Gender Based Taxation and the Division of Family Chores *

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February, 2009

Abstract

Gender Based Taxation (GBT) satisfies Ramsey's optimal criterion by taxing less the more elastic labor supply of women. This holds when different elasticities between men and women are taken as exogenous and primitive. We study GBT in a model in which, instead, elasticity differences emerge endogenously from the bargained allocation of family duties. We explore two polar cases, which summarize the channels through which GBT affects an economy encompassing a wider set of possible reasons for gender differences. In the first case, the allocation of family chores is uneven between spouses because men have a superior bargaining power. In the second, instead, women take up more chores because they have a comparative advantage in household activities. We show how GBT emerges as an optimal policy tool as result of the interaction between incentives within the family and the Ramsey criterion, which is internalized by the government but not by household members.

JEL-Code: D13, H21, J16, J20.
Keywords: Optimal Taxation, Economics of Gender, Family Economics, Elasticity of Labor Supply.

*We thank George Akerlof, George-Marios Angeletos, Claudia Goldin, Larry Katz, James Poterba, Emmanuel Saez, Ivan Werning, seminar participants at the Universities of Berkeley, Bologna, Jerusalem, Harvard, Milan, MIT, Munich, Torino (Istituto Carlo Alberto), Tsinghua, the CEPR-ESSLE, and the NBER summer institute, and our discussant Stefania Albanesi at the 2009 ASSA Session on Income Redistribution, for helpful comments and suggestions.

1 Introduction

According to optimal taxation theory a benevolent government should tax less the goods and services which have a more elastic supply. Women labor supply is more elastic than men's. Therefore, tax rates on labor income should be lower for women than for men.

This argument is well known in the academic literature, but it is not taken seriously as a policy proposal. On the contrary, as Table 1 shows, most OECD countries effectively impose higher marginal tax rates on married women's decision to participate in the labor market, relative to the tax rate on singles.[1] It is surprising that while the simple proposal of taxing women less than men has never been "on the table", a host of other gender based policies are routinely discussed, and often implemented, such as gender based affirmative action, quotas, different retirement policies for men and women, and also indirect gender based policies like child care subsidies, and maternal leaves.[2] This is puzzling in light of the basic economic principle that policies interfering with "prices" (such as the tax rate) are considered superior to those interfering with "quantities" (such as affirmative action or quotas) in the market.[3]

The optimality of Gender Based Taxation (GBT) hinges on different elasticities of the labor supply between men and women. If the labor supply elasticity is taken as a primitive, exogenous parameter that differentiates genders, then the argument is

[1]Joint taxation usually results in higher tax rates for women as second earners' income is pooled with the income of the first earner. With separate taxation, the participation decision of second earners is effectively taxed at a higher rate, relative to that of singles, in systems where the dependent spouse allowance is lost when both family members work or due to other similar family-based tax measures. In addition, in countries where retired couples receive pensions that increase with the benefit of the highest earner, the effective payroll tax on first earners is lower than that on second earners (see Feldstein and Liebman, 2002). For instance, in the US a retired couple receives 150% of the pension of the highest earner, which implies that married men close to retirement face a close to zero (or even negative) social security marginal tax rate.

[2]For instance, gender based affirmative action is common in the US while Spain and Norway have recently introduced stringent quota systems in favor of females and public support for child care is common in many European countries. Sweden has recently reformed paternal leave policies with the goal of inducing males to stay more at home with children and females to participate more continuously in the labor market.

[3]In international trade, for instance, a sort of "folk theorem" states that tariffs are weakly superior to import quotas as a trade policy. Taxing polluting activities is generally considered superior to controlling them with quantitative restrictions.

straightforward. GBT provides substantial welfare, income and employment gains because it minimizes the aggregate social loss from labor market distortions. As we discuss below these results are robust to perturbations in the modeling framework (Ramsey or Mirrlees), and to extensions of the model that consider cross elasticities, heterogenous households and household production. However, differences in labor supply functions of men and women, including their elasticities most likely do not only depend on innate characteristics or preferences but may emerge endogenously from the internal organization of the family. In fact, as documented for instance by Goldin (2006), Blau and Kahn (2007) and Albanesi and Olivetti (2007), both women participation rate and the elasticity of their labor supply, evolves over time as a result of technologically induced or culturally induced changes in the organization of the family.[4]

