

Tax Filing Choices for the Household*

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Abstract

What role do tax filing choices play in an optimal tax system? Under the unitary approach to household behavior, giving spouses the option to either file individually or jointly is equivalent to offering the envelope budget set. If a collective approach is used instead, this needs no longer to be the case. In this paper, we follow this approach and assume that couples' choices are the outcome of a Nash Bargain. Threat points for the bargain are the outcomes of games played under schedules that may never be chosen by the couple. Our numerical exercises show that redistribution across spouses due to this effect may be substantial even when this option to file individually is never chosen. This places filing options as a nontrivial aspect of tax policies for the household.

Keywords: Tax Filing Options, Collective Model.

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1. Introduction

Why would any country adopt a tax system which gives couples the option to choose whether to file individually or jointly? The whole system might be replaced with one that generates the envelope of the relevant budget sets with no effect on equilibrium allocations *if* couples' choices may be rationalized by the maximization of a well-defined household utility function.¹ Our goal in this paper is to show that eliminating these never chosen choices is not inconsequential when we depart from this 'unitary' view of the household.

This is not a purely theoretical standpoint. However convenient from a modeling perspective, the unitary approach has been under attack due to the poor empirical performance of its theoretical underpinnings. In fact, the empirical shortcomings of this approach have led to the emergence of a new paradigm, the so-called collective approach, to model household behavior.²

Following Manser and Brown (1980) and McElroy and Horney (1981), we consider a specific collective decision process for the household represented by a Nash bargaining game. Threat points are potential utility levels which spouses could reach in the absence of an agreement with their partner. In contrast with these works, we assume that threat points are internal to marriage, rather than the utility attained with divorce. The idea, first explored by Ulph (1988), Wooley (1988), Lundberg and Pollak (1993), is that, in many circumstances, divorce is too strong a threat given what is at stake.³

As the allocations that arise from a Nash bargain are efficient, they dwell on the envelope of the two tax schedules. Yet, the tax system *cannot* be replaced with one that simply defines the envelope budget set: the schedule not chosen by the household may still play a role by potentially affecting the threat points of the bargaining game. In this context, a crucial element of our analysis is the nature of the off-equilibrium non-cooperative games — which we call, *counterfactual games* — that define spouses' threat points. When spouses are allowed to choose the tax schedule, each one recognizes that he or she may opt (in the counterfactual game) to file individually; the utility obtained under the individual budget set is always feasible, whereas threat points are reached in counterfactual games played under the joint tax schedule if the option to file individually is not offered.

The literature has considered two alternative types of threat points: 'external', the utility attained by each spouse as single, and 'internal', the utility attained by spouses when cooperation ceases but divorce is not chosen. A conceptual difficulty has probably led to the dominance of divorce as the threat point in the analysis of

¹Alternative justifications for such approach are Samuelson (1956) and Becker (1974, 1991).

²While assuming 'spot' efficiency, the collective approach, as defined by Chiappori (1988), Chiappori and Bourguignon (1992), Browning et al. (2012), rules out the strong form of commitment that is required for allocations to be chosen under Pareto weights defined once and for all by the couple.

³See the discussion in Browning et al. (2012).

joint taxation: the absence of a ‘natural’ or ‘conventional’ rule under which taxes would be shared between spouses if they could not reach an agreement.⁴ That is, if couples cannot reach an agreement, how are they going to establish a rule for assigning tax liabilities? We consider decision protocols under which one of the spouses moves first and makes his or her choices by treating the joint tax schedule as if it were the tax schedule he or she faced as a single. Next, the other spouse chooses to define his or her budget set by the residual schedule. In somewhat more formal terms, we assume that the decision protocol has one of the spouses as a Stackelberg leader and the other one as a follower. The idea of a first mover suggests the tax assignments we consider, which is the closest sense of ‘natural’ which we can think of.

We initially consider the case in which it is always the primary earner of each couple who moves first. It means that the primary earner’s utility as a leader and the secondary earner’s utility as a follower in a Stackelberg game are the relevant threat points. Under this view of the household, we identify that tax filing choices always improve the secondary earner’s welfare. The result is intuitive. If tax schedules are progressive, then being a follower is the worst position to be in the decision protocol we consider.

This common sense view of the decision protocol should not, however, be taken at heart. It is probably driven by the empirical observation that if only one spouse works, this is the primary earner, which ‘looks like’ a first-mover advantage, rather than a careful examination of household behavior. But this is an observation of choices *actually made* by households *under agreement*. The relevant question is centered on the behavior of households in counterfactual game; something we know little about.

We take this state of ignorance seriously by assuming that either spouse can be the leader and that agents live in a state of uncertainty regarding which spouse would take on such role. More to the point, we consider that counterfactual Stackelberg games define the threat points of one couple. In each game, one spouse, the leader, chooses his or her taxable income, pays taxes, collects eventual benefits from the tax system, and leaves the residual budget set for the other spouse, the follower – which is the relevant information for our analysis. The threat points are the utilities each spouse attains as a *follower* of his/her counterfactual Stackelberg game. We view these counterfactual games not as games that would actually be played by spouses, but rather as mental processes through which each spouse assesses a utility that he or she can attain if cooperation fails under alternative decision protocols.

Our results uncover an important role that shadow tax schedules may play in policy design. We make this point in a stark manner by assuming preferences to be quasilinear. As a result, filing options alter the way income, but not labor

⁴One must at least take a stand on which level of cooperation would remain and on which agreements would be respected if the bargain ceased.

supply choices, is shared between spouses. Redistribution across spouses is, in this sense, attained at no additional efficiency cost,⁵ and our discussion can be framed without any change as a true tax reform.

We analyze two tax systems. The first one is what we call a prototypical joint tax system. It is a tax system comprised of a joint and an individual tax schedule for which the couple's average income is treated as the income of a single individual.⁶ The tax schedules are piecewise linear, comprised of a single exemption level and a positive marginal tax rate for those above this threshold. The combination of a progressive tax schedule and income averaging implies that filing individually never leads to lower taxes. The joint schedule defines the envelope. We run numerical exercises which show that the potential impacts of these options may be substantial.

The consumption-equivalent utility gains increase in the productivity difference between spouses and the elasticity of labor supply. In the prototypical system we study, it is always the secondary earner who benefits from having the option to file individually. If we allow the primary earner's wage to be twice that of the secondary earner, these gains reach 23% for an elasticity of labor supply of 0.25. Even if we restrict our analysis to couples that do not have a productivity difference in excess of 25%, the gain for the secondary earner may be as high as 6.5% of her consumption.

For the second tax system we examine, the only difference between individual and joint filing is that there is a demogrant in the latter that is absent in the former. Depending on how large the demogrant is as compared to the exemption (common to the joint and individual schedules), the envelope budget set may be non-convex. Independently of whether this is the case, we find that the spouse who benefits (most) from the existence of an option is not the same for different households. The redistributive effect is substantially smaller than under the prototypical system. When the relevant budget set is not convex, the agents' choices are discontinuous. Somewhat surprisingly, equilibrium *utilities* that arise from the Stackelberg game may also display discontinuity in the sense that similar couples may end up with very different surplus sharing. As the utility attained in the counterfactual game affects the distribution of surplus in the equilibrium, this statement is about utilities actually attained.

This paper is organized as follows. The economic environment we study is described in Section 2. Section 3 presents the main results for our prototypical joint taxation scheme. The alternative tax system is presented and informally discussed in Section 4 with actual findings presented in the Appendix. Section 5 concludes the paper.

⁵Allowing for income effects would lead to changes in labor supply as well, with potentially interesting consequences for policymakers.

⁶This roughly corresponds to the US current system.

2. The Environment

The economy is inhabited by individuals of two different types $i = m, f$. For ease of exposition, we assume that all couples consist of one individual of each type. Individuals have preferences defined over their own consumption of a market good, x , and their effort l . To make our point as stark as possible, we assume that preferences are identical across individuals and quasilinear. They may be represented by

$$u_i(x_i, l_i) = x_i - v(l_i),$$

where $v', v'' > 0$. We, therefore, disregard the possible existence of public goods and externalities in consumption within the household.

Our focus on quasilinear preferences is to concentrate on distribution issues between spouses. By eliminating income effects, we guarantee that equilibrium labor supply choices are independent of the distribution of resources within the household. As a consequence, any tax scheme that does not affect the budget set chosen by couples leaves tax revenues unaltered. We may easily compare the redistributive effects of different tax systems while holding tax revenues constant.

Besides their types, individuals in this economy only differ with respect to their labor market productivity, w . A couple is identified by a pair of productivities (w_f, w_m) associated with member f – henceforth, the wife – and member m – henceforth, the husband. Due to the empirical evidence which points out that the male partner is usually the primary earner, we shall consider $w_f < w_m$ and use the masculine pronoun to refer to the primary earner and the feminine pronoun to refer to the secondary earner.

The Budget Sets

Gains from marriage in our model are exclusively due to economies of scale in consumption.⁷ With total expenditures, c , a couple may consume $x_m + x_f \leq zc$, $z > 1$, whereas the same expenditures would only allow two single individuals to consume $x_m + x_f \leq c$.

Let $y_i = w_i l_i$ be a person's labor income. If the person is single, his or her budget set is simply

$$x_i \leq y_i - T_U(y_i),$$

where $T(\cdot)$ is the tax schedule and subscript U stands for unmarried.

If two persons are married, the couple's budget set is

$$\frac{x_f + x_m}{z} \leq y_f + y_m - T_M(y_f, y_m),$$

where subscript M stands for married.

⁷There are, we believe, other reasons why people get married; love being one of them. To incorporate 'love' in as simple a form as possible in our model, we could assume preferences of the caring type. Given our modeling choices, this would only add noise to the discussion without offering novel insights into the issues we aim to address.

A joint tax schedule may, in principle, be any function mapping (y_f, y_m) into \mathbb{R} . In particular, we may have $T_M(a, b) \neq T_M(b, a)$ for some $b \neq a$. We shall, however, focus on two extreme, albeit very common, types of symmetric tax schedules.⁸ The first one is represented by $T_M(y_f, y_m) = T_I(y_f) + T_I(y_m)$, where T_I denotes the relevant schedule for a married person filing individually. It treats each individual as if he or she were single. This schedule does not take into account the marital status of an individual when defining the taxes that are due. The second one is such that when the couple files jointly, the tax system will be denoted T_J and will be a function of a couple's total income, $y_f + y_m$. i.e., $T_M(y_f, y_m) = T_J(y_f + y_m)$.

