJA (w1)	20.93	14.04	17.61	20.14	23.88	28.97
Net real wage post-TCJA	22.17	14.70	18.51	21.27	25.33	31.06
Hours (h1), if working	43.54	41.73	43.53	43.68	43.89	44.78
Age	45.05	42.26	45.31	46.09	44.69	46.89
Disability = 1	4.9%	7.0%	5.8%	5.7%	3.6%	2.4%
Race						
White	76.4%	53.6%	77.1%	84.0%	83.8%	83.2%
Black	6.2%	11.1%	7.6%	5.0%	3.9%	3.3%
Hispanic	10.6%	28.6%	10.3%	5.8%	4.8%	3.7%
Other	6.8%	6.7%	5.0%	5.2%	7.5%	9.8%
Education						
Less than HS	6.2%	27.5%	2.4%	1.0%	--	--
High School	26.8%	53.4%	52.5%	22.1%	5.3%	0.5%
Some College	26.4%	17.2%	37.3%	46.7%	25.2%	5.4%
College	25.3%	1.5%	7.0%	25.6%	49.2%	43.2%
Grad School	15.4%	0.4%	0.9%	4.6%	20.3%	50.9%
Wife Average Characteristics						
Working = 1	79.4%	69.4%	79.8%	82.1%	82.1%	83.9%
Self-employed = 1	7.2%	4.7%	6.7%	7.8%	7.7%	9.2%
Net real wage pre-TCJA (w2)	16.72	11.13	13.72	16.27	19.49	22.99
Net real wage post-TCJA	17.70	11.60	14.39	17.17	20.67	24.67
Hours (h2), if working	37.27	35.98	37.21	37.43	37.41	38.09
Age	43.12	40.03	43.47	44.14	42.88	45.10
Disability = 1	4.5%	6.7%	6.1%	4.3%	3.4%	2.1%
Race						
White	75.9%	54.1%	77.1%	83.1%	83.3%	82.0%
Black	5.4%	9.8%	6.6%	4.3%	3.4%	3.1%
Hispanic	10.8%	28.1%	10.4%	6.1%	5.3%	4.0%
Other	7.9%	8.0%	5.9%	6.6%	8.1%	10.9%
Education						
Less than HS	4.9%	22.1%	1.8%	0.6%	0%	0%
High School	22.3%	50.3%	43.2%	14.4%	3.1%	0.4%

	Full Sample	Q1	Q2	Q3	Q4	Q5
Some College	27.7%	23.9%	43.0%	46.2%	20.4%	4.9%
College	28.2%	3.4%	10.8%	32.5%	55.1%	39.3%
Grad School	16.9%	0.3%	1.3%	6.3%	21.4%	55.5%
Family Average Characteristics						
Net real weekly non-labor (virtual) income pre-TCJA (Y)	369.35	239.85	296.13	363.73	411.58	535.45
Net real weekly non-labor (virtual) income post-TCJA (Y)	358.99	236.22	288.20	353.66	400.18	516.69
Number of children less 0-5	0.332	0.403	0.281	0.282	0.378	0.313
Number of children less 6-12	0.492	0.545	0.448	0.381	0.471	0.616
Number of children less 13-18	0.24	0.219	0.233	0.22	0.228	0.298
Federal marginal tax rate						
pre-TCJA (%)	21.15	17.73	18.93	20.68	22.73	25.65
post-TCJA (%)	17.22	14.39	15.41	16.85	18.58	20.89
State marginal tax rate						
pre-TCJA (%)	4.28	3.59	4.01	4.30	4.57	4.91
post-TCJA (%)	4.26	3.57	3.99	4.29	4.57	4.90

Notes: Wages include those assigned to non-workers through predictive mean matching methodology described in text. Post-TCJA values for wages and non-labor income are not actual, but merely the observed values in the sample period (2015-2017) evaluated at post-TCJA tax rates. Virtual non-labor income is the intersection of the budget constraint if the person's budget constraint segment were extended to the vertical axis at zero hours.

Table 3 Distribution of households by employment status and worker classification

	Full Sample	Q1	Q2	Q3	Q4	Q5
Both husband and wife not working	1.27	1.08	1.29	1.61	1.24	1.14
Wife not working, Husband Wage worker						
Husband wage earner	16.84	26.50	16.55	14.26	14.45	12.46
Husband self-employed	2.44	3.03	2.41	2.07	2.21	2.50
Husband not working, Wife Wage worker						
Wife wage earner	4.20	7.16	4.78	4.18	2.68	2.19
Wife self-employed	0.20	0.40	0.19	0.24	0.12	0.07
Both husband and wife wage earners	59.92	52.02	59.74	61.42	62.66	63.79
Husband self-employed, wife wage earner	8.07	5.47	8.58	8.62	9.03	8.66
Wife self-employed, husband wage earner	4.31	2.53	3.89	4.33	4.64	6.17
Both husband and wife self-employed	2.73	1.82	2.58	3.26	2.99	3.01

