The taxation of couples*

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Abstract

Are reforms towards individual taxation politically feasible? Are they desirable from a welfare perspective? We develop a novel method to answer such questions and apply it to the US federal income tax since the 1960s. Main findings are: As of today, Pareto-improvements require a move away from joint taxation. Revenue-neutral reforms towards individual taxation are not Pareto-improving, but attract majority-support. Such reforms are rejected by Rawlsian welfare measures and supported by ones with weights that are increasing in the secondary earner's income share. Thus, there is a tension between the welfare of "the poor" and the welfare of "working women."

Keywords: Taxation of couples; Tax reforms; Optimal taxation; Political economy; Non-linear income taxation.

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1 Introduction

The tax treatment of couples is a recurrent theme in debates about tax policy. Levying taxes based on the couple's joint income implies that the primary and secondary earners face the same marginal tax rate. A welfare-maximizing policy would look different. The behavioral responses to changes in the tax rate tend to be stronger for secondary earners than for primary earners. A secondary earner is, for instance, more likely to reduce hours worked or even leave the labor market than a primary earner. The inverse elasticities logic of optimal tax theory, therefore, implies that the marginal tax rate on secondary earnings should be lower than the marginal tax rate on primary earnings, see e.g. Boskin and Sheshinski (1983). Moreover, empirical analyses have shown that, in many countries, the tax and transfer system is a hindrance to the labor market integration of women, see e.g. Bick and Fuchs-Schündeln (2017). Against this background, this paper is motivated by the following broad questions:

1. Can political economy forces explain the persistence of the traditional tax treatment of couples?

2. Are reforms towards individual taxation in everybody's interest? Are they in the interest of secondary earners? Are they in the interest of "the poor"? Do they require an affirmative action rationale or can they be justified by an appeal to Pareto-efficiency or other conventional notions of social welfare?

To make progress on these questions, we derive formulas for an evaluation of tax reforms and bring them to US data using the Current Population Survey (CPS) and NBER's TAXSIM microsimulation model. Our focus is on reforms towards individual taxation. Are such reforms Pareto-improving? Is there majority support? Do they raise "Feminist welfare" and/ or Rawlsian welfare? We document how the answers to these questions have changed over time since the 1960s and hence with the drastic changes in the earning profiles of women, the increased number of singles relative to couples and the increased number of dual-earner couples relative to single-earner couples.

The conceptual framework. The starting point of our analysis is an existing income tax system that has a tax function for singles and one for married couples. In the status quo, the tax base for married couples is the sum of their incomes, with the implication that the primary and the secondary earner face the same marginal tax rate. We develop a conceptual framework for an analysis of tax reforms in this setting. We are particularly interested in *reforms towards individual taxation*, reforms that involve an increase of the marginal tax rates on primary earnings or a decrease of the marginal tax rates on secondary earnings.[1]

We assume that all individuals derive utility from consumption and incur an effort cost when generating earnings. The effort costs may entail both fixed and variable costs so that there are behavioral responses to taxation both at the intensive and the extensive margins. Couples engage in Nash bargaining, thereby determining who earns how much and who gets to consume what share of the couple's disposable income. The spouses bargain subject to a

[1]The longer working paper version of this article, Bierbrauer, Boyer, Peichl and Weishaar (2023a), contains a detailed analysis of the reforms that actually took place in the US. These were reforms *in* the system rather than reforms *towards individual taxation*: They involved changes of the tax functions for singles or couples, with implications for the size of marriage penalties and bonuses. They did not break with the principle that the tax base for couples is the sum of the spouses' incomes.

budget constraint that is shaped by the status quo tax function for couples. We assume that the revenue generated by a reform, if any, is redistributed lump sum. By an application of the envelope theorem individuals that belong to a tax unit are reform beneficiaries if and only if the tax unit's disposable income goes up. A corollary to this observation is that the preferences of the spouses in a couple are aligned. A reform either makes both spouses better off, or makes both spouses worse off. It cannot break the alignment of the primary and the secondary earner in a given couple.

Revenue functions are the key ingredients of the formulas that we use to evaluate tax reforms. Any such function gives the change in tax revenue when marginal tax rates are increased over a narrow range of incomes. There are separate functions applying, respectively, when marginal tax rates are changed only for secondary earners, only for primary earners or simultaneously for primary and secondary earners. In part B of the Appendix, we develop a *positive* theory of multidimensional screening that tells us "who does what" in the status quo. We then consider perturbations of the status quo to obtain characterizations of the revenue functions in terms of sufficient statistics that capture the behavioral responses to these perturbations. We use these sufficient statistics formulas in our evaluation of reforms towards individual taxation.[2]

[2]Our positive theory contrasts with the *normative* theory of optimal multi-dimensional screening. This approach has been used to study the optimal taxation of couples by Kleven, Kreiner and Saez (2009) and, more recently, by Golosov and Krasikov (2023). We consider couples that differ in the productive abilities of the primary and the secondary earner, in their respective fixed costs of labor market participation and in their weights in the couple's internal bargaining procedure. This framework is richer than what has previously been considered in papers that approach the optimal taxation of couples as a problem of multi-dimensional screening. Kleven et al. (2009) focus on a setting in which a primary earner only makes intensive margin choices and a secondary earner only makes an extensive margin

In our setup, joint taxation gives rise to an interdependence of primary and secondary earnings: When primary earnings go up, secondary earnings go down. There is, moreover, an asymmetry in the extensive margin decisions: Whether the primary earner works or not does not depend on the type of the secondary earner. By contrast, a secondary earner who is married to a high earning spouse is less likely to work than a secondary earner married to a low-income spouse. Thus, the model is consistent with the findings in the empirical literature on how the traditional tax treatment of couples affects the earnings choices of women (e.g., Bick and Fuchs-Schündeln (2017)). The development of this theory is a contribution in itself.

Pareto-improving reforms towards individual taxation. In our empirical analysis, we find that marginal tax rates for high-income secondary earners have been inefficiently high for decades. Thus, lowering marginal tax rates for secondary earners would have been self-financing and hence Pareto-improving. This does not imply, however, that joint taxation as such was inefficient. When tax rates are too high also for primary earners, then a Pareto improvement could be realized by lowering marginal tax rates for everybody and hence within the traditional system that has equal tax rates for the primary and the secondary earner. An efficiency rationale for a move towards individual taxation requires that (i) there is no Pareto-improving reform in the traditional system and (ii) that lowering marginal tax rates for secondary earners is Pareto-improving. In our analysis, we find that, for instance, that in the years preceding the Reagan tax cuts in the mid 1980s, marginal tax rates on high incomes were too high both for primary and secondary earners. By

choice. Golosov and Krasikov (2023) have spouses who both only make intensive margin choices.

contrast, as of 2019, (i) and (ii) both hold. This suggests that, as of today, and in contrast to the mid-1980s, sticking to the traditional tax treatment of couples is a genuine source of inefficiency.

Revenue-neutral reforms: Political feasibility. Revenue-neutral reforms toward individual taxation create winners and losers. Losers are couples with the lion's share of the joint income being due to the primary earner. For such couples, the increase of the tax rates on primary earnings is the dominant effect. The lower rates on secondary earnings can mitigate, but not offset, this effect. Winners, by contrast, are couples with secondary earnings close to primary earnings. We study how the political support for such reforms has evolved since the 1960s and hence with the increased number of dual-earner couples. In the 1960s, about 20 percent of all couples would have benefited from such a reform. This share was rising over the years and passed the 50 percent threshold only recently. This suggests that revenue-neutral reforms toward individual taxation might not have been politically feasible in the past, but might attract sufficient political support today.

Revenue-neutral reforms: Welfare implications. Single-earner couples are more concentrated in the bottom deciles of the couples' income distribution. Consequently, a Rawlsian social welfare function would not approve a revenue-neutral reform towards individual taxation. By contrast, an Affirmative Feminist social welfare function – one that gives extra weights to couples with positive secondary earnings – would approve it. Thus, there is a conflict between Rawlsian and Feminist notions of social welfare.

Outline. The remainder is organized as follows. The next section discusses related literature. Section 3 introduces a conceptual framework for the analysis of reforms towards individual taxation. It is complemented by part B of the Appendix, in which we develop a more detailed theory of how couples choose in the status quo and obtain sufficient statistics formulas for the revenue implications of tax reforms. We then use these formulas for an empirical evaluation of the potential inefficiencies generated by joint taxation in Section 4 and of reforms towards individual taxation in Section 5. Concluding remarks can be found in Section 6. All formal proofs, additional empirical findings and robustness checks are relegated to Appendices.[3]

2 Related literature

There is a rich literature that studies the optimal taxation of couples. The seminal reference is Boskin and Sheshinski (1983). The subsequent literature has branched out in numerous ways, covering non-linear taxes and a richer range of behavioral responses.[4] Our approach differs in that we analyze reform directions in a neighborhood of a status quo tax system that has been inherited from the past.[5] Our theoretical analysis is based on a model with multiple hid-

[3]The longer working paper version of this article contains an analysis of past reforms in the US. It documents the changes to marriage penalties and bonuses since the 1960s, evaluates these reforms from a welfare perspective and looks into whether or not there was majority support, both amongst singles and amongst married couples.

[4]See e.g. Kleven et al. (2009), Immervoll, Kleven, Kreiner and Verdelin (2011), Cremer, Lozachmeur and Pestieau (2012), Gayle and Shephard (2019), Malkov (2020), Alves, da Costa, Lobel and Moreira (2021), or Ales and Sleet (2022).

[5]This perturbation approach is frequently used in optimal tax theory. References include Piketty (1997), Saez (2001), Golosov, Tsyvinski and Werquin (2014), Saez and Stantcheva (2016), Lorenz and Sachs (2016), Sachs, Tsyvinski and Werquin (2020), Jacquet

den characteristics:[6] Using a simplified version of the same setup, Golosov and Krasikov (2023) give conditions under which the “traditional” tax treatment of couples with taxes levied on the joint income is welfare-maximizing. Thus, one cannot criticize the traditional system as being per se unjustifiable. To examine whether a traditional system that has been inherited from the past is well-designed or leaves room for further improvements, one must come up with an explicit analysis of reform options. This is what we do in this paper.

Our positive theory of multi-dimensional screening yields comparative statics predictions on how the status quo tax system shapes the earnings incentives of the spouses in a couple. A complementary literature studies the implications of joint taxation in quantitative dynamic models.[7] Holter, Krüger and Stepancuk (2023) use such a framework to show that the transition from joint to individual taxation comes with an increase in the government’s ability to generate tax revenue.

There is a rich literature on the political economy of taxation.[8] To the best of our knowledge, there is no previous work that looks at the taxation of couples from a political economy perspective. This paper covers new ground by studying what the changes of inequality between men and women since the 1960s imply for the political feasibility of reforms towards individual taxation.

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and Lehmann (2021b), Jacquet and Lehmann (2021a), Spiritus, Lehmann, Renes and Zoutman (2022). Gender-based taxation, see Alesina, Ichino and Karabarbounis (2011), is a related topic.

[6]The literature on multi-dimensional screening characterizes welfare- or profit-maximizing outcomes settings with multiple hidden characteristics, see Rochet and Choné (1998), and, more recently, Boerma, Tsyvinski and Zimin (2022).

[7]See Guner, Kaygusuz and Ventura (2012), Guner, Kaygusuz and Ventura (2014), Bick and Fuchs-Schündeln (2017), Borella, De Nardi, Pak, Russo and Yang (2022), Borella, De Nardi and Yang (2023).

[8]Bierbrauer, Tsyvinski and Werquin (2022) provide a detailed discussion.

We combine our theoretical analysis with an empirical approach that employs the TAXSIM microsimulation model and CPS micro data.[9] The microsimulation model uses rich data on individual characteristics so that we can elicit, at the level of an individual tax unit, what implications a tax reform would have on individual welfare. Our evaluation of tax reforms rests on empirical estimates of the primary and secondary earners' behavioral responses to taxation. In our calibrations we draw on a rich empirical literature that has provided estimates of the relevant elasticities.[10]

3 Conceptual framework

We consider a status quo tax system in which married couples are taxed according to their joint income. We introduce a framework for an analysis of tax reforms in this setting.[11]

[9]Our empirical approach builds on and extends work by Eissa, Kleven and Kreiner (2008), Bargain, Dolls, Immervoll, Neumann, Peichl, Pestel and Siegloch (2015) and Bierbrauer, Boyer and Peichl (2021). Similar approaches have also been used for the purpose of *ex ante* policy evaluation, see Immervoll, Kleven, Kreiner and Saez (2007) for a prominent example.

[10]See Gustafsson (1992), Blundell and MaCurdy (1999), Blau and Kahn (2007), Eissa and Hoynes (2004), LaLumia (2008), Kaygusuz (2010), Bargain, Orsini and Peichl (2014), and Neisser (2021).

[11]In the longer working paper version (Bierbrauer et al. (2023a)), we develop a more general formalism covering reforms that change both the tax function for singles and the tax function for couples. Here, we present a stripped down version that involves only what is needed to evaluate reforms towards individual taxation. We focus, moreover, on reforms that are "small". The working paper version contains an extension of this approach that enables us to evaluate the "large" reforms that actually took place in the US.

Tax reforms. In the status quo, married couples are taxed according to the function $T_{m0} : y_m \mapsto T_{m0}(y_m)$, where $y_m = y_1 + y_2$ is the couple's joint income, y_1 is the income of the primary earner and y_2 is the income of the secondary earner. We assume that T_{0m} is increasing, continuous and convex. This allows for both linear and for progressive non-linear taxation. A tax reform replaces this system by a new tax function T_{m1} so that

$$T_{m1}(y_1, y_2) = T_{m0}(y_m) + \tau_m \; h_m(y_1, y_2) \; .$$

We refer to the function $h_m : (y_1, y_2) \mapsto h_m(y_1, y_2)$ as the reform directions and to the scalar $\tau_m \geq 0$ as the measure of reform intensity.

A reform *in* the system is such that h_m is a function of $y_m = y_1 + y_2$. Consequently, both before and after the reform, the tax base for married couples is their joint income. We refer to reforms *of* the system that push marginal tax rates on primary and secondary earnings in opposite directions as *reform towards individual taxation.* To give an example, let

$$h_m(y_1, y_2) = \tau_1 \; y_1 + \tau_2 \; y_2 \; ,$$

with $\tau_1 > 0$ and $\tau_2 < 0$. Then,

$$\frac{\partial T_{m1}(y_1, y_2)}{\partial y_1} \quad = \quad T'_{m0}(y_1 + y_2) + \tau_m \; \tau_1 \quad > \quad T'_{m0}(y_1 + y_2) \; ,$$

and

$$\frac{\partial T_{m1}(y_1, y_2)}{\partial y_2} \quad = \quad T'_{m0}(y_1 + y_2) + \tau_m \; \tau_2 \quad < \quad T'_{m0}(y_1 + y_2) \; .$$

We denote the change in tax revenue due to the reform by $R_m(\tau_m, h_m)$. It is an endogenous object which depends on the status quo tax system and the behavioral responses to the change of the tax system. We assume that the revenue change is rebated lump sum, so that, after the reform, every couples receives an additional transfer of $R_m(\tau, h)$.[12]

Couples' behavior. A married couple consists of two individuals, labeled 1 for the primary and 2 for the secondary earner. Thus, $y_1 \geq y_2$. With joint earnings of $y_m = y_1 + y_2$, the disposable income of the couple is $c_m = b_m + y_m - T_m(y_m)$, where b_m is a government transfer to couples with no income, and $y_m - T_m(y_m)$ is the extra consumption that is available to couples with earnings of y_m. Given y_1 and y_2, spouse $i = 1, 2$ realizes utility $u_i(\alpha_i(c_m, \cdot), y_i, \theta_i)$. Utility functions are taken to be continuously differentiable and increasing in the first argument and decreasing in the second argument. With this formalism, we allow for the possibility that spouse i derives consumption utility only from a fraction of the couple's disposable income that we denote by $\alpha_i(c_m, \cdot)$. Possibly, this fraction depends on arguments such as the spouses' bargaining weights or their respective contributions to the couple's earnings. All this is summarized under the place-marker "$\cdot$". Each spouse i has a type $\theta_i \in \Theta \subset \mathbb{R}^n$. The cross-section distribution of married couples with characteristics $\theta_m = (\theta_1, \theta_2)$ is assumed to be atomless and represented by a cumulative distribution function F_m.

We assume that primary and secondary earnings are determined by Nash bargaining over who works and consumes how much. These earnings levels

[12] This way of closing the model is convenient. A more detailed treatment of government expenditures would be an alternative. Here, we suppress preferences over expenditure policies. Heterogeneity in preferences over tax reforms is then entirely due to heterogeneity in how individual tax burdens change.

admit a characterization as the solution to

$$\max_{y_1,y_2\in\mathcal{Y}} \quad \gamma_1\, u_1(\alpha_1(c_m,\cdot),y_1,\theta_1)+\gamma_2\, u_2(\alpha_2(c_m,\cdot),y_2,\theta_2)\ ,$$
$$\text{s.t.} \quad c_m=b_m+y_m-T_m(y_m)\ ,$$

where γ_1 and $\gamma_2 = 1-\gamma_1$ are the spouse's bargaining weights. The distribution of the bargaining weights $\gamma_m = (\gamma_1, \gamma_2)$ in the population is assumed to be atomless and represented by a cumulative distribution function Γ_m. For technical reasons, discussed in Bierbrauer, Boyer and Hansen (2023b), we assume that there is a bounded set of feasible earnings levels $\mathcal{Y} = [0, \bar{y}]$, where $\bar{y}$ can be arbitrarily large. We assume, moreover, that a single-crossing condition holds in one dimension of the type space, Θ: If type (θ_j, θ_{-j}) weakly prefers a bundle (c, y) to another bundle $(c', y') < (c, y)$, then type (θ'_j, θ_{-j}) with $\theta'_j > \theta_j$ strictly prefers (c, y) to (c', y'). This assumption implies that the individuals' earnings are increasing in θ_j.

We show in part A of the Appendix that our formulation based on the functions α_i is consistent with household consumption being a public good or individual consumption being a private good. Furthermore, it can also be extended to include bargaining over family duties without affecting the conclusions from the analysis below.

Preferences over tax reforms. We derive preferences over tax reforms from indirect utility functions. Let $V_i(\tau_m, h_m, \theta_m, \gamma_m)$ be the indirect utility realized by spouse $i \in \{1, 2\}$ in a couple with characteristics $\theta_m = (\theta_1, \theta_2)$ and bargaining weights $\gamma_m = (\gamma_1, \gamma_2)$. The derivative of V_i with respect to τ, evaluated at $\tau = 0$, indicates how these individuals are affected if a reform in direction h_m is undertaken. By the envelope theorem (see Milgrom and Segal (2002)):

$$\frac{\partial V_i(0,h,\rho_m,\theta_m,\gamma_m)}{\partial \tau} = u^0_{i1}(\theta_m,\gamma_m)\alpha^0_{i1}(\theta_m,\gamma_m)\Big[R^0_1(h)-h_m(y_1,y_2)\Big]\ . \quad (1)$$

In these expressions, the subscript 1 indicates the derivative of a function with respect to its first argument, and the superscript 0 indicates that the derivative is evaluated at the status quo. Thus, $u^0_{i1}(\theta_m, \gamma_m)$ is the marginal utility of consumption of spouse i in the status quo; $\alpha^0_{i1}(\theta_m, \gamma_m)$ is the marginal gain in consumption for spouse i when the couple's disposable income goes up, and, finally, $R^0_1(h)$ is the reform's marginal impact on tax revenue. These equations show that whether the spouses in a couple benefit from a reform simply depends on how the change of tax revenue compares to the change in the tax obligation. When $\alpha^0_{i1}(\theta_m, \gamma_m) > 0$, for $i = 1, 2$ – in words, every spouse realizes additional consumption utility when the couple's disposable income goes up – the preferences of the spouses in a married couple are aligned. They both benefit if $R^0_1(h) - h(y_m) > 0$ and both lose otherwise. As we show in the Appendix, $\alpha^0_{i1}(\theta_m, \gamma_m) > 0$, for $i = 1, 2$, holds both when the disposable income c_m is treated as a public good and when it is treated as a budget that needs to be split between the spouses.

One-bracket reforms. A particular class of reforms plays a significant role in our analysis, namely reforms in which marginal tax rates are increased for incomes in only one bracket $[y, y + \ell]$, where ℓ is the length of the bracket. The more general tax reforms that we are interested in can be interpreted as combinations of several such reforms. So, as a preliminary step, we introduce this class of reforms.

A one-bracket reform of the tax schedule for married couples T_m within the system of joint taxation can be represented by a pair (τ_m, h_m) with

$$\tau_m \, h_m(\hat{y}_m) = \begin{cases} 0, & \text{for} \quad \hat{y}_m \leq y_m \, , \\ \tau_m(\hat{y}_m - y_m), & \text{for} \quad \hat{y}_m \in (y_m, y_m + \ell) \, , \\ \tau_m \, \ell, & \text{for} \quad \hat{y}_m \geq y_m + \ell \, , \end{cases}$$

where $y_m = y_1 + y_2$ is the couple's joint income. The function $\mathcal{R}_m : y_m \mapsto \mathcal{R}_m(y_m)$ gives the marginal change in tax revenue as both τ_m and ℓ vanish.[13]

To study reforms towards individual taxation we also introduce one-bracket reforms that alter marginal tax rates only for primary earnings or only for secondary earnings. The former are represented by a pair (τ_1, h_1) with

$$\tau_1 \; h_1(\hat{y}_1) = \begin{cases} 0, & \text{for} \quad \hat{y}_1 \leq y_1 \; , \\ \tau_1(\hat{y}_1 - y_1), & \text{for} \quad \hat{y}_1 \in (y_1, y_1 + \ell) \; , \\ \tau_1 \; \ell, & \text{for} \quad \hat{y}_1 \geq y_1 + \ell \; . \end{cases}$$

The corresponding revenue function is denoted by $\mathcal{R}_1 : y_1 \mapsto \mathcal{R}_1(y_1)$. One bracket reforms that alter marginal tax rates only for secondary earnings are denoted by (τ_2, h_2) and defined in the analogous way. Their revenue implications are captured by the function $\mathcal{R}_2 : y_2 \mapsto \mathcal{R}_2(y_2)$.

Revenue implications of tax reforms. When the functions $\mathcal{R}_m$, $\mathcal{R}_1$ and $\mathcal{R}_2$ are known, the revenue implication of any continuous reform direction can be computed using the following formulas (see Proposition 3 in Bierbrauer et al. (2023b)):

$$R^0_m(h_m) = \int_{\mathcal{Y}} h'_m(y_m)\mathcal{R}_m(y_m) \; dy_m \; ,$$

where $R^0_m(h_m)$ is the derivative of $R_m(\tau_m, h_m)$ with respect to its first argument evaluated at the status quo, i.e. for $\tau_m = 0$. Analogously, for reforms $h_1 : y_1 \mapsto$

[13] More formally, let $R_m(\tau, \ell, y)$ be the revenue from a one-bracket reform, as a function of y where the relevant bracket starts, the length ℓ of the bracket, and the change of marginal tax rates within the bracket, τ_s. Then,

$$\mathcal{R}_m(y) \quad := \quad \lim_{\ell \to 0} \frac{\partial}{\partial \ell} \lim_{\tau_m \to 0} \frac{\partial}{\partial \tau_m} R_m(\tau_m, \ell, y) \; .$$

$h_1(y_1)$ and $h_2 : y_2 \mapsto h_2(y_2)$, we have

$$R_1^0(h_1) = \int_{\mathcal{Y}} h_1'(y_1)\mathcal{R}_1(y_1)\; dy_1 \quad \text{and} \quad R_2^0(h_s) = \int_{\mathcal{Y}} h_2'(y_2)\mathcal{R}_2(y_2)\; dy_2\;.$$

Different models of taxation and of intra-family bargaining differ with respect to the assumptions on preferences and behavioral responses that are explicitly taken into account. For instance, a model may or may not include fixed costs of labor market participation and thus behavioral responses at the extensive margin. Different specifications of preferences and of the spouses' choice sets give rise to different functions $\mathcal{R}_m$, $\mathcal{R}_1$ and $\mathcal{R}_2$. The analysis in this section is general in the sense that it is compatible with any such framework.

A more specific framework. In part B of the Appendix, we derive the revenue functions $\mathcal{R}_m$, $\mathcal{R}_1$ and $\mathcal{R}_2$ for the workhorse model of taxation which has only intensive margin responses, no income effects, and in which household consumption is a pure public good. We also cover an extension that involves extensive margin responses both by the primary and the secondary earner. Here, we state the revenue functions under two further assumptions: First, the tax system is piecewise linear, as is the case in the US. Second, the primary and the secondary earners' effort costs are, respectively, represented by isoleastic functions and the Frisch elasticities governing the primary and secondary earners' intensive margin responses are denoted by ε_1 and ε_2. Under these assumptions, and without extensive margin responses, the function $\mathcal{R}_m$ takes the following form,

$$\mathcal{R}_m(y_m) = -\frac{T'_{m0}(y_m)}{1 - T'_{m0}(y_m)}\; y_m\; f^y_m(y_m)\; \bar{\mathcal{E}}_m(y_m) + \; 1 - F^y_m(y_m)\;, \tag{2}$$

where F^y_m is the (endogenous) *cdf* and f^y_m the density of the earnings distribution amongst married couples and

$$\bar{\mathcal{E}}_m(y_m) \quad = \quad \mathbf{E}_{(\theta_m,\gamma_m)}\left[\varepsilon_1\pi_1^0 + \varepsilon_2\pi_2^0 \mid y_m^0(\theta_m,\gamma_m) = y_m\right]$$

is a measure of the behavioral responses to a one-bracket tax reform affecting couples with a joint income close to y_m. In this expression, $\pi_1^0 = \frac{y_1^0}{y_m^0}$ and $\pi_2^0 = \frac{y_2^0}{y_m^0}$ are, respectively, the primary and the secondary earners' income shares. The revenue function $\mathcal{R}_2$, by contrast, looks as follows,

$$\begin{aligned} \mathcal{R}_2(y_2) \quad = \quad & -y_2\ f_2^y(y_2)\ \varepsilon_2\ \mathbf{E}_{(\theta_m,\gamma_m)}\left[\tfrac{T_m'(y_m^0(\theta_m,\gamma_m))}{1-T_m'(y_m^0(\theta_m,\gamma_m))}\mid y_2^0(\theta_m,\gamma_m)=y_2\right] \\ & +1-F_2^y(y_2)\ , \end{aligned} \tag{3}$$

where F_2^y is the *cdf* and f_2^y the density characterizing the distribution of secondary earnings amongst married couples.

The revenue function $\mathcal{R}_m$ is shaped by the distribution of incomes amongst couples, the marginal tax rates that these couples are facing and behavioral responses that are captured by a convex combination of the primary and secondary earners' Frisch elasticities, with the weights equal to their shares in the couple's joint income. The revenue function $\mathcal{R}_2$, by contrast, is shaped by the marginal distribution of secondary earnings and the secondary earners' Frisch elasticities; that is, the primary earners' behavioral responses do not matter for $\mathcal{R}_2$. Primary earnings still matter as the marginal tax rates that secondary earners face in the status quo depend on the income of their spouse.[14]

With extensive margin responses, a tax reform affects the masses of single and dual earner couples. In this case, $\mathcal{R}_m$ is given by

$$\mathcal{R}_m(y) \quad = \quad \mathcal{X}_{sec}(y_m)+\mathcal{I}_{sec}(y)+\mathcal{X}_{dec}(y_m)+\mathcal{I}_{dec}(y)\ ,$$

where

$$\begin{aligned} \mathcal{I}_{sec}(y) \quad &= \quad \lambda_{sec}^0\left(-\tfrac{T_{m0}'(y)}{1-T_{m0}'(y)}\ y\ f_{sec}^y(y)\ \bar{\mathcal{E}}_{sec}(y)+1-F_{sec}^y(y)\right)\ , \\ \mathcal{X}_{sec}(y) \quad &= \quad -\lambda_{sec}^0\int_y^{\bar{y}}\tfrac{T_{m0}(y')}{y'-T_{m0}(y')}\ \bar{\pi}_{sec}(y')\ f_{sec}^y(y')\ dy'\ , \end{aligned}$$

[14]The formulas characterizing the revenue functions $\mathcal{R}_s$ and $\mathcal{R}_1$ can be found in part B of the Appendix.

$$\mathcal{I}_{dec}(y) \quad = \quad \lambda^0_{dec} \left(-\tfrac{T'_{m0}(y)}{1-T'_{m0}(y)} \; y \; f^y_{dec}(y) \; \bar{\mathcal{E}}_{dec}(y) + 1 - F^y_{dec}(y) \right) \ ,$$

and

$$\mathcal{X}_{dec}(y) \quad = \quad -\lambda^0_{dec} \; \int_y^{\bar{y}} \tfrac{T_{m0}(y')}{y'-T_{m0}(y')} \; \bar{\pi}_{dec}(y') \; f^y_{dec}(y') \; dy \ .$$

The mass of single earner couples with an income exceeding y is denoted by $\lambda^0_{sec}(1 - F^y_{sec}(y))$, where λ^0_{sec} is the share of single earner couples among all couples, and F^y_{sec} is the *cdf* of the income distribution among single earner couples, and f^y_{sec} is the density associated with this distribution. The terms for dual earner couples are analogously defined. The average intensive margin elasticity for single earners with an income of y is denoted by $\bar{\mathcal{E}}_{sec}(y)$ and analogously for $\bar{\mathcal{E}}_{dec}(y)$. Again, these are weighted averages of the primary and the secondary earners' Frisch elasticities where separate averages are computed for single and dual earner couples with an income close to y. The average extensive margin elasticity for single earner couples with an income of y is denoted by $\bar{\pi}_{sec}(y)$ and analogously for $\bar{\pi}_{dec}(y)$. Any such elasticity measures the percentage of couples with an income close to y who opt out of being a single or dual earner couple after a one percent decrease of their after-tax income.[15]

Implications for social welfare. The social welfare that is realized after a tax reform (τ_m, h_m) has taken place is given by

$$\begin{aligned} \mathcal{W}(\tau, h) \quad = \quad & \mathbf{E}_{(\theta_m,\gamma_m)} \left[g_1(\theta_m, \gamma_m) V_1(\tau, h, \rho_m, \theta_m, \gamma_m) \right] \\ & + \mathbf{E}_{(\theta_m,\gamma_m)} \left[g_2(\theta_m, \gamma_m) V_2(\tau, h, \rho_m, \theta_m, \gamma_m) \right] \ , \end{aligned} \tag{4}$$

where the operator $\mathbf{E}_{(\theta_m,\gamma_m)}$ indicates that expectations are taken with respect to the joint distribution of $\theta_m = (\theta_1, \theta_2)$ and γ_m. We allow for the possibility

[15] In part B of the Appendix we explain what the revenue functions $\mathcal{R}_1$ and $\mathcal{R}_2$ look like with extensive margin effects.

that there are different welfare weights for the primary and the secondary earner in a couple, as captured by the functions $g_1 : (\theta_m, \gamma_m) \mapsto g_1(\theta_m, \gamma_m)$ and $g_2 : (\theta_m, \gamma_m) \mapsto g_2(\theta_m, \gamma_m)$. We leave these welfare weights unspecified for now, but will consider specific formulations below. The marginal change in social welfare due to a tax reform (τ_m, h_m), evaluated at the status quo, can be written as

$$\begin{aligned} \mathcal{W}(\tau, h) &= \mathbf{E}_{(\theta_m,\gamma_m)}\left[g_1(\theta_m,\gamma_m)\tfrac{\partial}{\partial\tau}V_1(0,h,\rho_m,\theta_m,\gamma_m)\right] \\ &\quad +\mathbf{E}_{(\theta_m,\gamma_m)}\left[g_2(\theta_m,\gamma_m)\tfrac{\partial}{\partial\tau}V_2(0,h,\rho_m,\theta_m,\gamma_m)\right] \ . \end{aligned} \tag{5}$$

Using the envelope theorem, see Equation (1), the marginal change in social welfare due to a tax reform (τ_m, h_m), evaluated at the status quo, can be written as

$$\begin{aligned} \mathcal{W}_\tau(0, h) &= \mathbf{E}_{(\theta_m,\gamma_m)}[\mathbf{g}_m(\gamma_m,\theta_m)]\ R_1^0(h) \\ &\quad -\mathbf{E}_{(\theta_m,\gamma_m)}\left[\mathbf{g}_m(\gamma_m,\theta_m)h(y_m^0(\theta_m,\gamma_m))\right] \ , \end{aligned} \tag{6}$$

where $R_1^0(h)$ is the reform's marginal impact on tax revenue evaluated at the status quo, and

$$\begin{aligned} \mathbf{g}_m(\gamma_m, \theta_m) &= g_1(\theta_m,\gamma_m)u_{11}^0(\theta_m,\gamma_m)\alpha_{11}^0(\theta_m,\gamma_m) \\ &\quad +g_2(\theta_m,\gamma_m)u_{21}^0(\theta_m,\gamma_m)\alpha_{21}^0(\theta_m,\gamma_m) \end{aligned}$$

is a measure of the welfare gains that are realized when the disposable income of a couple of type (θ_m, γ_m) is slightly increased.