2.1 The Household Decision Process

We assume that couples' choices may be rationalized as the solution of a Nash bargaining game. That is, for a couple (w_f, w_m) , the chosen allocation is found by solving

$$\max_{(x_f, l_f, x_m, l_m) \in B_M(w_f, w_m)} [x_f - v(l_f) - \bar{U}_f] [x_m - v(l_m) - \bar{U}_m], \quad (1)$$

where \bar{U}_i , $i = f, m$ are the threat points and $B_M(w_f, w_m)$ is the relevant budget set.

Threat points are utilities that spouses envision as attainable if an agreement is not reached. Instead of focusing on the utility attained in the case of a divorce — e.g., Manser and Brown (1980), McElroy and Horney (1981) — we consider utilities attained in (counterfactual) non-cooperative games played by the couple when they remain married. This means that each spouse maximizes his or her own utility subject to a budget set of the form

$$\frac{x_i}{z} \leq y_i - \mathcal{T}(y_i; y_{-i}),$$

where $\mathcal{T}(y_i; y_{-i})$ is the tax schedule that spouse i faces given the choice y_{-i} of spouse $-i$ when cooperation breaks down. The expression above makes explicit the role that the decision protocol plays in determining the utility attained by an agent in the disagreement game.

When spouses choose to file individually, having the option to file jointly is innocuous. If filing individually is optimal, at least one of the two spouses must necessarily lose by filing jointly. We assume that one can never be forced to file jointly in the counterfactual game. He or she would block this choice in a non-cooperative game by filing individually. So, in what follows, we restrict our analysis to equilibria in which couples choose to file jointly.

The counterfactual games are straightforward when couples have the option to file individually, since no strategic interaction between spouses remains. The

⁸By symmetric, we mean, $T_M(a, b) = T_M(b, a)$ for all $a, b \in \mathbb{R}_+$. We, therefore, refrain from discussing gender-based taxes. See, however, Alesina et al. (2011) for a modern take on the issue.

utility is simply what is attained by the individual optimization problem when $\mathcal{T}(y_i; y_{-i}) = T_I(y_i)$.

When spouses do not have such option, however, the decision protocol in disagreement is key. The first protocol we consider has the primary earner moving first. This protocol corresponds to a Stackelberg game that has the primary earner always as the leader. Under the couple's budget, the leader chooses how much to work, pays the taxes, reaps the benefits that would be available if he or she were a single earner but were allowed to use the schedule of a couple filing jointly, and leaves the residual budget set to the other spouse, the *follower*. The follower, then, optimizes under the residual budget set.

This is the protocol which seems to be in the minds of those who argue that joint taxation leads secondary earners not to participate due to the high marginal tax rates they face. Under this particular protocol, very sharp results regarding the benefits of allowing for individual taxation are possible – see Proposition 2. The point here is that this protocol implies that the secondary earner is always in a very weak position.

There is, however, no a priori reason to assume that the primary earner *must* be the leader in this disagreement game. We then assume that spouses do not know, ex ante, which one will have the right to move first, i.e. both protocols, the one in which the primary earner is the leader and the one in which the secondary earner is the leader, are possible in the disagreement game. Spouses simply do not know which one will be used. We calculate the equilibria of two Stackelberg games, each having a different spouse as the leader. The threat point utility for each spouse is his or her utility as a *follower* of the game for which the other spouse is the leader.

It is this optimization that defines our threat point when couples are not allowed to choose the tax filing.

Formally, let y_{-i}^L be the leader's choice. As a follower, each spouse faces the residual tax function,

$$\mathcal{T}_F^S(y_i; y_{-i}^L) = T_J(y_i + y_{-i}^L) - T_J(y_{-i}^L).$$

We define $\tilde{\tau}^S(y; y_{-i}) \equiv \partial \mathcal{T}_F^S(y; y_{-i}^L) / \partial y$ as the *individually effective marginal tax rate* faced by individual i . Under this assumption, the individually marginal tax rate faced by the Stackelberg follower is the marginal tax rate of the household, $\tilde{\tau}^S(y; y_{-i}) = T_J'(y_i + y_{-i}^L)$.

Another important step in the analysis is to assess how the utility attained in the counterfactual games translates into equilibrium utility. Due to our quasilinear assumption, all that is necessary to determine which spouse benefits from the option to choose the tax filing is to compare the threat points utilities for each of these situations.

Let \bar{U}_i^J be the counterfactual utility attained by spouse i if the couple does not have the option to file individually and \bar{U}_i^I the utility attained by the same

spouse if they do have the option. Next, if $\Delta \bar{U}_i = \bar{U}_i^I - \bar{U}_i^J$, then the following proposition is an immediate consequence of the Nash bargain structure along with the assumption of quasilinear preferences.

Proposition 1. *The utility gain that spouse i attains in equilibrium if couples are allowed to file individually is given by*

$$\Delta U_i = \frac{1}{2} \{ \Delta \bar{U}_i - \Delta \bar{U}_{-i} \}.$$

It is important to bear in mind that we compare tax systems that induce the same budget sets. Any bundle that is feasible for the couple in one tax system is also feasible in the other. Our main goal is to investigate how the surplus division is affected when governments allow couples to choose whether to file individually or jointly instead of simply offering them the envelope of these two schedules. This is where the quasilinearity assumption facilitates our analysis. Under quasilinear preferences, the way surplus is split does not affect labor supply choices. Because the same bundles are available for the tax systems we compare, the same labor supply and total consumption will be optimal under either system, which allows us to focus on surplus division alone.

In Section 3.2, we discuss a different protocol under which spouses move simultaneously. The threat points are the equilibria of a Cournot-Nash counterfactual game in which spouses simultaneously choose their allocations and split taxes proportionately to their earnings.

It should be apparent by now that different assumptions about counterfactual games may lead to different conclusions regarding the usefulness of allowing for such filing options. Not surprisingly, this is a central theme in our work, which we discuss next.

2.2 Discussion: The counterfactual game

In deriving threat points, most of the literature has considered a divorce threat point. A smaller set of works assumed that if cooperation ceased, the couple would play a single non-cooperative game and the threat point would be the equilibrium utility profile that arises from this single game.

The Nash bargaining theory does not inform us of a unique way of defining threat points, and we may devise many different forms to find these counterfactual utilities. In particular, there is no restriction that threat point utilities come from a single game. In other words, a counterfactual utility pair (\bar{U}_f, \bar{U}_m) need not arise in *any* single game.

Nash (1953) pioneered the discussion of the nature of threat points using the definition of ‘rational threats.’ These are determined not as an equilibrium of a counterfactual game. Rather, they are derived under the assumption that players recognize that threats are never carried out in equilibrium but affect the utilities that they attain in the bargain. Individuals commit to strategies that may not

be optimal if they would really play the game, but which are optimal when they anticipate that the threats will never be carried on. Rational threats, therefore, require a strong form of commitment from both players.

Alternatively, Myerson (1997) describes two other possibilities for determining threat points: an equilibrium theory of threat points, which is exactly what most of the literature on household behavior uses, and a minimax strategy.

In the minimax case, each spouse is assumed to have a planned offensive strategy that he or she would use if the bargain failure was the other spouse's fault and a defensive strategy to be used in case it was his or her fault. The resulting threat point profile (\bar{U}^f, \bar{U}^m) is comprised of the maximum utility a spouse may attain in the game for which the other spouse is simply trying to hurt him or her. This concept, too, requires commitment to an offensive strategy that need not be optimal for the counterfactual game. Similar to ours, it is an example of threat point which is not associated with the equilibrium of a single game.

Our counterfactual game In essence, our view is that counterfactual games are only 'mentally' played by each spouse separately to assess his or her utility in case of disagreement. This view of counterfactual games bypasses the need to arbitrarily define rules about how to split the tax burden between spouses. The use of Stackelberg games, on the other hand, means that spouses do not view themselves as endowed with the commitment technology that is required for one to carry on strategies that might not be optimal if they were to be actually played, e.g., rational threats or minimax strategies.

The rationale for our modeling choice is that spouses do not know who will be the leader and who will be the follower in the decision protocol that would arise in disagreement. Nor are they able to assign probabilities to each possibility. Each spouse makes an assessment of what the utility associated with the worst alternative is within these two possibilities, being a follower if schedules are progressive. In this mental experiment, each spouse assumes that the other spouse's choice is rational and has its own utility maximization as an objective. We maintain an internal threat point, but we make it more robust to changes in tax sharing rules for which very little is known in practice. There is, in this sense, no need for an explicit off-equilibrium protocol.

Another important aspect of our model is that each spouse conceives the strategy of the other spouse to be optimal *in the counterfactual game*. When compared to threat points generated through minimax strategies, our assumption means that spouses are assuming that the other spouse cannot commit not to behave optimally in the counterfactual game.

We have also considered threat points generated by minimax and by the equilibrium of a single Cournot-Nash game. For the latter, the results are very similar to the ones we obtain here, whereas for the former, the results are almost the exact opposite.

Before we move on to the analysis of specific tax systems, it is important to note that it will not be always the case that the counterfactual utility of remaining married is higher than that of breaking up marriage if the possibility of filing individually is not available — see Section 3.2. When divorce is better, it is always the primary earner that benefits from the existence of an option to file individually; a simple envelope argument shows that the gains from marriage are proportional to taxable income. In what follows, however, we focus on the cases in which divorce never dominates being married, i.e., we assume that z is ‘high enough.’

3. A Prototypical Tax System

Define a *prototypical tax system* as one for which the joint tax schedule results from treating the average taxable income of a couple as if it were the taxable income of a single agent. Under a prototypical joint tax schedule, the household budget set is of the form,

$$\frac{x_m + x_f}{z} \leq y_m + y_f - 2T_I\left(\frac{y_m + y_f}{2}\right).$$

Let $y^L(w_{-i})$ denote the taxable income that would be chosen under joint taxation by a Stackelberg leader of productivity w_{-i} in the counterfactual game. Give this choice of $-i$, define the *residual budget set*, $B^F(y^L(w_{-i}))$, available to the follower of the Stackelberg game, i , as

$$B^F(y^L(w_{-i})) \equiv \left\{ (x, y) \in \mathbb{R}_+^2; \frac{x}{z} \leq y - [T_J(y + y^L(w_{-i})) - T_J(y^L(w_{-i}))] \right\}. \quad (2)$$

A *tax schedule is progressive* if $T(\cdot)$ is a convex function. Prototypical progressive tax schedules have interesting properties described next.