Table 4 Sample means for full sample by work status and children classifications

	Neither Spouse Self-employed	Either Spouse Self-employed	Without Children	With Children
Number of Married Families	30,567	6,603	17,227	19,943
Husband Average Characteristics				
Working = 1	93.35%	98.85%	90.31%	97.79%
Self-employed=1	0	74.57%	14.22%	7.20%
Net real wage pre-TCJA (w1)	$20.42	$23.26	$20.86	$20.99
Net real wage post-TCJA	$21.58	$24.90	$21.99	$22.33
Hours (h1), if working	43.3	35.5	38.4	36.3
Age	44.5	47.4	49.7	41.0
Disability = 1	5.15%	3.73%	7.53%	2.49%
Race				
White	74.95%	82.86%	81.49%	71.92%
Black	6.65%	4.04%	6.22%	6.15%
Hispanic	11.22%	7.91%	7.05%	13.73%
Other	7.18%	5.19%	5.24%	8.19%
Education				
Less than HS	6.36%	5.27%	5.49%	6.74%
High School	26.89%	26.20%	29.44%	24.46%
Some College	26.30%	26.59%	27.58%	25.29%
College	25.03%	26.43%	23.41%	26.90%
Grad School	15.42%	15.51%	14.08%	16.60%
Wife Average Characteristics				
Working = 1	.7797	86.25%	80.84%	78.24%
Self-employed=1	0	40.80%	7.31%	12.41%
Net real wage pre-TCJA (w2)	$16.43	$18.06	$16.49	$16.92
Net real wage post-TCJA	$17.37	$19.23	$17.37	$17.98
Hours (h2), if working	37.7	44.7	42.9	44.1
Age	42.7	45.3	48.1	38.8
Disability = 1	4.67%	3.85%	6.87%	2.63%
Race				
White	74.59%	81.95%	80.38%	72.03%
Black	5.89%	3.41%	5.62%	5.30%
Hispanic	11.27%	8.37%	7.32%	13.73%
Other	8.24%	6.27%	6.68%	8.94%

	Neither Spouse Self-employed	Either Spouse Self-employed	Without Children	With Children
Education				
Less than HS	5.15%	3.70%	4.34%	5.37%
High School	22.63%	20.52%	26.54%	18.56%
Some College	27.68%	27.71%	28.22%	27.22%
College	27.70%	30.65%	26.25%	29.93%
Grad School	16.84%	17.42%	14.65%	18.93%
Family Average Characteristics				
Net real weekly non-labor (virtual) income pre-TCJA (Y)	$358.71	$418.60	$369.36	$369.33
Net real weekly non-labor (virtual) income post-TCJA (Y)	$348.94	$405.51	$356.88	$360.81
Number of children less 0-5	0.34	0.29	0.00	0.62
Number of children less 6-12	0.49	0.51	0.00	0.92
Number of children less 13-18	0.23	0.27	0.00	0.45
Federal marginal tax rate				
pre-TCJA (%)	21.07%	21.48%	19.52%	22.55%
post-TCJA (%)	17.28%	16.95%	15.92%	18.35%
State marginal tax rate				
pre-TCJA (%)	4.26%	4.35%	4.18%	4.36%
post-TCJA (%)	4.25%	4.31%	4.14%	4.37%

Notes: See notes to Table 2.

Table 5 Estimated elasticities, marginal utilities, and changes in hours, consumption and welfare.

	Full Sample	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Husband						
Own Wage Elasticity	-0.014***	-0.051***	0.023**	0.006	-0.019**	-0.04***
	(0.003)	(0.009)	(0.009)	(0.020)	(0.006)	(0.005)
Cross Wage Elasticity	-0.028***	-0.036***	-0.046***	-0.049***	-0.037***	-0.039***
	(0.002)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)
Income Elasticity	-0.018***	-0.034***	-0.029***	-0.03**	-0.021	-0.026
	(0.002)	(0.005)	(0.006)	(0.015)	(0.023)	(2.976)
Wife						
Own Wage Elasticity	0.056***	0.014	0.064***	0.072***	0.049***	0.034**
	(0.006)	(0.021)	(0.014)	(0.014)	(0.012)	(0.013)
Cross Wage Elasticity	-0.09***	-0.077***	-0.101***	-0.105***	-0.109***	-0.118***
	(0.004)	(0.015)	(0.011)	(0.010)	(0.011)	(0.011)
Income Elasticity	-0.037***	-0.035***	-0.036***	-0.04***	-0.041***	-0.05
	(0.002)	(0.006)	(0.005)	(0.005)	(0.006)	(0.035)
Marginal utilities, wrt:						
husband's non-market time	1.591***	1.617***	4.521***	3.638***	1.671***	1.133***
	(0.175)	(0.460)	(0.606)	(0.560)	(0.339)	(0.289)
wife's non-market time	1.609***	2.303**	5.12***	3.667***	1.691***	1.049***
	(0.192)	(0.732)	(0.837)	(0.649)	(0.347)	(0.249)
income	0.066***	0.04	0.242***	0.17***	0.066***	0.037***
	(0.008)	(0.030)	(0.036)	(0.028)	(0.014)	(0.009)
Changes						
Δ in Husband Hours/wk	-0.087***	-0.13***	-0.023	-0.069***	-0.119***	-0.205***
	(0.007)	(0.014)	(0.017)	(0.018)	(0.016)	(0.018)
Δ in wife Hours/wk	-0.051***	-0.062**	-0.033*	-0.027	-0.076***	-0.136***
	(0.010)	(0.020)	(0.020)	(0.022)	(0.023)	(0.028)
Δ in Real Cons. ($/wk)	64.40***	28.68***	45.78***	59.20***	77.04***	108.84***
	(0.395)	(0.453)	(0.619)	(0.796)	(0.918)	(1.331)
Total Δ in Utility	67.73***	37.48***	46.91***	61.25***	82.02***	118.95***
($ equivalent/wk)	(0.236)	(5.129)	(0.346)	(0.423)	(0.485)	(1.055)
dV Direct Cons. effect	69.18***	31.72***	47.14***	62.12***	83.60***	121.83***
	(0.168)	(0.179)	(0.255)	(0.332)	(0.394)	(0.550)
dV Indirect Cons. effect	-4.603***	-2.942***	-1.494***	-2.946***	-6.316***	-12.24***
	(0.260)	(0.310)	(0.413)	(0.532)	(0.627)	(0.926)
dV Hours effect	3.335***	8.808	1.127**	2.049**	4.982***	10.113***
	(0.366)	(5.445)	(0.553)	(0.638)	(0.915)	(1.602)