Below, we will use Equation (6) for an evaluation of tax reforms. We will then focus on specific social welfare functions, such as Rawlsian social welfare functions or affirmative Feminist welfare functions which concentrate weights on women with positive earnings.

Pareto-improving reforms *in* the system. Under what conditions does there exist a reform direction $h_m : y_m \mapsto h_m(y_m)$ that makes every couple better off? According to the results in Bierbrauer et al. (2023b), such a reform exists if and only if one of the following conditions is violated: the function $\mathcal{R}_m$ is (i) bounded from below by 0, (ii) bounded from above by 1, and (iii) non-increasing. To interpret these conditions, note first that, when there exists y so that $\mathcal{R}_m(y) < 0$, then lowering marginal tax rates for incomes close to y yields a revenue gain. Hence, all taxpayers benefit from increased transfers and some benefit additionally from lower taxes. This logic is familiar from analyses of the Laffer curve. Second, when there exists y so that $\mathcal{R}_m(y) > 1$, then an increase of marginal tax rates for incomes close to y yields so much additional revenue that even those who face higher tax rates are compensated by the gain in revenue. In this case, marginal tax rates in the status quo are inefficiently low. Third, when there exist income levels y_a and $y_b > y_a$ so that $\mathcal{R}_m(y_a) < \mathcal{R}_m(y_b)$, then it is possible to lower marginal tax rates for incomes close to y_a and to increase them for incomes close to y_b, so that there is an overall revenue gain, and individuals with incomes between y_a and y_b benefit from lower taxes, whilst everyone else's tax burden remains unchanged.[16] In our empirical analysis we will use these conditions to check whether there are inefficiencies in the US income tax schedules for married couples.

[16]To see intuitively why such a non-monotonicity indicates an inefficiency, consider the following thought experiment. A local one-bracket reform at an annual income of, say, 70,000 implies that the tax burden increases by a small amount of $\tau_m\ \ell$ for every couple making more than 70,000 a year. A small one-bracket reform at an annual income of 80,000 has the same effect, it raises the tax burden by $\tau_m\ \ell$, albeit for a smaller group of people namely those couples making more than 80,000 a year. If the latter still raises more revenue than the former, it must be the case that the tax system creates perverse incentives for couples with incomes between 70,000 and 80,000 a year.

Pareto-improving reforms *towards individual taxation.* A reform *towards individual taxation* lowers marginal tax rates for secondary earners or increases them for primary earners. Again, by the results Bierbrauer et al. (2023b), the tax treatment of primary earnings is Pareto-efficient if the functions $\mathcal{R}_1$ is non-increasing, bounded from below by 0 and from above by 1; and analogously for the tax treatment of secondary earnings.

Inefficiency of joint taxation. When a tax system is inefficient, it may well be the case that Pareto improvements exist both in the system and away from the system. Which direction is taken is then a matter of political preferences. It may also be the case that there is no scope for Pareto improvements *in* the system, but that there is a Pareto-improving reform *of* the system. Suppose, for instance, that $\mathcal{R}_m$ is close to, but above zero for a range of joint incomes, hence marginal tax rates on the couples' joint incomes are not beyond the Laffer bound. As discussed above, the elasticities which shape $\mathcal{R}_m$ are a weighted average of the primary and secondary earner's behavioral responses, whereas $\mathcal{R}_2$ depends on the behavioral responses of the secondary earner. Thus, the elasticities that matter for $\mathcal{R}_2$ are larger than those that matter for $\mathcal{R}_m$. Consequently, $\mathcal{R}_2$ lies below zero when $\mathcal{R}_m$ lies just above. In this case, a tax cut just for secondary earnings is Pareto-improving, whereas a joint tax cut for primary and secondary earnings is not. In the empirical analysis, we find that this constellation prevailed in the US in the recent past.

The following Proposition characterizes tax systems with an inefficiency that can only be cured by moving away from joint taxation. In our empirical analysis we will make use of it to identify situations in which *joint taxation is inefficient* in the sense that there is a Pareto-superior tax system without joint taxation, but no Pareto-superior tax system with joint taxation.

Proposition 1 *Joint taxation is inefficient when:*

(i) One of the following conditions is violated: The functions $\mathcal{R}_1$ and $\mathcal{R}_2$ are non-increasing, bounded from below by 0 *and from above by 1.*

(ii) The following conditions all hold: The function $\mathcal{R}_m$ is non-increasing, bounded from below by 0 *and from above by 1.*

Revenue-neutral reforms towards individual taxation. A revenue-neutral reform towards individual taxation raises the marginal tax rates on primary earnings and lowers the marginal tax rates on secondary earnings. Moreover, the increased revenue from the higher taxes on primary earnings is used to finance the tax cuts for secondary earners. Revenue neutrality implies, in particular, that such a reform is without consequence for singles. It has distributive effects only among married couples. It tends to make couples with a rather equal within-couple distribution better off at the expense of couples with a dominant primary earner. Formally, we consider reform directions so that

$$h_m(y_1, y_2) = \tau_1 \; h_1(y_1) + \tau_2 \; h_2(y_2) \; .$$

A special case of interest is that marginal tax rates are increased for all primary earners and decreased for all secondary earners. In this case $h_1(y_1) = y_1$, for all y_1 and $h_2(y_2) = y_2$, for all y_2. Such a reform is revenue neutral if

$$\frac{\tau^2}{\tau^1} \quad = \quad -\frac{\int_{\mathcal{Y}} \mathcal{R}^1(y_1) dy_1}{\int_{\mathcal{Y}} \mathcal{R}^2(y_2) dy_2} \quad =: \quad -r \; . \tag{7}$$

We will repeatedly refer to the ratio on the right hand side of (7) in the following. For ease of reference, we use r as a shorthand.

A married couple that has earnings of y_1^0 and y_2^0 in the status quo is made better off if $\tau_1 \; y_1^0 + \tau_2 \; y_2^0 < 0$ or, equivalently, if $y_1^0 < r \, y_2^0$. This inequality will prove useful for our analysis of whether reforms towards individual taxation would have had majority support at the eve of the major tax reforms in the US. Specifically, we will plot the line $y_1^0 = r\, y_2^0$ in a y_2^0-y_1^0-diagram. All couples with (y_2^0, y_1^0) below the line are reform winners, all couples with (y_2^0, y_1^0) above are reform losers. To determine political feasibility, we simply need to check whether the households above the line outnumber those below the line. To check how political feasibility has evolved, we look into how this line and the distribution of primary and secondary earnings has shifted over time.[17]

We also examine the implications for social welfare, employing various welfare functions. We will focus on welfare functions with high weights on "the poor" and on welfare functions with weights that increase in secondary earnings. From the perspective of a generic welfare function, a revenue neutral reform with $h_m(y_1, y_2) = \tau_1 y_1 + \tau_2 y_2$ is desirable if and only if $Y_1^g < r Y_2^g$, where

$$Y_1^g := \mathbf{E}_{(\theta_m,\gamma_m)} \left[\mathbf{g}_m(\gamma_m, \theta_m) y_1^0(\gamma_m, \theta_m) \right] \;, \quad \text{and}$$

$$Y_2^g := \mathbf{E}_{(\theta_m,\gamma_m)} \left[\mathbf{g}_m(\gamma_m, \theta_m) y_2^0(\gamma_m, \theta_m) \right] .$$

The following Proposition summarizes this discussion.

Proposition 2 *Consider a revenue neutral reform towards individual taxation with $h_1(y_1) = y_1$, for all y_1, and $h_2(y_2) = y_2$, for all y_2.*

(i) Such a reform is politically feasible if the population share of couples with $y_1^0 < r\, y_2^0$ exceeds $\frac{1}{2}$.

(ii) For given welfare weights such a reform increases social welfare if $Y_1^g < r\, Y_2^g$.

[17]Note that r shifts with the behavioral responses that shape the functions $\mathcal{R}^1 : y_1 \mapsto \mathcal{R}^1(y_1)$ and $\mathcal{R}^2 : y_2 \mapsto \mathcal{R}^2(y_2)$. The less elastic primary earnings are relative to secondary earnings, the larger is r.

4 Is joint taxation inefficient?

By Proposition 1, a status quo tax system with joint taxation is Pareto-efficient if and only if the revenue function $\mathcal{R}_m$ is non-increasing, bounded from below by 0 and bounded from above by 1. Any violation of these conditions implies the existence of a Pareto-improving reform *in* the system. In the following, we use data from the Annual Social and Economic Supplement of the Current Population Survey (CPS-ASEC) to present an empirical analysis of whether these conditions were satisfied since the 1960s.[18] If the answer is "no", we check whether there is an efficiency rationale for reforms *of* the system. If the answer to this second question is "yes", we conclude that joint taxation is inefficient.

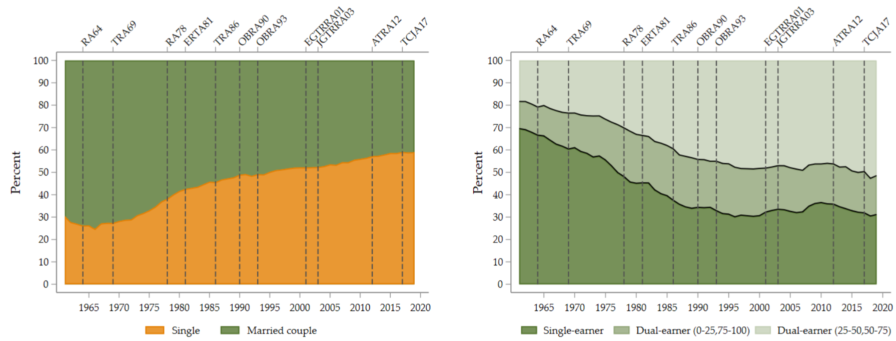
Demographics. Since the 1960s, the share of singles relative to married couples has increased in the US. Also, the share of dual earner couples has increased relative to single-earner couples. These changes have taken place in a continuous fashion (see Figure 1). If the tax system had stayed the same, the share of individuals benefiting from marriage bonuses would have gone down since the 1960s.[19]

[18]See Flood, King, Rodgers, Ruggles, Warren and Westberry (2021) and `https://cps.ipums.org` for a detailed description of CPS data. Appendix C.1 provides details on the data preparation. We use CPS data because it provides separate demographic and earnings information for both spouses. In contrast, the tax return microdata (SOI-PUF) from the Internal Revenue Service (IRS) used in Bierbrauer et al. (2021) does not contain this information (except for the year 1974; see Figure C.4 for a comparison).

[19]How the distribution of penalties and bonuses has actually changed over time is documented in the longer working paper version of this paper, see Bierbrauer et al. (2023a).

Figure 1: Demographic change over time

(a) Tax unit types (b) Couple types



Notes: This figure shows the distribution of tax unit types over time. Figure 1a displays the share of single tax units (orange area) and the share of couple tax units (green area). Figure 1b displays the share of single-earner and dual-earner couples. A single-earner couple refers to a married couple, in which one spouse is not employed (dark green area). The figure further displays the share of dual-earner couples in which both spouses are employed and (i) one spouse earns between 0 and 25 percent (mid green area) and (ii) between 25 and 50 percent of total earnings (light green area). Earnings shares are computed on the basis of wage, business and farm income. Reforms of the federal income tax code are displayed as vertical lines. All estimates are based on tax units with strictly positive gross income in which both spouses are between 25 and 55 years old. Figure E.26 replicates this figure for the full adult population.
Source: Authors' calculations based on CPS-ASEC.

Calibration. In Appendix C.2, we explain in detail how we calibrate the revenue functions $\mathcal{R}_m$, $\mathcal{R}_1$ and $\mathcal{R}_2$ Here we elaborate on what we assume about the elasticities that capture the behavioral responses to taxation. Our assumptions shown in Table 1 are guided by the empirical literature that finds stronger behavioral responses to taxation for secondary earners (see, e.g., Eissa and Hoynes (2004) and Bargain et al. (2014)) while acknowledging the variation of estimates (see, e.g., Blau and Kahn (2007), Saez, Slemrod and Giertz (2012), Neisser (2021)).

In our baseline scenario, we assume that intensive margin elasticities are constant over time and equal 0.25 for primary earners in couples, and 0.75 for secondary earners.[20] We also consider a scenario with elasticities that are higher than the ones in the baseline, and one with lower elasticities. We finally assume that the extensive margin elasticities decrease with income from 0.65 to 0.25 until the 90th percentile of the gross income distribution, and stays constant in the top decile (see Figure C.14).

Table 1: Assumptions about Labor Supply Elasticities

	Primary Earner	Secondary Earner
Low Elasticity Scenario	0.15	0.35
Baseline Elasticity Scenario	0.25	0.75
High Elasticity Scenario	0.5	1.5

Notes: This table displays our assumptions about the labor supply elasticities for primary and secondary earners in married couples. Assumptions are guided by the range of estimates found in the literature, e.g. Gustafsson (1992), Blundell and MaCurdy (1999), Blau and Kahn (2007), Eissa and Hoynes (2004), LaLumia (2008), Kaygusuz (2010), Saez et al. (2012), Bargain et al. (2014), and Neisser (2021).

Results. By Proposition 1, joint taxation is inefficient if two conditions hold: First, the revenue function $\mathcal{R}_m : y_m \mapsto \mathcal{R}_m(y_m)$ lies throughout between zero and one and is non-increasing. In this case, there is no Pareto-improving reform of the tax function for married couples that stays *in* the system. Second,

[20]Note that even though elasticities are constant for primary and secondary earners, the average elasticity for couples can vary across the income distribution and across years since it is a weighted average based on the income shares of the primary and secondary earner (see Appendix Figure C.10).

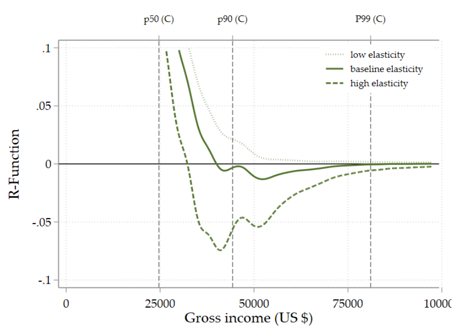
there are Pareto-improving reforms towards individual taxation. For instance, this is the case if marginal tax rates on secondary earnings are inefficiently high, so that there are ranges of secondary earnings where the function $\mathcal{R}_2 : y_2 \mapsto \mathcal{R}_2(y_2)$ lies below zero.

The plots of the revenue functions $\mathcal{R}_m$ and $\mathcal{R}_2 : y_2 \mapsto \mathcal{R}_2(y_2)$ in Figure 2 show that, in 1980, there existed Pareto-improving reforms both *in* the system and *towards individual taxation.* At the top of the income distribution marginal tax rates were inefficiently high across the board. Lowering them just for secondary earners would have been Pareto-improving. But lowering them simultaneously for primary and secondary earners would have been Pareto-improving too. In 2019, by contrast, there was no Pareto-improving reform *in* the system, while marginal tax rates on secondary earners were inefficiently high so that there was a Pareto-improving reform *towards individual taxation.*

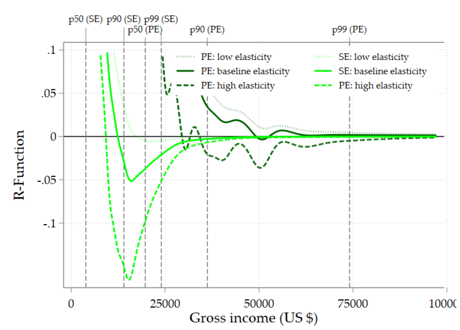
Figures D.19 and D.20 in the Appendix show these the revenue functions for years ranging from 1965 until 2019. Figure D.20 shows that marginal tax rates on secondary earners from the upper part of the income distribution have been inefficiently high throughout. Thus, lowering marginal tax rates on secondary earnings in this range would have been a self-financing tax cut. No such case can be made for lowering the marginal tax rates on primary earnings. As Figure D.19 shows, the year 1980 is the only one where we identify the possibility of a Pareto-improving reform *in* the system under the baseline assumptions on the behavioral responses to taxation. In other years, such reforms exist only under the assumption of more pronounced behavioral responses. In the more recent past, i.e. in the year 2019, there is no Pareto-improving reform even if under these strong assumptions. Thus, according to our baseline, the year 2019 is “representative” and the year 1980 is the ”exception.” If instead we assume the relevant elasticities to be very high, then this pattern is reversed. In any case, as of 2019, we find that joint taxation is inefficient.

Figure 2: Reforms *in* the system versus reforms *of* the system

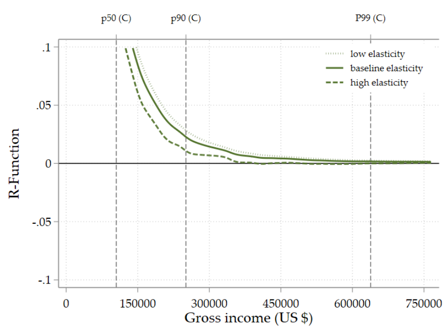
(a) Reforms *in* the system (1980)



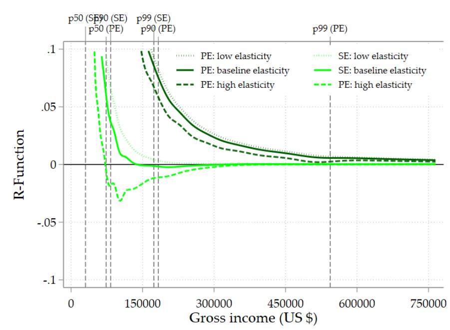
(b) Reforms *of* the system (1980)



(c) Reforms *in* the system (2019)



(d) Reforms *of* the system (2019)



Notes: This figure shows for 1980 and 2019 the revenue functions for married couples as a whole (left panel) and separately for primary and secondary earners (right panel). The revenue function accounts for intensive and extensive margin behavioral responses. Intensive margin responses are differentiated by baseline (solid line), low (dotted line), and high (dashed line) elasticity scenarios (see Table 1). The reform potential *in* the system and *of* the system for other years is shown in Appendix. Figures D.19 and D.20) in the Appendix show these the revenue functions for years ranging from 1965 until 2019. All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old. Figure E.27 replicates this figure for the full adult population.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

5 Revenue neutral reforms towards individual taxation

The previous section identified Pareto-improving reforms that involved lower marginal tax rates on secondary earnings in specific ranges of the income distribution, while leaving the tax treatment of primary earnings unchanged. We now turn to revenue-neutral reforms towards individual taxation. These are reforms that affect all primary earners and all secondary earners. Specifically, we check whether the conditions for political feasibility and welfare improvements in Proposition 2 have been satisfied empirically.

Political feasibility. Figures 3 and 4 show how the population shares of reform winners and losers have changed over time. In these graphs, winners from a reform towards individual taxation are those couples, whose primary earnings are below the (green) line. In 1961, only a fifth of all married couples would have benefited from the reform. Couples with high secondary earnings were rare and hence a reform towards individual taxation would not have been politically feasible.[21] The relative size of primary and secondary earners' responses to taxation governs the slope of the green line. Larger elasticities of primary earners tilt the lines to the right and thus tend to decrease the number of reform winners. Under our baseline assumptions about behavioral responses to taxation, support has increased from around 23 percent in the 1960s to 55 percent as of today.[22] Even under the empirically implausible

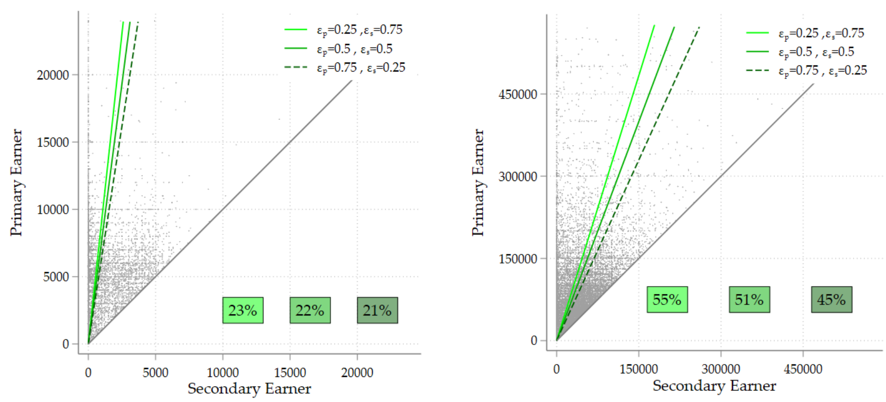
[21]In 1961, around sixty percent of couples had no secondary earnings at all. These couples lie exactly on the vertical axis of Figure 3 and represent a large fraction of reform losers.

[22]As of 2019, married couples represent 37 (54) percent of all tax units (individuals). Since singles are unaffected, this implies that around 30 percent of individuals would benefit from the reform, 24 percent would be made worse off, and 46 percent would be unaffected.

assumption of a high elasticity of primary earnings to taxation, the reform is with 45 percent close to the majority threshold. Thus, while reforms towards individual taxation have not been politically feasible in the past, they will be if the trend continues.

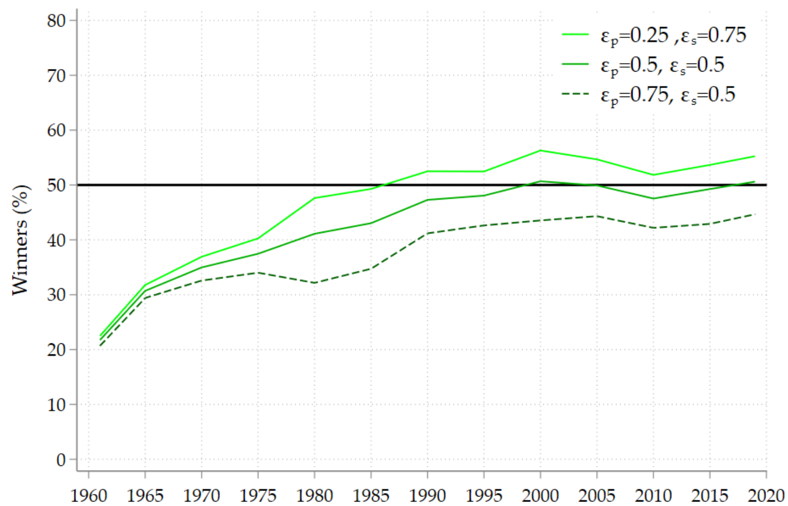
Figure 3: Reform towards individual taxation: Political economy

(a) 1961 (b) 2019



Notes: This figure shows for 1961 and 2019, how the political support for a revenue neutral reform towards individual taxation among married couples varies with behavioral responses to taxation. Each gray dot represents a couple in the data with specific income of the primary (secondary) earner displayed on the vertical (horizontal) axis. Couples that lie below (above) the green line are winners (losers) from a reform towards individual taxation. The light green solid line refers to the baseline elasticity scenario of Table 1 in which the primary (resp. secondary) earner has an elasticity of 0.25 (resp. 0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). All results are displayed including extensive margin responses. The figure also displays the respective share of couples than benefits from a reform towards individual taxation. Note that couples with no secondary earnings lie exactly on the vertical axis and constitute around 60 percent in 1961 and 25 percent in 2019. Figures for more years are displayed in Appendix Figure D.21. All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old. Figure E.28 replicates this figure for the full adult population.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure 4: Reform towards individual taxation: Share of winners over time



Notes: This figure shows how the political support for a revenue neutral reform towards individual taxation among married couples evolved over time. All results are displayed including extensive margin responses. The light green solid line illustrates the result under the baseline elasticity scenario of Table 1 in which the primary (resp. secondary) earner has an elasticity of 0.25 (resp. 0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old. Figure E.29 replicates this figure for the full adult population.

Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

The welfare of "the poor" and the welfare of "working women". By Proposition 2, a generic social welfare function approves a revenue-neutral reform towards individual taxation if $Y_1^g < r\ Y_2^g$. With the reverse inequality it is welfare-damaging. Figure 5 shows results for various social welfare functions and for different assumptions about behavioral responses.[23] If welfare-

[23]See Table D.2 in the Appendix for the exact specification of these welfare functions.

evaluation dots locate above (resp. below) the respective green line, the reform is considered welfare decreasing (resp. welfare improving).

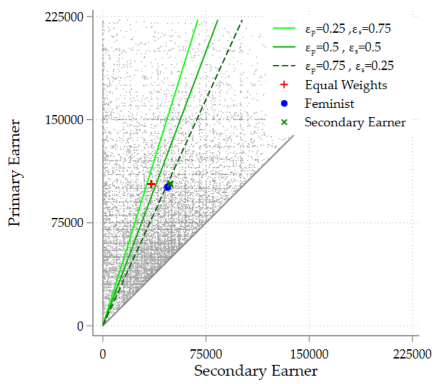
A striking feature is that a Rawlsian welfare function (with welfare weights concentrated on low income couples) and an Affirmative Feminist social welfare function (with weights that are increasing in the women's income share) are on different sides of the line that separates winners and losers. The reason is that among low-income couples the share of primary earnings tends to be high (see Figure D.24 in the Appendix). Therefore, only few low-income couples benefit from lower taxes on secondary earnings, and all are harmed by the higher taxes on primary earnings.

Discussion. That reforms towards individual taxation may give rise to a conflict between the welfare of "the poor" and the welfare of "working women" is a major insight of this paper, without precedence in the previous literature. It raises two questions. First, we have been looking at a specific reform towards individual taxation, one that lowers marginal tax rates for all secondary earnings and increases marginal tax rates for all primary earnings. Are there alternative reforms towards individual taxation that do not give rise to such a conflict? Second, are such conflicts empirically plausible? When we do an evaluation of actual – as opposed to hypothetical – tax reforms, do we also find such conflicts?

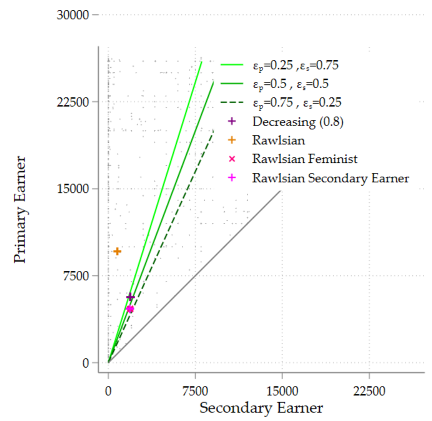
To answer the first question, we consider an alternative reform towards individual taxation. We suppose that marginal tax rates are lowered for all secondary earners, as before, but marginal tax rates are increased only for primary earners from the upper half of the income distribution. By construction, Rawlsian welfare will not decrease following such a reform. Poor couples with positive secondary earnings benefit, and poor couples without secondary

Figure 5: Reform towards individual taxation: Welfare (2019)

(a) Middle of distribution



(b) Bottom of distribution



Notes: This figure shows for the current tax system, how a reform towards individual taxation is evaluated from a welfare perspective under different exogenous welfare weights. Figure 5a (5b) displays welfare implications for welfare weights centered in the middle (bottom) of the income distribution. Each gray dot represents a couple in the data with specific income of the primary (secondary) earner displayed on the vertical (horizontal) axis. Couples that lie below (above) the green line are winners (losers) from a reform towards individual taxation. Welfare evaluations with different welfare weights are plotted as a colored dot the location of which is defined via the average welfare-weighted primary earnings (vertical axis) and the average welfare-weighted secondary earnings (horizontal axis). Welfare evaluations below (above) the green line indicate that the reform is welfare increasing (decreasing). The light green solid line illustrates the result under the baseline elasticity scenario of Table 1 in which the primary (secondary) earner has an elasticity of 0.25 (0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). All results are displayed including extensive margin responses. For detailed information on welfare weight specification, see Table D.2. The specific percentile used for Rawlsian weights is P5 and $a = 0.8$ for decreasing welfare weights. Illustrations for other years are shown in Appendix Figures D.22 and D.23. All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old. Figure E.30 replicates this figure for the full adult population.

Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

earnings are not harmed. The reform does not collect as much revenue as one that taxes all primary earnings at a higher rate, with the implication that the tax rates on secondary earnings cannot be reduced as much. As Figure D.25 in the Appendix shows, an affirmative feminist welfare function still goes up under such a reform. The reform is, moreover, politically feasible. There is one group that is harmed: couples from the upper part of the income distribution with low secondary earnings. The complementary group of reform beneficiaries accounts for more than 70 percent of the population.

To answer the second question, the longer working paper version of this paper, Bierbrauer et al. (2023a), contains an evaluation of past reforms using (amongst others) Rawlsian and Feminist welfare measures. Reforms, mostly by Republican administrations, that lowered tax rates implied a loss of tax revenue and are rejected by a Rawlsian social welfare function. At the same time, they reduced distortions in the system, hence also the distortions faced by secondary earners. With strong behavioral responses to taxation by secondary earners, such reforms are approved by Feminist social welfare functions.[24]

6 Concluding remarks

Should one move away from the traditional tax treatment of married couples with its detrimental impact on the earnings incentives of secondary earners who mostly are women? The main results in this paper shed light on this question.

[24] The evaluation of past reforms using Feminist welfare functions is more involved than the evaluation of hypothetical revenue-neutral reforms. These reforms affected both singles mothers and married women, so that their also is an internal Feminist tradeoff between the welfare of "rich" and the welfare of "poor" women.

First, we find that, in the US, marginal tax rates on secondary earnings have been inefficiently high over decades: Lowering marginal tax rates on secondary earnings would have been a self-financing tax reform, one that has no losers and only winners. However, there were periods, such as the 1980s, where marginal tax rates were too high also for primary earners. A reform *in* the system that lowered marginal tax rates for high-income couples would have been self-financing too. In the recent past, however, we find that the scope for Pareto improvements *in* the system has been exhausted. The only way to reap the benefits from lower taxes on secondary earnings, therefore, is a reform *of* the system.

Second, our welfare analysis of reforms towards individual taxation shows the possibility of a conflict between the interests of "the poor" and the interests of "working women." Among "the poor", the share of single-earner couples is particularly high. These couples are made worse off by such a reform. The beneficiaries are couples with secondary earnings close to primary earnings. Thus, such a reform increases an Affirmative Feminist welfare measure.

We also look at reforms towards individual taxation from a political economy perspective. Since the 1960s, both the share of singles relative to individuals living in married couples and the share of dual-earner couples relative to single-earner couples have been increasing. Consequently, the share of individuals benefiting from marriage bonuses has been decreasing. We find that in the 1960s only about a fifth of all individuals would have benefited from a reform towards individual taxation. In the recent past, this number has risen to fifty percent. Thus, at the time of writing, reforms towards individual taxation are at the brink of becoming politically feasible in the US – in the sense that a majority of individuals would benefit from such a reform.