Claim 1. *Under a prototypical progressive tax system, the residual budget set of followers is decreasing in the choice of the leader. i.e., $B^F(y) \subseteq B^F(y') \Leftrightarrow y \geq y'$.*

Claim 2. *Under a prototypical progressive tax system, it is weakly better for the couple to file jointly than to file separately.*

Both claims are immediate consequences of the convexity of $T(\cdot)$.

By construction, if m is the primary earner, $y_m \geq y_f$ no matter what the tax system is. Let $y_I(w)$ denote the taxable income of a married person who is filing individually and whose skill is w . In this case, note that $y_J^L(w_i) \geq y_I(w_i)$ for $i = f, m$. Indeed, quasilinearity means that only the marginal tax rate matters for determining taxable income while progressivity guarantees that marginal tax rates are non-decreasing in income. Because the taxable income for the Stackelberg leader is effectively half of what would be the case were he or she filing individually, progressivity implies that he or she faces a (weakly) lower marginal tax rate than he or she would be facing if filing individually.

For most of our discussions, we will take as threat points (or fall-back utilities) the utility that spouses get if, in disagreement, they find themselves in the weak position of having to follow their spouses in a Stackelberg game.

In a sense, it is as if spouses formed beliefs about their fall-back utilities under Knightian uncertainty, regarding the decision protocol under disagreement. In some environments, one may object that primary earners are assured to lead in case of disagreement. If this were the case, we would get the very strong result that, under a progressive schedule, it is always the secondary earner that benefits from the option to file individually.

Indeed, given our focus on progressive taxation, let us consider schedules such that $T(\cdot)$ is convex and $T(0) \leq 0$.

Proposition 2. *Let $T^I(\cdot)$ be a convex strictly increasing function with $T^I(0) \leq 0$, and let $T^J(y) = 2T^I(y/2)$, then, if the primary earner is always the leader in the disagreement game, allowing spouses to file separately always benefits the secondary earner.*

What Proposition 2 shows is that progressivity leads a follower to face a worse budget set than she would under individual filing whenever she is less productive than the leader. In such a world, allowing for individual filing would then improve her disagreement utility, thus leading to a larger share of the household surplus.

When either protocol may be used in the disagreement game, the fact that the residual budget set is weakly smaller for the secondary earner than for the primary earner is not sufficient for one to determine who benefits and who is hurt from moving from one system to the other. In particular, it is important to check whether, for each spouse, the chosen bundle remains in his or her budget set when one is a follower in the Stackelberg game instead of one filing individually. No single answer has to apply to all couples. To complete the analysis, it is necessary to further specify the tax system.

For the rest of this section, we consider one specific prototypical progressive tax system, which we describe as follows. If an individual files alone (either he or she is single or is married, filing individually), then, total taxes as a function of taxable income are

$$T_I(y) = \begin{cases} 0, & \text{for } y \leq \bar{y}_I, \\ \tau[y - \bar{y}_I], & \text{for } y > \bar{y}_I, \end{cases} \quad (3)$$

where $\tau, \bar{y}_I > 0$. If, instead, the couple files jointly, then

$$T_J(y_m + y_f) = \begin{cases} 0, & \text{for } y_m + y_f \leq \bar{y}_J, \\ \tau[y_m + y_f - \bar{y}_J], & \text{for } y_m + y_f > \bar{y}_J, \end{cases} \quad (4)$$

where $\bar{y}_J = 2\bar{y}_I$.

This tax system treats the average household income, $(y_m + y_f)/2$, as if it were the income of a single person — it is, indeed, prototypical. Note also that $T_J(\cdot)$ is itself the envelope of the whole tax system; the couple can never do better by

filing individually.⁹ It means that under this tax system, the efficient allocation for a couple is always the joint taxation. Yet, $T_I(\cdot)$ may still play a role as we shall see.

Consider the definition (2) of a residual budget set. When the tax system is the one defined by (3) and (4), then $B^F(y) \subseteq B^F(y') \Leftrightarrow y \geq y'$, an immediate consequence of Claim 1. Figure 1 illustrates for each choice of a leader (top panels) the residual budget sets (bottom panels). However, the fact that the residual budget set is weakly smaller for the secondary earner than for the primary earner is not enough to determine who benefits and who is hurt from moving to the tax system that allows couples to choose the type of tax filing. The following proposition summarizes our first findings.

Proposition 3. *For the prototypical progressive tax system defined by equations (3) and (4), if both spouses' choices under individual filing are not at the kink of their budget sets, then it is the secondary earner who benefits from the option to file individually.*

If choices are not at the kink of the budget set, it is never the case that both individuals are induced to change their choices at the same time. Indeed, the only way for the bundle chosen by the primary earner in the individual schedule not to be available to him as a Stackelberg follower is if $y_I(w_f) \geq \bar{y}_I$. Since we are assuming that choices are not at corners, $y_I(w_f) > \bar{y}_I$, which implies that both spouses make the same choices under either joint or individual filings. Both have their utilities lowered as a consequence of reduced virtual income, but this reduction is never greater for the primary earner.

Things change when one of the spouses chooses at the kink. Except for the case in which $y_I(w_f) < y_I(w_m) = \bar{y}_I$, one cannot rule out the possibility that it is the primary earner who benefits from having the option to file individually.¹⁰

To understand what is taking place in this case, assume that $y_I(w_m) > y_I(w_f) = \bar{y}_I$. Assume also that $y_J^L(w_m) > y_J^L(w_f) > \bar{y}_I$. Because $y_J^L(w_m) > y_J^L(w_f) > \bar{y}_I$, both spouses get a lower exemption level as a Stackelberg follower than what they would obtain if filing individually. For the primary earner, this drop in virtual income — represented in Figure 2 by vertical line A — is all that takes place in terms of utility change. As for the secondary earner, it is useful to decompose her utility change into two parts. First, there is the drop in virtual income — line A. There is, however, another change which is a utility gain due to reduced labor supply — lines B or B', depending on her wage, w_f .

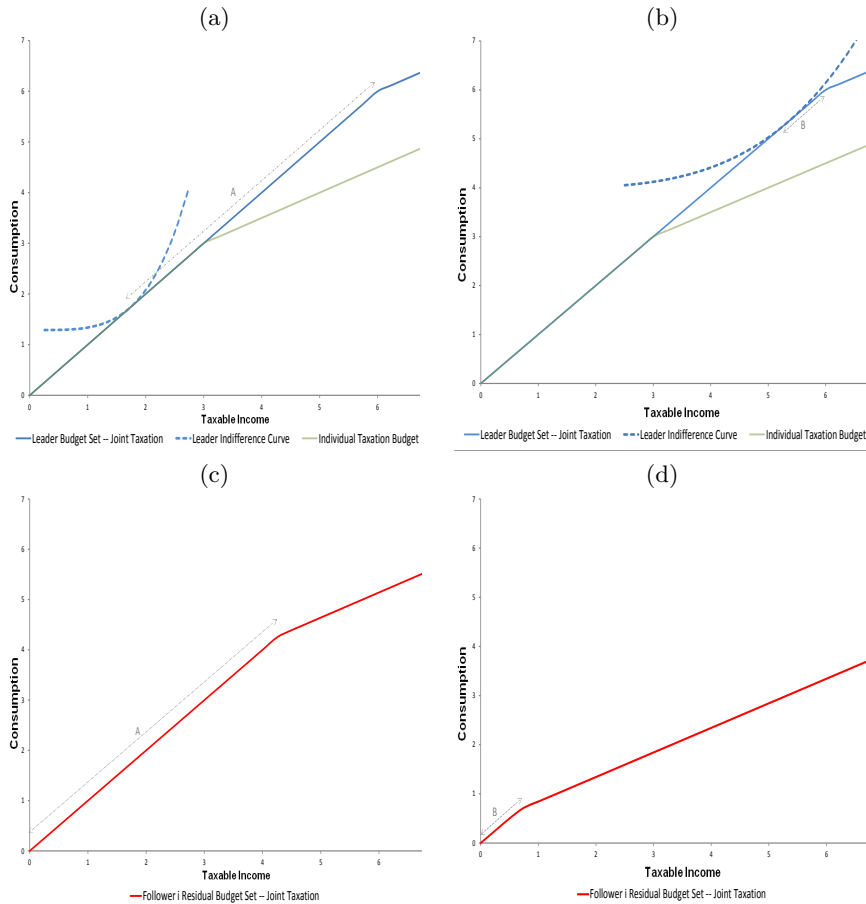
To understand this latter effect, recall that, at the corner, the secondary earner is working more than she would like to for a marginal tax rate of τ and less than

⁹This is an immediate consequence of Jensen's inequality when the tax system is progressive in the sense of displaying weakly increasing marginal and average tax rates.

¹⁰In this case, the primary earner as a leader chooses $y_J^L(w_m) \geq \bar{y}_I$, which means that the secondary earner either gains nothing or loses utility due to a reduction of the exemption level. The secondary earner as a leader, on the other hand, chooses $y_J^L(w_f) = y_I(w_f) < \bar{y}_I$, ensuring a higher level of utility for the primary earner as a follower.

Figure 1

Panel (a) displays the case in which the spouse earns less than the individual exemption level, $y_I(w) < \bar{y}_I$. This spouse's income as a leader, $y_J^L(w)$, is equal to the one he or she earns when filing individually. Panel (b) displays the other possible case in which the leader earns more income than when he or she files individually, $y_J^L(w) > y_I(w)$. Panels (c) and (d) display the residual budget set for the follower of the leaders of panels (a) and (b), respectively. In each case, the follower's exemption level is the joint exemption level, \bar{y}_J , reduced by the leader's choice, y_J^L .