	Full Sample	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
As Share of Total Income	3.286***	3.358***	2.923***	3.086***	3.374***	3.753***
Before Taxes	(0.011)	(0.459)	(0.022)	(0.021)	(0.020)	(0.033)
Total Income Before taxes	2061.1	1116.4	1604.4	1984.5	2431.0	3169.3

Note: Table reflects estimates for the average family in each quintile. Statistical significance levels calculated via the Delta method; *, **, *** => estimated parameter statistically significantly different from zero at the 90, 95, and 99 percent confidence levels, respectively.

Table 6 Estimated elasticities, marginal utilities, and changes in hours, consumption and welfare, by family characteristics.

	Neither Spouse Self-employed	Either Spouse Self-employed	Without Children	With Children	Home Owner	Home Renter
Husband						
Own Wage Elasticity	-0.012***	-0.022***	-0.009**	-0.017***	-0.015***	-0.007**
	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Cross Wage Elasticity	-0.028***	-0.028***	-0.031***	-0.026***	-0.029***	-0.025***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Income Elasticity	-0.018***	-0.021**	-0.02**	-0.017***	-0.02***	-0.014
	(0.004)	(0.008)	(0.007)	(0.005)	(0.004)	(0.009)
Wife						
Own Wage Elasticity	0.058***	0.044***	0.061***	0.051***	0.053***	0.065***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Cross Wage Elasticity	-0.089***	-0.094***	-0.082***	-0.097***	-0.094***	-0.075***
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)
Income Elasticity	-0.036***	-0.042***	-0.037***	-0.037***	-0.04***	-0.028***
	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)
Marginal utilities, wrt:						
husband's non-market time	0.864***	4.961***	1.79***	1.42***	1.933***	0.426**
	(0.173)	(0.185)	(0.188)	(0.186)	(0.179)	(0.173)
wife's non-market time	1.508***	2.078***	1.668***	1.558***	1.721***	1.229***
	(0.182)	(0.241)	(0.194)	(0.194)	(0.204)	(0.153)
income	0.069***	0.054***	0.07***	0.062***	0.063***	0.078***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
Changes						
Δ in Husband Hours/wk	-0.08***	-0.117***	-0.065***	-0.106***	-0.096***	-0.054***
	(0.007)	(0.007)	(0.006)	(0.008)	(0.007)	(0.006)
Δ in wife Hours/wk	-0.045***	-0.079***	-0.018**	-0.079***	-0.062***	-0.013
	(0.010)	(0.011)	(0.009)	(0.011)	(0.010)	(0.008)
Δ in Real Cons. ($/wk)	61.85***	76.19***	54.01***	73.37***	69.18***	48.08***
	(0.360)	(0.615)	(0.344)	(0.456)	(0.440)	(0.256)
Total Δ in Utility	63.84***	90.13***	56.08***	77.77***	73.86***	48.59***
($ equivalent/wk)	(0.223)	(1.646)	(0.212)	(0.274)	(0.308)	(0.207)
dV Direct Cons. effect	65.63***	85.64***	57.32***	79.43***	74.71***	50.317***
	(0.151)	(0.270)	(0.179)	(0.214)	(0.188)	(0.123)
dV Indirect Cons. effect	-3.67***	-8.922***	-3.199***	-5.815***	-5.295***	-2.241***
	(0.246)	(0.363)	(0.220)	(0.301)	(0.288)	(0.172)

	Neither Spouse Self-employed	Either Spouse Self-employed	Without Children	With Children	Home Owner	Home Renter
dV Hours effect	1.994***	13.94***	2.068***	4.406***	4.685***	0.506***
	(0.257)	(1.806)	(0.307)	(0.437)	(0.501)	(0.147)
As Share of Total Income	3.192***	3.846***	2.741***	3.749***	3.358***	3.059***
Before Taxes	(0.011)	(0.070)	(0.010)	(0.013)	(0.014)	(0.013)
Total Income Before taxes	2000.2	2343.3	2045.9	2074.2	2000.2	2343.3

Note: Table reflects estimates for the average family in each quintile. Statistical significance levels calculated via the Delta method; *, **, *** => estimated parameter statistically significantly different from zero at the 90, 95, and 99 percent confidence levels, respectively.