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Online Appendix (for online publication only)

A Bargaining in married couples

Cooperative bargaining in a married couple selects a point on the couples' Pareto frontier. Any such point maximizes a social welfare function

$$\gamma_1 \, u_1(c_1, y_1, \theta_1) + \gamma_2 \, u_2(c_2, y_2, \theta_2) \ ,$$

where the weights γ_1 and $\gamma_2 = 1 - \gamma_1$ reflect the spouses' bargaining powers, and $c_1 \leq c_m$ and $c_2 \leq c_m$ are, respectively, the part of household consumption from which the spouses derive consumption utility. Alternative assumptions are conceivable here. If household consumption is a pure public good, then $c_1 = c_2 = c_m$. If consumption is a pure private good, then $c_1 + c_2 = c_m$. In the following, we will characterize the bargaining solution for these two polar cases.

Individual consumption as a private good. In this, case the married couples' optimization problem is to choose y_1, y_2, c_1 and c_2 to maximize

$$\gamma_1 \, u_1(c_1, y_1, \theta_1) + \gamma_2 \, u_2(c_2, y_2, \theta_2) \ ,$$

subject to $c_m \leq y_1 + y_2 - T_m(y_1 + y_2)$ and $c_1 + c_2 = c_m$. We can decompose this into an inner problem, the choice of c_1 and c_2 given y_1 and y_2 and hence c_m, and an outer problem, the choice of y_1 and y_2.

The inner problem's solution is characterized by two equations, the budget constraint $c_1 + c_2 = c_m$ and the first order condition

$$\gamma_1 \frac{\partial u_1(\cdot)}{\partial c_1} = \gamma_2 \frac{\partial u_2(\cdot)}{\partial c_2} \ .$$

The solution (c_1^*, c_2^*) depends in a parametric way on the earnings levels, the disposable income, the spouses' characteristics and the bargaining weights. Thus,

$$c_1^* = \alpha_1(c_m, y_1, y_2, \theta_m, \gamma_m)$$

and

$$c_2^* = \alpha_2(c_m, y_1, y_2, \theta_m, \gamma_m) \ ,$$

where we use the shorthand $\theta_m = (\theta_1, \theta_2)$, and $\gamma_m = (\gamma_1, \gamma_2)$. The outer problem then is to choose y_1, y_2 so as to maximize

$$\gamma_1 \ u_1(\alpha_1(\cdot), y_1, \theta_1) + \gamma_2 \ u_2(\alpha_2(\cdot), y_2, \theta_2) \ ,$$

subject to $c_m = y_1 + y_2 - T_m(y_1 + y_2)$.

Household consumption as a public good. In this case, the inner problem has a trivial solution: For all $c_m, y_1, y_2, \theta_m, \gamma_m$,

$$\alpha_1(\cdot) = c_m \quad \text{and} \quad \alpha_2(\cdot) = c_m \ .$$

The outer problem is to choose y_1, y_2 and c_m to maximize

$$\gamma_1 \ u_1(c_m, y_1, \theta_1) + \gamma_2 \ u_2(c_m, y_2, \theta_2) \ ,$$

subject to $c_m = y_1 + y_2 - T_m(y_1 + y_2)$.

Household production. We now extend the couples' bargaining problem to include who does how much of household production, takes care of children or the elderly in the family, etc. For ease of exposition, we only do so for the case in which individual consumption is a private good. Denote by d_1 the family duties of spouse 1 and by d_2 those of spouse 2. We now include the determination of d_1 and d_2 in the inner problem which now reads as: Given y_1, y_2 and hence c_m, choose c_1, c_2, d_1 and d_2 to maximize

$$\gamma_1 \ u_1(c_1, d_1, y_1, \theta_1) + \gamma_2 \ u_2(c_2, d_2, y_2, \theta_2) \ ,$$

subject to $c_1 + c_2 = c_m$ and $d_1 + d_2 = d_m$, where d_m is an exogenously given total level of family duties. There is now a further first order condition that determines the assignment of family duties

$$\gamma_1 \frac{\partial u_1(\cdot)}{\partial d_1} = \gamma_2 \frac{\partial u_2(\cdot)}{\partial d_2} \ ,$$

and the solution (d_1^*, d_2^*) can be written as

$$d_1^* = \beta_1(c_m, y_1, y_2, \theta_m, \gamma_m)$$

and

$$d_2^* = \beta_2(c_m, y_1, y_2, \theta_m, \gamma_m) \ .$$

The outer problem is to choose y_1, y_2 so as to maximize

$$\gamma_1 \ u_1(\alpha_1(\cdot), \beta_1(\cdot), y_1, \theta_1) + \gamma_2 \ u_2(\alpha_2(\cdot), \beta_2(\cdot), y_2, \theta_2) \ ,$$

subject to $c_m = y_1 + y_2 - T_m(y_1 + y_2)$.

Taking account of household production leads to a modification of Equation (1) in the main text which characterizes preferences over tax reforms. It now reads as

$$\tfrac{\partial}{\partial \tau} V_i(0, h, \rho_m, \theta_m, \gamma_m) = w_i(\theta_m, \gamma_m) \Big[\rho_m R_1^0(h) - h_m(y_m) \Big] \ . \qquad \text{(A.1)}$$

where

$$w_i(\theta_m, \gamma_m) := u_{i1}^0(\theta_m, \gamma_m) \alpha_{i1}^0(\theta_m, \gamma_m) + u_{i2}^0(\theta_m, \gamma_m) \beta_{i1}^0(\theta_m, \gamma_m) \ .$$

Hence, if $w_i(\theta_m, \gamma_m) > 0$ for all i, we still have that both spouses in a couple are reform beneficiaries if $\rho_m R_1^0(h) - h(y_m) > 0$ and are reform losers otherwise. This property holds for frequently invoked functional forms. For instance, if the utility or disutility from home production is additively separable from the other arguments of the utility function, then the solution to

$$\gamma_1 \frac{\partial u_1(\cdot)}{\partial d_1} = \gamma_2 \frac{\partial u_2(\cdot)}{\partial d_2} ,$$

is independent of c_m so that $\beta_{i1}^0(\theta_m, \gamma_m) = 0$, for all i.

B A positive theory of multi-dimensional screening

We now provide a characterization of the revenue functions $\mathcal{R}_s$, $\mathcal{R}_m$, $\mathcal{R}_1$ and $\mathcal{R}_2$ for a special case of our general framework, albeit for one that is frequently used. Formal proofs of Lemmas and Propositions are collected in Subsection B.5. Specifically, we assume that household consumption is a public good and that preferences are quasi-linear in consumption: Thus, couples choose y_1 and y_2 to maximize

$$\gamma_1 \; u_1(c_m, y_1, \theta_1) + \gamma_2 \; u_2(c_m, y_2, \theta_2) \qquad \text{s.t.} \quad c_m = b_m + y_m - T_m(y_m) \; ,$$

where

$$u_1(c_m, y_1, \theta_1) = c_m - k_1(y_1, \theta_1) \quad \text{and} \quad u_2(c_m, y_2, \theta_1) = c_m - k_2(y_1, \theta_2) \; ,$$

and k_1 and k_2 are, respectively, the effort cost functions of the primary and the secondary earner. We let $\theta_1 \in \Theta_1 = \mathbb{R}_+$ and $\theta_2 \in \Theta_2 = \mathbb{R}_+$. We also impose the Spence-Mirrlees single crossing condition, so that the marginal effort costs of spouse i are decreasing in θ_i. Thus, θ_i is a measure of productive ability: more able individuals have lower marginal effort costs. A frequently used special case has iso-elastic effort cost functions, see Diamond (1998) for a prominent reference, so that

$$k_1(y_1, \theta_1) = \frac{1}{1+\frac{1}{\varepsilon_1}} \left(\frac{y_1}{\theta_1}\right)^{1+\frac{1}{\varepsilon_1}} , \tag{B.2}$$

and

$$k_2(y_2, \theta_2) = \frac{1}{1+\frac{1}{\varepsilon_2}} \left(\frac{y_2}{\theta_2}\right)^{1+\frac{1}{\varepsilon_2}} , \tag{B.3}$$

for the primary and the secondary earner, respectively. This formulation allows for different productive abilities as measured by θ_1 and θ_2 and for different Frisch elasticities, ε_1 and ε_2.

Golosov and Krasikov (2023) use this setup in their analysis of welfare-maximizing taxes.[25] They approach this as a problem of optimal multi-dimensional screening and obtain a characterization of an optimal tax system in terms of the model's primitives; i.e. in terms of the joint distribution of $\theta = (\theta_1, \theta_2)$. We also use this framework, but for a different purpose. We assume that some status quo tax system is given and describe the couple's choices given this tax system. Again, the characterization is in terms of the model's primitives, which is why we refer to our approach in this section as a *positive* theory of multidimensional screening. Once our model has told us *"who does what in the status quo"*, we perturb the tax system and obtain a characterization of the revenue functions $\mathcal{R}_s$, $\mathcal{R}_m$, $\mathcal{R}_1$ and $\mathcal{R}_2$.

For ease of exposition, we impose the assumption that the status quo tax function is twice differentiable. Moreover, we assume that it has non-

[25]Golosov and Krasikov (2023) do not consider Nash-bargaining within couples. Instead, couples are assumed to maximize their joint surplus, defined as the couple's disposable income net of the spouses' effort costs. In our analysis this is nested as the special case that arises for $\gamma_1 = \gamma_2$.

decreasing marginal tax rates, a property satisfied by all contemporaneous income tax systems. As we show formally below, this implies that secondary earnings go down when primary earnings go up, and vice versa. Thus, our framework captures that with joint and progressive taxation, secondary earnings suffer from downward distortions that are more pronounced than what they would be under individual taxation.

Finally, as an extension, we introduce fixed costs of labor market participation, with the implication that the fractions of single and dual earner couples are endogenous to the tax system and will be affected by tax reforms. The empirical literature documents that there are significant behavioral responses at the extensive margin. Thus, a positive theory of multidimensional screening with behavioral responses only at the intensive margin would be incomplete. Specifically, Propositions B.3 and B.4 contain formal characterizations of the revenue function $\mathcal{R}_m$ with and without behavioral responses at the extensive margin. Detailed proofs are in Appendix B.5. We state the analogous formulas for $\mathcal{R}_s$, $\mathcal{R}_1$ and $\mathcal{R}_2$ without proof.

B.1 Behavioral responses at the intensive margin only

With bargaining weights of γ_1 for spouse 1 and of $\gamma_2 = 1 - \gamma_1$ for spouse 2, the first order conditions that determine the utility-maximizing earning levels are

$$1 - T_m'(y_1 + y_2) = \gamma_1 \; k_{1,1}(y_1, \theta_1) \; , \tag{B.4}$$

and

$$1 - T_m'(y_1 + y_2) = \gamma_2 \; k_{2,1}(y_2, \theta_2) \; , \tag{B.5}$$

where $k_{1,1}$ and $k_{2,1}$, denote, respectively, the derivative of the cost functions k_1 and k_2 with respect to their first argument. Denote the solution to this system of equations by $y_1^*(\theta_1, \theta_2, \gamma_1)$ and $y_2^*(\theta_1, \theta_2, \gamma_1)$. The following Lemma gives comparative statics. The proof is straightforward and therefore omitted.

Lemma B.1 *Let T_m be continuous and convex. Then*

(i) The function y_1^* is non-decreasing in θ_1, and non-increasing in θ_2 and γ_1.

(ii) The function y_2^* is non-decreasing in θ_2 and γ_1, and non-increasing in θ_1.

(iii) The function $y_m^* = y_1^* + y_2^*$ is non-decreasing in both θ_1 and θ_2.

Lemma B.1 shows that higher primary earnings crowd out secondary earnings and vice versa. When the productive abilities of, say, the primary earner go up then primary earnings go up as well. This leads to a higher marginal tax rate also for the secondary earner who responds with reduced earnings. Primary and secondary earnings are not perfect substitutes, though. The couple's joint earnings increase when one of the spouses becomes more productive.

Recall that $\mathcal{R}_m(y_m)$ gives the change in tax revenue in response to a reform that increases marginal tax rates for married couples with a joint income in a small neighborhood of y_m. Proposition B.3 decomposes this change into a mechanical and a behavioral effect. The behavioral effect is due to the change of marginal tax rates for couples with an income close to y_m. Their earnings incentives go down when the marginal tax rate goes up, as captured by the elasticity $\bar{\mathcal{E}}_m(y_m)$ of joint earnings with respect to the retention or net of tax rate, $1-T'$. This behavioral effect tends to lower tax revenues. The mechanical effect, captured by the mass of couples who pay higher taxes without facing higher marginal tax rates, $1 - F_m^y(y_m)$, tends to increase it.

Proposition B.3 *Given a status quo tax system for couples T_{m0}, we have*

$$\mathcal{R}_m(y_m) = -\frac{T'_{m0}(y_m)}{1 - T'_{m0}(y_m)} \, y_m \, f_m^y(y_m) \, \bar{\mathcal{E}}_m(y_m) + \; 1 - F_m^y(y_m) \; , \tag{B.6}$$

where F_m^y is the (endogenous) cdf and f_m^y the density of the earnings distribution of married couples and

$$\bar{\mathcal{E}}_m(y_m) \quad = \quad \mathbf{E}_{(\theta_m, \gamma_m)} \left[e(\theta_m, \gamma_m) \mid y_m^0(\theta_m, \gamma_m) = y_m \right]$$

is a measure of the behavioral responses to a one-bracket tax reform affecting couples with a joint income close to y_m.

Iso-elastic effort cost functions. Married couples with a joint income close to y_m are distinguished by their types (θ_m, γ_m) and $e_m(\theta_m, \gamma_m)$ is the elasticity for a couple with characteristics (θ_m, γ_m). What matters for revenue is $\bar{\mathcal{E}}_m(y_m)$, the average value of $e_m(\theta_m, \gamma_m)$ among all couples with a joint income close to y_m, weighted by the mass of these couples $f_m^y(y_m)$. We use the special case of iso-elastic cost functions to explain what determines the elasticity of the couple's joint income.

Lemma B.2 *For iso-elastic effort cost functions,*

$$\begin{aligned} e_m(\cdot) &:= -\frac{y^*_{1,\tau_m} + y^*_{2,\tau_m}}{y_m^0} \left(1 - T'(y_1^0 + y_2^0)\right) \\ &= \left(\varepsilon_1 \pi_1^0 + \varepsilon_2 \pi_2^0\right) \left(1 + \frac{T''(y_1^0 + y_2^0)}{1 - T'(y_1^0 + y_2^0)} (\varepsilon_1 y_1^0 + \varepsilon_2 y_2^0)\right)^{-1} , \end{aligned}$$

where $\pi_1^0 = \frac{y_1^0}{y_m^0}$ *and* $\pi_2^0 = \frac{y_2^0}{y_m^0}$.

Thus, the elasticity of the couple's joint income is essentially – i.e. modulo the correction term for the curvature of the tax function – a weighted average of the primary and the secondary earners' Frisch elasticities, with the weights reflecting their respective contributions to the couple's joint income.

B.2 On the proof of Proposition B.3

We sketch the main steps in the proof of Proposition B.3. We consider one-bracket reforms (τ_m, h_m); i.e. reforms so that

$$\tau_m \, h_m(\hat{y}_m) = \begin{cases} 0, & \text{for } \hat{y}_m \leq y_m \, , \\ \tau_m(\hat{y}_m - y_m), & \text{for } \hat{y}_m \in [y_m, y_m + \ell_m] \, , \\ \tau_m \, \ell_m, & \text{for } \hat{y}_m \geq y_m + \ell_m \, , \end{cases}$$

We denote by $R_m(\tau_m, \ell_m, y_m)$ the additional tax revenue due to the reform. With quasi-linear in consumption preferences, earnings do not depend on the transfer income. Hence,

$$\begin{aligned} R_m(\tau_m, \ell_m, y_m) &= \mathbf{E}_{(\theta_m,\gamma_m)}\left[T_{m1}(y_m^*(\tau_m,\theta_m,\gamma_m)) - T_{m0}(y_m^0(\theta_m,\gamma_m))\right] \\ &= \mathbf{E}_{(\theta_m,\gamma_m)}\left[T_{m0}(y_m^*(\tau_m,\theta_m,\gamma_m)) + \tau_m\ h_m(y_m^*(\tau_m,\theta_m,\gamma_m))\right] \\ &\quad -\mathbf{E}_{(\theta_m,\gamma_m)}\left[T_{m0}(y_m^0(\theta_m,\gamma_m))\right]\ , \end{aligned}$$

where the operator $\mathbf{E}_{(\theta_m,\gamma_m)}$ indicates that expectations are taken with respect to the joint distribution of $\theta_m = (\theta_1, \theta_2)$ and γ_m; $y_m^*(\tau_m, \theta_m, \gamma_m)$ is the couple's joint income as a function of the reform intensity τ_m and the couples' characteristics, and, finally, $y_m^0(\theta_m, \gamma_m) := y_m^*(0, \theta_m, \gamma_m)$ is the couple's income in the status quo. One can show – see e.g. Bierbrauer and Boyer (2018) for a derivation along these lines – that the derivative of $R_m(\tau_m, \ell_m, y_m)$ with respect to τ_m, evaluated at $\tau_m = 0$ equals

$$\begin{aligned} &R_{\tau_m}(0, \ell_m, y_m) = \\ &\quad \mathbf{E}_{(\theta_m,\gamma_m)}\left[\mathbf{1}(y_m^0(\theta_m,\gamma_m) \in [y_m, y_m+\ell_m])T_m'(y_m^0(\theta_m,\gamma_m))y_{m,1}^*(0,\theta_m,\gamma_m)\right] \\ &\quad + \mathbf{E}_{(\theta_m,\gamma_m)}\left[\mathbf{1}(y_m^0(\theta_m,\gamma_m) \in [y_m, y_m+\ell_m])(y_m^0(\theta_m,\gamma_m) - y_m)\right] \\ &\quad + \ell_m \mathbf{E}_{(\theta_m,\gamma_m)}\left[\mathbf{1}(y_m^0(\theta_m,\gamma_m) \geq y_m+\ell_m])\right]\ , \end{aligned} \tag{B.7}$$

where $\mathbf{1}$ is the indicator function. The proof of Proposition B.3 in the Appendix takes this expression as the starting point and then computes the limit as $\ell_m \to 0$; i.e.

$$\mathcal{R}_m(y_m) \quad := \quad \lim_{\ell_m \to 0}\ R_{\tau_m}(0, \ell_m, y_m)\ .$$

To obtain this characterization of the function $\mathcal{R}_m$ we partition the couples' type space. In particular, we identify the primary earners and the secondary earners who show a behavioral response to a one-bracket reform that alters marginal tax rates for joint earnings that lie between y_m and $y_m + \ell_m$.

Primary earner types consistent with a joint income in the bracket. Given θ_2 and γ_m, define

$$\underline{\theta}_1^0(y_m \mid \theta_2, \gamma_m) := \min\{\theta_1 \mid y_1^0(\theta_m, \gamma_m) + y_2^0(\theta_m, \gamma_m) \geq y_m\},$$

and

$$\overline{\theta}_1^0(y_m + \ell \mid \theta_2, \gamma_m) := \max\{\theta_1 \mid y_1^0(\theta_m, \gamma_m) + y_2^0(\theta_m, \gamma_m) \leq y_m + \ell_m\}.$$

Thus, in the status quo, and given θ_2 and γ_m, there are different primary earner types consistent with a joint income in the bracket $[y_m, y_m + \ell_m]$. The lowest such type is denoted by $\underline{\theta}_1^0(y_m \mid \theta_2, \gamma_m)$ and the highest such type is denoted by $\overline{\theta}_1^0(y_m + \ell \mid \theta_2, \gamma_m)$. Note that, by the definition of the primary earner, $y_1^0(\theta_m, \gamma_m) \geq y_2^0(\theta_m, \gamma_m)$. Moreover, by Lemma B.1,

$$\underline{\theta}_1^0(y_m \mid \theta_2, \gamma_m) \leq \overline{\theta}_1^0(y_m + \ell \mid \theta_2, \gamma_m)\ .$$

When this inequality is strict, this indicates that we can fix the secondary earner's type at θ_2 and then find a range of primary earner types so that the couples' joint income lies in the bracket of interest. With an equality, by contrast, there is only one primary earner type with this property.

Secondary earner types consistent with a joint income in the bracket. Given γ_m, let

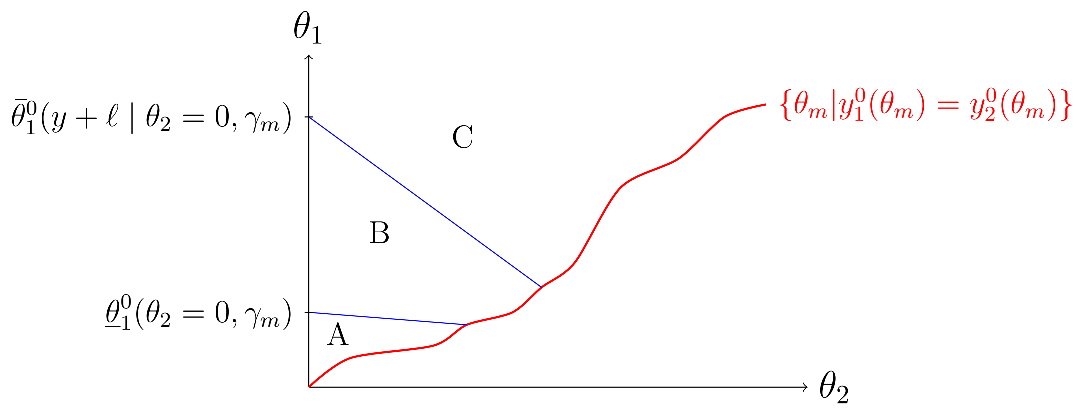
$$\underline{\theta}_2(y_m \mid \gamma_m) := \min\{\theta_2 \mid y_m^0(\theta_m, \gamma_m) \geq y_m\}$$

and

$$\overline{\theta}_2(y_m + \ell_m \mid \gamma_m) := \max\{\theta_2 \mid y_m^0(\theta_m, \gamma_m) \leq y_m + \ell_m\}$$

determine the range of secondary earner types for which one can find a primary earner so that the couple's joint income is in the bracket. Note that $\theta_2 = \bar{\theta}_2(\cdot)$

Figure B.1: The impact of a one-bracket reform – behavioral responses only at the intensive margin.



$A/B/C$: couples with joint income below/in/above the bracket

Notes: This figure illustrates how different types of couples are affected by a reform that raises marginal tax rates for joint incomes between y_m and $y_m + \ell_m$. The tax burden for couples in A does not change. Couples in B face an increase of their marginal tax rate. Couples in C do not face an increase of their marginal tax rate, but their tax burden increases.

implies that

$$y_1^0(\theta_m, \gamma_m) = y_2^0(\theta_m, \gamma_m) = \frac{1}{2}(y_m + \ell_m) \ .$$

Letting the length of the bracket vanish. As detailed in the Appendix, we can now write $R_{\tau_m}(0, \ell_m, y_m)$ as a sum of the revenue changes due to couples in the regions A, B and C in Figure B.1. Note that there is no change in revenue from couples in A and that the boundary between A and B does not depend on ℓ_m. Couples in C face no change of the marginal tax rate, i.e. their tax burden changes in a lump sum fashion. Couples in B are confronted with a change in the marginal tax rate and hence adjust their earnings. Moreover, the boundary between regions B and C depends on ℓ_m. The formal proof in the Appendix consists in computing derivatives of all these expressions with respect to ℓ_m using Leibnitz' rule and in evaluating the resulting expressions in the limit case $\ell_m \to 0$.

B.3 Behavioral responses also the extensive margin

We now extend the above framework and assume that the generation of earnings also comes with fixed costs, both for the primary and the secondary earner. A couple is then characterized by a measure of productivity or earnings ability for each spouse, a fixed cost for each spouse, and weights in the household bargaining problem. The primitives in this model are represented by a joint distribution of these characteristics. In this setup, changes in the tax system affect the mass of primary and secondary earners who choose to generate positive or earnings, or, alternatively, prefer to stay unemployed. Hence, there are behavioral responses both at the intensive and at the extensive margin.

We use, again, the model of household bargaining with quasi-linear in consumption preferences and household consumption as a public good. We add fixed costs of productive effort, captured by the parameters $\tilde{\phi}_m = (\tilde{\phi}_1, \tilde{\phi}_2)$. Thus, a couple with bargaining weights $\gamma_m = (\gamma_1, \gamma_1)$ solves: Choose y_1 and y_2 so as to maximize

$$C(y_1 + y_2) - \phi_1 \, \mathbf{1}(y_1 > 0) - \gamma_1 \, k_1(y_1, \theta_1) - \phi_2 \, \mathbf{1}(y_2 > 0) - \gamma_2 \, k_2(y_2, \theta_1) \ ,$$

where

$$C(y_1 + y_2) = y_1 + y_2 - T_m(y_1 + y_2),$$

and, we use, for ease of notation, the shorthand $\phi_1 = \gamma_1 \, \tilde{\phi}_1$, $\phi_2 = \gamma_2 \, \tilde{\phi}_2$ and $\phi_m = (\phi_1, \phi_2)$. Also for ease of notation, we impose the following assumption.

Assumption B.1 *The distribution of $\tilde{\phi}_1$ is stochastically independent of θ_2 and the distribution of $\tilde{\phi}_2$ is stochastically independent of θ_1.*

Assumption B.1 implies that the conditional densities that will be invoked in the derivation below carry fewer conditioning variables.

When, at a solution to the above utility-maximization problem, both the primary and the secondary earner have positive earnings, their optimal choices $y_1^*(\theta_m, \gamma_m)$ and $y_2^*(\theta_m, \gamma_m)$ satisfy the first order conditions in (B.4) and (B.5). When only the primary earner has positive earnings, then $y_1^* = y_{sec}^*$ and $y_2^* = 0$, where $y_{sec}^*(\theta_1, \gamma_m)$ is the level of y_1 solving

$$1 - T_m'(y_1) = \gamma_1 \; k_{1,1}(y_1, \theta_1) \; . \tag{B.8}$$

The secondary earner's extensive margin. For extensive margin decisions, the surplus of consumption utility over the variable efforts costs is compared to the fixed costs of effort. Going for positive earnings is the optimal choice if that surplus exceeds the fixed costs. Let $\Delta(\theta_m, \gamma_m)$ be the difference between the surplus realized by a couple when both are working and the surplus realized when only the primary earner is working;

$$\begin{aligned} \Delta(\theta_m, \gamma_m) \quad &= \quad C(y_1^*(\theta_m) + y_2^*(\theta_m)) - \gamma_1 \; k_1(y_1^*(\theta_m), \theta_1) - \gamma_2 \; k_2(y_2^*(\theta_m), \theta_1) \\ &\qquad - \Big(C(y_{1s}^*(\theta_1)) - \gamma_1 \; k_1(y_{1s}^*(\theta_1), \theta_1)) \Big) \; . \end{aligned}$$

The couple chooses positive secondary earnings when

$$\phi_2 \quad < \quad \Delta(\theta_m, \gamma_m).$$

Note that Δ is increasing in θ_2. Thus, given ϕ_2, γ_m and θ_1, there is a threshold value $\hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$ so that $y_2^* > 0$ when $\theta_2 > \hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$ and $y_2^* = 0$ when $\theta_2 < \hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$.

The primary earner's extensive margin. Consider a primary earner with type θ_1 and suppose first that she is married to a spouse with type $\theta_2 <$

$\hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$. Then the primary earner chooses positive earnings if

$$C(y^*_{1s}(\theta_1)) - \gamma_1\ k_1(y^*_{sec}(\theta_1), \theta_1) \quad > \quad \phi_1\ ,$$

and chooses zero earnings otherwise. The left-hand side of this expression is increasing in θ_1. Thus, there is a cutoff type $\hat{\theta}_1(\phi_1, \gamma_m)$ so that $y^*_1 > 0$ when $\theta_1 > \hat{\theta}_1(\phi_1, \gamma_m)$ and $y^*_1 = 0$ when $\theta_1 < \hat{\theta}_1(\phi_1, \gamma_m)$.

Now suppose that $\theta_2 \geq \hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$. Then the primary earner chooses positive earnings if

$$C(y^*_1(\theta_m) + y^*_2(\theta_m)) - \gamma_1\ k_1(y^*_1(\theta_m), \theta_1) - \gamma_2\ k_2(y^*_2(\theta_m), \theta_1) > \phi_1 + \phi_2\ ,$$

or, equivalently, if

$$C(y^*_{1s}(\theta_1)) - \gamma_1\ k_1(y^*_{sec}(\theta_1), \theta_1)) - \phi_1 \quad > \quad \phi_2 - \Delta(\theta_m, \gamma_m)\ .$$

This inequality holds whenever $\theta_1 > \hat{\theta}_1(\phi_1, \gamma_m)$. In this case, the left-hand side is positive by the definition of $\hat{\theta}_1(\phi_1, \gamma_m)$. Moreover, the right hand side is negative by the definition of $\hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$. Thus, a primary earner who works when the secondary earner has a low type and does not become active on the labor market, also works when paired with a secondary earner with a higher type and positive earnings. The following Lemma summarizes the preceding analysis.

Lemma B.3

1. *For any given ϕ_1 and γ_m, let $\hat{\theta}_1(\phi_1, \gamma_m)$ be the value of θ_1 that solves*

   $$C(y^*_{sec}(\theta_1)) - \gamma_1\ k_1(y^*_{sec}(\theta_1), \theta_1) \quad = \quad \phi_1.$$

   Then, $y^*_1 > 0$ when $\theta_1 > \hat{\theta}_1(\phi_1, \gamma_m)$ and $y^*_1 = 0$ when $\theta_1 < \hat{\theta}_1(\phi_1, \gamma_m)$.

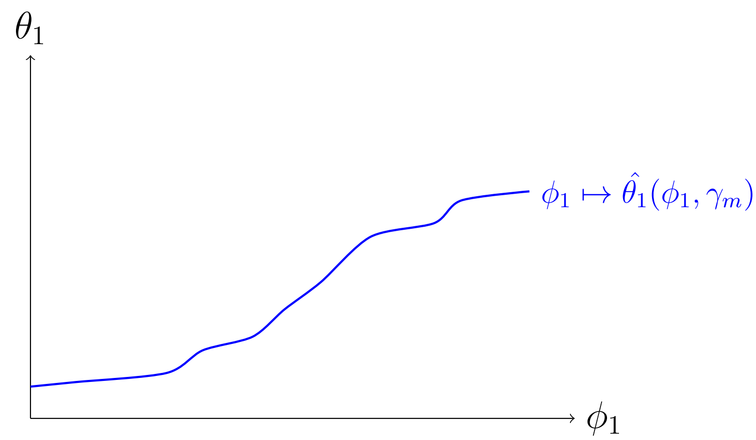
2. *For any given $\theta_1 > \hat{\theta}_1(\phi_1, \gamma_m)$ and ϕ_2, let $\hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$ be the value of θ_2 that solves*

   $$\Delta(\theta_1, \theta_2, \gamma_m) \quad = \quad \phi_2\ .$$

   Then $y^*_2 > 0$ when $\theta_2 > \hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$ and $y^*_2 = 0$ when $\theta_2 < \hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$.

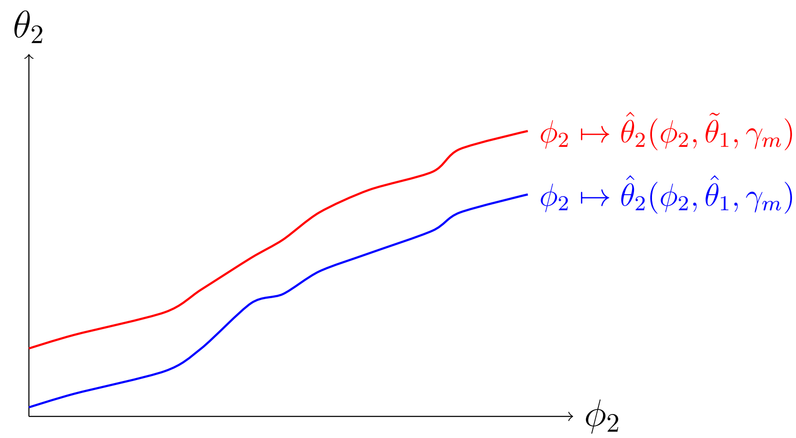
For given $\gamma_m = (\gamma_1, \gamma_2)$, the higher the fixed cost type, the larger the threshold level of ability $\hat{\theta}_1(\phi_1, \gamma_m)$ that is needed to overcome the fixed cost of generating positive earnings. Consequently, for given ϕ_1, the distribution of primary earnings is a truncated distribution that has no mass on $[0, y^*_{sec}(\hat{\theta}_1(\phi_1, \gamma_m)]$. The larger ϕ_1, the larger the gap. For secondary earners this is similar, but there is one important difference: the range of active secondary earners depends on the primary earner's productive ability. The higher the latter, the higher the productive abilities required of the secondary earner to justify positive earnings. Figures B.2 and B.3 provide an illustration.