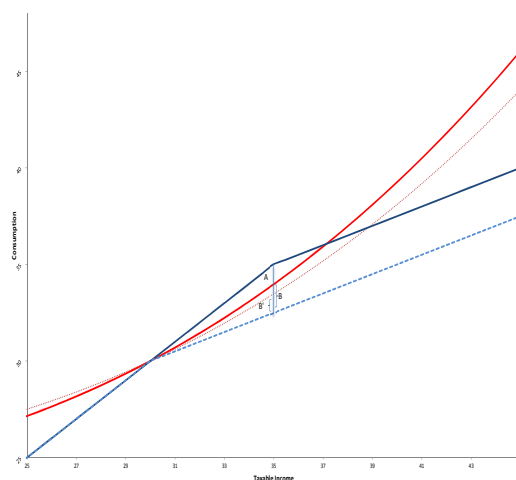


Figure 2

This figure shows how one can decompose the utility loss from becoming a Stackelberg follower in the drop in virtual income (A) and gains from re-optimization (B and B'). It is apparent that the second factor is greater for less productive individuals.

she would work if the marginal tax rate were 0. Under the residual budget set induced by the leader's choice, the secondary earner reduces her labor supply and consumption when compared to the individual budget set. Because her disutility of effort was greater than the net benefit given the marginal rate of τ , this reduction in effort is utility increasing. This 'efficiency' gain is represented by segment B (or B') in Figure 2. It is apparent that the efficiency gain is larger for the least productive individual; $B > B'$.

In Figure 2, we compared the utility variation for the two spouses given the same choice of the leader. Of course, when comparing the outcomes of primary and secondary earners, we take into account the fact that the drop in virtual income, $\Delta I_i = \tau \bar{y} - \tau y_j^L(w_{-i})$, is largest for the secondary earner. Whether the efficiency gain from reduced taxable income will compensate for a larger drop in virtual income is something we cannot tell *a priori*.

For a large enough marginal tax rate, it is possible to prove the following.

Proposition 4. *If the marginal tax rate is sufficiently large for the tax system described by equations (3) through (4), then there will be couples for whom it is the primary earner who benefits from the option to file individually.*

To prove the proposition, we offer an example of a couple whose choices are that it is the primary earner who benefits from the option to file individually. For a given assumption regarding preferences, this configuration of choices is only possible if the change in the slope of the budget set is sufficiently large at the kink — see footnote 14 for the details.

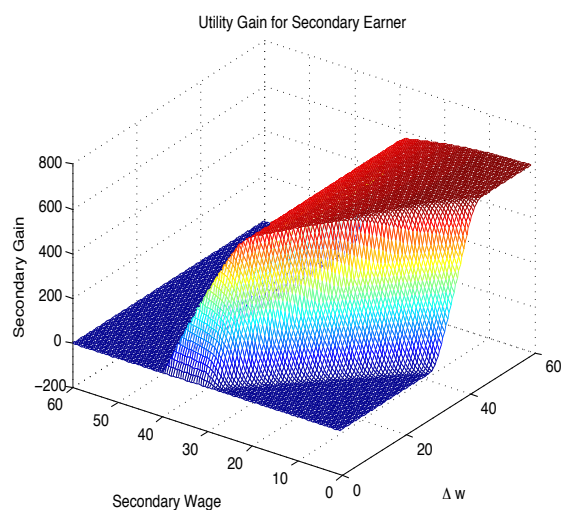


Figure 3
This figure displays the difference between the utility gain that the secondary and the primary earners obtain when, instead of a Stackelberg follower under joint taxation, they file individually. In the figure, $\Delta w = w_m - w_f$.

3.1 Numerical Results

For the numerical exercises, we assume that the disutility of work is of the form

$$v(l) = \frac{l^{1+\gamma}}{1+\gamma}, \quad (5)$$

where $1/\gamma$ is the elasticity of labor supply.

We first calculate the utility attained by each spouse as the follower of a Stackelberg game that has the other spouse as the leader. From Proposition 1, the utility gain from having the option to file individually is the utility attained under individual taxation minus the utility attained as a Stackelberg follower. Figure 3 displays the utility gain for the secondary earner minus the utility gain for the primary earner for the case that $\gamma = 1$, i.e., a quadratic disutility of labor. This counterfactual utility gain becomes the actual utility gain for the secondary earner given the couple's allocative choices.

For all couples, the difference is non-negative. It is, therefore, the secondary earner who benefits from the availability of a tax filing choice.

When $y_I(w_f) \leq y_I(w_m) \leq \bar{y}_I$, there is no change for either spouse in moving from individual to joint filing, as illustrated in the first flat region of Figure 3. When $y_I(w_f) < \bar{y}_I \leq y_I(w_m)$, it is the secondary earner who benefits from the option to choose the tax system. The second region illustrates this result for $y_I(w_m) + y_I(w_f) < \bar{y}_J$, and the third one, for $y_I(w_m) + y_I(w_f) > \bar{y}_J$. The possibility of a greater gain for the primary earner when $y_I(w_f) = \bar{y}_I$ does not materialize in our exercises.

Allowing spouses to file individually always benefits the secondary earner in our

numerical exercises. Our theoretical analysis in Section 3 has shown that this has to be the case when the choices are interior. The numerical results above generate the same pattern at kinks. In our exercise, we assume that $\tau < 0.5$. Given our choices of γ , $\tau > 1 - 2^{-1/\gamma}$, in all our examples.

Table 1 displays the maximum and the minimum gain obtained by the secondary earner, depending on the ratio of primary and secondary earner's productivities. We allow for different elasticities of labor supply, $1/\gamma$, and different marginal tax rates, τ . Gains are measured as percentage changes in consumption.

The first thing we learn from these numerical exercises is that the gains are substantial even if we do not allow for extreme productivity differences between spouses. For productivity differences not in excess of 100%, the consumption equivalent gain in utility may be as large as 34%. These gains are increasing in the elasticity of labor supply. Hence, if we focus on what we view as a more sensible choice for γ , namely $\gamma = 4$, gains are still as high as 23% for the same maximum productivity difference and a marginal tax rate of 35%.

Because in all exercises of Table 1 \bar{y} is held constant, an increase in τ amounts to an unambiguous increase in progressivity. The non-linearity in the tax schedule is crucial for there to be any potential gains from tax filing choices. As the numerical results clearly indicate, increases in progressivity are associated with increases in maximum utility gains for the secondary earner.

Although the numerical results ought to be taken with a grain of salt given the simplifying assumptions we have used, they are indicative of the potential gains of such policy. This calls for a future serious effort in estimating those potential gains.

3.2 Discussions and Caveats

Before we close this section, we address a loose end of our analysis. We discuss the possibility of divorce as the relevant threat and two alternative threat points within marriage.

Divorce as the Relevant Threat Although we have taken non-cooperation while remaining married as the relevant threat, it need not always be true that the utility attained as a Stackelberg follower is higher than what one may attain outside marriage. It suffices to assume that the leader chooses $y^L(w_{-i}) > \bar{y}_I$ for there to be a value of z sufficiently close to 1 such that getting a divorce is better than remaining married.

For z sufficiently close to 1, a simple envelope argument shows that it is the primary earner who benefits from the option to file individually. Divorce may, however, be a better option even for z significantly larger than one. In this case, if preferences are isoelastic, a global argument holds. Whenever it is best to end marriage, it is the primary earner who benefits from the option to file individually. Indeed, note that, if filing individually is an option, then it is never optimal to

split. In this case, all we need to do is to compare the utility of being single with that of being married and filing individually. In this case,

$$v(z) = z^{\frac{\gamma}{\gamma-1}} w^{\frac{\gamma}{\gamma-1}} (1 - \mathbb{1}\tau)^{\frac{\gamma}{\gamma-1}} (1 - 1/\gamma) + \mathbb{1}\bar{y}\tau,$$

where $\mathbb{1}$ is equal to one if $y > \bar{y}$ and zero otherwise. Clearly, $v(z) - v(1)$ is increasing in w for all $z > 1$.

Cournot-Nash Counterfactual Games

Threat points internal (to marriage) have been adopted in some works — e.g., Ulph (1988), Wooley (1988), Lundberg and Pollak (1993) — under the assumption that these are defined by the Cournot-Nash equilibrium of a game played by spouses in the case of disagreement.

The division of tax burdens between spouses becomes central to this analysis when joint filing is considered. There is, therefore, a sense in which one may feel uncomfortable with results found for any specific choice of tax sharing rule. This is the main reason why we refrained from following this path. Still, for the sake of completeness, we have numerically explored this case under the assumption that each spouse pays a fraction

$$\omega_i = \frac{y_i}{y_i + y_{-i}}$$

in taxes.

We found that it is always the secondary earner who benefits from the option to file individually.¹¹

Minimax Threat Points

Threat points are often associated with minimax games. That is, each spouse considers two different strategies. First, his or her best offensive strategy, which is the one that induces the lowest payoff for the other spouse, recognizing that the latter will respond with his or her best defensive strategy. The defensive strategy is, therefore, for a spouse the one that yields him or her the highest utility when the other spouse's only goal is to leave him or her the lowest possible utility. Threat points are given by the utilities attained by spouses when they use the defensive strategy.

It is not hard to show that it is always the *primary earner* that benefits from the option to file individually in this case. Indeed, the optimal offensive strategy is always to choose $y_i > \bar{y}_J$. This means that the best defensive strategy is simply to choose the optimal labor supply for the budget set $c \leq (1 - \tau)y$. For a spouse for whom $y_I(w) \geq \bar{y}_I$, this amounts to a utility loss $\tau\bar{y}$. For a spouse choosing $y_I(w) \leq \bar{y}_I$, the utility loss is smaller due to re-optimization gains. Hence, the result.

¹¹All our results regarding this possibility were reported in a previous version of this paper and are available upon request.

4. Alternative Tax System

The tax system we studied in Section 3.1 provides a natural reference for a joint tax scheme by treating a couple's average income as if it were the income of a single individual. Such a tax system captures some of the U.S. tax system's essential features; yet, it is far from being universal. In this section, we consider a tax system that has some other commonly observed features.

The tax system we study now is as follows. If spouses file individually, total taxes as a function of taxable income, y , are

$$T_I(y) = \begin{cases} 0, & \text{for } y \leq \bar{y}_I, \\ \tau[y - \bar{y}_I], & \text{for } y > \bar{y}_I, \end{cases} \quad (6)$$

where $\tau, \bar{y}_I > 0$.