ONLINE APPENDIX

Supplemental Online Appendices for

The Differential Impact of the 2017 Tax Cuts and Jobs Act on Labor Supply and Family Welfare of Married Families

Appendix A: Estimation Issues -- obtaining reasonable labor supply elasticities

The simulation methodology detailed in Section 2 is only possible to the extent to which we are able to obtain realistic estimates of labor supply elasticities through which the change in family welfare is calculated. This appendix discusses a number of issues well-known to the literature related to the estimation of those labor supply elasticities and the implications of those issues to the problem at hand. Many of the caveats, warnings, solutions, and implications related to this specific model were first detailed in Hotchkiss et al (2012).

First of all, the stochastic errors accounted for in equation (7) represent errors in optimization -- observed hours do not exactly reflect desired hours. Keane (2011) points out that there may exist measurement error in observed wages and non-labor income. This classical measurement error may bias elasticity estimates toward zero. Heim (2009), using a methodology most similar to the one used here, presents results showing that accounting for measurement error produces elasticities practically identical to when it is not accounted for. A typical strategy to mitigate the introduction of measurement error on wages per hour has been to restrict the sample to hourly-paid workers. Unfortunately, restricting the sample to hourly workers reduces the sample size too much. Instead, we construct the person's hourly wage using information about weekly earnings and usual weekly hours. This means our wage estimate might suffer from what Keane refers to as "denominator bias," which will have the tendency of biasing labor supply elasticities downward.

Keane (2011) also identifies two potential sources of endogeneity. First, it is reasonable to expect that observed wages and non-labor income are correlated with a person's taste for work (reflected through hours of work). Both fixed effects and instrumental variables have been used to resolve this issue, but are simply not possible in this case since we do not have panel data and because of the highly non-linear nature of the labor supply functions. In addition to the inclusion of variables expected to affect the taste for work (e.g., children), we expect that the inclusion of spousal variables (through the estimation of joint labor supply) will help to remove additional sources of correlation from the error term (i.e., because of positive assortative mating, people with similar taste for work will be married to each other (see Lam 1988; Herrnstein and Murray 1994). In addition, we abstract from the progressivity of the tax structure by using net wages and "linearizing" the budget constraint (see Hall 1973), which is valid if preferences are strictly convex. This means that family members would make the same hours choice facing this linearized budget constraint that they would have made facing the nonlinear budget constraint. It should also be pointed out that assuming a linear budget constraint is for empirical simplification only. The ultimate test of the generated bias is if the model produces labor supply elasticities in line with existing literature. The accomplishment of this goal is illustrated in Figure 1.

This assumption of strictly convex preferences can be tested by analyzing the second order conditions of the maximization problem, which are akin to the internal consistency conditions established by (Amemiya 1974, 1006). Using the nomenclature presented in equations 5 and 6, the conditions imply that $\Omega_1 < 0$; $\Omega_4 < 0$ and $\Omega_1\Omega_4 > \Omega_2 * \Omega_2$, which are found to be true for all the models estimated here. If this assumption is binding, Keane points out that labor supply elasticities will be biased in a negative direction. Aaronson and French (2009) illustrate only a very slight downward bias when progressivity of the tax system is not taken into account.

An additional concern Keane (2011) identifies in the literature is making sure the hours/wage combinations observed in the data are coming off workers' labor supply curve, rather than off employers' labor demand curve. Identification of the labor supply relationship boils down to including regressors (determinants of hours) that reflect the demand for a person's skills (thus determine the observed wage) that are not reflective of that person's taste for work. Toward that end, we include an indicator for race that could affect observed wage through employer discrimination, but, *ceteris paribus* (e.g., controlling for education), should not affect taste for work.

Further, the issue of the presence of fixed costs of working is raised by Apps and Rees (2009). We only marginally control for fixed costs by including the presence of children in the determination of hours. However, Heim (2009) presents results showing that once demographics are controlled for, additional consideration of fixed costs only very slightly impacts estimates of the parameters of the utility function (Heim, Table 3).

As is seen in Section 4, the simplifications that we've made because of the complexity of the model do not harm our goal of obtaining reasonable labor supply elasticities with which to perform the simulations in this paper.

Appendix B: First order conditions of utility maximization problem and labor supply equations.