Figure B.2: Primary earners – behavioral responses at the extensive margin



Notes: This figure shows the type space of primary earners, for fixed bargaining weights γ_m. The blue line separates those with positive earnings (above the line) and those with zero earnings (below the line). Positive primary earnings require productive abilities that exceed a cutoff $\hat{\theta}_1$. The cutoff depends on the primary earner's fixed costs. The higher the fixed costs, the larger is the cutoff.

Figure B.3: Secondary earners – behavioral responses at the extensive margin



Notes: This figure shows the type space of secondary earners, for fixed bargaining weights γ_m. The lines separate those with positive earnings (above the line) and those with zero earnings (below the line). Positive secondary earnings require productive abilities that exceed a cutoff $\hat{\theta}_2$. The cutoff depends on the secondary earner's fixed costs. The higher the fixed costs, the larger the cutoff. The position of the line depends on the primary earner's productive abilities: Higher abilities of the primary earner shift the line upwards. The blue line is drawn for $\theta_1 = \hat{\theta}_2$ and the red line is drawn for $\theta_1 = \tilde{\theta}_1$, where $\tilde{\theta}_1 > \hat{\theta}_1$.

Revenue implications of one bracket reforms. Again, we consider reforms (τ_m, h_m) so that

$$\tau_m\ h_m(y'_m) = \begin{cases} 0, & \text{for} \quad y'_m \leq y_m\ , \\ \tau_m(y'_m - y_m), & \text{for} \quad y'_m \in [y_m, y_m + \ell_m]\ , \\ \tau_m\ \ell_m, & \text{for} \quad y'_m \geq y_m + \ell_m\ . \end{cases}$$

The reform raises marginal tax rates by τ_m for all couples with a joint income that lies between y_m and $y_m + \ell_m$. Again, we seek to characterize the marginal effect on tax revenue in the limit as $\tau_m \to 0$ and $\ell_m \to 0$. A challenge for the characterization of the function $\mathcal{R}_m$ that describes this revenue effect is that, in the given setting, Figure B.1 describes the effect of such a reform only for couples with low fixed cost types, i.e. fixed cost types for which incomes (primary, secondary and joint) at the extensive margin lie below y_m. For couples with higher fixed cost types, the reform affects the incentives to generate positive earnings – formally, the cutoff types $\hat{\theta}_1(\phi_1, \gamma_m)$ and $\hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$ become functions of the reform intensity τ_m. The derivation of $\mathcal{R}_m$ in the Appendix deals with these issues and provides a decomposition of the reform's revenue effect into extensive ($\mathcal{X}$) and intensive ($\mathcal{I}$) margin effects, both for single earner couples (sec) and dual earner couples (dec).

Proposition B.4 *Given a status quo tax system for couples T_{m0}, we have*

$$\mathcal{R}_m(y) = \mathcal{X}_{sec}(y_m) + \mathcal{I}_{sec}(y) + \mathcal{X}_{dec}(y_m) + \mathcal{I}_{dec}(y) \ ,$$

where

$$\begin{aligned}
\mathcal{I}_{sec}(y) &= \lambda^0_{sec} \left(-\tfrac{T'_{m0}(y)}{1-T'_{m0}(y)} \ y \ f^y_{sec}(y) \ \bar{\mathcal{E}}_{sec}(y) + 1 - F^y_{sec}(y) \right) \ , \\
\mathcal{X}_{sec}(y) &= -\lambda^0_{sec} \int_y^{\bar{y}} \tfrac{T_{m0}(y')}{y'-T_{m0}(y')} \ \bar{\pi}_{sec}(y') \ f^y_{sec}(y') \ dy' \ , \\
\mathcal{I}_{dec}(y) &= \lambda^0_{dec} \left(-\tfrac{T'_{m0}(y)}{1-T'_{m0}(y)} \ y \ f^y_{dec}(y) \ \bar{\mathcal{E}}_{dec}(y) + 1 - F^y_{dec}(y) \right) \ ,
\end{aligned}$$

and

$$\mathcal{X}_{dec}(y) = -\lambda^0_{dec} \int_y^{\bar{y}} \tfrac{T_{m0}(y')}{y'-T_{m0}(y')} \ \bar{\pi}_{dec}(y') \ f^y_{dec}(y') \ dy \ .$$

The mass of single earner couples with an income exceeding y is given by $\lambda^0_{sec}(1 - F^y_{sec}(y))$, where λ^0_{sec} is the share of single earner couples among all couples, and F^y_{sec} is the *cdf* of the income distribution among single earner couples, and f^y_{sec} is the density associated with this distribution. The terms for dual earner couples are analogously defined.

The average intensive margin elasticity for single earners with an income of y is denoted by $\bar{\mathcal{E}}_{sec}(y)$ and analogously for $\bar{\mathcal{E}}_{dec}(y)$. Again, these are weighted averages of the elasticities of joint earnings with respect to the retention rate $1-T'$, where separate averages are computed for single and dual earner couples with an income close to y. The average extensive margin elasticity for single earner couples with an income of y is denoted by $\bar{\pi}_{sec}(y)$ and analogously for $\bar{\pi}_{dec}(y)$. Any such elasticity measures the percentage of couples with an income close to y who opt out of being a single or dual earner couple after a one percent decrease of their after-tax income.

B.4 The revenue functions $\mathcal{R}_1$ and $\mathcal{R}_2$

The formulas in Propositions B.3 and B.4 that characterize the revenue function $\mathcal{R}_m$ also apply to the revenue functions $\mathcal{R}_s$, $\mathcal{R}_1$ and $\mathcal{R}_2$ with an important qualification: The relevant notions of income and also the relevant elasticities are different ones. For instance, with behavioral responses only at the intensive margin, and an obvious change of notation,

$$\mathcal{R}_s(y_s) = -\frac{T_s'(y_s)}{1 - T_s'(y_s)}\ y_s\ f_s^y(y_s)\ \bar{\mathcal{E}}_s(y_s) + \ 1 - F_s^y(y_s)\ , \tag{B.9}$$

for

$$\bar{\mathcal{E}}_s(y_s) := \mathbf{E}_{\theta_s}\left[e_s(\theta_s) \mid y_s^0(\theta_s) = y_s\right]\ .$$

With intensive margin responses only, we also have

$$\begin{aligned}\mathcal{R}_1(y_1) \quad = \quad & -y_1 f_1^y(y_1)\mathbf{E}_{(\theta_m,\gamma_m)}\left[\tfrac{T_m'(y_m^0(\theta_m,\gamma_m))}{1-T_m'(y_m^0(\theta_m,\gamma_m))} e_1(\theta_m,\gamma_m) \mid y_1^0(\theta_m,\gamma_m) = y_1\right] \\ & +1 - F_1^y(y_1)\ ,\end{aligned} \tag{B.10}$$

where F_1^y is the *cdf* and f_1^y the density of the primary earnings in married couples, and $e_1(\theta_m, \gamma_m)$ is the elasticity of the couple's joint income with respect to the marginal tax rate faced by the primary earner. Analogously,

$$\begin{aligned}\mathcal{R}_2(y_2) \quad = \quad & -y_2 f_2^y(y_2)\mathbf{E}_{(\theta_m,\gamma_m)}\left[\tfrac{T_m'(y_m^0(\theta_m,\gamma_m))}{1-T_m'(y_m^0(\theta_m,\gamma_m))} e_2(\theta_m,\gamma_m) \mid y_2^0(\theta_m,\gamma_m) = y_2\right] \\ & +1 - F_2^y(y_2)\ ,\end{aligned} \tag{B.11}$$

where F_2^y is the *cdf* and f_2^y the density of the secondary earnings in married couples, and where $e_2(\theta_m, \gamma_m)$ is the elasticity of the couple's joint income with respect to the marginal tax rate faced by the secondary earner.

A difference to Proposition B.3 is that the ratio $\frac{T_m'(y_m^0(\theta_m,\gamma_m))}{1-T_m'(y_m^0(\theta_m,\gamma_m))}$ now appears in the expectation operator rather than in front of it. The reason is that revenue effects depend on the couple's joint income in the status quo; e.g. for $\mathcal{R}_1$, the behavioral response comes from all couples with primary earnings close to y_1, but the consequences of these behavioral responses for tax revenue depend on the couple's joint income y_m.

We again use the special case of iso-elastic effort cost functions to illustrate the difference between the relevant elasticities for the revenue functions $\mathcal{R}_m$, $\mathcal{R}_1$ and $\mathcal{R}_2$.[26]

Lemma B.4 *With iso-elastic cost functions*

$$e_1(\cdot) = \varepsilon_1 \left(1 + \frac{T''(y_1^0+y_2^0)}{1-T'(y_1^0+y_2^0)}(\varepsilon_1 y_1^0 + \varepsilon_2 y_2^0)\right)^{-1} ,$$

and

$$e_2(\cdot) = \varepsilon_2 \left(1 + \frac{T''(y_1^0+y_2^0)}{1-T'(y_1^0+y_2^0)}(\varepsilon_1 y_1^0 + \varepsilon_2 y_2^0)\right)^{-1} ,$$

Remember that $\mathcal{R}_m$ depends on a weighted average of the primary and the secondary earners' Frisch elasticities, with the weights reflecting their relative contributions to the couple's joint income. By contrast, for $\mathcal{R}_1$ only the primary earner's Frisch elasticity matters and for $\mathcal{R}_2$ it is the secondary earner's Frisch elasticity.

The extensive margin elasticities that matter for the revenue functions $\mathcal{R}_1$ and $\mathcal{R}_2$ are also different from the ones that matter for $\mathcal{R}_m$. For $\mathcal{R}_1$ and $\mathcal{R}_2$, the relevant extensive margin elasticities are measures of how the masses of single and dual earner couples change in response to a change in the tax treatment of primary or secondary earnings.[27] Again, revenue effects depend on the couple's

[26] We omit a formal proof of Lemma B.4. The Lemma can be proven along the same lines as Lemma B.2. For the latter the proof is in Appendix B.5.

[27] More formally, the cutoff types at the extensive margin – defined in Equations (B.22) and (B.23) in the Appendix for the case of $\mathcal{R}_m$ – become functions of τ_1 for the case of $\mathcal{R}_1$ and of τ_2 and for the case of $\mathcal{R}_2$.

joint income in the status quo while behavioral responses are triggered by a change in the tax treatment of primary or secondary earnings. For instance, for dual earner couples the extensive margin response to a "small" one bracket reform that affects primary earnings larger or equal to y_1 is now captured by

$$\mathcal{X}_{dec}(y_1) \;=\; -\int_{y_1}^{\bar{y}} \Pi_{dec}(y_1')\, m_{dec}^{y_1}(y_1')\, dy_1' \;,$$

for

$$\Pi_{dec}(y_1') \;=\; \mathbf{E}_{(\theta_m,\phi_m,\gamma_m)} \Big[\tfrac{T_{m0}(y_m^0(\theta_m,\phi_m,\gamma_m))}{y_m^0(\theta_m,\phi_m,\gamma_m)-T_{m0}(y_m^0(\theta_m,\phi_m,\gamma_m))} \times$$

$$\pi_{dec,1}(\theta_m,\phi_m,\gamma_m) \tfrac{m_{dec}(\theta_m,\phi_m,\gamma_m)}{m_{dec}^{y_1}(y_1')} \mid y_1^0(\theta_m,\phi_m,\gamma_m) = y_1' \Big]$$

where $m_{dec}(\theta_m,\phi_m,\gamma_m)$ is the mass of dual earner couples with characteristics $(\theta_m,\phi_m,\gamma_m)$ and $m_{dec}^{y_1}(y_1')$ is the mass of dual earner couples with primary earnings close to y_1'. The extensive margin elasticity $\pi_{dec,1}(\theta_m,\phi_m,\gamma_m)$ gives the percentage change in dual earner couples with characteristics $(\theta_m,\phi_m,\gamma_m)$ – in response to a change in the tax treatment of primary earnings. Appendix C.2 provides insights on how revenue functions are estimated in the data.

B.5 Proofs

B.5.1 Proof of Lemma B.2

We characterize $e_m(\theta_m,\gamma_m)$ for the special case of iso-elastic cost functions, i.e. for the cost functions in (B.2) and (B.3). The first order conditions characterizing $y_1^*(\tau_m,\theta_m,\gamma_m)$ and $y_2^*(\tau_m,\theta_m,\gamma_m)$ are then

$$1 - T'(y_1^*(\cdot) + y_2^*(\cdot)) - \tau_m = \gamma_1\, \theta_1^{-\left(1+\frac{1}{\varepsilon_1}\right)} y_1^*(\cdot)^{\frac{1}{\varepsilon_1}} \;, \tag{B.12}$$

and

$$1 - T'(y_1^*(\cdot) + y_2^*(\cdot)) - \tau_m = \gamma_2\, \theta_2^{-\left(1+\frac{1}{\varepsilon_2}\right)} y_2^*(\cdot)^{\frac{1}{\varepsilon_2}} \;. \tag{B.13}$$

Differentiating with respect to τ_m, evaluating at $\tau_m = 0$, and using (B.12) and (B.13) yields

$$-T''(y_1^0+y_2^0)(y^*_{1,\tau_m}+y^*_{2,\tau_m})-1 = \Big(1-T'(y_1^0+y_2^0)\Big)\ \frac{1}{\varepsilon_1}\ \frac{1}{y_1^0}\ y^*_{1,\tau_m}(\cdot)\ , \quad \text{(B.14)}$$

and

$$-T''(y_1^0+y_2^0)(y^*_{1,\tau_m}+y^*_{2,\tau_m})-1 = \Big(1-T'(y_1^0+y_2^0)\Big)\frac{1}{\varepsilon_2}\ \frac{1}{y_2^0}\ y^*_{2,\tau_m}(\cdot)\ , \quad \text{(B.15)}$$

where y_1^0 and y_2^0 are respectively, primary and secondary earnings in the status quo. Equations (B.14) and (B.15) imply

$$y^*_{1,\tau_m}+y^*_{2,\tau_m} = -\frac{\varepsilon_1 y_1^0+\varepsilon_2 y_2^0}{1-T'(y_1^0+y_2^0)}\left(1+\frac{T''(y_1^0+y_2^0)}{1-T'(y_1^0+y_2^0)}(\varepsilon_1 y_1^0+\varepsilon_2 y_2^0)\right)^{-1} . \quad \text{(B.16)}$$

Hence,

$$\begin{aligned} e_m &:= -\tfrac{y^*_{1,\tau_m}+y^*_{2,\tau_m}}{y_m^0}\ (1-T'(y_1^0+y_2^0)) \\ &= (\varepsilon_1\pi_1^0+\varepsilon_2\pi_2^0)\left(1+\tfrac{T''(y_1^0+y_2^0)}{1-T'(y_1^0+y_2^0)}(\varepsilon_1 y_1^0+\varepsilon_2 y_2^0)\right)^{-1} , \end{aligned}$$

where

$$\pi_1^0 = \frac{y_1^0}{y_m^0} \quad \text{and} \quad \pi_2^0 = \frac{y_2^0}{y_m^0}$$

are, respectively, the income share of the primary and the secondary earner.

B.5.2 Proof of Proposition B.3

Rewriting Equation (B.7). We can rewrite the terms that enter Equation (B.7) in the following way: First,

$$\begin{aligned} &\mathbf{E}_{(\theta_m,\gamma_m)}\left[\mathbf{1}(y_m^0(\theta_m,\gamma_m)\in[y_m, y_m+\ell_m])T'_m(y_m^0(\theta_m,\gamma_m))y^*_{m,1}(0,\theta_m,\gamma_m)\right] \\ &= \mathbf{E}_{\gamma_m}\left[\int_{\underline{\theta}_2}^{\bar{\theta}_2}\int_{\underline{\theta}_1^0}^{\bar{\theta}_1^0} a(\theta_1,\theta_2,\gamma_m)d\theta_1\ d\theta_2\right] \end{aligned}$$

where, for ease of notation, we suppressed the arguments in the limits of the double integral, and

$$a(\theta_1, \theta_2, \gamma_m) := T'_m(y^0_m(\theta_m, \gamma_m))y^*_{m,1}(0, \theta_m, \gamma_m)f^\theta_1(\theta_1 \mid \theta_2, \gamma_m)f^\theta_2(\theta_2 \mid \gamma_m) \ .$$

The function $f^\theta_1(\cdot \mid \theta_2, \gamma)$ is the density representing the conditional distribution of θ_1 for given θ_2 and γ_m. Analogously, $f^\theta_2(\cdot \mid \gamma_m)$ is the density of θ_2 conditional on γ_m.

Second,

$$\begin{aligned}
&\mathbf{E}_{(\theta_m,\gamma_m)}\left[\mathbf{1}(y^0_m(\theta_m, \gamma_m) \in [y_m, y_m + \ell_m])(y^0_m(\theta_m, \gamma_m) - y_m)\right] \\
&= \mathbf{E}_{\gamma_m}\left[\int_{\underline{\theta}_2}^{\bar{\theta}_2} \int_{\underline{\theta}^0_1}^{\bar{\theta}^0_1} b(\theta_m, \gamma_m)d\theta_1 \, d\theta_2\right]
\end{aligned}$$

where

$$b(\theta_m, \gamma_m) := (y^0_m(\theta_m, \gamma_m) - y_m)f^\theta_1(\theta_1 \mid \theta_2, \gamma_m)f^\theta_2(\theta_2 \mid \gamma_m) \ .$$

Third, let F^y_m be the *cdf* of y_m, then we can write

$$\begin{aligned}
&\ell_m\mathbf{E}_{(\theta_m,\gamma_m)}\left[\mathbf{1}(y^0_m(\theta_m, \gamma_m) \geq y_m + \ell_m])\right] \\
&= \ell_m F^y_m(y_m + \ell_m) \ .
\end{aligned}$$

Thus, collecting terms, we have

$$\begin{aligned}
&R_{\tau_m}(0, \ell_m, y_m) = \\
&\quad \mathbf{E}_{\gamma_m}\left[\int_{\underline{\theta}_2}^{\bar{\theta}_{m2}} \int_{\underline{\theta}^0_1}^{\bar{\theta}^0_{m1}} a(\theta_1, \theta_2, \gamma_m)d\theta_1 \, d\theta_2\right] \\
&\quad + \mathbf{E}_{\gamma_m}\left[\int_{\underline{\theta}_2}^{\bar{\theta}_{m2}} \int_{\underline{\theta}^0_1}^{\bar{\theta}^0_{m1}} b(\theta_1, \theta_2, \gamma_m)d\theta_1 \, d\theta_2\right] \\
&\quad + \ell_m(1 - F^y_m(y_m + \ell_m)) \ ,
\end{aligned} \tag{B.17}$$

The cross-derivative. We turn to a characterization of the cross derivative R_{τ_m,ℓ_m} evaluated at $\tau_m = 0$ and $\ell_m = 0$. To this end, for all terms that appear in (B.17) we compute the derivative with respect to ℓ_m and evaluate the resulting expression at $\ell_m = 0$.

For the first two terms, we make use of Leibnitz rule. Specifically consider an abstract function $h : (\theta_1, \theta_2) \mapsto h(\theta_1, \theta_2)$ and define the function $G : \ell \mapsto G(\ell)$

$$G(l) = \int_{\underline{\theta}_2}^{\overline{\theta}_2(l)} \int_{\underline{\theta}_1}^{\overline{\theta}_1(l)} h(\theta_1, \theta_2) d\theta_1 d\theta_2 \; .$$

Note that G depends on ℓ via the upper limits in the double integral. A repeated application of Leibnitz' rule yields,

$$\begin{aligned} G'(l) &= \textstyle\int_{\underline{\theta}_2}^{\overline{\theta}_2(l)} h(\overline{\theta}_1(l), \theta_2) \, \overline{\theta}'_{m1}(l) \, d\theta_2 \\ &\quad + \textstyle\int_{\underline{\theta}_1}^{\overline{\theta}_1(l)} h(\theta_1, \overline{\theta}_2(l)) \, \overline{\theta}'_{m2}(l) \, d\theta_1 \; . \end{aligned}$$

Upon noting that $\theta_2 = \overline{\theta}_2(l)$ implies $\underline{\theta}_1 = \overline{\theta}_1(l)$, this expression simplifies:

$$G'(l) = \int_{\underline{\theta}_2}^{\overline{\theta}_2(l)} h(\overline{\theta}_1(l), \theta_2) \, \overline{\theta}'_{m1}(l) \, d\theta_2 \; .$$

Using this formula to differentiate

$$\mathbf{E}_{\gamma_m} \left[\int_{\underline{\theta}_2}^{\bar{\theta}_2} \int_{\underline{\theta}_1}^{\bar{\theta}_1} a(\theta_1, \theta_2, \gamma_m) d\theta_1 \, d\theta_2 \right]$$

with respect to ℓ_m and evaluating at $\ell_m = 0$ yields

$$\mathbf{E}_{\gamma_m} \left[\int_{\underline{\theta}_2(y_m|\gamma_m)}^{\bar{\theta}_2(y_m|\gamma_m)} a(\bar{\theta}_{m1}(y_m \mid \theta_2, \gamma_m), \theta_2, \gamma_m) \, \bar{\theta}'_{m1}(y_m \mid \theta_2, \gamma_{m1}) \, d\theta_2 \right],$$

where $\bar{\theta}'_{m1}(\cdot \mid \theta_2, \gamma_{m1})$ is the derivative of the function $\bar{\theta}_{m1}(\cdot \mid \theta_2, \gamma_{m1})$.

Analogously, using it to differentiate

$$\mathbf{E}_{\gamma_m} \left[\int_{\underline{\theta}_2}^{\bar{\theta}_2} \int_{\underline{\theta}_1}^{\bar{\theta}_1} b(\theta_1, \theta_2, \gamma_m) d\theta_1 \, d\theta_2 \right]$$

with respect to ℓ_m and evaluating at $\ell_m = 0$ yields

$$\mathbf{E}_{\gamma_m} \left[\int_{\underline{\theta}_2(y_m|\gamma_m)}^{\bar{\theta}_{m2}(y_m|\gamma_m)} b(\bar{\theta}_{m1}(y_m \mid \theta_2, \gamma_m), \theta_2, \gamma_m) \, \bar{\theta}'_{m1}(y_m \mid \theta_2, \gamma_{m1}) \, d\theta_2 \right].$$

Since the function b is bounded from below by zero and from above by ℓ_m this term vanishes.

Finally, a straightforward application of the product rule shows that the derivative of $\ell_m(1 - F^y_m(y_m + \ell_m))$ with respect to ℓ_m, evaluated at $\ell_m = 0$, simply equals $1 - F^y_m(y_m)$. Thus upon collecting terms we have

$$\begin{aligned} R_{\tau_m,\ell_m}(0,0,y_m) &= \mathbf{E}_{\gamma_m}\left[\int_{\underline{\theta}_2(y_m|\gamma_m)}^{\bar{\theta}_2(y_m|\gamma_m)} a(\bar{\theta}_1(y_m \mid \theta_2,\gamma_m),\theta_2,\gamma_m)\, \bar{\theta}_1'(y_m \mid \theta_2,\gamma_m)\, d\theta_2\right] \\ &\quad + 1 - F^y_m(y_m)\ , \end{aligned} \tag{B.18}$$

where, for ease of reference, we recall that

$$a(\theta_m,\gamma_m) := T'_m(y^0_m(\theta_m,\gamma_m))y^*_{m,1}(0,\theta_m,\gamma_m)f^\theta_1(\theta_1 \mid \theta_2,\gamma_m)f^\theta_2(\theta_2 \mid \gamma_m)\ .$$

With a bracket length of zero, evaluating $a(\cdot)$ at

$$\theta_m = (\theta_1,\theta_2) = (\bar{\theta}_1(y_m \mid \theta_2,\gamma_m),\theta_2)$$

and integrating over $\theta_2 \in [\underline{\theta}_2(y_m \mid \gamma_m), \overline{\theta}_2(y_m \mid \gamma_m)]$ amounts to integrating over all couples, with bargaining weights γ_m who have a joint income equal to y_m. We now work towards a characterization of $R_{\tau_m,\ell_m}(0,0,y_m)$ that can be more easily interpreted.

θ_{mi} is also an admissible representation of the individual's type, in the sense that it yields a representation of preferences so that higher types have lower marginal effort costs and therefore end up choosing higher earnings levels. observed in the data, i.e. $\theta_2 = y^0_2$. Likewise, given θ_2 and γ_{m1}, we can represent the primary earner's type by her status quo earnings, $\theta_1 = y^0_1$. This is convenient as it allows us to identify abstract type distributions with the (conditional) distributions of status quo income. Thus, $f_2(\cdot \mid \gamma_m)$ is then the distribution of secondary earnings in the status quo, conditional on γ_m and $f_1(\cdot \mid \theta_2, \gamma_m)$ is the status quo distribution of primary earnings conditional on γ_m and secondary earnings of θ_2.

Step 1. The retention rate $1-T'_m(\cdot)$ gives the fraction of an additional income that a couple can spend on consumption. In the status quo, the derivative of the couple's earnings with respect to a change of the retention rate is given by

$$-y^*_{m,1}(0, \theta_m, \gamma_m) \; .$$

The elasticity of the married couples' earnings with respect to the retention rate then equals

$$e_m(\theta_m, \gamma_m) := -y^*_{m,1}(0, \theta_m, \gamma_m) \frac{1 - T'_m(\cdot)}{y^0_m(\theta_m, \gamma_m)} \; .$$

These two observations imply that

$$y^*_{m,1}(0, \theta_m, \gamma_m) = -e_m(\theta_m, \gamma_m) \, \frac{y^0_m(\theta_m, \gamma_m)}{1 - T'_m(\cdot)} \; . \tag{B.19}$$

Step 2. Define the shorthand

$$g(\theta_2, \gamma_m) := f^\theta_1(\bar{\theta}_{m1}(y_m \mid \theta_2, \gamma_m) \mid \theta_2, \gamma_m) f^\theta_2(\theta_2 \mid \gamma_m).$$

We now argue that the term

$$g(\theta_2, \gamma_m)\bar{\theta}'_{m1}(y_m \mid \theta_2, \gamma_{m1})$$

admits an interpretation as a conditional density of the cross-sectional distribution of the couples' joint earnings. To see this, let μ be a measure on the set of types $\Theta_1 \times \Theta_2$, representing the joint distribution of θ_1 and θ_2. Then,

$$\begin{aligned}
& F_m^y(y_m \mid \gamma_m) := \mu(\theta_m \mid y_m^0(\theta_1, \theta_2) \le y_m) \\
= \quad & \mu\big(\{\theta_m \mid \theta_2 \le \underline{\theta}_2(y_m \mid \gamma_m)\}\big) \\
& + \mu\big(\{\theta_m \mid \theta_2 \in [\underline{\theta}_2(y_m \mid \gamma_m), \bar{\theta}_{m2}(y_m \mid \gamma_m)] \text{ and } \theta_1 \le \bar{\theta}_{m1}(y_m \mid \theta_2, \gamma_m)\}\big) \\
= \quad & F_2^\theta(\underline{\theta}_2(y_m \mid \gamma_m)) \\
& + \int_{\underline{\theta}_2(y_m|\gamma_m)}^{\bar{\theta}_{m2}(y_m|\gamma_m)} F_1^\theta(\bar{\theta}_{m1}(y_m \mid \theta_2, \gamma_m)) f_2^\theta(\theta_2 \mid \gamma_m) d\theta_2 \ ,
\end{aligned}$$

where F_1^θ and F_2^θ are the *cdf*s of the marginal distributions of θ_1 and θ_2, respectively, and f_1^θ and f_2^θ are the corresponding densities. Straightforward computations, invoking Leibnitz' rule, yield that

$$f_m^y(y_m \mid \gamma_m) = \frac{\partial}{\partial y_m} F_m^y(y_m \mid \gamma_m),$$

where

$$f_m^y(y_m) := \mathbf{E}_{\gamma_m}\left[\int_{\underline{\theta}_2(y_m|\gamma_m)}^{\bar{\theta}_{m2}(y_m|\gamma_m)} g(\theta_2, \gamma_m)\, \bar{\theta}'_{m1}(y_m \mid \theta_2, \gamma_m)\, d\theta_2\right] .$$

Thus, we can interpret $g(\theta_2, \gamma_m)\, \bar{\theta}'_{m1}(y_m \mid \theta_2, \gamma_m)$ as a density of y_m conditional on θ_2 and write

$$f_m^y(y_m \mid \theta_2) = g(\theta_2, \gamma_m)\, \bar{\theta}'_{m1}(y_m \mid \theta_2, \gamma_m) \ . \tag{B.20}$$

Step 3. Substituting (B.19) and (B.20) into (B.18) yields

$$R_{\tau_m, \ell_m}(0, 0, y_m) \quad = \quad -\tfrac{T'_m(y_m)}{1 - T'_m(y_m)}\, y_m\, f_m^y(y_m)\, \bar{\mathcal{E}}_m(y_m) + \ 1 - F_m^y(y_m) \ , \tag{B.21}$$

where

$$\begin{aligned}
\bar{\mathcal{E}}_m(y_m) \quad &:= \quad \mathbf{E}_{\gamma_m}\left[\int_{\underline{\theta}_2(y_m|\gamma_m)}^{\bar{\theta}_{m2}(y_m|\gamma_m)} e_m(\bar{\theta}_{m1}(y_m \mid \theta_2, \gamma_m)\theta_2, \gamma_m) \tfrac{f_m^y(y_m|\theta_2)}{f_m^y(y_m)} d\theta_2\right] \\
&= \quad \mathbf{E}_{(\theta_m, \gamma_m)}\left[e_m(\theta_m, \gamma_m) \mid y_m^0(\theta_m, \gamma_m) = y_m\right]
\end{aligned}$$

is the average value of $e_m(\theta_m, \gamma_m)$ among all married couples with a joint income of y_m.

B.5.3 Proof of Proposition B.4

Extensive margin effects. For a given reform direction h_m, the cutoff types $\hat{\theta}_1$ and $\hat{\theta}_2$, for the primary and the secondary earner, respectively, become functions of the reform intensity τ_m, and we write $\hat{\theta}_1(\tau_m, \phi_1, \gamma_m)$ and $\hat{\theta}_2(\tau_m, \phi_2, \theta_1, \gamma_m)$. More precisely, $\hat{\theta}_1(\tau_m, \phi, \gamma_m)$ is now the value of θ_1 that solves

$$y^*_{sec}(\theta_1) - T_{m0}(y^*_{sec}(\theta_1)) - \tau_m h_m(y^*_{sec}(\theta_1)) - \gamma_{m1} k_1(y^*_{sec}(\theta_1), \theta_1) \quad = \quad \phi_1 \ . \tag{B.22}$$

Note that for $\tau_m = 0$, the cutoff type $\hat{\theta}_1(\tau_m, \phi_1, \gamma_m)$ coincides with the status quo cutoff type $\hat{\theta}_1, (\phi_1, \gamma_m)$ defined in the body of the text, for any h_m. More formally, $\hat{\theta}_1(0, \phi_1, \gamma_m) = \hat{\theta}_1(\phi_1, \gamma_m)$, for all h_m.