If, instead, couples files jointly, then

$$T_J(y_m + y_f) = \begin{cases} -B, & \text{for } y_m + y_f \leq \bar{y}_J, \\ -B + \tau[y_m + y_f - \bar{y}_J], & \text{for } y_m + y_f > \bar{y}_J, \end{cases} \quad (7)$$

where $\bar{y}_J = \bar{y}_I = \bar{y}$, and $B > 0$.

This tax system treats the income generated by couples and by single persons (or married persons filing individually) identically, except for the fact that married couples are entitled to a deduction when they file jointly.¹² For the prototypical tax system, income averaging combined with convexity of the budget set means that it is always efficient for a couple to file jointly. Here, this need not be the case. Because there is also an exemption level, \bar{y} , below which marginal taxes are zero, it is not always the case that joint filing is better than individual filing.

A crucial assumption we make in order to analyze this tax system is that the deduction, B , is kept by the leader in the counterfactual Stackelberg game. This is the natural assumption to be made given our view of the counterfactual game as two mental processes through which each spouse assesses his or her utility as *follower*. Of course, some countries target these transfers to a specific gender, in which case spouses might take this into account when assessing their threat points.

The deduction, B , increases the leader's utility but has no effect on his or her labor supply choice, i.e., $y_J^L(w_i) = y_I(w_i)$ for $i = f, m$, since the exemption level is the same for both tax schedules. Yet, it does play an important role in our analysis. Its value is critical in determining the regions where either schedule dominates the other, i.e., it is an important parameter in defining the envelope budget set.

¹²Many countries provide all types of deductions and 'subsistence transfers' for families despite not necessarily offering special tax treatment for couples. In some places, we see a mix of the two types of treatments, and we hope that our analysis will shed light on the probable consequences for the different systems.

If $B \geq \tau \bar{y}$, then filing jointly is always better for a couple, whereas if $B < \tau \bar{y}$, this is not always the case. Whichever the case, it is possible to show that for some couples it is the primary earner and for others it is the secondary earner who benefits from having the option to file individually. The following proposition formalizes this finding.

Proposition 5. *For the tax system described by equations (6) and (7), neither the primary nor the secondary earners will always benefit from the option to file individually.*

As previously discussed, if $B \geq \tau \bar{y}$, a couple can never do better by filing individually: $T_J(\cdot)$ is itself the envelope of the whole tax system. The convexity of the budget set guarantees that $B^F(y) \subseteq B^F(y') \Leftrightarrow y \geq y'$, just as in the tax system of Section 3. Yet, the presumption that it is the secondary earner who benefits is no longer valid.¹³

The novelty here is that, independently of whether it is the primary or the secondary earner, the follower in the Stackelberg game is always (weakly) worse off than he or she would be in the case of individual filing under this alternative system. The utility change from joint to individual taxation may, again, be decomposed into a drop in consumption due to a variation in virtual income, and a (possible) re-optimization. For many couples, it will be the case that although it is the secondary earner that experiences the largest consumption drop, it is also she who experiences the largest re-optimization gains. Which of the two effects dominates is what will ultimately determine whether it is the primary or the secondary earner who will benefit from the option to file individually.

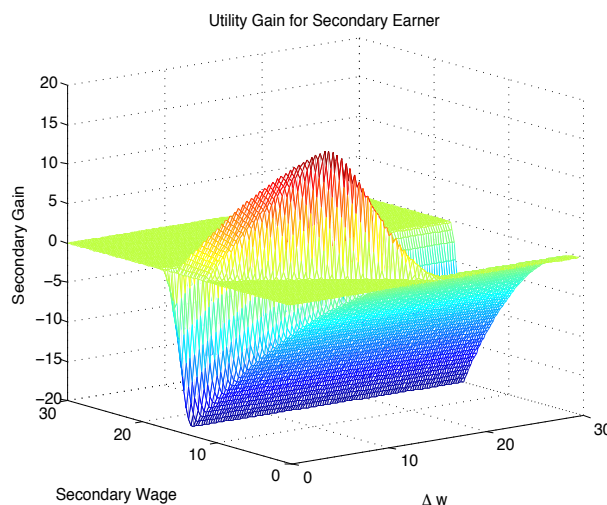
Numerical results for this case are displayed in Figure 4. Even though the budget sets are still convex, meaning that the budget set of the secondary earner as a Stackelberg follower is weakly smaller than that of the primary earner, for a large region of the $w_f \times w_m$ space it is the primary earner who benefits from having the option to file individually.

Similarly to the prototypical tax system, Table 2 displays the maximum and the minimum gain obtained by both spouses depending on the ratio of primary and secondary earner's productivities, for different elasticities of labor supply, $1/\gamma$, and different marginal tax rates, τ . Gains are measured as percentage changes in consumption. The first observation from the direct comparison between Tables 1 and 2 is that the magnitude of the impact is smaller under the alternative tax system.

Now it is also observed that losses and gains are decreasing with the elasticity of labor supply and increasing with the marginal tax rate. Moreover, as theoretically

¹³Contrary to what happened there, a bundle chosen by the primary earner under individual filing may cease to be available in the Stackelberg game even if $y_I(w_f) \leq \bar{y}$. Under the prototypical system, the primary earner could only have his budget set reduced if the secondary earner was taxed under the individual schedule. This leads to an equal loss in utility for both spouses, which allowed us to prove Proposition 5.

Figure 4
This graph displays the relative gain for the secondary earner for the case in which $B \geq \tau \bar{y}$. The negative regions of the graph indicates couples, i.e., pairs (w_f, w_m) for which the secondary earner is hurt by the option to file individually.



predicted, neither the primary nor the secondary earners always benefits from the option to file individually. The impact can be positive (utility gain) and negative (loss of utility) for both spouses. However, it is always greater in magnitude for the secondary earner.

Regardless of the marginal tax rate when the elasticity is 0.10, the impact on consumption – both positive and negative – is very small; generally smaller than 0.3%. But when we increase the elasticity of labor supply, the impact increases in magnitude, reaching around 3%. For productivity differences not in excess of 100%, the consumption equivalent to the secondary earner's gain (loss) in utility may be between 0.9% and 3% (-0.8% and -3.1%), which are increasing in the marginal tax rate.

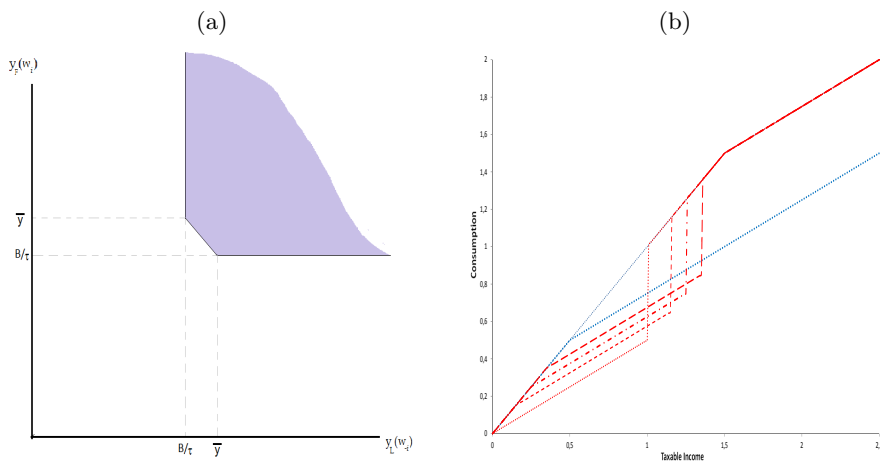
Although the numerical results are only suggestive of the real-world consequences due to the simplifying assumptions we have used, they also indicate the potential impacts of such policy. The comparison between these results and those of the prototypical system highlights the importance of the tax system structure.

Non-convexities The other possibility regarding the shape of the budget set is when $B < \tau \bar{y}$. In this case, the individual tax schedule is not dominated by the joint schedule. Parts of the envelope coincide with the individual tax schedule while others do so with the joint tax schedule. When one of the spouses earns very little, it may be better to file jointly, whereas for large values of $y_m + y_f$, it will be better to file individually.

This lack of dominance may induce non-convexities on budget sets as illustrated in Figure 5. Panel (a) in this figure displays regions of the $y_f \times y_m$ space for which

Figure 5

Panel (a) displays the regions in which either form of filing, individually or jointly, dominates. Panel (b) displays the follower's budget set for different taxable income choices of the leader. Note that discontinuity only happens when there is a change in the choice of the optimal tax schedule that defines the envelope.



either schedule dominates. The envelope schedule is one which coincides with the joint schedule in the white region and with the individual schedule in the shaded region. The fact that no tax schedule dominates the other leads to non-convexities of the envelope budget set — Panel (b) in Figure 5. Beyond the usual technical problems associated with the characterization of actual choices, some aspects of the counterfactual Stackelberg game deserve a more careful scrutiny. In particular, the leader must take into account the possibility that the follower's choice may lead to a discontinuous change in his or her utility, due to the non-convexity in the budget set.

For the leader to get the deduction, it must be the case that the follower's choice is such that $(y_J^L(w_i), y_J^F(w_{-i}))$ is not in the shaded region of panel (a). Let us, then, define a 'myopic' choice for the leader as one in which he or she simply chooses taxable income, taking the budget set as given. That is, the leader does not take into account how his or her choice will change his or her budget set through the follower's choice. Of course, this is not necessarily the optimal choice, but it is useful to highlight how the leader realizes that by deviating from this optimal 'myopic' choice he or she may induce the follower to remain in the joint budget set.