The quadratic functional form as presented in equation (4) in the text can also be written in the following form:

$$U(Z) = a_1(L_1) + a_2(L_2) + a_3(C) - \frac{1}{2}b_{11}(L_1)^2 - \frac{1}{2}b_{22}(L_2)^2 - \frac{1}{2}b_{33}(C)^2 - b_{12}L_1L_2 - b_{13}L_1C - b_{23}L_2C \quad \text{(B1)}$$

Where $L_1 = T - h_1; L_2 = T - h_2; and, C = w_1h_1 + w_2h_2 + Y$

This becomes an unconstrained utility maximization problem which depends on the working hours h_1 and h_2, assuming that Y (non-labor income) is exogenous. The corresponding first order conditions become:

$$\frac{\partial u}{\partial h_1} = a_1^* + a_3^*w_1 - b_{11}h_1 - b_{33}w_1(w_1h_1 + w_2h_2 + Y) - b_{12}h_2 + b_{13}(2w_1h_1 + w_2h_2 + Y) + b_{23}w_1h_2 = 0 \quad \text{(B2)}$$

$$\frac{\partial u}{\partial h_2} = a_2^* + a_3^*w_2 - b_{22}h_2 - b_{33}w_2(w_1h_1 + w_2h_2 + Y) - b_{12}h_1 + b_{23}(w_1h_1 + 2w_2h_2 + Y) + b_{13}w_2h_1 = 0 \quad \text{(B3)}$$

There is no need to specify a time endowment (T) in order to estimate the labor supply functions because a_1^*, a_2^*, and a_3^* are re-parameterized functions of T and Y. This re-parameterization is necessary for identification of the labor supply equations. It is through these starred parameters that differences in tastes across families are allowed to enter. Specifically,

$a_1^* = X_1\Gamma_1$ and $a_2^* = X_2\Gamma_2$

where X_1 and X_2 are vectors of individual and family characteristics and Γ_1 and Γ_2 are parameters to be estimated.

Using equations (B2) and (B3), we can solve the system obtaining the values of h_1 and h_2 that maximize the utility function, in the following way:

$$\Omega_1h_1^* + \Omega_2h_2^* + \Omega_3 = 0 \quad \text{(B4)}$$

$$\Omega_2h_1^* + \Omega_4h_2^* + \Omega_5 = 0, \quad \text{where,} \quad \text{(B5)}$$

$$\Omega_1 = 2b_{13}w_1 - b_{11} - b_{33}w_1^2; \quad \text{(B6)}$$

$$\Omega_2 = b_{23}w_1 + b_{33}w_1w_2 - b_{12} + b_{13}w_2; \quad \text{(B7)}$$

$$\Omega_3 = a^*{}_1 + a^*{}_3 w_1 + (b_{33} w_1 + b_{13})Y; \quad \text{(B8)}$$

$$\Omega_4 = 2b_{23} w_2 - b_{22} - b_{33} w_2^2; \text{ and} \quad \text{(B9)}$$

$$\Omega_5 = a^*{}_2 + a^*{}_3 w_2 + (b_{33} w_2 + b_{23})Y. \quad \text{(B10)}$$

From equations (B4) and (B5), the solutions for h_1^* and h_2^* become:

$$h_1^* = \frac{\Omega_3 \Omega_4 - \Omega_2 \Omega_5}{\Omega_2^2 - \Omega_1 \Omega_4} \quad \text{and} \quad h_2^* = \frac{\Omega_1 \Omega_5 - \Omega_2 \Omega_3}{\Omega_2^2 - \Omega_1 \Omega_4} \ . \quad \text{(B11)}$$

These derivatives are obtained with the help of Mathematica® (version 8 2010). We calculate expected hours conditional on being positive according to (Muthen 1990).

Appendix C: Additional Tables and Figures

C.1 Endogenous Location on Income Distribution

With the expectation that where a family falls along the income distribution is endogenous to a family's labor supply decisions, we use potential income quintiles to assess the heterogeneity of welfare impacts across the income distribution. Potential income is exogenously determined as follows. We estimate a fully non-parametric model using total income per week as the dependent variable as a function of the husband's and wife's age and education, race of the household, metropolitan area status, and region of household residence. Optimal bandwidths are obtained using a leave-one-out cross validation procedure. Robustness to the exclusion of education and region is performed.

Note that the non-parametric model is not estimated aiming to maximize the R-squared, but, rather, to minimize the leave-one-out cross-validation criteria (Qi and Racine 2007, chap. 4). This is a kind of out of sample predictive power of the model. For the model used to predict household income, we end up with an R-squared = 0.3254 (this is calculated as the squared correlation between the predicted income and actual income). In terms of the predicted quintiles, a cross tab between actual and predicted is found in Table C1. The cross-tabs in Table C1 show that the simple non-parametric model does a reasonably good job predicting household income. Table C2 contains the maximum likelihood parameter estimates for families in each of their predicted income quintile.

Because education might be endogenous to income, we re-estimated the model predicting income quintile excluding education. The corresponding R-squared for this model is .08123. The actual/predicted cross-tabs for this alterative and comparison of estimated elasticities are found in Tables C3 and C4, respectively. Since the fit is better using education and since the estimates are note appreciably affected, we use the first prediction for the results discussed in the paper.

Table C1 Actual/predicted matrix for quintile prediction including education from estimation; specification used for results discussed in paper.

Actual Income	Predicted Quintiles					
Quintiles	1st	2nd	3rd	4th	5th	Total
1st	3531	1696	1135	729	344	7435
2nd	2252	2133	1533	1043	474	7435
3rd	1088	1900	1877	1592	978	7435
4th	417	1130	1731	2046	2111	7435
5th	146	575	1158	2024	3527	7430
Total	7434	7434	7434	7434	7434	37170

Table C2 Maximum likelihood parameter estimates.