Therefore, we explore the implications of GBT in a model where elasticities of labor supply arise endogenously. As for the organization of the family we posit an efficient bargaining game between spouses regarding the allocation of family duties (chores). We consider two polar (but non mutually exclusive) cases. One in which the bargaining power between spouses is unbalanced, namely when for cultural or historical reasons men can impose more duties on women. Second, we allow instead for the possibility that women assume more household chores because they have a comparative advantage in them. In both cases, men who assume fewer unpleasant, tiring home duties, participate more in the market, exercise more effort, and earn more than their female spouses. The avoidance of home duties allows men to engage in careers that offer "upside potential" in terms of wages and promotions. For women, it is the opposite: more so than men, they work for their wage. As a result, men are less sensitive to changes in the wage since what matters for them, relative to women, is also the intrinsic expected pleasure they derive from careers and market activity. This mechanism links household chores to labor supply and makes labor supply elasticities endogenous to the organization of the family. We note that the implied positive correlation between the amount of

[4]Alesina and Giuliano (2007) study the effect of different cultural traits on family values and ties as a determinant of women participation in the labor force. Ichino and Moretti (2009) show instead how more persistent biological gender differences may affect the absenteeism of men and women and, indirectly, labor market equilibria.

home duties and the elasticity of labor supply in our model accords well with recent empirical evidence. Aguiar and Hurst (2007) and Blau and Kahn (2007) document a decline both in the ratio of female over male home duty and in the ratio of female over male elasticity of labor supply in the last 50 years. Still, however, these ratios remain well above one.

The critical argument is as follows. The family bargaining, even if fully efficient, does not internalize the Ramsey principle of taxation, which is instead faced by the government. Imagine that, for whatever reason, in equilibrium the family bargaining produces an allocation of work at home and in the market such that labor supply elasticities of men and women are different, namely higher for men. Then a benevolent government faces a "Ramsey" incentive to tax women and men differently in order to minimize the distortionary costs of taxation. This in turn changes the equilibrium within the family which may react to the differentiated tax rates by changing the allocation of home duties and market opportunities between genders. We examine two polar cases. In one the bargaining between women and men is unbalanced. Men have more bargaining power and therefore allocate more unpleasant household duties to the wives. In this case GBT not only satisfies the Ramsey principle of optimality but also reduces the uneven distribution of household chores, since it increases the relative benefits of working in the market for women. A more balanced participation of the two spouses in the market increases total family income, expands the tax base and reduces distortions per unit of government spending. If society perceives the uneven allocation as "unfair" and weights people equally, GBT is even more desirable because it promotes gender equity.

The other polar case is one in which women stay at home more and have a higher labor elasticity because they have a comparative advantage (or derive more pleasure) from household duties. But the social planner, as opposed to the family, takes into account the Ramsey principle of optimal taxation and a more even allocation of household chores improves government finances. Interestingly, the larger the comparative advantage of women in household chores, the more different are the (endogenous) elasticities of labor supply between men and women and the larger the Ramsey gains of

GBT non internalized by the family. Therefore, it is *not* true that the larger the comparative advantage of women at home the less beneficial is GBT, despite the increasing distortions introduced in the production of the household good.[5] As we show these two polar cases encompass a host of others cases (for instance, labor market discrimination against women) which, from the point of view of GBT, are isomorphic to one of the two cases above and thus lead to similar conclusions.

We can also interpret our result in terms of a difference between short versus long run effects of GBT. The case in which labor supply functions and their different elasticities across gender are exogenous can be interpreted as the short run, namely an horizon in which the family organization and the allocation of home duties is not likely to change. In the long run, instead, the family responds to government policies and evolves to a new equilibrium with a different organization and allocation of home duties.

Our approach differs from the literature in modeling household production. The traditional approach builds on the Beckerian theory of the allocation of time (Becker, 1965), and assumes that household duty is an input to the family production function for the production of a household good. In our model with endogenous gender differences in elasticities we start by a woman and a man who form a family and receive a collection of shocks that *must* be allocated between the two spouses. With this assumption we intend to capture the fact that there are features of the daily household routine, for example a sick child or a broken dishwasher, that are easy to conceptualize as exogenous but negotiable jobs to be done but not as the output of an intra-household process that transforms time input into a household good. In other words, in our model home duty is intrinsically different from just having a second job, and one cannot "quit a child". Obviously the two approaches are not mutually exclusive and therefore, we also discuss a more general model of household allocation of time and shocks that captures both aspects of family life.