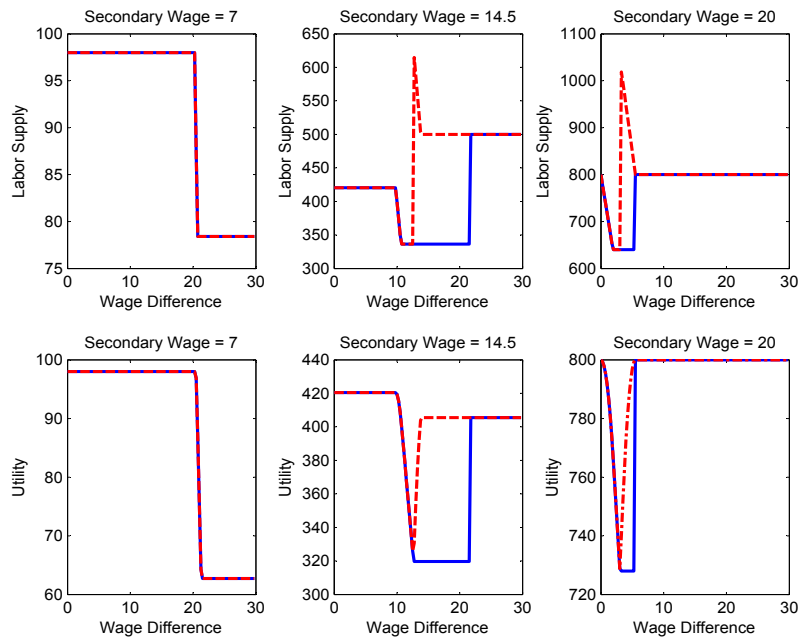
Figure 6 displays the consequences of such behavior from the leader. The blue solid lines represent labor supply (top panels) and utility (bottom panels) of a follower as a function of the leader's productivity w_{-i} . Each pair of panels considers a different value for the follower's productivity w_i . In all cases shown in the figure, the follower is a secondary earner.

Take the two panels on the left of Figure 6. The secondary earner's productivity is such that it is never optimal for the couple to file individually. Starting with $w_m = w_f$, the couple earns so little that their earnings are not taxed. As we increase $\Delta = w_m - w_f$, the leader starts making choices that lead the couple to the kink of the budget set. Further increases in Δ induce the primary earner to increase his labor supply as a leader, while the secondary earner remains at the kink. The kink of the residual budget set is $\bar{y} - y_J^L(w_m)$, which decreases with w_m . This explains the drop in both taxable income and utility of the secondary earner as a follower – see Figure 6. For high enough w_m , the kink becomes so low that the secondary earner prefers to be taxed than to stay at the kink. Further increases in w_m will no longer reduce her labor supply, although it might still reduce her utility (hard to visualize, but it is there!). Finally, when $y(w_m) \geq \bar{y}$, the follower's budget set no longer varies with the leader's choice.

For the panels in the middle, let us first consider how the follower's taxable income and utility vary with the leader's 'myopic' choice. For very low Δ , the couple is not taxed. As we increase Δ , the couple reaches the kink of the budget set. Once again, we see a fast decrease in the secondary earner's taxable income and utility followed by a stabilization in her taxable income when she starts making an interior choice (around $\Delta = 10$ in the figure). Her utility still decreases with

Figure 6

These figures show how taxable income (top panels) and utility (bottom panels) of a follower, characterized by his or her productivity, w_i , change as a function of the leader's productivity, w_{-i} . Each pair of panels considers a different value for the follower's w_i . In all cases shown in the figure, the follower is a secondary earner. The blue lines represent the follower's labor supply and utility for the actual choice of the leader, whereas the red dotted line represents the same variables when we assume a *myopic* behavior from the leader.



an increase in w_m since the deduction she gets keeps falling with $y_J^L(w_m)$. As we increase $y(w_m)$, one reaches a point at which the secondary earner jumps to the part of the schedule in which individual filing dominates — the shaded region in Figure 5. By following this discontinuous change, her taxable income starts to decrease until her budget set stabilizes. Interestingly, the secondary earner remains in the discontinuity region of the residual budget set as we increase Δ , which is why her labor supply remains higher than at low levels of w_m .

Throughout the analysis in the previous paragraph, we have assumed, for expository reasons, a myopic behavior from the leader. Let us then consider what the leader would actually do at the point in which the follower would choose to jump to the shaded region of $y_f \times y_m$ in Figure 5. In this region, there is no deduction. Because the leader was the one who received the deduction, he anticipates that the myopic choice would lead him to lose the deduction, thus experiencing a large drop in utility. To avoid this, the leader decides not to increase his labor supply, inducing, instead, the follower to keep her taxable income constant. Distorting his labor supply choice has, however, a cost for the leader. At one point, i.e., for high enough w_m , this is too high a price to pay to keep the deduction. The leader refrains from doing so and the couple jumps to the shaded region of Figure 5. The follower's *utility* goes up discretely with such move. That is, the Stackelberg leader may be willing to distort his or her choice to induce the follower not to go to the region of the envelope that corresponds to individual taxation up to the point where the cost of deviating from his or her preferred choice just equates the gain from remaining in the joint schedule. There will be a threshold value w_m above which the leader no longer distorts his or her choice, thus jumping straight to his or her optimum. This generates a discontinuous *change* in the follower's budget set that causes discontinuity in utility — See Figure 6. The panels on the right tell a similar story.

In the numerical exercises, one observes a large region in which the secondary earner is hurt by the option to file individually — Figure 7. This is *not* a consequence of non-convexity, since this result was also present in the case $B > \tau\bar{y}$ — Figure 4. The interesting result that does depend on non-convexity is that very similar couples may end up with a very different division of the household's surplus due to a discontinuity in the equilibrium utilities that arise from the Stackelberg game.

5. Conclusion

In this paper, we have highlighted the auxiliary role that ‘shadow’ tax schedules can play in optimal taxation when households are not unitary.

The ideas presented here may also be of relevance as we think about tax reforms in countries like the United States, in which couples have filing options. Indeed, in assessing a tax reform, one must usually be aware of the indirect effects that the reforms will have on the threat point of households. In particular, the movement

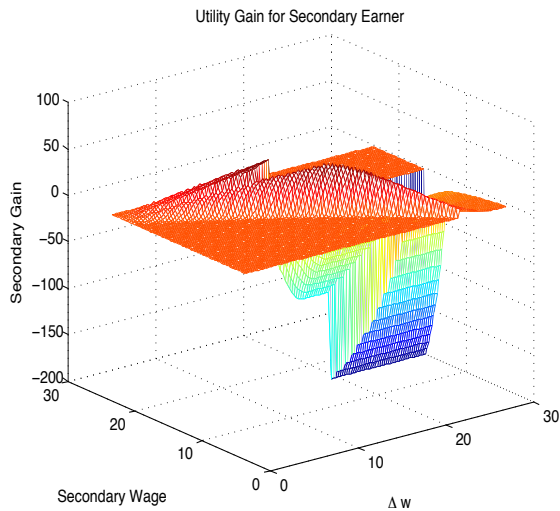


Figure 7
This figure displays the difference in utility gains for secondary and primary earners as followers of a Stackelberg game from moving to individual taxation. Negative values indicate that primary earners benefit most from having the option to file individually.

towards more ‘individualized’ tax systems, which, as mentioned by Cremer et al. (2012), has been present in most OECD countries, cannot be analyzed without the recognition of its impact on intra-household allocations. A consequence of our findings here is that the presence of tax filing options eliminates these effects and allows for a much simpler analysis.

We must emphasize, however, that we have not tried to derive optimal schedules. Yet, our findings suggest that an optimal tax system will most likely display the use of ‘shadow’ tax schedules as further discussed in da Costa and de Lima (2015).

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A. Appendix

Proof of Proposition 1. Our assumption regarding transferability of utility leads to a Pareto set of the form $U_f + U_m = k$ for some constant k . Optimality, on the other hand, implies $U_f - U_m = \bar{U}_f - \bar{U}_m$, or $2U_m = k + \bar{U}_m - \bar{U}_f$. Hence the result. \square

Proof of Proposition 2. Under our assumptions, if $T^J(0) < 0$, the leader always grabs the transfer $B = \lim_{y \rightarrow 0} T^J(y) - T^J(0)$. So, proving the result for $T^J(0) = 0$ suffices.

Let $T^J(y) = 2T^I(y/2)$, where $T^I(\cdot)$ is a convex increasing function such that $T^I(0) = 0$. Then, let

$$y^I(w) = \operatorname{argmax}_y \{y - T^I(y) - h(y/w)\}.$$

Then, it is not hard to see that

$$\begin{aligned} v^J(w) &= \max_y \{y - T^I(y) - h(y/w)\} \geq y^I(w) - T^J(y^I(w)) - h(y^I(w)/w) \\ &\geq y^I(w) - T^I(y^I(w)) - h(y^I(w)/w), \end{aligned}$$

where the second inequality stems from the convexity of $T^I(\cdot)$ and the fact that $T^I(0) = 0$.

By the same token, let

$$y^F(\hat{w}) = \operatorname{argmax}_y \left\{ y - 2T^I\left(\frac{y + y^L(w)}{2}\right) - h\left(\frac{y}{\hat{w}}\right) \right\},$$

where

$$y^L(w) = \operatorname{argmax}_y \left\{ y - 2T^I\left(\frac{y}{2}\right) - h\left(\frac{y}{w}\right) \right\}.$$

It is not hard to see that $y^L(w) > y^F(\hat{w})$ for all $w > \hat{w}$.

Now, using the convexity of $T^I(\cdot)$, we have

$$T^I\left(\frac{y^F(\hat{w}) + y^L(w)}{2}\right) - T^I\left(\frac{y^L(w)}{2}\right) > \frac{1}{2}T(y^F(\hat{w}))$$

thus leading to

$$\begin{aligned} y^I(w) - T^I(y^I(w)) - h\left(\frac{y^I(w)}{w}\right) &> \\ \max_y \left\{ y - 2T^I\left(\frac{y + y^L(w)}{2}\right) - h\left(\frac{y}{\hat{w}}\right) \right\} + 2T^I\left(\frac{y^L(w)}{2}\right). \end{aligned}$$

\square

Proof of Proposition 3. To compare the outcomes under the two systems, we start with the (counterfactual) choices that spouses make when filing individually and compare them with the choices made in the (counterfactual) Stackelberg games. For each of the possible cases, we compare spouses' utilities when they have the option to file individually to their utilities as followers in the Stackelberg game. Although the choices of each spouse as leaders are not the focus of our discussion, they need to be analyzed because they are crucial in identifying the followers' residual budget set.

There are three possibilities. First, both spouses earn less than the individual exemption level when filing individually, $y_I(w_f) < y_I(w_m) < \bar{y}_I$. Second, the primary earner earns more than the exemption and the secondary earner earns less, $y_I(w_f) < \bar{y}_I < y_I(w_m)$. And, finally, both spouses are above the exemption level, $\bar{y}_I < y_I(w_f) < y_I(w_m)$.