	Full Sample	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
a1: Husband						
Age	1.488*	1.053*	1.385*	1.064*	1.746*	1.486*
	(0.0726)	(0.164)	(0.187)	(0.189)	(0.173)	(0.209)
Age^2	-0.0184*	-0.0146*	-0.0177*	-0.0140*	-0.0218*	-0.0175*
	(0.000802)	(0.00185)	(0.00204)	(0.00206)	(0.00189)	(0.00220)
Education (Baseline HS)						
Less than Highschool	-3.419*	-2.717*	-2.503+	0.953		
	(0.351)	(0.472)	(1.235)	(1.889)		
Some College	1.017*	0.514	-0.491	-0.427	-1.256^	-4.268^
	(0.211)	(0.548)	(0.427)	(0.486)	(0.720)	(2.316)
College	2.735*	-0.0787	1.121	-0.0517	-0.941	-2.794
	(0.228)	(1.620)	(0.820)	(0.625)	(0.731)	(2.237)
Grad School	4.751*	-0.754	-0.203	0.910	0.647	-1.024
	(0.276)	(3.104)	(2.104)	(1.052)	(0.803)	(2.240)
Race						
Black	-3.375*	-3.258*	-3.648*	-2.047+	-1.798+	-0.214
	(0.330)	(0.649)	(0.746)	(0.892)	(0.857)	(0.919)
Hispanic	-1.108*	-0.403	-1.453+	-1.256	-0.333	0.395
	(0.270)	(0.490)	(0.649)	(0.810)	(0.737)	(0.829)
Other	-2.919*	-2.795*	-2.738*	-2.764*	-2.011*	-2.236*
	(0.320)	(0.797)	(0.894)	(0.880)	(0.641)	(0.569)
#Children 0-5	0.210	0.549^	0.267	-0.149	-0.643+	0.0847
	(0.143)	(0.332)	(0.378)	(0.403)	(0.321)	(0.312)
#Children 6-13	0.524*	0.571+	0.608+	0.448	-0.0356	0.442^
	(0.107)	(0.251)	(0.271)	(0.302)	(0.244)	(0.227)
#Children 14-18	1.068*	1.136*	1.201*	1.013+	0.380	1.299*
	(0.153)	(0.405)	(0.384)	(0.398)	(0.341)	(0.297)
Has Any Disability	-16.60*	-20.48*	-17.12*	-16.77*	-12.30*	-13.03*
	(0.382)	(0.839)	(0.851)	(0.870)	(0.916)	(1.159)

	Full Sample	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
_cons	15.38*	28.48*	18.63*	26.99*	16.17*	20.29*
	(1.575)	(3.486)	(4.313)	(4.317)	(4.009)	(5.298)
a2: Wife						
Age	0.496*	0.407*	0.819*	1.115*	0.761*	0.495*
	(0.0617)	(0.145)	(0.279)	(0.276)	(0.166)	(0.125)
Age^2	-0.00664*	-0.00591*	-0.0121*	-0.0146*	-0.0101*	-0.00625*
	(0.000799)	(0.00188)	(0.00348)	(0.00343)	(0.00213)	(0.00152)
Education (Baseline HS)						
Less than Highschool	-2.606*	-3.561*	-7.889*	-0.0127		
	(0.344)	(0.965)	(2.444)	(1.919)		
Some College	0.881*	1.547*	3.000*	1.247+	0.791	-2.448+
	(0.136)	(0.492)	(0.836)	(0.539)	(0.488)	(0.984)
College	1.587*	1.842+	4.733*	3.499*	2.160*	-0.961
	(0.202)	(0.821)	(1.405)	(0.974)	(0.654)	(0.833)
Grad School	3.078*	-0.257	-0.962	4.296*	3.575*	0.346
	(0.361)	(2.129)	(2.080)	(1.275)	(0.913)	(0.823)
Race						
Black	0.360+	0.747	1.363	1.054	-0.0616	0.683+
	(0.159)	(0.477)	(1.003)	(0.795)	(0.452)	(0.348)
Hispanic	-0.960*	-1.629*	-2.199+	-1.454+	-0.362	-0.549^
	(0.157)	(0.532)	(0.882)	(0.698)	(0.351)	(0.289)
Other	-1.381*	-0.571	-3.018*	-3.693*	-2.342*	-1.060*
	(0.198)	(0.465)	(1.148)	(1.000)	(0.558)	(0.283)
#Children 0-5	-1.820*	-2.258*	-4.854*	-4.951*	-2.567*	-1.101*
	(0.224)	(0.644)	(1.137)	(1.112)	(0.562)	(0.276)
#Children 6-13	-0.892*	-0.857*	-2.125*	-2.032*	-1.258*	-0.806*
	(0.118)	(0.284)	(0.571)	(0.514)	(0.299)	(0.206)
#Children 14-18	-0.155+	0.773+	0.883^	-0.208	-0.569*	-0.483*
	(0.0706)	(0.310)	(0.478)	(0.327)	(0.213)	(0.161)
Has Any Disability	-5.390*	-8.331*	-19.58*	-10.68*	-4.800*	-2.159*
	(0.635)	(2.208)	(4.189)	(2.366)	(1.042)	(0.585)
_cons	1.495+	6.587+	16.92*	1.476	0.246	0.523
	(0.699)	(2.667)	(6.037)	(3.463)	(2.025)	(1.758)
Utility function parameters (see equation B1 in Appendix B for reference)						
a3	0.207*	0.363*	0.586*	0.443*	0.237*	0.191*
	(0.0169)	(0.0680)	(0.0766)	(0.0599)	(0.0327)	(0.0249)
b12	0.0390*	0.0440+	0.0474^	0.0536+	0.0961*	0.0440+
	(0.00714)	(0.0185)	(0.0272)	(0.0258)	(0.0210)	(0.0197)
b13	-0.176*	-0.491*	-0.294*	-0.263*	-0.174*	-0.195*
	(0.0114)	(0.0586)	(0.0426)	(0.0337)	(0.0232)	(0.0191)
b22	0.280*	0.375*	0.867*	0.598*	0.312*	0.200*
	(0.0326)	(0.0995)	(0.184)	(0.129)	(0.0655)	(0.0460)