Analogously, $\hat{\theta}_2(\tau_m, \phi_2, \theta_1, \gamma_m)$ is the value of θ_2 that solves

$$\Delta(\theta_1, \theta_2, \gamma_m) - \tau_m \Big(h_m \left(y^*_1(\theta_1, \theta_2) + y^*_2(\theta_1, \theta_2) \right) - h_m \left(y^*_{sec}(\theta_1) \right) \Big) \quad = \quad \phi_2 \ . \tag{B.23}$$

If, say, $\hat{\theta}_1$ and $\hat{\theta}_2$ increase in τ_m, then a reform in direction h_m implies that some previously active primary and secondary earners no longer generate positive earnings. Again, $\hat{\theta}_2(0, \phi_2, \theta_1, \gamma_m) = \hat{\theta}_2(\phi_2, \theta_1, \gamma_m)$

Intensive margin effects. Utility-maximizing earnings levels are now also functions of τ_m and we write $y^*_{sec}(\tau_m, \theta_1, \gamma_m)$, $y^*_1(\tau_m, \theta_m, \gamma_m)$ and $y^*_2(\tau_m, \theta_m, \gamma_m)$. Note that, with quasi-linear in consumption preferences, the derivative of these functions with respect to τ_m are different from zero only when the couple's joint income lies in the bracket ranging from y_m to $y_m + \ell_m$, i.e. in the range of incomes where marginal tax rates change due to the reform.

Earnings levels and behavioral responses at the extensive margin. Tax reforms modify tax rates that depend on income. In our formal framework, behavioral responses depend on the individuals' types. To trace out the extensive margin effects associated with a tax reform, it will prove useful to have a mapping from the set of incomes subject to a change of the tax burden to the set of types who adjust their behavior at the extensive margin. Here, we introduce such a mapping.

The reform (τ_m, h_m) defined above has no effect on the taxes paid by couples with a joint income below y_m. For all other couples the tax burden is affected, with the consequence of extensive margin effects. Our formalism captures this as follows: The cutoff types $\hat{\theta}_1$ and $\hat{\theta}_2$ depend on the fixed costs ϕ_1 and ϕ_2. A reform that affects marginal tax rates in a bracket ranging from y_m to $y_m + \ell_m$ has extensive margin effects only for levels of ϕ_1 and ϕ_2 so that

$$y^*_{sec}(\tau_m, \hat{\theta}_1(\tau_m, \phi_1, \gamma_m), \gamma_m) \geq y_m$$

or

$$y^*_1(\tau_m, \theta_1, \hat{\theta}_2(\tau_m, \phi_2, \theta_1, \gamma_m), \gamma_m) + y^*_2(\tau_m, \theta_1, \hat{\theta}_2(\tau_m, \phi_2, \theta_1, \gamma_m), \gamma_m) \geq y_m \ .$$

Single earner couples. Let $\underline{\phi}_1(\tau_m, y \mid \gamma_m)$ be the value of ϕ_1 that solves

$$y^*_{sec}(\tau_m, \hat{\theta}_1(\phi_1, \gamma_m)\gamma_m) = y \ .$$

Thus, $\underline{\phi}_1(\tau_m, y \mid \gamma_m)$ is the lowest fixed cost type consistent with an earnings level of y in a single earner couple. Higher fixed cost types only consider earnings levels exceeding y. In the status quo, i.e. for $\tau_m = 0$, we write $\underline{\phi}^0_1(y \mid \gamma_m)$, etc. The function $y \mapsto \underline{\phi}^0_1(y \mid \gamma_m)$ will prove useful below. It is a mapping from the set of earnings levels to the set of single-earner couples types with extensive margin responses: A "small" reform (τ_m, h_m) that affects the tax burden of couples with a joint income of y_m and above, has extensive margin effects in the set single earner couples with $\phi_1 \geq \underline{\phi}_1^0(y \mid \gamma_m)$. Put differently, $\phi_1 < \underline{\phi}_1^0(y \mid \gamma_m)$ implies that $\hat{\theta}_1(\tau_m, \phi_1, \gamma_m)$ remains constant as τ_m changes.

Dual earner couples. For dual earner couples, we proceed analogously. Denote by

$$\underline{y}_{dec}(\tau_m, \phi_m, \gamma_m) := y_m^*(\tau_m, \hat{\theta}_1(\tau_m, \phi_1, \gamma_m), \hat{\theta}_2(\tau_m, \phi_2, \hat{\theta}_1(\tau_m, \phi_1, \gamma_m), \gamma_m), \gamma_m) \ ,$$

the lowest level of joint earnings consistent with a pair of fixed cost types $\phi_m = (\phi_1, \phi_2)$. In the status quo, for $\tau_m = 0$, we write

$$\underline{y}_{dec}^0(\phi_m, \gamma_m) := y_m^0(\hat{\theta}_1^0(\phi_1, \gamma_m), \hat{\theta}_2^0(\phi_2, \hat{\theta}_1^0(\phi_1, \gamma_m), \gamma_m), \gamma_m) \ .$$

For a "small" reform, the mapping from joint earnings to the set of dual earner couples with extensive margin responses is then given by the function $y \mapsto \Phi_m^0(y \mid \gamma_m)$, where

$$\Phi_m^0(y \mid \gamma_m) := \{\phi_m \mid \underline{y}_{dec}^0(\phi_m) \geq y\} \ .$$

Revenue implications. We denote by $R_m(\tau_m, \ell_m, y_m)$ the additional tax revenue due to the reform. With quasi-linear in consumption preferences, earnings choices do not depend on transfers. Hence,

$$\begin{aligned}
& R_m(\tau_m, \ell_m, y_m) \\
&= \mathbf{E}_{(\theta_m, \phi_m, \gamma_m)} \left[T_{m1}(y_m^*(\tau_m, \theta_m, \phi_m, \gamma_m)) - T_{m0}(y_m^0(\theta_m, \phi_m, \gamma_m))\right] \\
&= \mathbf{E}_{(\theta_m, \phi_m, \gamma_m)} \left[T_{m0}(y_m^*(\tau_m, \theta_m, \phi_m, \gamma_m)) + \tau_m \ h_m(y_m^*(\tau_m, \theta_m, \phi_m, \gamma_m))\right] \\
&\quad - \mathbf{E}_{(\theta_m, \phi_m, \gamma_m)} \left[T_{m0}(y_m^0(\theta_m, \phi_m, \gamma_m))\right] \ ,
\end{aligned}$$

where the operator $\mathbf{E}_{(\theta_m, \phi_m \gamma_m)}$ indicates that expectations are taken with respect to the joint distribution of θ_m, ϕ_m and γ_m; $y_m^*(\tau_m, \theta_m, \phi_m, \gamma_m)$ is the couple's joint income as a function of the reform intensity τ_m and the couple's characteristics, and, finally, $y^0_m(\theta_m, \phi_m, \gamma_m)$ is the couple's income in the status quo. Using the law of iterated expectations, we can also write this as

$$R_m(\tau_m, \ell_m, y_m) \quad = \quad \mathbf{E}_{\gamma_m}\mathbf{E}_{\phi_m}\left[R_m(\tau_m, \ell_m, y_m \mid \gamma_m, \phi_m)\right] \quad ,$$

where

$$\begin{aligned}
&R_m(\tau_m, \ell_m, y_m \mid \gamma_m, \phi_m) \\
&= \mathbf{E}_{\theta_m}\left[T_{m0}(y^*_m(\tau_m, \theta_m, \phi_m, \gamma_m)) + \tau_m\ h_m(y^*_m(\tau_m, \theta_m, \phi_m, \gamma_m)) \mid \gamma_m, \phi_m\right] \\
&\quad -\mathbf{E}_{\theta_m}\left[T_{m0}(y^0_m(\theta_m, \phi_m, \gamma_m)) \mid \gamma_m, \phi_m\right] \ ,
\end{aligned}$$

Using that $T_{m0}(0) = h(0) = 0$, we can also write

$$\begin{aligned}
&R_m(\tau_m, \ell_m, y_m \mid \gamma_m, \phi_m) \\
&= \int_{\hat{\theta}_1(\tau_m,\phi_1,\gamma_m)}^{\bar{y}} \int_0^{\hat{\theta}_2(\tau_m,\theta_1,\phi_2,\gamma_m)} a_{sec}(\tau_m, \theta_m, \gamma_m)\ d\theta_2\ d\theta_1 \\
&\quad + \int_{\hat{\theta}_1(\tau_m,\phi_1,\gamma_m)}^{\bar{y}} \int_{\hat{\theta}_2(\tau_m,\theta_1,\phi_2,\gamma_m)}^{\bar{y}} a_{dec}(\tau_m, \theta_m, \gamma_m)\ d\theta_2\ d\theta_1 \\
&\quad -\mathbf{E}_{\theta_m}\left[T_{m0}(y^0_m(\theta_m, \phi_m\gamma_m)) \mid \gamma_m, \phi_m\right] \ ,
\end{aligned}$$

where

$$\begin{aligned}
a_{dec}(\tau_m, \theta_m, \phi_m, \gamma_m) \quad &= \quad \Big(T_{m0}(y^*_m(\tau_m, \theta_m, \gamma_m)) + \tau_m\ h_m(y^*_m(\tau_m, \theta_m, \gamma_m))\Big) \\
&\qquad \times f^\theta_2(\theta_2 \mid \theta_1, \gamma_m, \phi_m) f^\theta_1(\theta_1 \mid \gamma_m, \phi_m) \ .
\end{aligned}$$

and

$$\begin{aligned}
a_{sec}(\tau_m, \theta_m, \phi_m, \gamma_m) \quad &= \quad \Big(T_{m0}(y^*_{sec}(\tau_m, \theta_1, \gamma_m)) + \tau_m\ h_m(y^*_{sec}(\tau_m, \theta_1, \gamma_m))\Big) \\
&\qquad \times f^\theta_2(\theta_2 \mid \theta_1, \gamma_m, \phi_m) f^\theta_1(\theta_1 \mid \gamma_m, \phi_m) \ .
\end{aligned}$$

Revenue implications at the margin. The derivative of $R_m(\tau_m, \ell_m, y_m)$ with respect to the first argument, evaluated at $\tau_m = 0$, equals

$$R_{m,\tau_m}(0, \ell_m, y_m) \quad = \quad \mathbf{E}_{\gamma_m}\mathbf{E}_{\phi_m}\left[R_{m,\tau_m}(0, \ell_m, y_m \mid \gamma_m, \phi_m)\right] \quad ,$$

where $R_{m,\tau_m}(0, \ell_m, y_m \mid \gamma_m, \phi_m)$ can be decomposed into a term due to single earner couples and a term due to couples with both primary and secondary earnings:

$$R_{m,\tau_m}(0, \ell_m, y_m \mid \gamma_m, \phi_m) = R^{sec}_{m,\tau_m}(0, \ell_m, y_m \mid \gamma_m, \phi_m) + R^{dec}_{m,\tau_m}(0, \ell_m, y_m \mid \gamma_m, \phi_m) \ .$$

for

$$R^{sec}_{m,\tau_m}(0,\ell_m,y_m \mid \gamma_m,\phi_m) = \frac{d}{d\tau_m}\left(\int_{\hat\theta_1(\tau_m,\phi_1,\gamma_m)}^{\bar y}\int_0^{\hat\theta_2(\tau_m,\theta_1,\phi_2,\gamma_m)} a_{sec}(\tau_m,\theta_m,\gamma_m)d\theta_1 d\theta_2\right)\Bigg|_{\tau_m=0}$$

and

$$R^{dec}_{m,\tau_m}(0,\ell_m,y_m \mid \gamma_m,\phi_m) = \frac{d}{d\tau_m}\left(\int_{\hat\theta_1(\tau_m,\phi_1,\gamma_m)}^{\bar y}\int_{\hat\theta_2(\tau_m,\theta_1,\phi_2,\gamma_m)}^{\bar y} a_{dec}(\tau_m,\theta_m,\gamma_m)d\theta_1 d\theta_2\right)\Bigg|_{\tau_m=0}$$

Computing these derivatives, invoking the Leibnitz rule, yields

$$\begin{aligned}
&R^{sec}_{m,\tau_m}(0,\ell_m,y_m \mid \gamma_m,\phi_m) = \\
&\int_{\hat\theta^0_1(\phi_1,\gamma_m)}^{\bar y} a^0_{sec}(\theta_1,\hat\theta^0_2(\theta_1,\phi_2,\gamma_m),\gamma_m)\ \hat\theta^0_{2,\tau_m}(\theta_1,\phi_2,\gamma_m)\ d\theta_1 \\
&-\left(\int_0^{\hat\theta^0_2(\hat\theta^0_1(\phi_1,\gamma_m),\phi_2,\gamma_m)} a^0_{sec}(\hat\theta^0_1(\phi_1,\gamma_m),\theta_2,\gamma_m)\ \hat\theta^0_{1,\tau_m}(\phi_1,\gamma_m)\ \ d\theta_2\right) \\
&+\int_{\hat\theta^0_1(\phi_1,\gamma_m)}^{\bar y}\int_0^{\hat\theta^0_2(\theta_1,\phi_2,\gamma_m)} a^0_{sec,\tau_m}(\theta_m,\gamma_m)\ d\theta_1 d\theta_2,
\end{aligned}$$

and

$$\begin{aligned}
&R^{dec}_{m,\tau_m}(0,\ell_m,y_m \mid \gamma_m,\phi_m) = \\
&-\left(\int_{\hat\theta^0_2(\hat\theta^0_1(\phi_1,\gamma_m),\phi_2,\gamma_m)}^{\bar y} a^0_{dec}(\hat\theta^0_1(\phi_1,\gamma_m),\theta_2,\gamma_m)\ \hat\theta^0_{1,\tau_m}(\phi_1,\gamma_m)\ d\theta_2\right) \\
&-\left(\int_{\hat\theta^0_1(\phi_1,\gamma_m)}^{\bar y} a^0_{dec}(\theta_1,\hat\theta^0_2(\theta_1,\phi_2,\gamma_m),\gamma_m)\ \hat\theta^0_{2,\tau_m}(\theta_1,\phi_2,\gamma_m)\ d\theta_1\right) \\
&+\int_{\hat\theta^0_1(\phi_1,\gamma_m)}^{\bar y}\int_{\hat\theta^0_2(\theta_1,\phi_2,\gamma_m)}^{\bar y} a^0_{dec,\tau_m}(\theta_m,\gamma_m)\ \ d\theta_1 d\theta_2,
\end{aligned}$$

where the superscript 0 indicates an evaluation at the status quo, i.e. for $\tau_m = 0$, and the subscript τ_m indicates the derivative of a function with respect to τ_m.

We now take an expectation over fixed cost types and write

$$\mathcal{R}^{sec}_{m,\tau_m}(0,\ell,y_m) := \mathbf{E}_{\phi_m}\left[R^{sec}_{m,\tau_m}(0,\ell_m,y_m \mid \gamma_m,\phi_m)\right]$$

and

$$\mathcal{R}^{dec}_{m,\tau_m}(0,\ell,y_m) := \mathbf{E}_{\phi_m}\left[R^{dec}_{m,\tau_m}(0,\ell_m,y_m \mid \gamma_m,\phi_m)\right]$$

Repeating the steps outlined previously in Section B.5.2, we now compute the cross-derivatives

$$\mathcal{R}^{sec}_{\tau_m,\ell_m}(0,0,y_m \mid \gamma_m) \quad \text{and} \quad \mathcal{R}^{dec}_{\tau_m,\ell_m}(0,0,y_m \mid \gamma_m,\phi_m)\ .$$

We obtain

$$
\begin{aligned}
&\mathcal{R}^{sec}_{\tau_m,\ell_m}(0,0,y_m \mid \gamma_m) = \\
&\mathbf{E}_{\phi_m}\left[\mathbf{1}\left(\phi_1 \geq \underline{\phi}^0_1(y_m \mid \gamma_m)\right)\left(\int_{\hat{\theta}^0_1(\phi_1,\gamma_m)}^{\bar{y}} a^0_{sec}(\theta_1,\hat{\theta}^0_2(\theta_1,\phi_2,\gamma_m),\gamma_m)\ \hat{\theta}^0_{2,\tau_m}(\theta_1,\phi_2,\gamma_m)\ d\theta_1\right)\right] \\
&-\mathbf{E}_{\phi_m}\left[\mathbf{1}\left(\phi_1 \geq \underline{\phi}^0_1(y_m \mid \gamma_m)\right)\left(\int_0^{\hat{\theta}^0_2(\hat{\theta}^0_1(\phi_1,\gamma_m),\phi_2,\gamma_m)} a^0_{sec}(\hat{\theta}^0_1(\phi_1,\gamma_m),\theta_2,\gamma_m)\ \hat{\theta}^0_{1,\tau_m}(\phi_1,\gamma_m)\ d\theta_2\right)\right] \\
&+\mathbf{E}_{\phi_m}\left[\lambda_{sec}(\gamma_m,\phi_m) I_s(y_m \mid \gamma_m,\phi_m)\right]
\end{aligned}
$$

where

$$
I_{sec}(y_m \mid \gamma_m,\phi_m) := -\frac{T'(y_m)}{1-T'(y_m)}\ y_m\ \mathcal{E}_{sec}(y_m \mid \gamma_m,\phi_m)\ f^y_{sec}(y_m \mid \gamma_m,\phi_m) + 1 - F^y_{sec}(y_m \mid \gamma_m,\phi_m)\ .
$$

Moreover, $\lambda_{sec}(\gamma_m,\phi_m)$ is the share of single earner couples among all couples with characteristics (γ_m,ϕ_m), $F^y_{sec}(\cdot \mid \gamma_m,\phi_m)$ is the (conditional) *cdf* representing the distribution of incomes among single earner couples and $f^y_{sec}(\cdot \mid \gamma_m,\phi_m)$ the corresponding density; finally, $\mathcal{E}_{sec}(y_m \mid \gamma_m,\phi_m)$ is the intensive margin elasticity of earnings (for single earner couples with earnings of y_m) with respect to the net of tax rate.

Analogously, we obtain

$$
\begin{aligned}
&\mathcal{R}^{dec}_{m,\tau_m,\ell_m}(0,0,y_m \mid \gamma_m) = \\
&-\mathbf{E}_{\phi_m}\left[\mathbf{1}(\phi_m \in \Phi^0_m(y_m \mid \gamma_m))\left(\int_{\hat{\theta}^0_2(\hat{\theta}^0_1(\phi_1,\gamma_m),\phi_2,\gamma_m)}^{\bar{y}} a^0_{dec}(\hat{\theta}^0_1(\phi_1,\gamma_m),\theta_2,\gamma_m)\ \hat{\theta}^0_{1,\tau_m}(\phi_1,\gamma_m)\ d\theta_2\right)\right] \\
&-\mathbf{E}_{\phi_m}\left[\mathbf{1}(\phi_m \in \Phi^0_m(y_m \mid \gamma_m))\left(\int_{\hat{\theta}^0_1(\phi_1,\gamma_m)}^{\bar{y}} a^0_{dec}(\theta_1,\hat{\theta}^0_2(\theta_1,\phi_2,\gamma_m),\gamma_m)\ \hat{\theta}^0_{2,\tau_m}(\theta_1,\phi_2,\gamma_m)\ d\theta_1\right)\right] \\
&+\mathbf{E}_{\phi_m}\left[\lambda_{dec}(\gamma_m,\phi_m)\ I_{dec}(y_m \mid \gamma_m,\phi_m)\right]\ ,
\end{aligned}
$$

where

$$
\Phi^0_m(y_m \mid \gamma_m) := \{\phi_m \mid \underline{y}^0_{dec}(\phi_m) \geq y_m\}\ ,
$$

with

$$
\underline{y}^0_{dec}(\phi_m) := y^0_m(\hat{\theta}^0_1(\phi_1,\gamma_m),\hat{\theta}^0_2(\phi_2,\hat{\theta}^0_1(\phi_1,\gamma_m),\gamma_m))\ ,
$$

and

$$
I_{dec}(y_m \mid \gamma_m,\phi_m) := -\frac{T'(y_m)}{1-T'(y_m)}\ y_m\ \mathcal{E}_{dec}(y_m \mid \gamma_m,\phi_m)\ f^y_{dec}(y_m \mid \gamma_m,\phi_m) + 1 - F^y_{dec}(y_m \mid \gamma_m,\phi_m)\ .
$$

Collecting terms capturing intensive margin responses of single earner couples. Above we derived an expression for $I_{sec}(y_m \mid \gamma_m,\phi_m)$ that captures the intensive margin responses of single earner couples, conditional on bargaining weights being given by γ_m and fixed costs being given be ϕ_m. Using the law of iterated expectations, we now compute the average intensive margin response of all single earner couples:

$$
\begin{aligned}
\mathcal{I}_{sec}(y) &:= \mathbf{E}_{\gamma_m}\mathbf{E}_{\phi_m}\left[\lambda_{sec}(\gamma_m,\phi_m) I_{sec}(y_m \mid \gamma_m,\phi_m)\right] \\
&= \tfrac{T'(y_m)}{1-T'(y_m)}\, y_m\, \mathbf{E}_{\gamma_m}\mathbf{E}_{\phi_m}\left[\lambda_{sec}(\gamma_m,\phi_m)\, f^y_{sec}(y_m \mid \gamma_m,\phi_m)\, \mathcal{E}_{sec}(y_m \mid \gamma_m,\phi_m)\right] \\
&\quad + \quad \mathbf{E}_{\gamma_m}\mathbf{E}_{\phi_m}\left[\lambda_{sec}(\gamma_m,\phi_m)(1 - F^y_{sec}(y_m \mid \gamma_m,\phi_m))\right] \ .
\end{aligned}
$$

To obtain a more concise expression, let

$$
M^+_{sec}(y) := \mathbf{E}_{\gamma_m}\mathbf{E}_{\phi_m}\left[\lambda_{sec}(\gamma_m,\phi_m)(1 - F^y_{sec}(y_m \mid \gamma_m,\phi_m))\right]
$$

be the mass of single earner couples with an income above y, and

$$
m_{sec}(y) := \mathbf{E}_{\gamma_m}\mathbf{E}_{\phi_m}\left[\lambda_{sec}(\gamma_m,\phi_m)\, f^y_{sec}(y_m \mid \gamma_m,\phi_m)\right]
$$

the mass of single earner couples with an income close to y. Then, we can write

$$
\begin{aligned}
&\mathbf{E}_{\gamma_m}\mathbf{E}_{\phi_m}\left[\lambda_{sec}(\gamma_m,\phi_m)\, f^y_{sec}(y_m \mid \gamma_m,\phi_m)\, \mathcal{E}_{sec}(y_m \mid \gamma_m,\phi_m)\right] \\
&= m_s(y)\, \mathbf{E}_{\phi_m}\left[\tfrac{\lambda_s(\gamma_m,\phi_m)\, f^y_{ms}(y_m \mid \gamma_m,\phi_m)}{m_s(y)}\, \mathcal{E}_{ms}(y_m \mid \gamma_m,\phi_m)\right] \\
&=: m_s(y)\, \bar{\mathcal{E}}_{ms}(y) \ ,
\end{aligned}
$$

where $\bar{\mathcal{E}}_{sec}(y)$ is the average intensive margin elasticity among single earner couples with an income close to y. Thus,

$$
\mathcal{I}_{sec}(y) \quad = \quad -\tfrac{T'(y)}{1-T'(y)}\, y\, m_{sec}(y)\, \bar{\mathcal{E}}_{sec}(y) + M^+_{sec}(y) \ .
$$

Collecting terms capturing intensive margin responses of dual earner couples. Following the same steps as in the previous paragraph we obtain

$$
\begin{aligned}
\mathcal{I}_{dec}(y) \quad = \quad & -\tfrac{T'(y)}{1-T'(y)}\, y\, \mathbf{E}_{\gamma_m}\mathbf{E}_{\phi_m}\left[\lambda_{dec}(\gamma_m,\phi_m)\, f^y_{dec}(y_m \mid \gamma_m,\phi_m)\, \mathcal{E}_{dec}(y_m \mid \gamma_m,\phi_m)\right] \\
& + M^+_{dec}(y) \ ,
\end{aligned}
$$

where $M^+_{dec}(y)$ is the mass of dual earner couples with an income above y. This formula can be rewritten as

$$\mathcal{I}_{dec}(y) \quad = \quad -\tfrac{T'(y)}{1-T'(y)}\; y\; m_{dec}(y)\; \bar{\mathcal{E}}_{dec}(y) + M^+_{dec}(y)\ ,$$

where $m_{dec}(y)$ is the mass of dual earner couples with an income close to y, and $\bar{\mathcal{E}}_{dec}(y)$ is the average intensive margin elasticity among dual earner couples with an income close to y.

Extensive margin responses, single earner couples. We treat γ_m as a fixed parameter, also suppress it in terms of notation, and consider

$$X^2_{sec}(y_m) := \mathbf{E}_{\phi_1}\left[\mathbf{E}_{\phi_2}\left[\mathbf{1}\left(\phi_1 \geq \underline{\phi}^0_1(y_m)\right)\left(\int_{\hat{\theta}^0_1(\phi_1)}^{\bar{y}} a^0_{1s}(\theta_1, \hat{\theta}^0_2(\theta_1,\phi_2))\; \hat{\theta}^0_{2,\tau_m}(\theta_1,\phi_2)\; d\theta_1\right) \mid \phi_1\right]\right],$$

and

$$X^1_{sec}(y_m) := \mathbf{E}_{\phi_1}\left[\mathbf{E}_{\phi_2}\left[\mathbf{1}\left(\phi_1 \geq \underline{\phi}^0_1(y_m)\right)\left(\int_0^{\hat{\theta}^0_2(\hat{\theta}^0_1(\phi_1),\phi_2)} a^0_{1s}(\hat{\theta}^0_1(\phi_1), \theta_2)\; \hat{\theta}^0_{1,\tau_m}(\phi_1)\; d\theta_2\right) \mid \phi_1\right]\right].$$

<u>*Step 1. Rewriting $X^2_{sec}(y_m)$.*</u> Note that

$$X^2_{sec}(y_m) = \int_{\underline{\phi}^0_1(y_m)}^{\bar{y}} \mathbf{E}_{\phi_2}\left[\left(\int_{\hat{\theta}^0_1(\phi_1)}^{\bar{y}} a^0_{1s}(\theta_1, \hat{\theta}^0_2(\theta_1,\phi_2))\; \hat{\theta}^0_{2,\tau_m}(\theta_1,\phi_2)\; d\theta_1\right) \mid \phi_1\right] f^{\phi_1}_1(\phi_1)d\phi_1\ ,$$

where $f^{\phi_1}_1$ is the density of the distribution of ϕ_1. Using the assumption that ϕ_2 and θ_1 are stochastically independent, this can be rewritten as

$$X^2_{sec}(y_m) = \int_{\underline{\phi}^0_1(y_m)}^{\bar{y}} \left(\int_{\hat{\theta}^0_1(\phi_1)}^{\bar{y}} T_{m0}(y^0_{1s}(\theta_1))\; z(\theta_1,\phi_1)\; d\theta_1\right) f^{\phi_1}_1(\phi_1)d\phi_1\ ,$$

where

$$z(\theta_1,\phi_1) := \mathbf{E}_{\phi_2}\left[f^\theta_2(\hat{\theta}_2(\theta_1,\phi_2) \mid \theta_1,\phi_m)\; \hat{\theta}^0_{2,\tau_m}(\theta_1,\phi_2) \mid \phi_1\right]\; f^\theta_1(\theta_1 \mid \phi_m)\ .$$

After an integration by substitution, this can be rewritten as

$$X^2_{sec}(y_m) = \int_{\underline{\phi}_1(y_m)}^{\bar{y}} \left(\int_{\phi_1}^{\bar{y}} T_{m0}(y^0_{1s}(\hat{\theta}^0_1(\phi_1)))\; z(\hat{\theta}^0_1(\phi_1),\phi_1)\; \hat{\theta}^{0'}_1(\phi_1)\; d\phi_1\right) f^{\phi_1}_1(\phi_1)d\phi_1\ ,$$

where $\hat{\theta}^{0'}_1$ is the derivative of the function $\hat{\theta}^0_1$. After an integration by parts, this latter expression can be written as

$$X^2_{sec}(y_m) = \int_{\underline{\phi}_1(y_m)}^{\bar{y}} T_{m0}(y^0_{1s}(\hat{\theta}^0_1(\phi_1)))\; z(\hat{\theta}^0_1(\phi_1),\phi_1)\; \hat{\theta}^{0'}_1(\phi_1)\; \left(F^\phi_1(\phi_1) - F^\phi_1(\underline{\phi}_1(y_m))\right) d\phi_1\ .$$

After another integration by substitution, we obtain

$$X^2_{sec}(y_m) = \int_{y_m}^{\bar{y}} T_{m0}(y)\; g_{sec}(y)\; dy,$$

where

$$g_{sec}(y) := z(\hat{\theta}^0_1(\underline{\phi}_1(y)), \phi_1)\; \hat{\theta}^{0\prime}_1(\underline{\phi}_1(y))\; \left(F^{\phi}_1(\underline{\phi}_1(y)) - F^{\phi}_1(\underline{\phi}_1(y_m))\right) \underline{\phi}^{\prime}_1(y)$$

measures the gain of single earner couples with an income close to y due to the tax reform; this gain comes from dual earner couples in which the secondary earner becomes inactive.

Upon defining an extensive margin elasticity that relates changes in the fraction of single earner households to changes in their after-tax incomes

$$\pi^+_{sec}(y) := \frac{g_{sec}(y)}{m^y_{sec}(y)}(y - T_{m0}(y))\;,$$

where $m_{sec}(y)$ is the mass of single earner couples with an income close to y,[28] we can rewrite $X^2_{sec}(y_m)$ one more time:

$$X^2_{sec}(y_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)}\; \pi^+_{sec}(y)\; m^y_{sec}(y)\; dy\;.$$

Averaging over γ_m. Now, we bring back the conditioning variable γ_m and write this as

$$X^2_{sec}(y_m \mid \gamma_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)}\; \pi^+_{sec}(y \mid \gamma_m)\; m^y_{sec}(y \mid \gamma_m)\; dy\;.$$

We finally define

$$\mathcal{X}^2_{sec}(y_m) := \mathbf{E}_{\gamma_m}\left[X^2_{sec}(y_m \mid \gamma_m)\right]$$

and note that

$$\mathcal{X}^2_{sec}(y_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)}\; \mathbf{E}_{\gamma_m}\left[\pi^+_{sec}(y \mid \gamma_m)\; m^y_{sec}(y \mid \gamma_m)\right] dy\;.$$

Step 2. Rewriting $X^1_{sec}(y_m)$. Repeating, mutatis mutandis, the analysis in Step 1, brings the following results: Denote by $l^1_{sec}(y)$ the loss/fraction of single earner couples with an income close to y that are turned into couples with no earnings in response to the tax reform. The corresponding extensive margin elasticity is

$$\pi^-_{sec}(y) := \frac{l^1_{sec}(y)}{m^y_{sec}(y)}(y - T_{m0}(y))\;.$$

[28]Formally, m_{sec} is the derivative of the function M^-_{sec}, where $M^-_{sec}(y)$ is the mass of single earner couples with an income below y.