Let us start with the case for which the optimal choices under individual filing are such that $y_I(w_f) < y_I(w_m) < \bar{y}_I$. In this case, the choices that are available for spouses when filing individually are still available in the residual budget set as followers of a Stackelberg game. As a consequence, both spouses make exactly the same choices in both situations and have the same utilities.

When $y_I(w_f) < \bar{y}_I < y_I(w_m)$, the secondary earner either increases her utility or gains nothing when one moves from a compulsory joint taxation to the option to file individually, while the primary earner always reduces his utility. As a follower, the only thing that happens to the primary earner is that his exemption level increases, whereas for the secondary earner the effect is either not to change anything or to induce her to pay taxes, which is something she was not doing with individual filings. For this reason, the secondary earner benefits from the option to file individually. Figure 8 illustrates this case.

Finally, if $\bar{y}_I < y_I(w_f) < y_I(w_m)$, both spouses face a marginal tax rate of τ , both when they file individually and when they are Stackelberg followers. Since $y_J^L(w_{-i}) \geq y_I(w_{-i})$, $\bar{y}_J - y_J^L(w_{-i}) \leq \bar{y}_I$ and the follower reaches the exemption level at a lower y than he or she would reach with individual filing. Therefore, $y_J^F(w_i) = y_I(w_i)$ for $i = f, m$ since $y_I(w_i) > \bar{y}_I$. The only impact that moving to joint taxation has on spouses' utilities is through the value $\max\{\bar{y}_J - y_J^L(w_{-i}); 0\}$ that one gets as exemption. If $y_J^L(w_i) > \bar{y}_J = 2\bar{y}_I$ for $i = m, f$, then, followers get no exemption and both individuals gain exactly the same utility from moving from joint to individual taxation. If, however, $y_J^L(w_i) < \bar{y}_J$, the secondary earner necessarily gains more when moving from joint to individual taxation. \square

Proof of Proposition 4. We shall prove the proposition by offering an example of a couple for whom it is the primary earner who benefits from having the option to file individually. Let $y_{(\tau)}(w_i)$ denote the optimal choice for an individual i who faces a linear budget set with a marginal tax rate of τ , and assume that $y_{(0)}(w_m) > y_{(0)}(w_f) = \bar{y}_J$ and $y_{(\tau)}(w_m) = \bar{y}_I > y_{(\tau)}(w_f)$. This configuration of

Figure 8

Panel (a) illustrates both spouses' choices when they file individually. The leaders' incomes are displayed in Panel (b). The primary earner is taxed when the couple chooses to file individually, $y_I(w_m) > \bar{y}_I$. As a leader, he re-optimizes and his income is larger, $y_I^L(w_m) > y_I(w_f)$. For the secondary earner, there is no change. Panel (c) displays the residual budget sets for both spouses when leaders' choices are those in Panel (b). Finally, Panel (d) illustrates the main result – the utility difference for each spouse when the couple has the option to file individually from when they do not have it. The dotted indifference curves represent the utilities when the couple chooses to file individually.

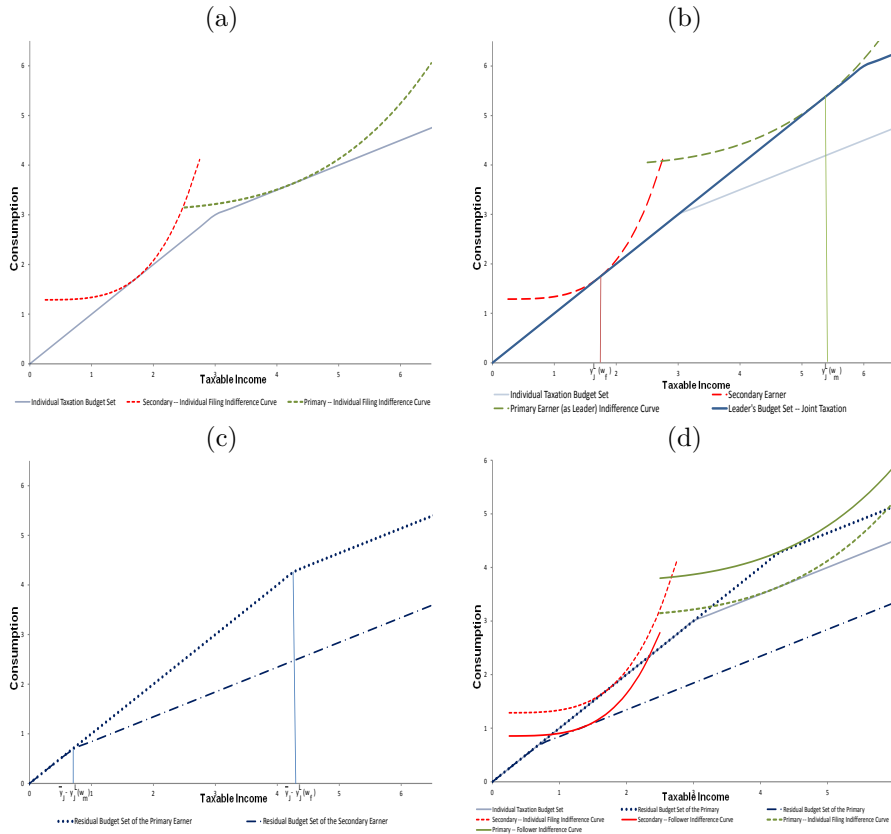
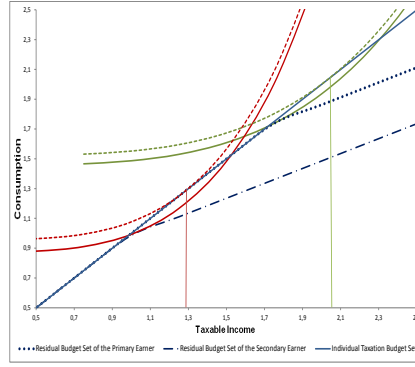


Figure 9

The utility change for each spouse can be measured by the vertical difference between the two indifference curves of each individual. Our intention is to compare the two vertical differences. It is key to our statement to observe that $y_I(w_i) - y_J^F(w_i) = y_I(w_{-i}) - y_J^F(w_{-i})$ and that $v' \left(\frac{y_m^*}{w_m} \right) \frac{1}{w_m} = v' \left(\frac{y_f^*}{w_f} \right) \frac{1}{w_f}$.



choices is possible provided that τ is sufficiently large.¹⁴ Under these assumptions, $y_L(w_i) = \bar{y}_J$, $y_F(w_i) = y_{(\tau)}(w_i)$ for $i = f, m$, whereas $y_{(\tau)}(w_m) = y_I(w_m) = \bar{y}_I$ and $y_{(\tau)}(w_f) < y_I(w_f) = \bar{y}_I$. For m , the utility difference is simply $\tau \bar{y}_I$. For f , there is the same loss, but there is also a utility gain from getting closer to her optimal choice ($y_{(\tau)}(w_f)$ is not in the budget set).

Hence, the primary earner is the one who benefits most from having the option to file individually. \square

Proof of Proposition 5. When $y_I(w_f) + y_I(w_m) \leq \bar{y}$, the move from individual filing to the joint one as followers does not change anything since the choices when filing individually are still available in the residual budget set, i.e., both spouses make the same choices and have the same utility.

When $y_I(w_i) \leq \bar{y}$ for $i = f, m$, but $y_I(w_f) + y_I(w_m) \in (\bar{y}, \bar{y} + B/\tau)$. As $y_I(w_i) > \bar{y} - y_J^L(w_{-i})$, the chosen bundles are no longer feasible for any spouses in the Stackelberg game. If both spouses choose at the kink as Stackelberg followers, then their consumptions are reduced by the exact same value and the decrease in utility for the secondary earner is greater than the decrease in utility for the primary earner when the couple does not have the option to file individually, i.e., if both spouses remain at the kink, $y_I(w_i) - y_J^F(w_i) = y_I(w_{-i}) - y_J^F(w_{-i})$,¹⁵ which, along with quasilinear preferences and single crossing, allows us to show that it is the secondary earner who benefits most from this option to choose the tax filing.

¹⁴ Assume that preferences are isoelastic, then $y_{\tau}(w) = (1 - \tau)^{\frac{1}{\gamma}} w^{\frac{1+\gamma}{\gamma}}$. If $y_0(w_m) = w_m^{\frac{1+\gamma}{\gamma}} > \bar{y}_J$, and $y_{\tau}(w_m) = (1 - \tau)^{\frac{1}{\gamma}} w_m^{\frac{1+\gamma}{\gamma}} = \bar{y}_I$, then $(1 - \tau)^{-\frac{1}{1+\gamma}} \bar{y}_I^{\frac{\gamma}{1+\gamma}} > (2\bar{y}_I)^{\frac{\gamma}{1+\gamma}}$. This imposes a restriction, $1 - \tau < 2^{-\gamma}$ on the marginal tax rate. This is the sense in which marginal tax rates must be sufficiently high.

¹⁵ Observe that individual i remains at the kink, $y_I(w_i) - y_J^F(w_i) = y_I(w_i) - [\bar{y} - y_J^L(w_{-i})] = y_I(w_i) + y_J^L(w_{-i}) - \bar{y} = y_I(w_i) + y_I(w_{-i}) - \bar{y} = y_I(w_{-i}) - [\bar{y} - y_J^L(w_i)] = y_I(w_{-i}) - y_J^F(w_{-i})$.

Figure 9 illustrates it. When the disutility of work is given by (5), quasilinearity implies

$$v' \left(\frac{y_I(w_i)}{w_m} \right) \frac{1}{w_m} = v' \left(\frac{y_I(w_f)}{w_f} \right) \frac{1}{w_f}.$$

Since $y_m > y_f$, we can conclude that

$$v'' \left(\frac{y_I(w_i)}{w_m} \right) \frac{1}{w_m^2} < v'' \left(\frac{y_I(w_f)}{w_f} \right) \frac{1}{w_f^2},$$

, which means that the secondary earner is the one who gains most from the option to file individually.¹⁶ In fact, the result is valid even if we allow individuals not to choose at the kink, even though, the drop in consumption is no longer identical for the two individuals.