	Full Sample	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
b23	-0.0610*	-0.124+	-0.268*	-0.158*	-0.0634*	-0.0376*
	(0.00931)	(0.0515)	(0.0689)	(0.0450)	(0.0183)	(0.0130)
b33*1000	0.0292*	0.101*	0.102*	0.0691*	0.0394*	0.0233*
	(0.00351)	(0.0318)	(0.0182)	(0.0118)	(0.00771)	(0.00482)
Likelihood function estimates (see equation 8 in the text for reference)						
ρ	-0.00101	-0.103*	-0.00957	0.0536*	0.0388*	0.0116
	(0.00535)	(0.0120)	(0.0120)	(0.0120)	(0.0120)	(0.0119)
σ_1	2.652*	2.691*	2.688*	2.688*	2.590*	2.560*
	(0.00386)	(0.00885)	(0.00867)	(0.00866)	(0.00852)	(0.00846)
σ_2	3.026*	3.179*	3.011*	2.973*	2.974*	2.972*
	(0.00439)	(0.0108)	(0.00979)	(0.00959)	(0.00958)	(0.00944)
N	37170	7434	7434	7434	7434	7434

Notes: Standard errors in brackets, * p<0.01, + p<0.05, ^ p<0.1. Recall, b11 is assumed equal to one for identification.

Table C3 Actual/predicted matrix for quintile prediction excluding education from estimation.

Actual Income	Predicted Quintiles					
Quintiles	1st	2nd	3rd	4th	5th	Total
1st	2388	1764	1423	1094	766	7435
2nd	1977	1620	1456	1317	1065	7435
3rd	1431	1526	1529	1548	1401	7435
4th	931	1386	1474	1669	1975	7435
5th	707	1138	1554	1812	2219	7430
Total	7434	7434	7436	7440	7426	37170

Table C4 Comparison of elasticities for different quintile prediction strategies.

	1st Quintile		2nd Quintile		3rd Quintile		4th Quintile		5th Quintile	
Specification:	A	B	A	B	A	B	A	B	A	B
Husband										
Own Wage Elasticity	-0.051	-0.009	0.023	-0.007	0.006	0.014	-0.019	-0.019	-0.040	-0.031
Cross Wage Elasticity	-0.036	-0.023	-0.046	-0.017	-0.049	-0.039	-0.037	-0.028	-0.039	-0.032
Income Elasticity	-0.034	-0.014	-0.029	-0.012	-0.030	-0.036	-0.021	-0.018	-0.026	-0.021
Wife										
Own Wage Elasticity	0.014	0.042	0.064	0.018	0.072	0.068	0.049	0.064	0.034	0.052
Cross Wage Elasticity	-0.077	-0.061	-0.101	-0.046	-0.105	-0.104	-0.109	-0.105	-0.118	-0.112
Income Elasticity	-0.035	-0.024	-0.036	-0.019	-0.040	-0.05	-0.041	-0.044	-0.050	-0.045
Marginal utilities										
wrt husband's non-market time	1.617	1.448	4.521	1.285	3.638	4.23	1.671	1.31	1.133	0.923
wrt wife's non-market time	2.303	1.674	5.120	1.923	3.667	5.177	1.691	1.155	1.049	0.799
wrt income	0.040	0.054	0.242	0.058	0.170	0.204	0.066	0.051	0.037	0.032
Changes										
Change in Husband Hrs	-0.130	-0.051	-0.023	-0.047	-0.069	-0.053	-0.119	-0.101	-0.205	-0.154
Change in wife Hrs	-0.062	-0.02	-0.033	-0.042	-0.027	-0.049	-0.076	-0.057	-0.136	-0.089
Change in Real Consumption	28.676	43.434	45.778	57.807	59.198	65.481	77.037	71.621	108.835	84.874
Total Change in Utility	37.484	45.402	46.905	60.272	61.246	67.824	82.019	75.506	118.949	91.536
dV Direct Cons. effect	31.719	44.982	47.139	61.17	62.120	69.98	83.599	77.062	121.826	92.954
dV Indirect Cons. effect	-2.942	-1.565	-1.494	-3.176	-2.946	-4.535	-6.316	-5.259	-12.244	-7.607
dV Change in non-market time	8.808	1.968	1.127	2.465	2.049	2.343	4.982	3.885	10.113	6.662
As Share of Pre Trump-Tax Consumption	3.611	3.351	3.321	3.791	3.641	3.877	4.128	4.040	4.780	4.478
As Share of Total Income Before Taxes	3.358	2.950	2.923	3.226	3.086	3.220	3.374	3.326	3.753	3.629
Pre Trump Tax: Weekly Consumption	1037.9	1355.1	1412.3	1590.0	1681.9	1749.5	1986.7	1869.1	2488.5	2044.1
Total Income Before taxes	1116.4	1539.1	1604.4	1868.2	1984.5	2106.7	2431.0	2269.8	3169.3	2522.2