For given γ_m, this elasticity enters the expression

$$X^1_{sec}(y_m \mid \gamma_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)} \; \pi^-_{sec}(y \mid \gamma_m) \; m^y_{sec}(y \mid \gamma_m) \; dy \; .$$

Using that $\mathcal{X}^1_{sec}(y_m) := \mathbf{E}_{\gamma_m}\left[X^1_{sec}(y_m \mid \gamma_m)\right]$ we finally obtain

$$\mathcal{X}^1_{sec}(y_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)} \; \mathbf{E}_{\gamma_m}\left[\pi^-_{sec}(y \mid \gamma_m) \; m^y_{sec}(y \mid \gamma_m)\right] dy \; .$$

<u>*Step 3. Collecting terms*</u> We can now consolidate these expressions and define

$$\begin{aligned}
\mathcal{X}_{sec}(y_m) &= \mathcal{X}^1_{sec}(y_m) + \mathcal{X}^2_{sec}(y_m) \\
&= \int_{y_m}^{\bar{y}} \tfrac{T_{m0}(y)}{y - T_{m0}(y)} \; \mathbf{E}_{\gamma_m}\left[\left(\pi^-_{sec}(y \mid \gamma_m) + \pi^+_{sec}(y \mid \gamma_m)\right) \; m^y_{sec}(y \mid \gamma_m)\right] dy \\
&:= \int_{y_m}^{\bar{y}} \tfrac{T_{m0}(y)}{y - T_{m0}(y)} \; \mathbf{E}_{\gamma_m}\left[\pi_{sec}(y \mid \gamma_m) \; m^y_{sec}(y \mid \gamma_m)\right] dy,
\end{aligned}$$

where $\pi_{sec}(y \mid \gamma_m) := \pi^-_{sec}(y \mid \gamma_m) + \pi^+_{sec}(y \mid \gamma_m)$. Upon defining

$$m^y_{sec}(y) := \mathbf{E}_{\gamma_m}\left[m^y_{sec}(y \mid \gamma_m)\right],$$

and

$$\bar{\pi}_{sec}(y) := \mathbf{E}_{\gamma_m}\left[\pi_{sec}(y \mid \gamma_m) \; \frac{m^y_{sec}(y \mid \gamma_m)}{m^y_{sec}(y)}\right] \; ,$$

this can be rewritten as

$$\mathcal{X}_{sec}(y_m) \quad = \quad \int_{y_m}^{\infty} \tfrac{T_{m0}(y)}{y - T_{m0}(y)} \; \bar{\pi}_{sec}(y) \; m^y_{sec}(y) \; dy \; .$$

Extensive margin responses, dual earner couples. We proceed along the same lines as in the previous paragraph on single earner couples: We first treat γ_m as a fixed parameter, also suppress it in terms of notation, and compute

$$X^2_{dec}(y_m) := \mathbf{E}_{\phi_1}\left[\mathbf{E}_{\phi_2}\left[\mathbf{1}(\phi_m \in \Phi^0_m(y_m)) \left(\int_{\hat{\theta}^0_1(\phi_1)}^{\bar{y}} a^0(\theta_1, \hat{\theta}^0_2(\theta_1, \phi_2)) \; \hat{\theta}^0_{2,\tau_m}(\theta_1, \phi_2) \; d\theta_1\right) \mid \phi_1\right]\right],$$

and

$$X^1_{dec}(y_m) := \mathbf{E}_{\phi_1}\left[\mathbf{E}_{\phi_2}\left[\mathbf{1}(\phi_m \in \Phi^0_m(y_m)) \left(\int_{\hat{\theta}^0_2(\hat{\theta}^0_1(\phi_1), \phi_2)}^{\bar{y}} a^0(\hat{\theta}^0_1(\phi_1), \theta_2) \; \hat{\theta}^0_{1,\tau_m}(\phi_1, \gamma_m) \; d\theta_2\right) \mid \phi_1\right]\right].$$

The term X^2_{dec} measures a loss of tax revenue from dual earner couples because some are turned into single earner couples. The term X^1_{dec} measures a loss of tax revenue because some dual earner couples are turned into couples with no earnings at all. We will compute expectations with respect to γ_m afterwards. We only sketch how the derivations change relative to those for single earner couples.

Step 1. Rewriting $X^2_{dec}(y_m)$. Starting from

$$X^2_{dec}(y_m) = \int_{\underline{\phi}^0_{1dec}(y_m)}^{\bar{y}} \int_{\underline{\phi}^0_{2dec}(y_m|\phi_1)}^{\bar{y}} \left(\int_{\hat{\theta}^0_1(\phi_1)}^{\bar{y}} a^0(\theta_1, \hat{\theta}^0_2(\theta_1, \phi_2))\, \hat{\theta}^0_{2,\tau_m}(\theta_1, \phi_2)\, d\theta_1 \right) f^\phi_2(\phi_2 \mid \phi_1)\, d\phi_2\, f^\phi_1(\phi_1)\, d\phi_1,$$

we ultimately obtain

$$X^2_{dec}(y_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)}\, \pi_{21}(y)\, m^y_{dec}(y)\, dy\ .$$

where $\pi_{21}(y)$ measures the fraction of dual earner couples with a joint income close to y that are turned into single earner couples.

Averaging over γ_m. Now, we bring back the conditioning variable γ_m and write this as

$$X^2_{dec}(y_m \mid \gamma_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)}\, \pi_{21}(y \mid \gamma_m)\, m^y_{dec}(y \mid \gamma_m)\, dy\ .$$

We finally define

$$\mathcal{X}^2_{dec}(y_m) := \mathbf{E}_{\gamma_m}\left[X^2_{dec}(y_m \mid \gamma_m)\right]$$

and note that

$$\mathcal{X}^2_{dec}(y_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)}\, \mathbf{E}_{\gamma_m}\left[\pi_{21}(y \mid \gamma_m)\, m^y_{dec}(y \mid \gamma_m)\right] dy\ .$$

Step 2. Rewriting $X^1_{dec}(y_m)$ and averaging over γ_m. Analogously, we find

$$X^1_{dec}(y_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)}\, \pi_{20}(y)\, m^y_{dec}(y)\, dy\ .$$

where $\pi_{20}(y)$ measures the fraction of dual earner couples with a joint income close to y that are turned into couples with no earnings. As before, we have

$$X^1_{dec}(y_m \mid \gamma_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)}\, \pi_{20}(y \mid \gamma_m)\, m^y_{dec}(y \mid \gamma_m)\, dy\ .$$

$$\mathcal{X}^1_{dec}(y_m) := \mathbf{E}_{\gamma_m}\left[X^1_{dec}(y_m \mid \gamma_m)\right],$$

and

$$\mathcal{X}^1_{dec}(y_m) = \int_{y_m}^{\bar{y}} \frac{T_{m0}(y)}{y - T_{m0}(y)}\, \mathbf{E}_{\gamma_m}\left[\pi_{20}(y \mid \gamma_m)\, m^y_{dec}(y \mid \gamma_m)\right] dy\ .$$

Step 3. Collecting terms. We finally define

$$\begin{aligned}
\mathcal{X}_{dec}(y_m) \quad &:= \quad X^1_{dec}(y_m) + X^2_{dec}(y_m) \\
&= \quad \int_{y_m}^{\bar{y}} \tfrac{T_{m0}(y)}{y - T_{m0}(y)}\, \mathbf{E}_{\gamma_m}\left[\Big(\pi_{20}(y \mid \gamma_m) + \pi_{21}(y \mid \gamma_m)\Big)\, m^y_{dec}(y \mid \gamma_m)\right] dy \\
&:= \quad \int_{y_m}^{\bar{y}} \tfrac{T_{m0}(y)}{y - T_{m0}(y)}\, \mathbf{E}_{\gamma_m}\left[\pi_2(y \mid \gamma_m)\, m^y_{dec}(y \mid \gamma_m)\right] dy,
\end{aligned}$$

where $\pi_{dec}(y \mid \gamma_m) = \pi_{20}(y \mid \gamma_m) + \pi_{21}(y \mid \gamma_m)$. Again, this can be rewritten as

$$\mathcal{X}_{dec}(y_m) \quad = \quad \int_{y_m}^{\bar{y}} \tfrac{T_{m0}(y)}{y - T_{m0}(y)} \, \bar{\pi}_{dec}(y) \, m^y_{dec}(y) \, dy \; .$$

cdf of the income distribution among single earner couples. Analogously, we define $M_s^-(y) = \lambda_s^0 F_s^y(y)$ and $m_s(y) = \lambda_s^0 \, f_s^y(y)$. The terms $M_b^+(y)$ and $m_b(y)$ for dual earner couples are analogously defined.

C From theory to empirics

C.1 Data

The Current Population Survey (CPS) is conducted by the US Census Bureau and the Bureau of Labor Statistics and contains nationally representative cross-sectional survey data from 1962 onward. We use data from the Annual Social and Economic Supplement of the Current Population Survey (CPS-ASEC).[29] The sample size of CPS-ASEC increased from around 30,000 households in 1962 to more than 90,000 in the most recent wave. In contrast to tax return micro data such as the public use files (IRS-SOI PUF) from the Statistics of Income (SOI) division of the Internal Revenue Service (IRS), as, e.g., used by Bargain et al. (2015) or Bierbrauer et al. (2021), the CPS data contain exact information about the incomes of primary and secondary earners of the tax unit.[30]

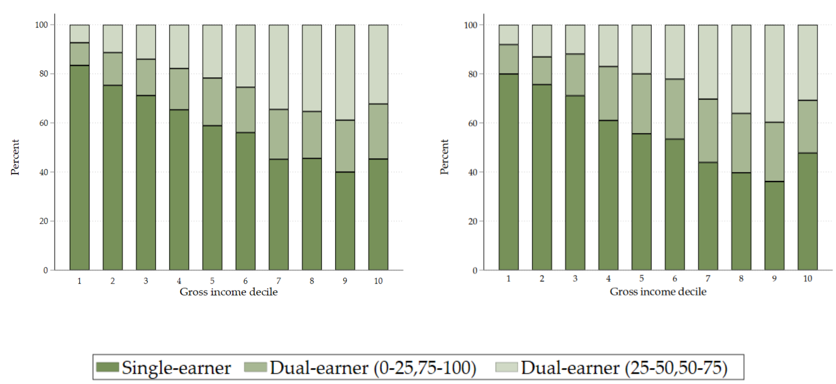
[29] See Flood et al. (2021) and `https://cps.ipums.org` for a detailed description of CPS data.

[30] In the IRS-SOI PUF, the relevant information on salaries and wages from the W2-form of the primary and secondary earner is only available for the year 1974 and imputed for all other years using an undocumented procedure. For 1974, in which reliable information is available, the distribution of different couple types across per capita income distribution is very similar to the CPS data (see Figure C.4). Moreover, Bargain et al. (2015) compare inequality measures as well as the direct policy effect, ΔT, based on CPS and SOI-PUF data and show that results are very similar (except for the very top of the distribution).

To adapt the CPS to the input requirements of the microsimulation model, we transform the CPS from a household-level data set to a tax unit level data set. For this purpose, we form tax units by joining all married spouses with their dependent children. Single individuals and unmarried spouses form separate tax units. Children of single individuals are in most cases allocated to the household head. Adult individuals with a total income below the year-specific personal exemption threshold are assumed to reflect dependents of the household head. Table C.1 illustrates in detail the correspondence between variables utilized in NBER TAXSIM and variables in the CPS data.

Figure C.4: Comparison of CPS and SOI data (1974), couple types

(a) CPS (b) SOI



Notes: This figure displays for the tax year of 1974 the distribution of married couple types across deciles of the per capita income distribution. The figure compares the distribution based on the CPS data (Figure C.4a) to the distribution based on the IRS-SOI PUF tax return micro data (Figure C.4b). All estimates are based on tax units with strictly positive gross income in which both spouses are between 25 and 55 years old.
Source: Authors' calculations based on CPS-ASEC and SOI PUF.

Treatment of top incomes In the CPS data, information on top incomes is limited by (i) public topcoding, and (ii) internal censoring. We address both limitations by harmonizing the treatment of top incomes across the different survey years and by following Piketty and Saez (2003) and Piketty (2003) in assuming that top incomes are well represented by a Pareto distribution.

In a first step, we address the challenge that public topcoding methods vary over time. In most recent years (since 2011), the Census Bureau uses a rank proximity swapping procedure to preserve the privacy for top income earners while maintaining the internal distribution of top incomes. In this procedure, values at or above a specific swap threshold are switched against other top income values within a bounded interval. For previous years, however, the CPS data originally contains top income values that are based on different procedures, in particular traditional topcoding (1962-1995), and a replacement value system procedure (1996-2010). To be able to consistently analyze the effect of tax reforms over the full time horizon, we apply the most recent method of rank proximity swapping also to previous years using supplementary files provided by IPUMS.[31] Thereby, we preserve the internally used distribution of top incomes whenever possible.

In a second step, we address the challenge that top incomes are also internally censored based on the value range limits of the income variables. As shown by Larrimore, Burkhauser, Feng and Zayatz (2008), since these censoring thresholds have changed discretely at specific points in time, the share of individuals affected by censoring varies and can reach up to one percent in specific years. To address the unequal representation of censored incomes, we replace censored incomes by random draws from a Pareto distribution. In particular, we first identify for every year and every income type the highest possible income T assigned in a given year. Based on this censoring thresh-

[31]For details on the treatment of top incomes in general and the data used for rank proximity swapping, see `https://cps.ipums.org/cps/topcodes_tables.shtml` and `https://cps.ipums.org/cps/income_cell_means.shtml`.

old, we generate for every year and every income type the parameter α of a Pareto distribution with density $f(Y) = \alpha * T^{\alpha} * Y^{-\alpha-1}$. We thereby assume that incomes above the 99th percentile follow a Pareto distribution and thus estimate the shape parameter α as

$$\alpha = \frac{ln\left(\frac{N_{Y \geq p99}}{N_{Y=T}}\right)}{ln\left(\frac{Y_T}{Y_{p99}}\right)}$$

where $N_{Y \geq p99}$ is the number of individuals with an income above the 99th percentile of the income distribution, $N_{Y=T}$ is the number of individuals at the highest income, and Y_T and Y_{p99} are the top income and the income at the 99th percentile respectively.[32] Finally, we use the distribution to replace the top incomes T by random draws from this calibrated distribution.[33]

Sample restrictions We are mainly interested in the differences between married couples and single individuals. We thereby assume that married couples always file jointly. While married couples can also file separately, this filing status is usually not beneficial (see Figure C.6) and is chosen by less than two percent of all tax units (see Figure C.5).[34] Similarly, we abstract from the qualifying widow(er) filing status that gives widowed individuals a preferential tax treatment in the two years following the spouses' death. Given

[32]Discussions of different estimation methods for the shape parameter of the Pareto distribution can be found in Armour, Burkhauser and Larrimore (2016) and Blanchet, Garbinti, Goupille-Lebret and Martínez-Toledano (2018).

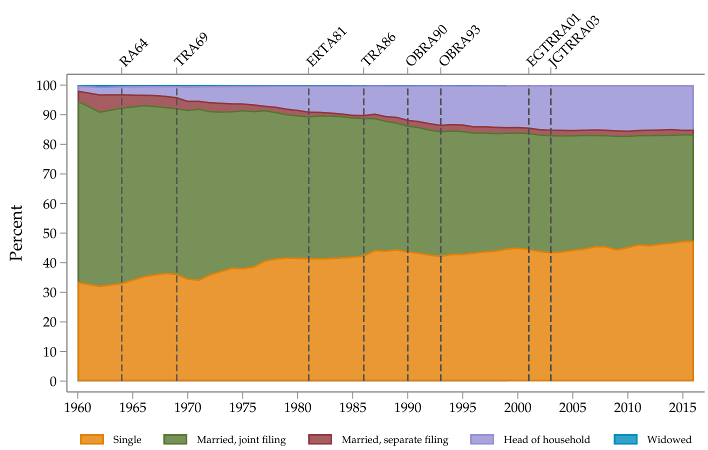
[33]To reduce the impact of random sampling on our results, we use quantiles of the distribution. The number of quantiles utilized depends on the number of individuals at the top income. For instance, if we observe 25 individuals at the top income, we assign these individuals income levels that correspond to the 25 quantiles of the randomly drawn values from the calibrated Pareto distribution. Thereby, we preserve the information of the distribution while limiting the influence of random draws.

[34]Filing separately can be beneficial in very particular circumstances that we do not observe, i.e., in the case of substantial itemizable deductions (e.g. high medical expenses or student loan repayments).

our sample restriction, the occurrence of widow(er)s is negligible (see also Figure C.5). If not indicated otherwise, we restrict the sample to tax units in which primary and secondary taxpayer are between 25 and 55 years old and have non-negative gross income. This sample restriction is guided by (i) our model that considers neither education nor retirement decisions, and (ii) the assumptions on labor supply responses to taxation that are not valid for young and old people with weak labor force attachment. In Section E we replicate all main results for an alternative sample restriction focusing on the full adult population.

Throughout the analysis, we calculate tax payments as well as average and marginal tax rates based on the federal income tax and abstract from state income tax and social security payroll taxes. Our pre-tax gross income variable of interest contains wage income, farm income, business income, income from dividends, income from interest, income from rent, and retirement income.

Figure C.5: Filing status according to SOI data



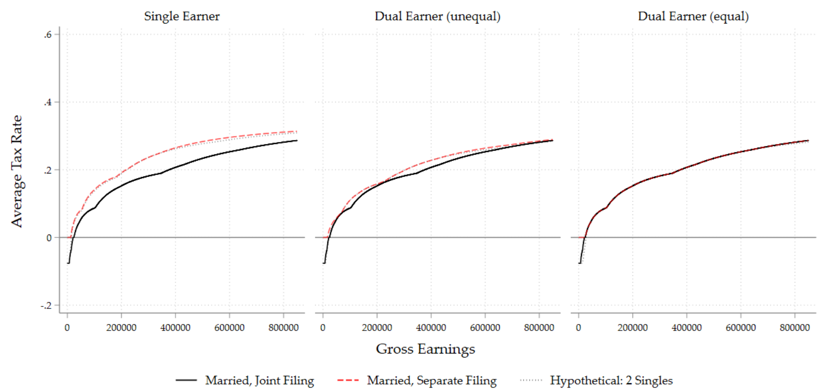
Notes: This figure shows the distribution of filing status from 1960 to 2016. Filing statuses are based on the IRS-SOI PUF administrative tax return micro data.
Source: Authors' calculations based on SOI PUF.

Table C.1: TAXSIM variables and CPS application

TAXSIM Variable	Explanation	CPS Application
taxsimid	Case ID	N/A
year	Tax year	ASEC income reference year
state	State	State of residence
mstat	Marital Status	Marital status (married vs. unmarried)
page	Age of primary taxpayer	Age of husband
sage	Age of spouse	Age of spouse
depx	Number of dependents	Number of children below and of age 18 + additional dependents
dep13	Number of children under 13	Number of children under 13
dep17	Number of children under 17	Number of children under 17
dep18	Number of qualifying children for EITC.	Number of children below and of age 18
pwages	Wage and salary income of Primary Taxpayer	Wage income + business income + farm income of husband
swages	Wage and salary income of Spouse	Wage income + business income + farm income of spouse
dividends	Dividend income	Income from dividends
intrec	Interest Received	Income from interest
stcg	Short Term Capital Gains or losses	N/A
ltcg	Long Term Capital Gains or losses.	Capital gains - capital losses
otherprop	Other property income	Income from rent
nonprop	Other non-property income	Income from other Source not specified + income from alimony
pensions	Taxable Pensions and IRA distributions	Retirement income
gssi	Gross Social Security Benefits	Social Security income
ui	Unemployment compensation received	Income from unemployment benefits
transfers	Other non-taxable transfer Income	Welfare (public assistance) income + income from worker's compensation + income from veteran benefits + income from survivor benefits + income from disability benefits + income from child support + income from educational assistance + income from SSI + income from assistance
rentpaid	Rent Paid	N/A
proptax	Real Estate taxes paid	Annual property taxes
otheritem	Other Itemized deductions	Indirect calculation via difference between adjusted gross income and taxable income calculated by the Census Bureau's taxy model.
childcare	Child care expenses	N/A
mortgage	Deductions not included in otheritem	N/A

Notes: This table displays the variables utilized as part of the tax calculation via the NBER TAXSIM (v32) microsimulation model and the corresponding information from the CPS used for the respective variables. For details on TAXSIM (v32) see Feenberg and Coutts (1993) and `https://users.nber.org/~taxsim/`.
Source: NBER TAXSIM and CPS-ASEC.

Figure C.6: Married couples filing jointly and separately (2019)



Notes: This figure shows how the average tax rate of a couple with specific gross earnings differs between whether this couple files separately or jointly. In addition, the figure also shows the average tax rate of two singles with the same joint income. The figure differentiates further by the type of couple: single earner couples (95% / 5%), unequal dual earner couples (75% / 25%) and dual earner couples with equal incomes (50% / 50%).
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

C.2 Calibration of revenue functions

To analyze whether reforms realized Pareto improvements, we estimate $\mathcal{R}_m(y_m)$ under intensive (and extensive) margin responses according to Proposition B.3 (and Proposition B.4).

Intensive margin. Remember that for couples, revenue functions considering only intensive margin responses are characterized by

$$\frac{1}{\nu_m}\mathcal{R}_m(y_m) = -\frac{T'_{m0}(y_m)}{1-T'_{m0}(y_m)}\; y_m\; f^y_m(y_m)\; \bar{\mathcal{E}}_m(y_m) + \; 1 - F^y_m(y_m)\;, \quad \text{(C.24)}$$

where F^y_m is the *cdf* and f^y_m the density of the earnings distribution of married couples and

$$\bar{\mathcal{E}}_m(y_m) \quad = \quad \mathbf{E}_{(\theta_m,\gamma_m)}\left[e(\theta_m,\gamma_m) \mid y^0_m(\theta_m,\gamma_m) = y_m\right]$$

is a measure of the behavioral responses to a one-bracket tax reform affecting couples with a joint income close to y_m.

The main ingredients of these equations are (i) estimates of the gross income distribution, (ii) an approximation of marginal and participation tax rates, and (iii) assumptions about behavioral responses at the intensive margin.

We estimate gross income distributions for couples and singles from the CPS data using an adaptive kernel density estimator with a Gaussian kernel on an equally spaced grid between the first percentile and a value equal to the 99.9th percentile of the gross income distribution. Subsequently, we adjust the estimated distribution to the share of tax units without any income. Figures C.7 and C.8 show the resulting cumulative distribution functions (CDF) and probability density functions (PDF).

We estimate effective marginal tax rates based on the TAXSIM microsimulation model for every tax unit in the data. To approximate effective marginal tax rates at a given income level, we estimate a kernel-weighted local polynomial using the same grid and bandwidth as for the estimation of the income distributions. Figure C.9 shows the estimated marginal tax rates.

Based on the assumptions about behavioral responses at the intensive margin illustrated in Table 1, we assign every single tax unit the respective intensive margin elasticity and every couple a weighted average based on the income shares of the primary and secondary earner. In line with the estimation of average effective marginal tax rates, we approximate the intensive margin elasticity at a given income level using a kernel weighted local polynomial. Note that even though elasticities are constant for primary and secondary earners, the average elasticity for couples can vary across the income distribution and across years due to the change in the earnings share of primary and secondary earners. Figure C.10 shows for the baseline assumptions about the elasticity of taxable income, how the average elasticities assigned to couples varies across the income distribution.

Intensive and extensive margin. Remember that for couples, revenue functions considering extensive and intensive margin responses are characterized by

$$\frac{1}{\nu_m}\mathcal{R}_m(y) \;=\; \mathcal{X}_{sec}(y_m) + \mathcal{I}_{sec}(y) + \mathcal{X}_{dec}(y_m) + \mathcal{I}_{dec}(y) \;,$$

where

$$\mathcal{I}_{sec}(y) \;=\; \lambda^0_{sec}\left(-\frac{T'_{m0}(y)}{1-T'_{m0}(y)}\; y\; f^y_{sec}(y)\; \bar{\mathcal{E}}_{sec}(y) + 1 - F^y_{sec}(y)\right) \;,$$

$$\mathcal{X}_{sec}(y) \;=\; -\lambda^0_{sec}\int_y^{\bar{y}} \frac{T_{m0}(y')}{y'-T_{m0}(y')}\; \bar{\pi}_{sec}(y')\; f^y_{sec}(y')\; dy' \;,$$

$$\mathcal{I}_{dec}(y) \;=\; \lambda^0_{dec}\left(-\frac{T'_{m0}(y)}{1-T'_{m0}(y)}\; y\; f^y_{dec}(y)\; \bar{\mathcal{E}}_{dec}(y) + 1 - F^y_{dec}(y)\right) \;,$$

and

$$\mathcal{X}_{dec}(y) \;=\; -\lambda^0_{dec}\int_y^{\bar{y}} \frac{T_{m0}(y')}{y'-T_{m0}(y')}\; \bar{\pi}_{dec}(y')\; f^y_{dec}(y')\; dy \;.$$

The additional ingredients with respect to the ones used above are (i) the share of dual and single earner couples, (ii) separate income distributions for dual and single earner couples - see Figures C.11 and C.12, (iii) estimates of the participation tax rate - see Figure C.13, (iv) assumptions about the participation elasticity. For the latter, we assume that participation tax do not vary across tax unit types, but vary across the income distribution, i.e. it decreases from 0.65 to 0.25 between a gross income of zero and the 90th percentile of the gross income distribution (see Figure C.14).

Application to primary and secondary earners. Based on Equation (B.10), and under the assumption of constant intensive margin elasticities for the primary and secondary earner, the revenue functions under intensive and extensive margin responses can be calculated as

$$\mathcal{R}_1^{int}(y_1) = -\ y_1\ f_1^y(y_1)\ e_1\ \mathbf{E}\left[\frac{T'_m(y_m^0)}{1 - T'_m(y_m^0)} \mid y_1^0 = y_1\right]\ +\ 1 - F_1^y(y_1),$$

where e_1 is the elasticity of the couple's joint income with respect to the marginal tax rate faced by the primary earner, for which we use the elasticities provided in table 1.

Beyond the elasticities for primary and secondary earners, the estimation of these revenue functions requires (i) separate income distributions for the primary and the secondary earner - see Figures C.15 and C.16, and (ii) an estimate of the couples' marginal tax rate at a given primary and secondary earnings level (see Figures C.17 and C.18).

For the consideration of extensive margin responses, we assume that the extensive margin reaction of dual earner couples does not differ of whether the tax treatment of primary or secondary earnings are modified, i.e. $\pi_{dec,1} = \pi_{dec_2} = \pi_{dec}$ revenue functions are

$$\mathcal{R}_1^{int+ext}(y_1) = -\ y_1\ f_1^y(y_1)\ e_1\ \mathbf{E}\left[\frac{T'_m(y_m^0)}{1 - T'_m(y_m^0)} \mid y_1^0 = y_1\right] + \mathcal{X}_{dec}(y_1) + \mathcal{X}_{sec}(y_1) + 1 - F_1^y(y_1)\ ,$$

$$\mathcal{X}_{dec}(y_1) = -\int_{y_1}^{\bar{y}} \mathbf{E}\left[\frac{T_{m0}(y_m^0)}{y_m^0 - T_{m0}(y_m^0)}\ \times \pi_{dec}(y_m^0) \mid y_1^0 = y_1'\right]\ m_{dec}^{y_1}(y_1')\ dy_1'\ ,$$

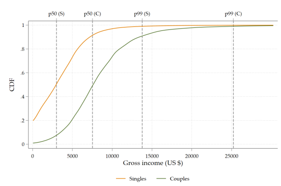
$$\mathcal{X}_{sec}(y_1) = -\int_{y_1}^{\bar{y}} \mathbf{E}\left[\frac{T_{m0}(y_m^0)}{y_m^0 - T_{m0}(y_m^0)}\ \times \pi_{sec}(y_m^0) \mid y_1^0 = y_1'\right]\ m_{sec}^{y_1}(y_1')\ dy_1'\ .$$

Again, we assume that participation responses are larger at the bottom of the income distribution, i.e. the participation elasticities decrease from

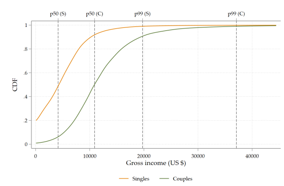
0.65 to 0.25 between a gross income of zero and the 90th percentile of the gross income distribution (see Figure C.14). Note that in contrast to intensive margin responses, we cannot put the participation elasticity in front of the expectation operator, because the participation elasticity is assumed to be income dependent. Therefore, we first compute the term inside the expectation operator at the tax unit level, and estimate the average of this term across varying levels of primary and secondary earnings.

Figure C.7: Cumulative distribution function

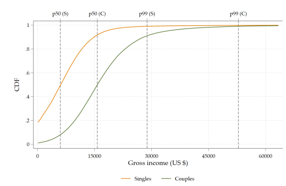
(a) 1965



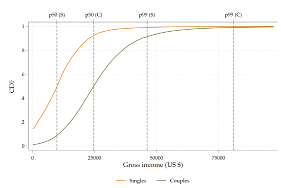
(b) 1970



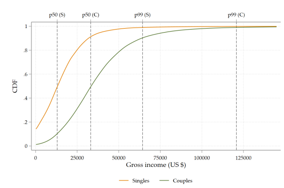
(c) 1975



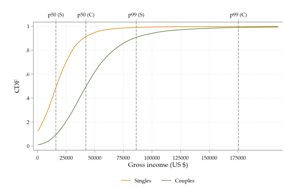
(d) 1980



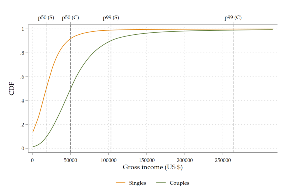
(e) 1985



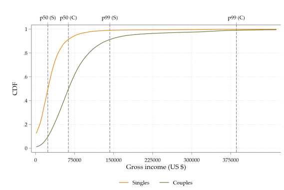
(f) 1990



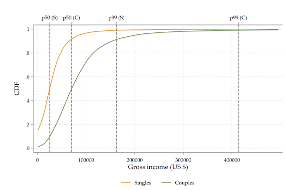
(g) 1995



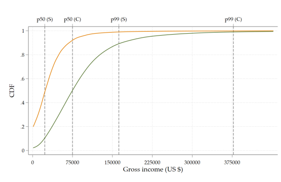
(h) 2000



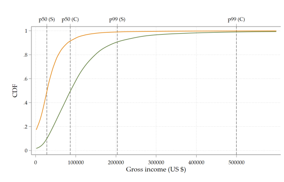
(i) 2005



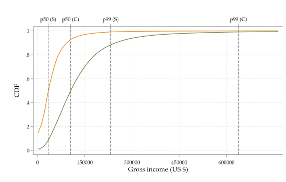
(j) 2010



(k) 2015



(l) 2019

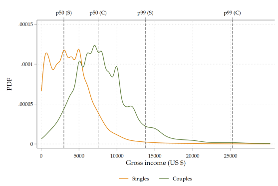


Notes: This figure displays estimates of the cumulative distribution function of gross income for singles (orange line) and couples (green line) in the respective year. Distributions are estimated using an adaptive kernel density estimator with a Gaussian kernel on an equally spaced grid between the first percentile and a value equal to the 99.9th percentile of the gross income distribution.