When $y_I(w_f) < \bar{y} < y_I(w_m)$, when one replaces the individual schedule with the residual budget set, the primary earner's utility declines due to a decrease in consumption, $\Delta c = \tau y_I(w_f)$. As for the secondary earner, her utility changes due to both a fall in consumption and a fall in taxable income. Assume that the secondary earner does not re-optimize, i.e., she chooses $y_J^F(w_f) = y_I(w_f)$ in the residual budget set. Her utility decreases by total taxes paid, $\tau y_I(w_f)$, which is exactly the same decrease in utility that the primary earner experiences as a follower. Because the secondary earner re-optimizes, she is the one that experiences the smallest decrease in utility. It is, therefore, the primary earner who benefits most from having the option to file individually. Figure 10 illustrates this case.

Finally, when $y_I(w_i) > \bar{y}$ for $i = f, m$, both spouses make the same choices and gain the same utility. So, no one benefits more from the choice of tax filing. \square

¹⁶The proof for the general case is a bit complicated since it requires comparing the slopes of spouses *in different bundles*. A complete proof is available upon request.

Figure 10

Panel (a) displays the choices when spouses file individually. Choices are the same when he or she is the Stackelberg leader since the exemption levels are the same whether the couple files individually or jointly. Panel (b) illustrates the residual budget set associated with these leaders' choices. Panel (c) shows the spouses' utilities as followers, whereas Panel (d) displays the main result – the utility difference for each spouse when the couple has the option to file individually from when they do not have it. The dotted indifference curves represent the utilities when the couple chooses to file individually. It is apparent that it is the primary earner who benefits the most from the option to choose.

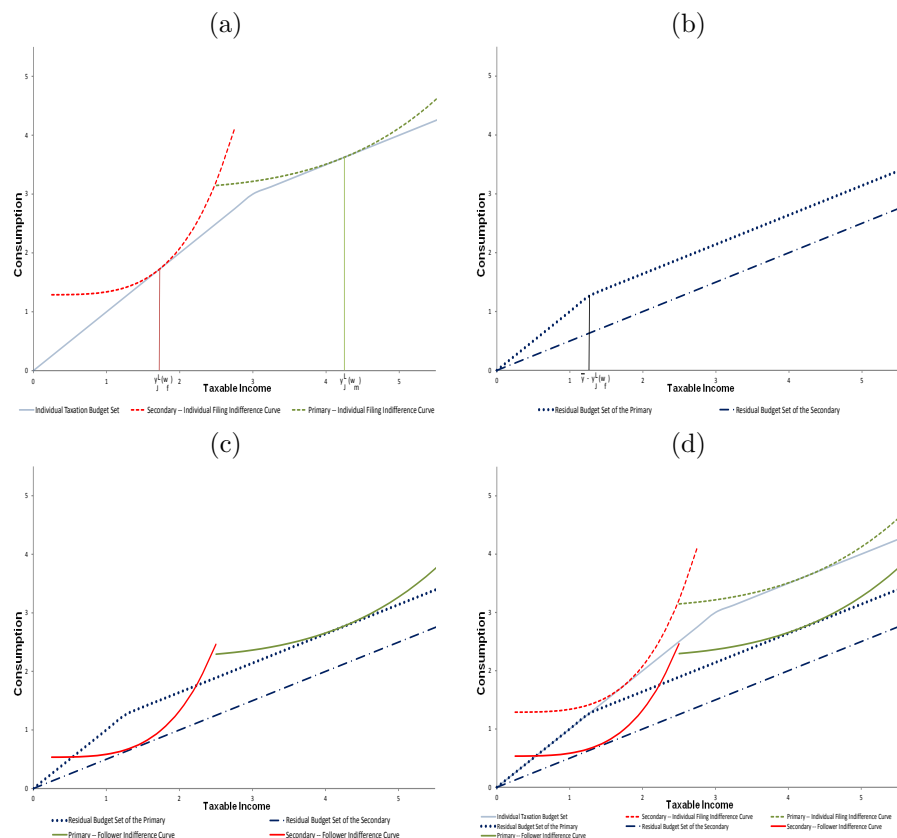


Table 1

The table displays the maximum and the minimum utility gain measured as percentage increase in consumption obtained by the secondary earner, for each elasticity of taxable income, $1/\gamma$, and each marginal tax rate, τ . We consider various degrees of heterogeneity for the couples, measured as percentage productivity differences between spouses.

	$1/\gamma = 1$						$1/\gamma = 0.25$						$1/\gamma = 0.10$					
	Primary			Secondary			Primary			Secondary			Primary			Secondary		
	Min gain	Max gain	Min gain	Max gain	Min gain	Max gain	Min gain	Max gain	Min gain	Max gain	Min gain	Max gain	Min gain	Max gain	Min gain	Max gain	Min gain	Max gain
$\tau = 0.175$	all couples	-5.02	0	0	90.13	-4.62	0	0	182.39	-4.59	0	0	209.72	-4.59	0	0	209.72	-4.59
	$w_m < 2w_f$	-4.98	0	0	15.74	-4.62	0	0	11.30	-4.59	0	0	10.14	-4.59	0	0	10.14	-4.59
	$w_m < 1.5w_f$	-4.68	0	0	8.73	-3.75	0	0	6.38	-3.35	0	0	5.39	-3.35	0	0	5.39	-3.35
	$w_m < 1.25w_f$	-3.47	0	0	5.32	-2.32	0	0	3.12	-2.06	0	0	2.67	-2.06	0	0	2.67	-2.06
$\tau = 0.25$	$w_m < 1.1w_f$	-1.79	0	0	2.17	-1.06	0	0	1.20	-0.95	0	0	1.06	-0.95	0	0	1.06	-0.95
	all couples	-7.43	0	0	143.18	-6.76	0	0	276.48	-6.71	0	0	314.64	-6.71	0	0	314.64	-6.71
	$w_m < 2w_f$	-7.43	0	0	24.44	-6.76	0	0	16.97	-6.71	0	0	15.15	-6.71	0	0	15.15	-6.71
	$w_m < 1.5w_f$	-7.00	0	0	13.44	-5.57	0	0	9.65	-4.95	0	0	8.08	-4.95	0	0	8.08	-4.95
$\tau = 0.325$	$w_m < 1.25w_f$	-5.26	0	0	8.00	-3.47	0	0	4.71	-3.05	0	0	4.01	-3.05	0	0	4.01	-3.05
	$w_m < 1.1w_f$	-2.82	0	0	3.46	-1.59	0	0	1.80	-1.41	0	0	1.59	-1.41	0	0	1.59	-1.41
	all couples	-9.65	0	0	206.04	-8.99	0	0	381.77	-8.91	0	0	430.24	-8.91	0	0	430.24	-8.91
	$w_m < 2w_f$	-9.65	0	0	34.36	-8.99	0	0	23.20	-8.91	0	0	20.61	-8.91	0	0	20.61	-8.91
$\tau = 0.325$	$w_m < 1.5w_f$	-9.38	0	0	18.60	-7.53	0	0	13.29	-6.64	0	0	11.04	-6.64	0	0	11.04	-6.64
	$w_m < 1.25w_f$	-7.38	0	0	11.49	-4.72	0	0	6.48	-4.13	0	0	5.48	-4.13	0	0	5.48	-4.13
	$w_m < 1.1w_f$	-4.03	0	0	5.00	-2.15	0	0	2.45	-1.92	0	0	2.17	-1.92	0	0	2.17	-1.92

Table 2

The table displays the maximum and the minimum utility gain measured as percentage increase in consumption obtained by the secondary earner, for each elasticity of taxable income, $1/\gamma$, and each marginal tax rate, τ , for the alternative tax system when $\bar{y}_I = \bar{y}_J$. We consider various degrees of heterogeneity for the couples, measured as percentage productivity differences between spouses.

	$1/\gamma = 1$						$1/\gamma = 0.25$						$1/\gamma = 0.10$					
	Primary			Secondary			Primary			Secondary			Primary			Secondary		
	Min gain	Max gain		Min gain	Max gain		Min gain	Max gain		Min gain	Max gain		Min gain	Max gain		Min gain	Max gain	
$\tau = 0.175$	-0.45	0.54	all couples	-0.76	1.13		-0.16	0.17		-0.18	0.64		-0.06	0.07		-0.07	0.30	
	-0.44	0.54	$w_m < 2w_f$	-0.76	0.86		-0.10	0.17		-0.18	0.18		-0.04	0.07		-0.07	0.07	
	-0.32	0.54	$w_m < 1.5w_f$	-0.76	0.49		-0.07	0.17		-0.18	0.10		-0.02	0.07		-0.07	0.04	
	-0.18	0.53	$w_m < 1.25w_f$	-0.63	0.22		-0.04	0.17		-0.18	0.05		-0.02	0.07		-0.07	0.02	
$\tau = 0.25$	0	0	$w_m < 1.1w_f$	0	0		-0.02	0.17		-0.18	0.02		-0.01	0.07		-0.07	0.01	
	-0.90	1.23	all couples	-1.69	1.78		-0.32	0.37		-0.40	1.29		-0.14	0.15		-0.16	0.63	
	-0.90	1.23	$w_m < 2w_f$	-1.69	1.78		-0.21	0.37		-0.40	0.40		-0.08	0.15		-0.16	0.14	
	-0.69	1.23	$w_m < 1.5w_f$	-1.69	1.07		-0.14	0.37		-0.40	0.21		-0.05	0.15		-0.16	0.08	
	-0.38	0.86	$w_m < 1.25w_f$	-1.03	0.47		-0.09	0.37		-0.40	0.11		-0.03	0.15		-0.16	0.04	
$\tau = 0.325$	0	0	$w_m < 1.1w_f$	0	0		-0.04	0.36		-0.38	0.04		-0.01	0.15		-0.16	0.02	
	-1.43	2.23	all couples	-3.10	2.87		-0.55	0.67		-0.73	2.10		-0.23	0.27		-0.29	1.04	
	-1.43	2.23	$w_m < 2w_f$	-3.10	2.87		-0.37	0.67		-0.73	0.71		-0.14	0.27		-0.29	0.25	
	-1.19	2.23	$w_m < 1.5w_f$	-3.10	1.87		-0.26	0.67		-0.73	0.38		-0.09	0.27		-0.29	0.14	
	-0.68	1.21	$w_m < 1.25w_f$	-1.46	0.85		-0.15	0.67		-0.73	0.19		-0.06	0.27		-0.29	0.07	
	0	0	$w_m < 1.1w_f$	0	0		-0.07	0.56		-0.60	0.07		-0.03	0.27		-0.29	0.03	