Specification A includes education in the prediction of income quintile. Specification B excludes education. Table reflects estimates for the average family in each quintile.

C.2 Implications of Sample Trimming

Because the simultaneous estimation of nonlinear labor supply functions is challenging, we "trim" the data to eliminate outliers that cause difficulties in the estimation process. About ten percent of the sample is eliminated based on the following restrictions: non-positive after-tax weekly household income, negative non-labor income, negative earnings, or an estimated marginal tax rate that is negative or 75 percent or higher. A comparison of means for the trimmed and un-trimmed samples are available in Table C5. There are very few characteristics for which the two samples differ in their means at a statistically significant level.

Table C5 Means comparisons, trimmed vs. non-trimmed samples.

	Sample before trimming		Sample after trimming		Z Statistic and Statistical significance of difference in means	
Husband	mean	Std Dev	mean	Std Dev	Z stat	
=1 if working	0.908	0.289	0.943	0.231	19.06971	***
=1 if self employed	0.131	0.338	0.132	0.339	0.548834	
Wage per hr	29.595	24.641	29.407	22.155	-1.08787	
Hrs of work if working	43.529	10.741	43.540	10.408	0.147871	
Age	45.053	10.813	45.048	10.748	-0.07207	
=1 any disability	0.062	0.241	0.049	0.216	-7.86718	***
White	0.755	0.430	0.764	0.425	2.951694	*
Black	0.066	0.248	0.062	0.241	-2.41161	
Hispanic	0.111	0.314	0.106	0.308	-1.97548	
Other	0.069	0.253	0.068	0.252	-0.23056	
Less than HS	0.071	0.257	0.062	0.240	-5.34868	**
HighSchool	0.270	0.444	0.268	0.443	-0.80651	
Some College	0.262	0.440	0.264	0.441	0.456185	
College	0.244	0.430	0.253	0.435	2.716849	*
Grad	0.152	0.359	0.154	0.361	0.860839	
Wife						
=1 if working	0.759	0.428	0.794	0.404	11.92981	***
=1 if self employed	0.074	0.261	0.072	0.259	-0.57082	
Wage per hr	23.969	21.317	23.809	19.785	-0.96301	

	Sample before trimming		Sample after trimming		Z Statistic and Statistical significance of difference in means	
Hrs of work if working	37.151	11.325	37.266	11.085	1.283193	
Age	43.103	10.813	43.123	10.755	0.264272	
=1 any disability	0.054	0.225	0.045	0.208	-5.50561	**
White	0.751	0.432	0.759	0.428	2.561831	
Black	0.058	0.234	0.054	0.227	-2.26697	
Hispanic	0.111	0.315	0.108	0.310	-1.73779	
Other	0.079	0.270	0.079	0.270	-0.13611	
Less than HS	0.059	0.235	0.049	0.216	-6.1924	**
HighSchool	0.228	0.420	0.223	0.416	-1.92469	
Some College	0.275	0.447	0.277	0.447	0.580187	
College	0.273	0.445	0.282	0.450	2.935019	*
Grad	0.165	0.371	0.169	0.375	1.66889	
Number of kids 0-5	0.344	0.666	0.332	0.654	-2.554	
Number of kids 6-12	0.509	0.833	0.492	0.819	-2.88059	*
Number of kids 13-18	0.246	0.561	0.240	0.551	-1.56188	
Observations	42,553		37,170			

Notes: Both samples include only households with members between 25-64 years of age and exclude households in which both are students or retires, unmarried couples or same-sex adults/partners couples, households with children older than 18 or extended adult family members, and households with employed children. The trimmed also excludes those with non-positive after-tax weekly household income, negative non-labor income, negative earnings, or an estimated marginal tax rate 75 percent or higher or negative marginal tax rates.

C.3 Comparison of Revenue Lost with Welfare Gained

This paper does not claim to offer a generalized accounting of the efficiency of aggregate welfare gains, but we can, again using the TaxSim software, offer a back-of-the-envelope comparison of welfare gains to the change in total tax paid by each family as a result of the TCJA. On average, the total welfare gain (annual dollar equivalent per family) is calculated to be $3,522, whereas the Federal revenue lost, on average, per family, is $3,634 (with an additional loss of an average of $66 state revenue per family). The difference between Federal revenue lost and welfare gained by income quintile is plotted in Figure C1.

Figure C1 Difference between total welfare gain and loss in tax revenue by income quintile.