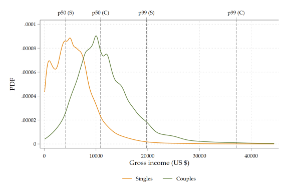
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure C.8: Probability density function

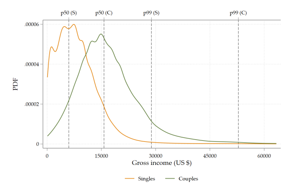
(a) 1965



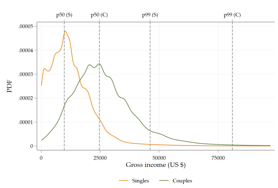
(b) 1970



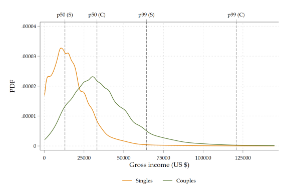
(c) 1975



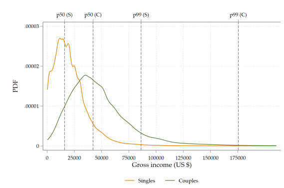
(d) 1980



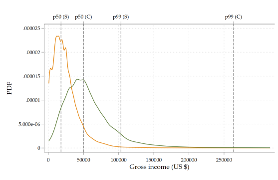
(e) 1985



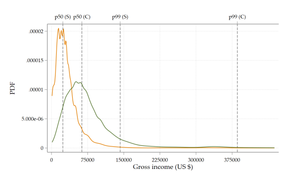
(f) 1990



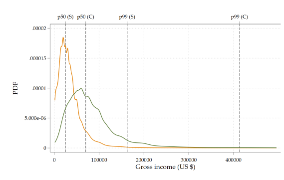
(g) 1995



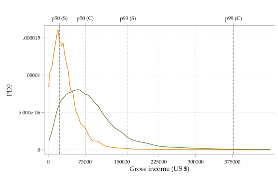
(h) 2000



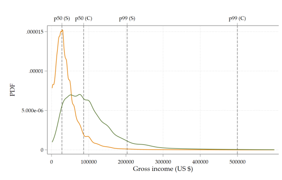
(i) 2005



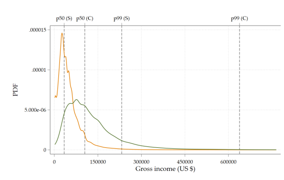
(j) 2010



(k) 2015



(l) 2019

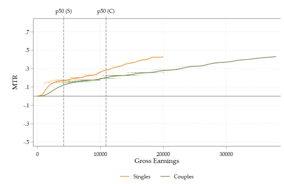


Notes: This figure displays estimates of the probability density function of gross income for singles (orange line) and couples (green line) in the respective year. Distributions are estimated using an adaptive kernel density estimator with a Gaussian kernel on an equally spaced grid between the first percentile and a value equal to the 99.9th percentile of the gross income distribution.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

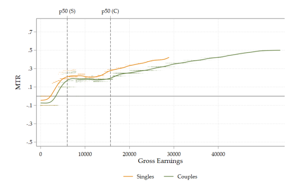
Figure C.9: Effective marginal tax rates

(a) 1965

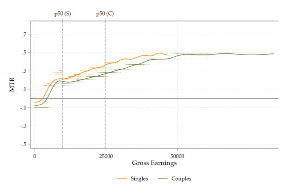
(b) 1970



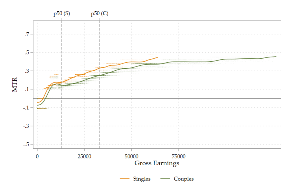
(c) 1975



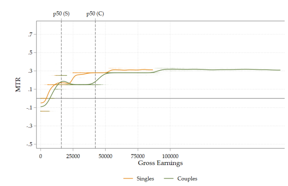
(d) 1980



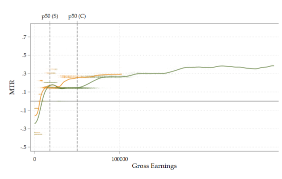
(e) 1985



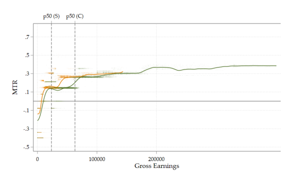
(f) 1990



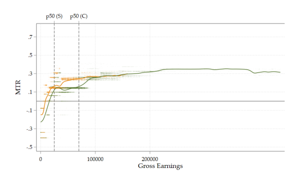
(g) 1995



(h) 2000

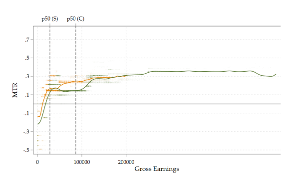


(i) 2005

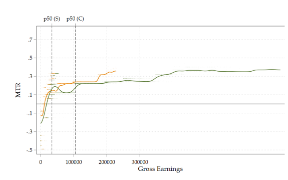


(j) 2010

(k) 2015



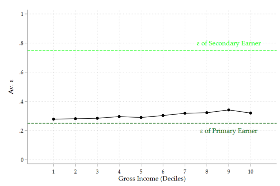
(l) 2019



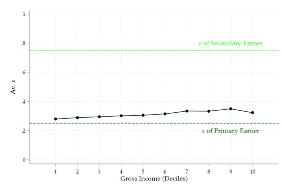
Notes: This figure displays average effective marginal tax rates for singles (orange lines) and couples (green lines) before the reform (solid lines) and after the reform (dashed lines). Average marginal tax rates at a given gross income level are estimated with a kernel-weighted local polynomial using the same grid and bandwidth as for the estimation of the income distributions (see Figure C.7 and C.8).
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure C.10: Average elasticities of couples

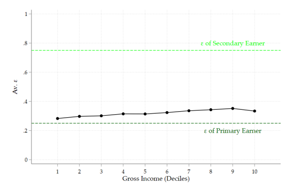
(a) 1965



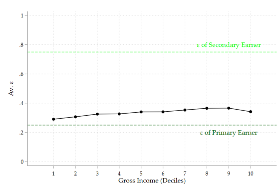
(b) 1970



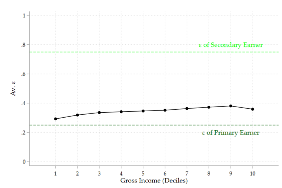
(c) 1975



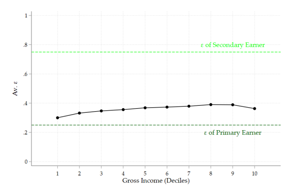
(d) 1980



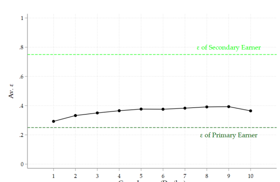
(e) 1985



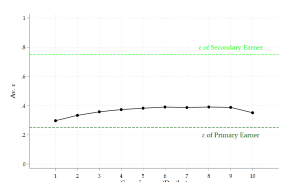
(f) 1990



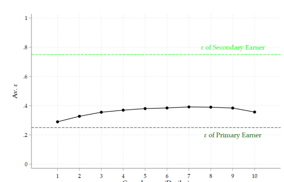
(g) 1995



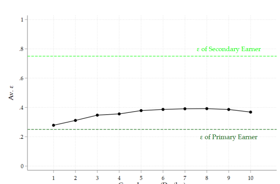
(h) 2000



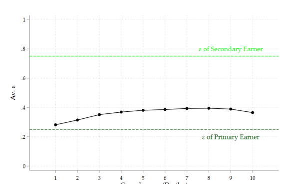
(i) 2005



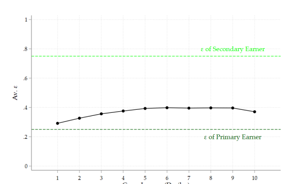
(j) 2010



(k) 2015



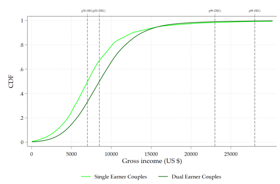
(l) 2019



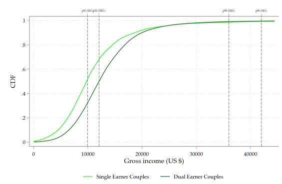
Notes: This figure displays the average intensive margin elasticity of taxable income for couples across gross income deciles in the respective year. Elasticities are calculated for every couple based on an income-share weighted elasticity of 0.25 for the primary earner and 0.75 for the secondary earner (see Table 1). Deciles are computed based on the gross income distribution of couples. Earnings shares are based on wage, business and farm income.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure C.11: CDF, single earner and dual earner couples

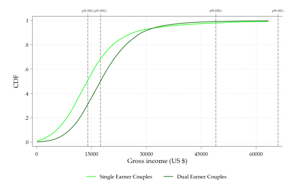
(a) 1965



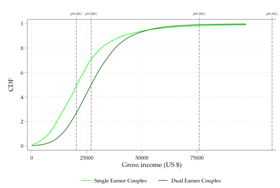
(b) 1970



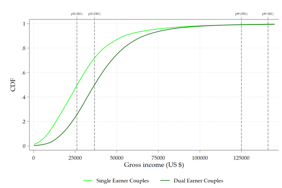
(c) 1975



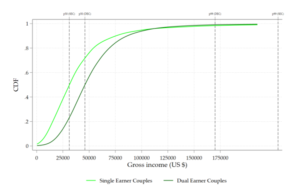
(d) 1980



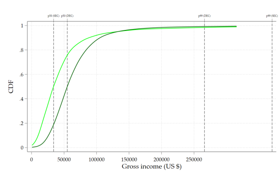
(e) 1985



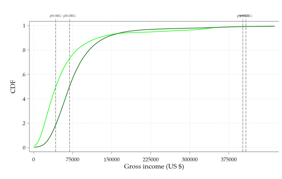
(f) 1990



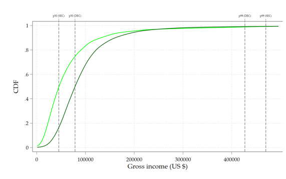
(g) 1995



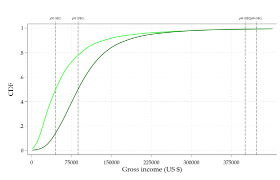
(h) 2000



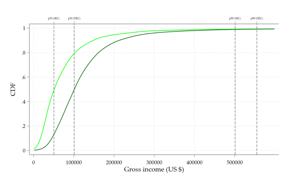
(i) 2005



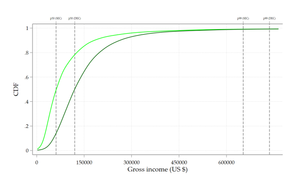
(j) 2010



(k) 2015

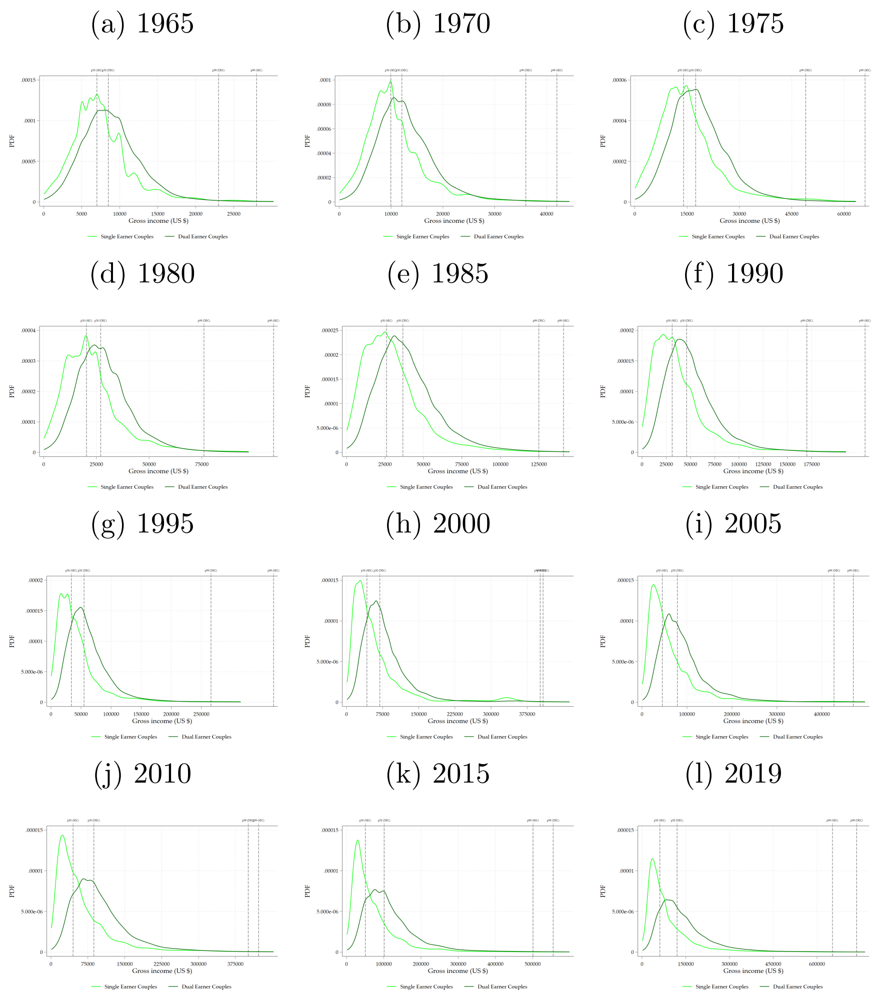


(l) 2019



Notes: This figure displays estimates of the cumulative distribution function of gross income for single earner (light green line) and dual earner couples (dark green line) in the respective year. Distributions are estimated using an adaptive kernel density estimator with a Gaussian kernel on an equally spaced grid between the first percentile and a value equal to the 99.9th percentile of the gross income distribution.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

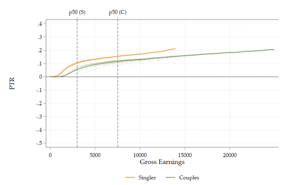
Figure C.12: PDF, single earner and dual earner couples



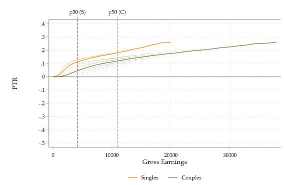
Notes: This figure displays estimates of the probability density function of gross income for single earner (light green line) and dual earner couples (dark green line) in the respective year. Distributions are estimated using an adaptive kernel density estimator with a Gaussian kernel on an equally spaced grid between the first percentile and a value equal to the 99.9th percentile of the gross income distribution.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure C.13: Participation tax rates

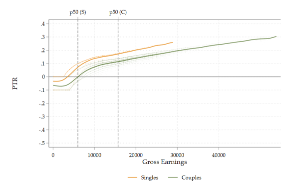
(a) 1965



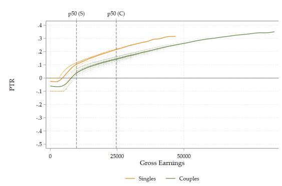
(b) 1970



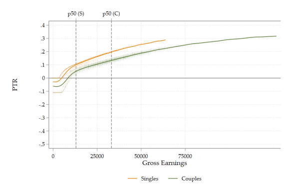
(c) 1975



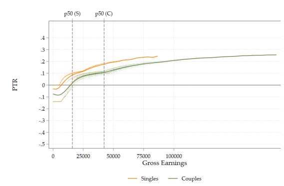
(d) 1980



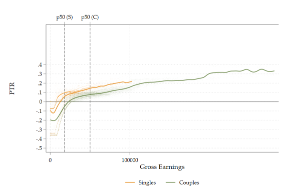
(e) 1985



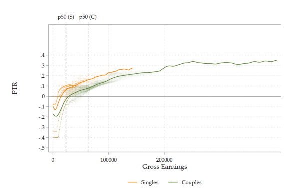
(f) 1990



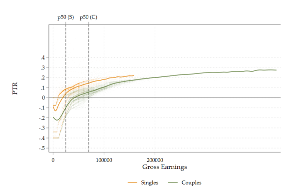
(g) 1995



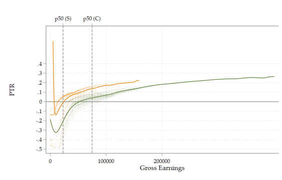
(h) 2000



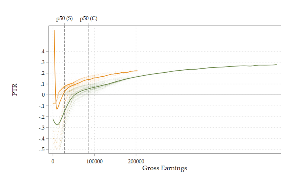
(i) 2005



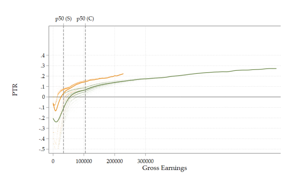
(j) 2010



(k) 2015



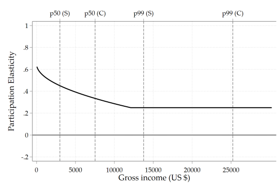
(l) 2019



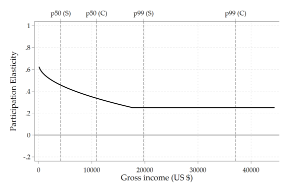
Notes: This figure displays participation tax rates for every single (light orange dots) and every couple (light green dots) in the respective year. Solid orange (green) lines represent estimates of the average marginal tax rate schedule for singles (couples). Average participation tax rates at a given gross income level are estimated with a kernel-weighted local polynomial using the same bandwidth as for the estimation of the income distributions (see Figure C.7 and C.8).
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure C.14: Participation elasticities

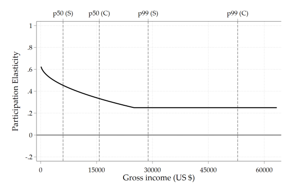
(a) 1965



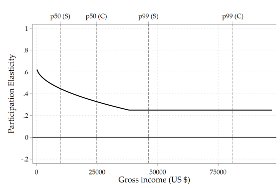
(b) 1970



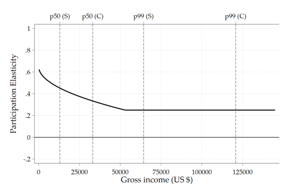
(c) 1975



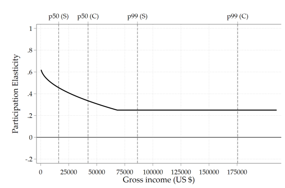
(d) 1980



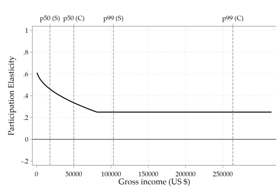
(e) 1985



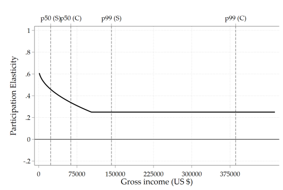
(f) 1990



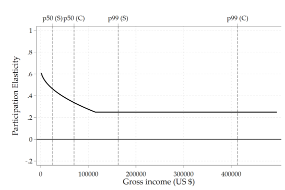
(g) 1995



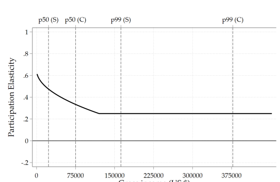
(h) 2000



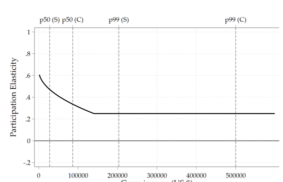
(i) 2005



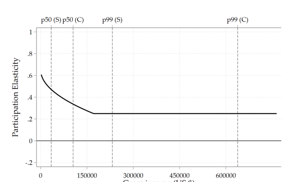
(j) 2010



(k) 2015

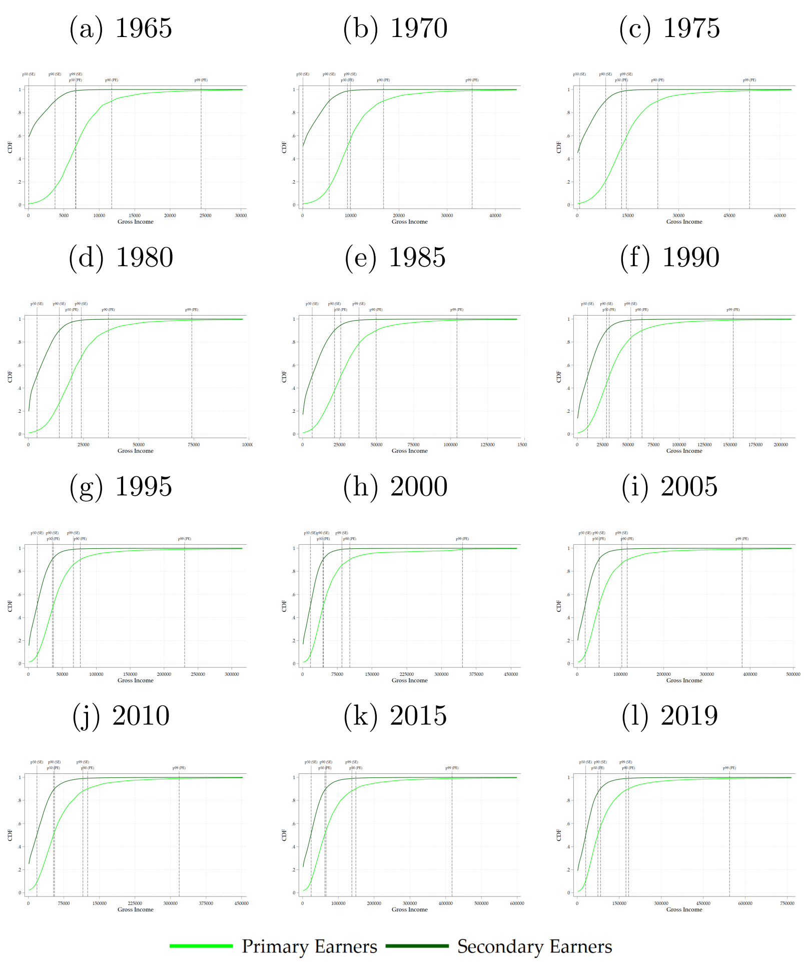


(l) 2019



Notes: This figure displays for every year the evolution of the participation elasticity over income. The participation elasticity is assumed to decrease from 0.65 to 0.25 between zero and the 90th percentile of the gross income distribution based on the formula $\pi = 0.65 - 0.4\left(\frac{y}{y_{P90}}\right)^{\frac{1}{2}}$.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

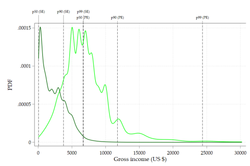
Figure C.15: Cumulative distribution function, primary and secondary earners



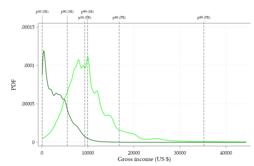
Notes: This figure shows for selected years the cumulative density function of primary and secondary earnings. Distributions are estimated using an adaptive kernel density estimator with a Gaussian kernel on an equally spaced grid between the first percentile and a value equal to the 99.9th percentile of the gross income distribution.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure C.16: Probability density function, primary and secondary earners

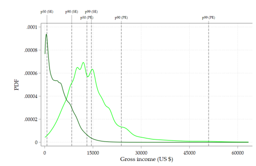
(a) 1965



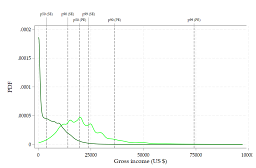
(b) 1970



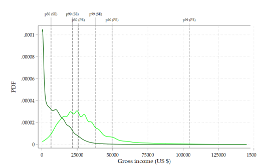
(c) 1975



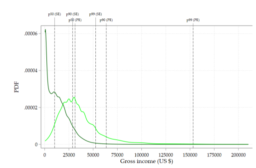
(d) 1980



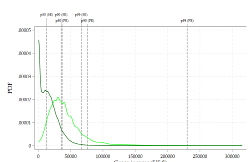
(e) 1985



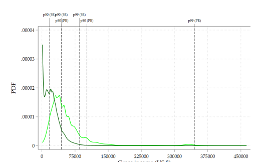
(f) 1990



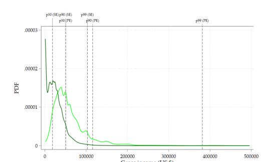
(g) 1995



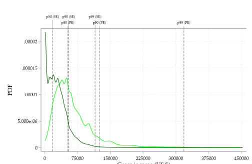
(h) 2000



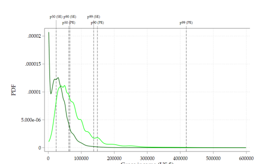
(i) 2005



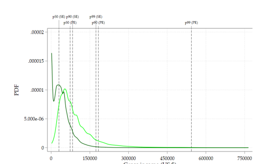
(j) 2010



(k) 2015



(l) 2019

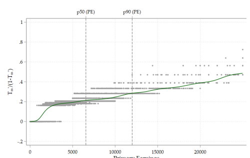


Primary Earners Secondary Earners

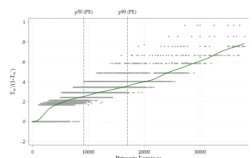
Notes: This figure shows for selected years the probability density function of primary and secondary earnings. Distributions are estimated using an adaptive kernel density estimator with a Gaussian kernel on an equally spaced grid between the first percentile and a value equal to the 99.9th percentile of the gross income distribution.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure C.17: Average marginal tax rates by primary earnings

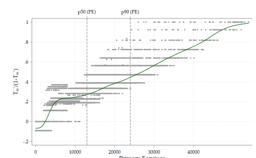
(a) 1965



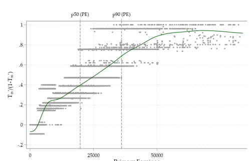
(b) 1970



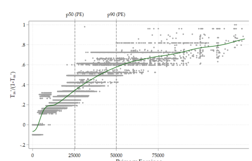
(c) 1975



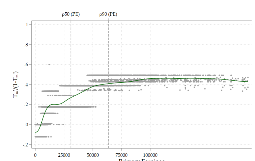
(d) 1980



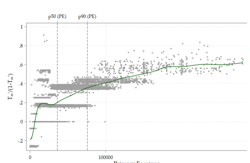
(e) 1985



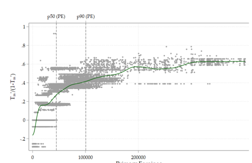
(f) 1990



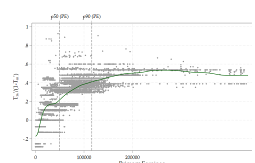
(g) 1995



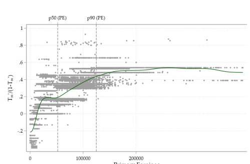
(h) 2000



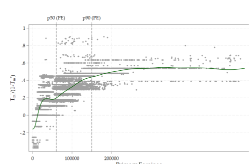
(i) 2005



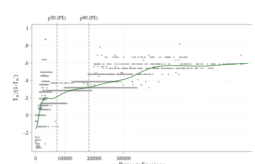
(j) 2010



(k) 2015



(l) 2019

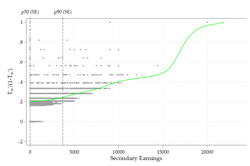


Notes: This figure shows for selected years the marginal tax rate ratio $\frac{T'}{1-T'}$ across primary earnings. The solid line represents an average calculated using a local polynomial regression.

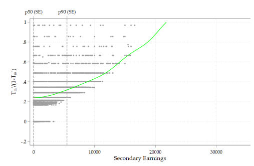
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure C.18: Average marginal tax rates by secondary earnings

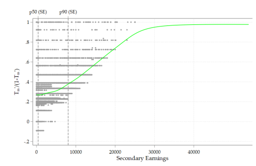
(a) 1965



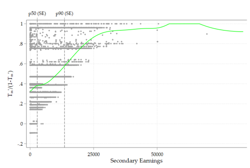
(b) 1970



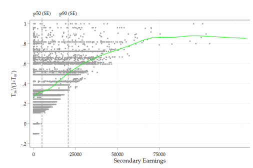
(c) 1975



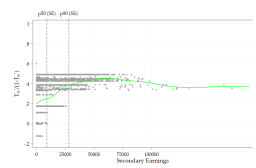
(d) 1980



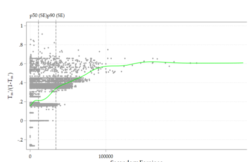
(e) 1985



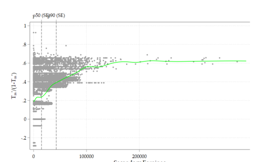
(f) 1990



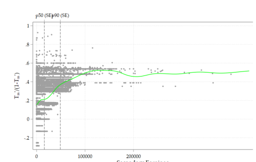
(g) 1995



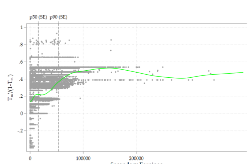
(h) 2000



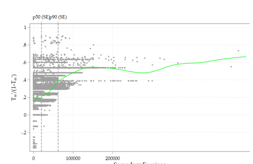
(i) 2005



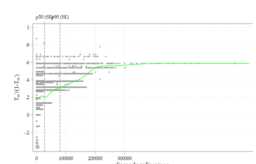
(j) 2010



(k) 2015



(l) 2019



Notes: This figure shows for selected years the marginal tax rate ratio $\frac{T'}{1-T'}$ across secondary earnings. The solid line represents an average calculated using a local polynomial regression.

Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

D Supplementary material: Reforms towards individual taxation

This part of the appendix contains supplementary material referenced in Section 4 and 5 of the main text. We provide empirical evidence for reforms *in* the system (Figure D.19), and reforms *towards individual taxation* (Figure D.20) for different years since 1965. Figure D.21 shows political support for revenue-neutral reforms towards individual taxation while Figure D.23 (D.22) contains the welfare analysis for welfare weights focused in the middle (bottom) of the income distribution. The exact specification of welfare weights is shown in Table D.2. Figure D.24 displays the median share of primary (male) earners in married couples. Figure D.25 shows results for a reform towards individual taxation that can reconcile Rawlsian and Feminist welfare.

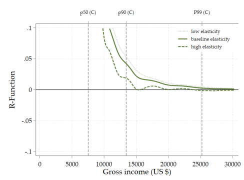
Table D.2: Welfare weights for reforms *of* the system

Welfare weights	
Equal (Feminist)	$\forall y_m,\ g_m(y_m) = 1$
Decreasing	$\forall y_m,\ g_m(y_m) = (y_1 + y_2)^{-a}$
Rawlsian	$\forall y_m,\ g_m(y_m) = \begin{cases} 1, & \text{for } y_m \leq \text{P} \\ 0, & \text{for } y_m \geq \text{P} \end{cases}$
Affirmative Action Secondary Earner	$\forall y_m,\ g_m(y_m) = \frac{y_2}{y_m}$
Affirmative Action Feminist	$\forall y_m,\ g_m(y_m) = \frac{y_{woman}}{y_{man}+y_{woman}}$
Rawlsian Affirmative Action Feminist	$\forall y_m,\ g_m(y_m) = \begin{cases} \frac{y_{woman}}{y_{man}+y_{woman}}, & \text{for } y_m \leq \text{P} \\ 0, & \text{for } y_m \geq \text{P} \end{cases}$

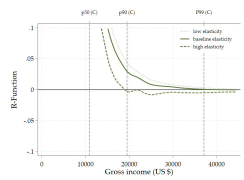
Notes: This table shows different specifications of welfare weights to evaluate reforms *of* the system. The sum of weights over the whole population of married couples is normalized to 1. P refers to specific percentiles of the couple income distribution and the parameter a is strictly positive. Note that our sample consists also of a small share of same-sex married couples (in 2019 around 0.8 percent of all married couples). While homosexual couples are included for the welfare analysis using Affirmative Action Secondary Earner welfare weights, they are not considered in the analysis using Affirmative Action Feminist welfare weights.

Figure D.19: Reforms *in* the system

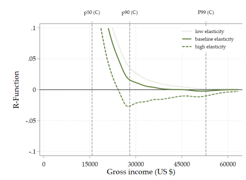
(a) 1965



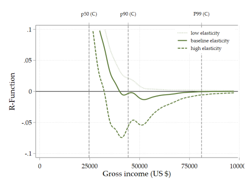
(b) 1970



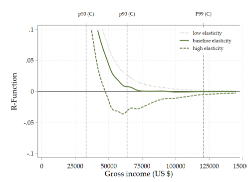
(c) 1975



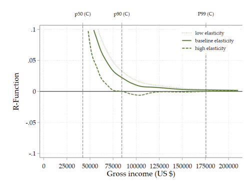
(d) 1980



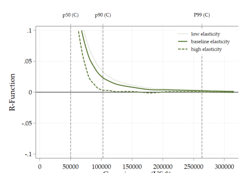
(e) 1985



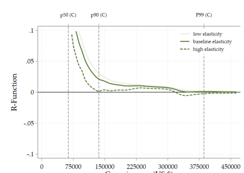
(f) 1990



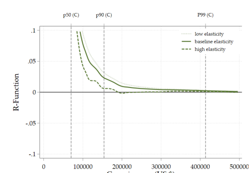
(g) 1995



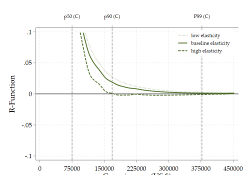
(h) 2000



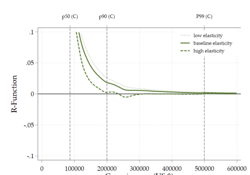
(i) 2005



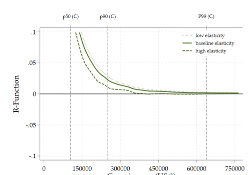
(j) 2010



(k) 2015



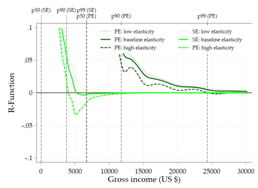
(l) 2019



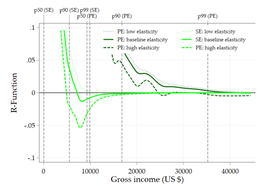
Notes: This figure replicates the left panels of Figure 2 for more years. It shows the revenue functions for married couples as a whole (reforms *in* the system). The revenue function accounts for intensive and extensive margin behavioral responses. Intensive margin responses are differentiated by baseline (solid line), low (dotted line), and high (dashed line) elasticity scenarios (see Table 1). All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure D.20: Reforms *of* the system

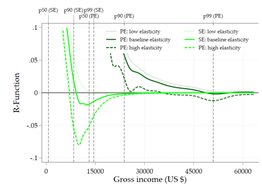
(a) 1965



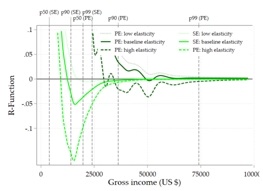
(b) 1970



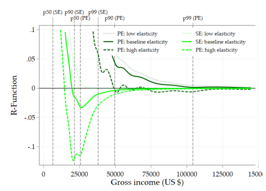
(c) 1975



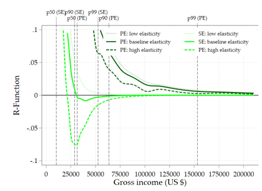
(d) 1980



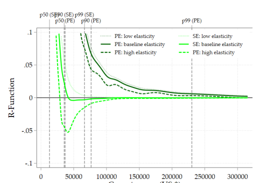
(e) 1985



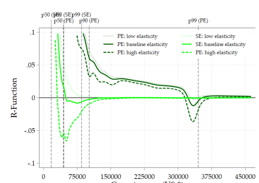
(f) 1990



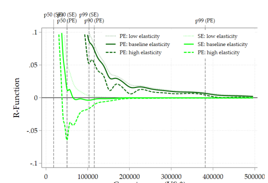
(g) 1995



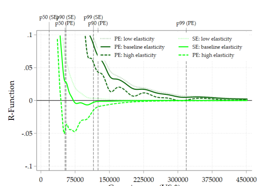
(h) 2000



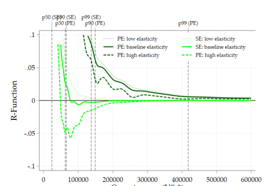
(i) 2005



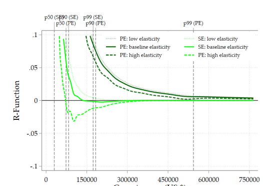
(j) 2010



(k) 2015



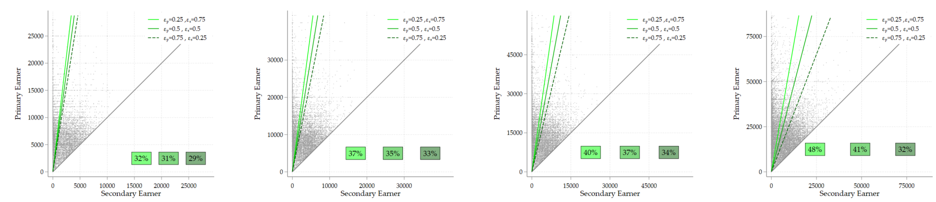
(l) 2019



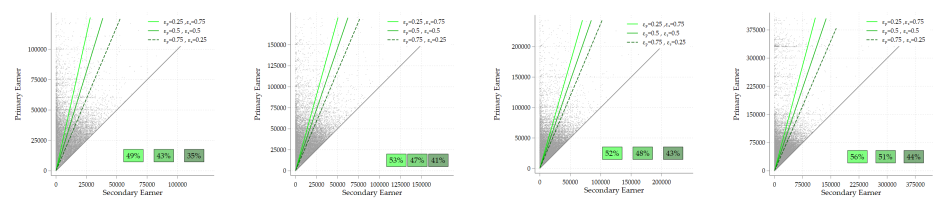
Notes: This figure replicates the right panels of Figure 2. It shows the revenue functions separately for primary and secondary earners (reforms *of* the system). The revenue function accounts for intensive and extensive margin behavioral responses. Intensive margin responses are differentiated by baseline (solid line), low (dotted line), and high (dashed line) elasticity scenarios (see Table 1). All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure D.21: Reform towards individual taxation, political economy

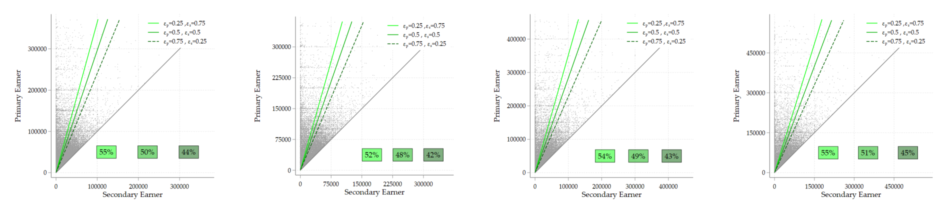
(a) 1965 (b) 1970 (c) 1975 (d) 1980



(e) 1985 (f) 1990 (g) 1995 (h) 2000



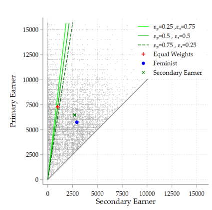
(i) 2005 (j) 2010 (k) 2015 (l) 2019



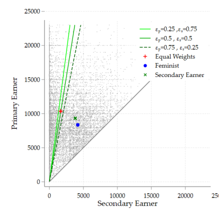
Notes: This figure replicates Figure 3 for more years. It shows how the political support for a revenue neutral reform towards individual taxation varies with behavioral responses to taxation. Each grey dot represents a couple in the data with specific income of the primary (secondary) earner displayed on the vertical (horizontal) axis. Couples that lie below (above) the green line are winners (losers) from a reform towards individual taxation. The light green solid line refers to the baseline elasticity scenario of Table 1 in which the primary (resp. secondary) earner has an elasticity of 0.25 (resp. 0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). All results are displayed including extensive margin responses. The figure also displays the respective share of couples than benefits from a reform towards individual taxation. All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure D.22: Reform towards individual taxation, welfare (middle)

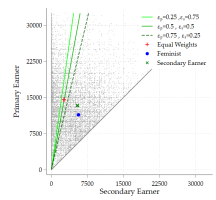
(a) 1965



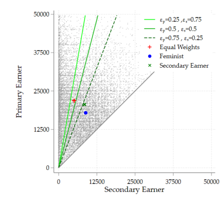
(b) 1970



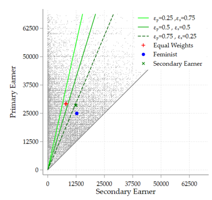
(c) 1975



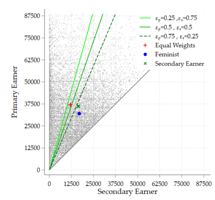
(d) 1980



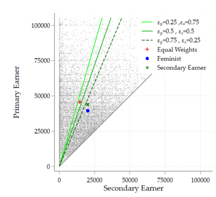
(e) 1985



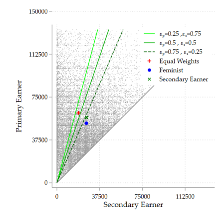
(f) 1990



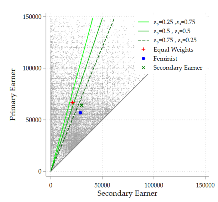
(g) 1995



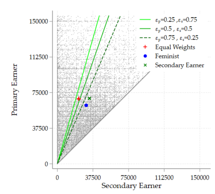
(h) 2000



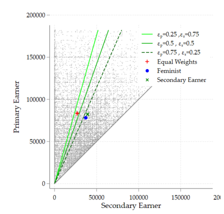
(i) 2005



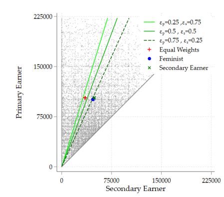
(j) 2010



(k) 2015



(l) 2019

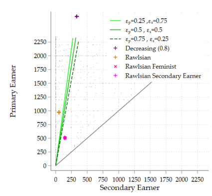


Notes: This figure replicates the left panel of Figure 5 for more years. It shows how a reform towards individual taxation is evaluated from a welfare perspective under different exogenous welfare weights. It displays welfare implications for welfare weights centered in the middle of the income distribution. Each gray dot represents a couple in the data with specific income of the primary (resp. secondary) earner displayed on the vertical (resp. horizontal) axis. Welfare evaluations with different welfare weights are plotted as a colored dot the location of which is defined via the average welfare-weighted primary earnings (vertical axis) and the average welfare-weighted secondary earnings (horizontal axis). Welfare evaluations below (above) the green line indicate that the reform is welfare increasing (decreasing). The light green solid line illustrates the result under the baseline elasticity scenario of Table 1 in which the primary (secondary) earner has an elasticity of 0.25 (0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). All results are displayed including extensive margin responses. For detailed information on welfare weight specification, see Table D.2. All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old.

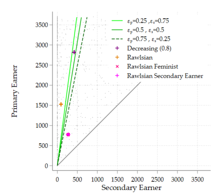
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure D.23: Reform towards individual taxation, welfare (bottom)

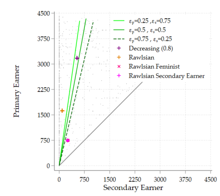
(a) 1965



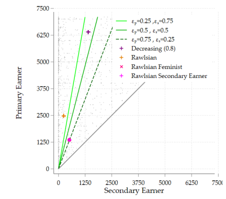
(b) 1970



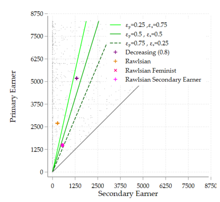
(c) 1975



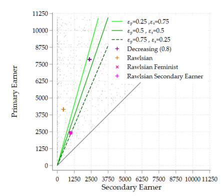
(d) 1980



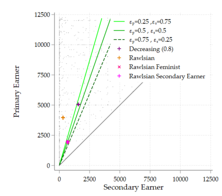
(e) 1985



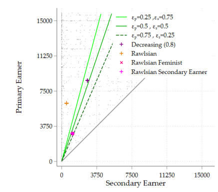
(f) 1990



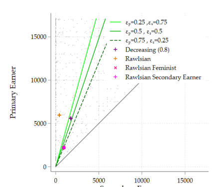
(g) 1995



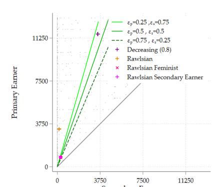
(h) 2000



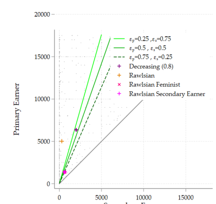
(i) 2005



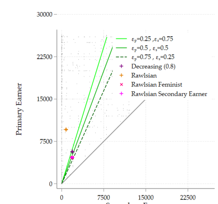
(j) 2010



(k) 2015

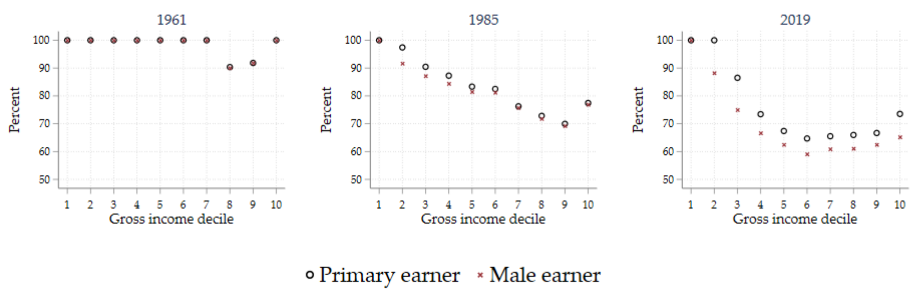


(l) 2019



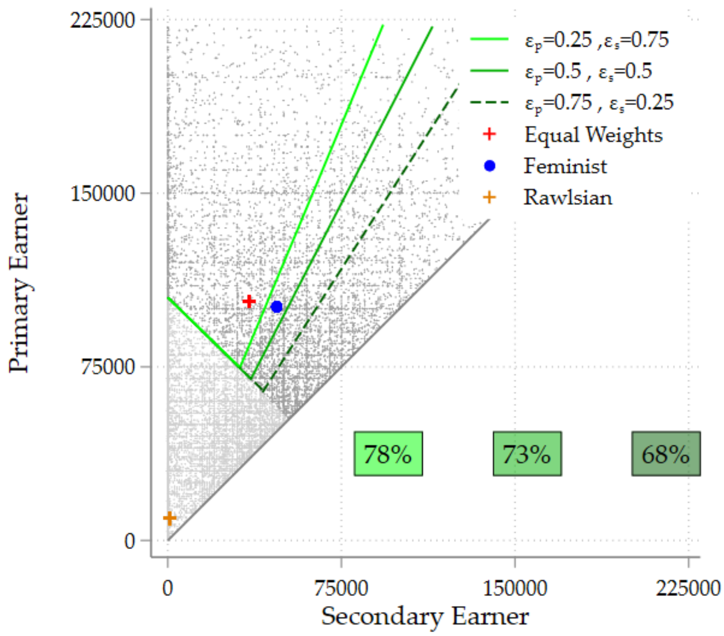
Notes: This figure replicates the right panel of Figure 5 for more years. It shows how a reform towards individual taxation is evaluated from a welfare perspective under different exogenous welfare weights. It displays welfare implications for welfare weights centered at the bottom of the income distribution. Each gray dot represents a couple in the data with specific income of the primary (resp. secondary) earner displayed on the vertical (resp. horizontal) axis. Welfare evaluations with different welfare weights are plotted as a colored dot the location of which is defined via the average welfare-weighted primary earnings (vertical axis) and the average welfare-weighted secondary earnings (horizontal axis). Welfare evaluations below (above) the green line indicate that the reform is welfare increasing (decreasing). The light green solid line illustrates the result under the baseline elasticity scenario of Table 1 in which the primary (secondary) earner has an elasticity of 0.25 (0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). All results are displayed including extensive margin responses. For detailed information on welfare weight specification, see Table D.2. The specific percentile used for Rawlsian weights is P5 and $a = 0.8$ for decreasing welfare weights. All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure D.24: Median share of primary and male earner



Notes: This figure shows the median income share of the primary earner in the couple by income decile. Earnings shares are computed on the basis of non-negative wage, business and farm income. All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old. Figure E.31 replicates this figure for the full adult population.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure D.25: Reconciling Rawlsian and Feminist welfare (2019)



Notes: This figure shows for the current tax system, how a partial reform towards individual taxation is evaluated from a welfare perspective under different exogenous welfare weights. A partial reform lowers marginal tax rates for all secondary earners, but raises marginal tax rates only for primary earners above the median of the couple income distribution. Each grey dot represents a couple in the data with specific income of the primary (resp. secondary) earner displayed on the vertical (resp. horizontal) axis. All results are displayed including extensive margin responses. The light green solid line illustrates the result under the baseline elasticity scenario of Table 1 in which the primary (resp. secondary) earner has an elasticity of 0.25 (resp. 0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). For detailed information on welfare weight specification, see Table D.2. The specific percentile used for Rawlsian weights is P5. All estimates are based on tax units with non-negative gross income in which both spouses are between 25 and 55 years old. Figure E.32 replicates this figure for the full adult population.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

E Supplementary material: Alternative sample restriction

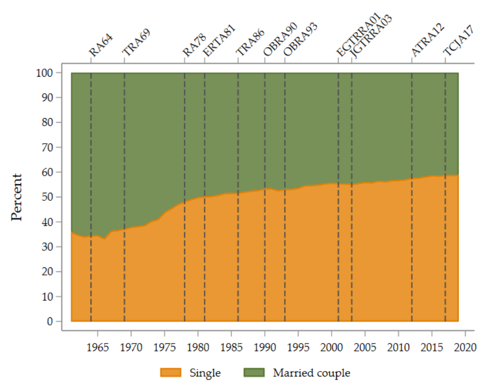
The analysis presented in Section 4 and 5 of the main text focuses on the working age population, i.e. we restrict the sample to tax units with non-negative gross income in which both spouses are between 25 and 55 years old. This sample restriction follows from our model that does not include retirement and education decisions. In addition, since labor force attachment is much lower among old and young groups, our assumptions on behavioral responses to taxation do not apply straightforwardly to these groups.

In this section, as a robustness check, we replicate the main figures for an alternative sample restriction in which we consider all adults in tax units with non-negative gross income.[35] The main takeaway from this analysis is that the qualitative properties of our results remain valid. In general, the full population contains more tax units with zero gross income, more singles, and more single-earner couples. The main quantitative differences are based on the latter fact. Given that single-earner couples tend to lose from a reform towards individual taxation, this reform has less support than in our main analysis (47 percent instead of 55 percent for our baseline scenario).

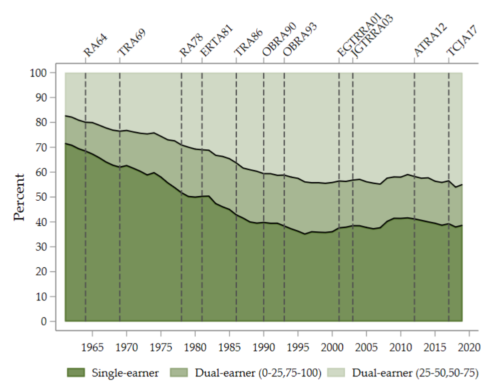
[35]Under this sample restriction, all singles and both spouses in a couple are at least 18 years old.

Figure E.26: Demographic change, alternative sample restriction

(a) Tax unit types



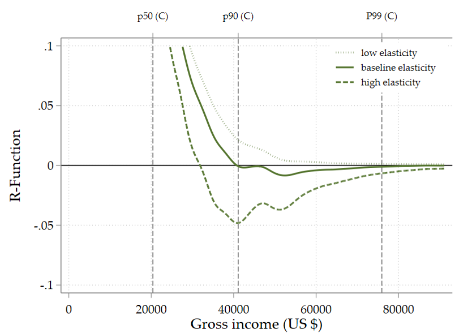
(b) Couple types



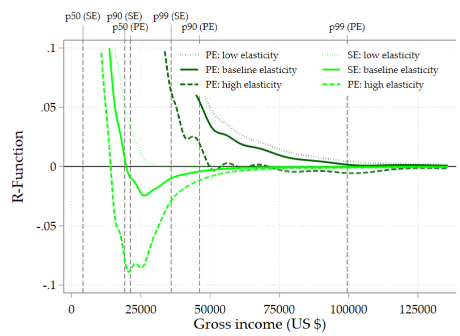
Notes: This figure replicates Figure 1 for the full adult population instead of the working age population. It shows the distribution of tax unit types over time. Figure E.26a displays the share of single tax units (orange area) and the share of couple tax units (green area). Figure E.26b displays the share of single-earner and dual-earner couples. A single-earner couple refers to a married couple, in which one spouse is not employed (dark green area). The figure further displays the share of dual-earner couples in which both spouses are employed and (i) one spouse earns between 0 and 25 percent (mid green area) and (ii) between 25 and 50 percent of total earnings (light green area). Earnings shares are computed on the basis of wage, business and farm income. Reforms of the federal income tax code are displayed as vertical lines. All estimates are based on tax units with strictly positive gross income in which both spouses are at least 18 years old.
Source: Authors' calculations based on CPS-ASEC.

Figure E.27: Reforms *in* the system versus reforms *of* the system, alternative sample restriction

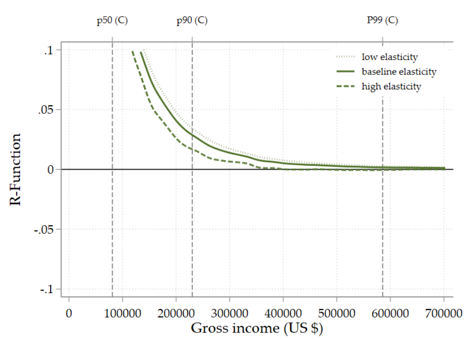
(a) Reforms *in* the system (1980)



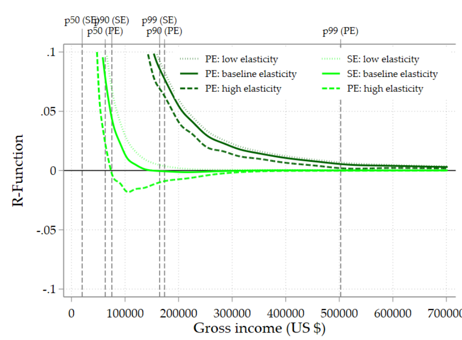
(b) Reforms *of* the system (1980)



(c) Reforms *in* the system (2019)

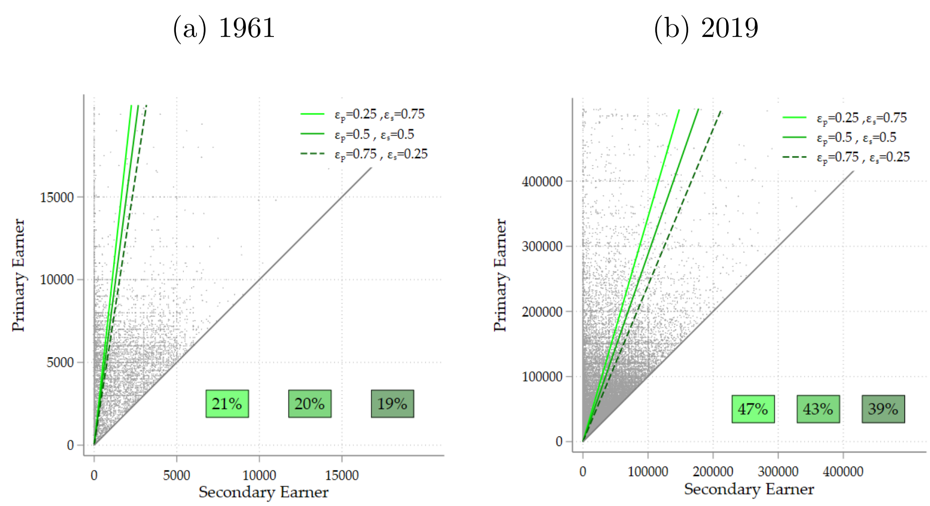


(d) Reforms *of* the system (2019)



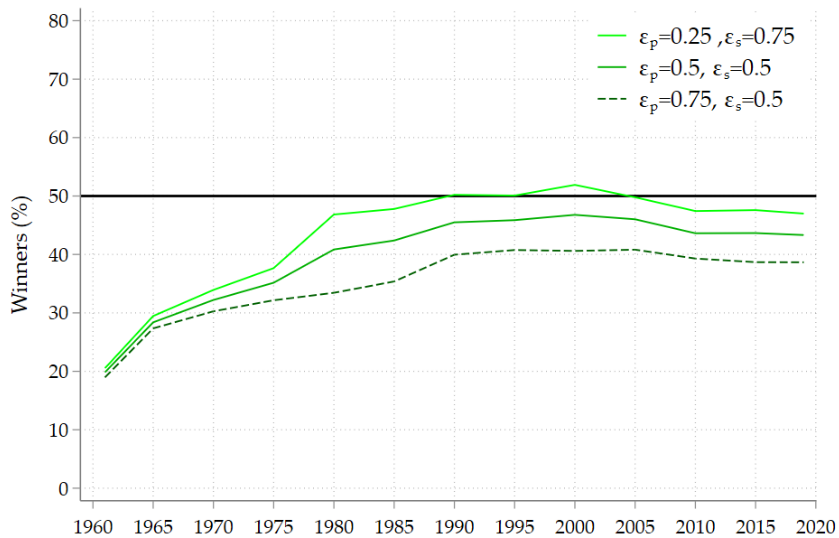
Notes: This figure replicates Figure 2 for the full adult population instead of the working age population. It shows for 1980 and 2019 the revenue functions for married couples as a whole (reforms *in* the system, left panel) and separately for primary and secondary earners (reforms *of* the system, right panel). The revenue function accounts for intensive and extensive margin behavioral responses. Intensive margin responses are differentiated by baseline (solid line), low (dotted line), and high (dashed line) elasticity scenarios (see Table 1). All estimates are based on tax units with non-negative gross income in which both spouses are at least 18 years old.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure E.28: Reform towards individual taxation: Political economy, alternative sample restriction



Notes: This figure replicates Figure 3 for the full adult population instead of the working age population. It shows for 1961 and 2019, how the political support for a revenue neutral reform towards individual taxation varies with behavioral responses to taxation. Each grey dot represents a couple in the data with specific income of the primary (secondary) earner displayed on the vertical (horizontal) axis. Couples that lie below (above) the green line are winners (losers) from a reform towards individual taxation. The light green solid line refers to the baseline elasticity scenario of Table 1 in which the primary (resp. secondary) earner has an elasticity of 0.25 (resp. 0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). All results are displayed including extensive margin responses. The figure also displays the respective share of couples than benefits from a reform towards individual taxation. All estimates are based on tax units with non-negative gross income in which both spouses are at least 18 years old.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

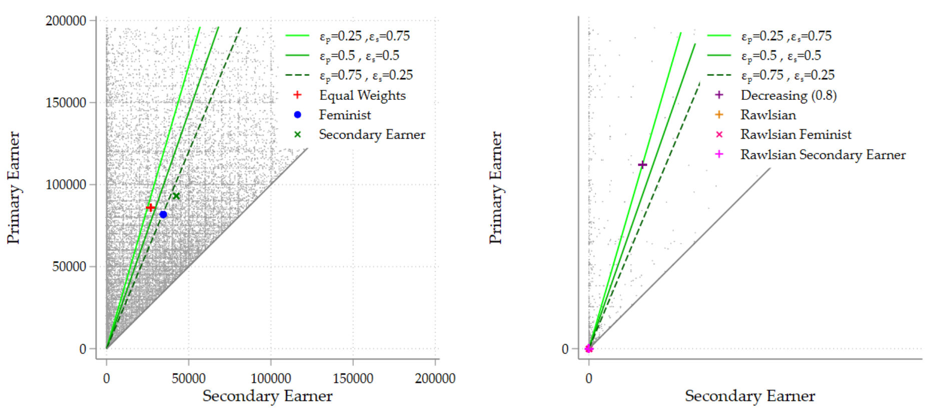
Figure E.29: Reform towards individual taxation: Share of winners over time, alternative sample restriction



Notes: This figure replicates Figure 4 for the full adult population instead of the working age population. It shows how the political support for a revenue neutral reform towards individual taxation evolved over time. All results are displayed including extensive margin responses. The light green solid line illustrates the result under the baseline elasticity scenario of Table 1 in which the primary (resp. secondary) earner has an elasticity of 0.25 (resp. 0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). All estimates are based on tax units with non-negative gross income in which both spouses are at least 18 years old.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

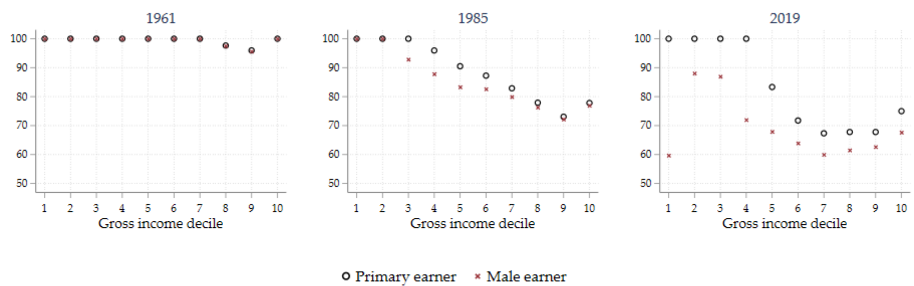
Figure E.30: Reform towards individual taxation: Welfare (2019), alternative sample restriction

(a) Welfare I (b) Welfare II



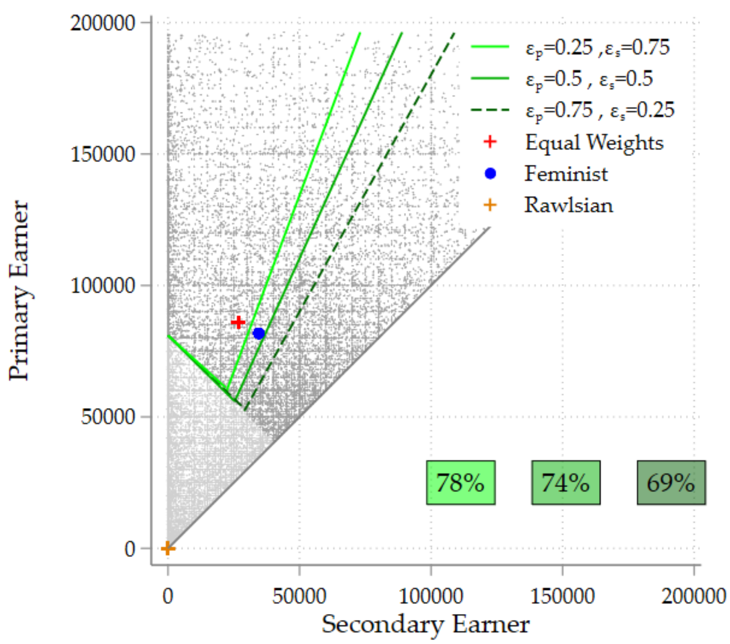
Notes: This figure replicates Figure 5 for the full adult population instead of the working age population. It shows for the current tax system, how a reform towards individual taxation is evaluated from a welfare perspective under different exogenous welfare weights. Figure E.30a (E.30b) displays welfare implications for welfare weights centered in the middle (bottom) of the income distribution. Each gray dot represents a couple in the data with specific income of the primary (resp. secondary) earner displayed on the vertical (resp. horizontal) axis. Couples that lie below (above) the green line are winners (losers) from a reform towards individual taxation. Welfare evaluations with different welfare weights are plotted as a colored dot the location of which is defined via the average welfare-weighted primary earnings (vertical axis) and the average welfare-weighted secondary earnings (horizontal axis). Welfare evaluations below (above) the green line indicate that the reform is welfare increasing (decreasing). The light green solid line illustrates the result under the baseline elasticity scenario of Table 1 in which the primary (secondary) earner has an elasticity of 0.25 (0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). All results are displayed including extensive margin responses. For detailed information on welfare weight specification, see Table D.2. The specific percentile used for Rawlsian weights is P5 and $a = 0.8$ for decreasing welfare weights. All estimates are based on tax units with non-negative gross income in which both spouses are at least 18 years old.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure E.31: Median share of primary and male earner, alternative sample restriction



Notes: This figure replicates Figure D.24 for the full adult population instead of the working age population. It shows the median income share of the primary earner in the couple by income decile. Earnings shares are computed on the basis of non-negative wage, business and farm income. All estimates are based on tax units with non-negative gross income in which both spouses are at least 18 years old.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.

Figure E.32: Reconciling Rawlsian and Feminist welfare (2019), alternative sample selection



Notes: This figure replicates Figure D.25 for the full adult population instead of the working age population. It shows for the current tax system, how a partial reform towards individual taxation is evaluated from a welfare perspective under different exogenous welfare weights. A partial reform lowers marginal tax rates for all secondary earners, but raises marginal tax rates only for primary earners above the median of the couple income distribution. Each grey dot represents a couple in the data with specific income of the primary (resp. secondary) earner displayed on the vertical (resp. horizontal) axis. Couples that lie below (above) the green line are winners (losers) from the reform. Welfare evaluations with different welfare weights are plotted as a colored dot the location of which is defined via the average welfare-weighted primary earnings (vertical axis) and the average welfare-weighted secondary earnings (horizontal axis). Welfare evaluations below (above) the green line indicate that the reform is welfare increasing (decreasing). The light green solid line illustrates the result under the baseline elasticity scenario of Table 1 in which the primary (secondary) earner has an elasticity of 0.25 (0.75). For illustrative purposes, the dark green solid line refers to the case where primary and secondary earners' elasticities coincide (0.5) while the dashed green line shows the results under the assumption that the primary earner's elasticity (0.75) is higher than for the secondary earner (0.25). All results are displayed including extensive margin responses. For detailed information on welfare weight specification, see Table D.2. The specific percentile used for Rawlsian weights is P5. All estimates are based on tax units with non-negative gross income in which both spouses are at least 18 years old.
Source: Authors' calculations based on NBER TAXSIM and CPS-ASEC.