We further illustrate the link between our model and the literature in Section 2.

[5]In any case, women comparative advantages seem less relevant in modern times. It is certainly a fact that women take more home duties upon themselves than men, as pointed out by several studies on use of time as in Aguiar and Hurst (2007) and Burda, Hamermesh and Weil (2007). Whether this is because women have a comparative advantage in home duties in modern times is however questionable, as shown in Albanesi and Olivetti (2007).

Section 3 discusses GBT in the short run, setting up the stage for the remaining sections. In Section 4 we endogenize the allocation of household chores and in Section 5 we show how family bargaining implies an intra-household division of duties, market participation and elasticities. In what we call the long run the government sets taxes anticipating the family's reaction to fiscal pressure. This is analyzed in Section 6. Section 7 concludes.

2 Related Literature

The present paper lies at the intersection of three strands of research. The first is concerned with the structure of the family.[6] The traditional "unitary" approach, in the spirit of Samuelson (1956) and Becker (1974), treats the household as a single decision making unit. Although this approach is closely linked with the traditional consumer's theory, it is at odds with the notion of individualism, and, most importantly for our purposes, lacks the proper foundations to conduct *intrahousehold* welfare analysis.[7] The "collective approach" to family modeling, initiated by Chiappori (1988, 1992) and Apps and Rees (1988), builds instead on the premise that every person has well defined individual preferences and only postulates that collective decisions lie on the Pareto frontier. A more specific approach, first taken by Manser and Brown (1980) and McElroy and Horney (1981), "selects" a specific point on the Pareto frontier by assuming that members of the family Nash-bargain over the allocation of commodities. Our (long run) model with endogenous elasticities is in the spirit of the collective approach with Nash-bargained household allocations. As we illustrate later, the difference with the above models is that the bargaining is on the allocation of home duties, which then maps into a certain allocation of goods and labor supplies across genders. In other words, in our model the internal organization of the family is the deeper determinant of labor supplies, elasticities and consumption of private and household goods.

[6] See Lundberg and Pollak (1996) and Vermeulen (2002) for excellent surveys.

[7] Two notable empirical failures of the unitary model are the restrictions that arise from the income pooling hypothesis and the symmetry of the Slutsky matrix. See, for example, Thomas (1990), Browning, Bourguignon, Chiappori and Lechene (1994), Lundberg, Pollak and Wales (1997), and Browning and Chiappori (1998).

The second relevant strand of literature refers to the taxation of couples. The "conventional wisdom" says that under specific assumptions, we should tax at a lower rate goods that are supplied inelastically as suggested by Ramsey (1927). The application of the Ramsey "inverse elasticity" rule in a model of labor supply implies that males should be taxed on a higher tax schedule than females because they have a less elastic labor supply function. This point was made by Rosen (1977) and formalized by Boskin and Sheshinski (1983).[8] Since gender is inelastically supplied, this proposition relates also to the insight that taxes should be conditioned on non-modifiable characteristics as in Akerlof (1978) and Kremer (2003).[9]

This conventional wisdom regarding lower taxes for women can be challenged or reinforced in at least three ways. First, it might be the case that the female's tax rate is a better policy instrument when considering *across* household redistribution. Boskin and Sheshinski (1983) show that this is not the case in their numerical calculations. Recently, Apps and Rees (2007) place the conventional wisdom on a firmer basis and give intuitive and empirically plausible conditions under which it is optimal to tax males at a higher rate even with heterogeneous households. Second, Piggott and Whalley (1996) raise the issue of intrahousehold distortion of efficiency in models with household production. Since the optimal tax schedule must maintain productive efficiency (Diamond and Mirrlees 1971a), imposing differential tax treatment distorts the intrahousehold allocation of resources and raises a further cost for the society. Although the Piggott and Whalley argument is intuitive, Apps and Rees (1999b) and Gottfried and Richter (1999) show that the cost of distorting the intra-household allocation of resources cannot offset the gains from taxing on an individual basis according to the standard Ramsey principle. We are interested in exploring the optimality of individual taxes in a model where *within* household redistribution is explicitly taken into

[8]The argument was raised using variants of the Diamond and Mirrlees (1971a and 1971b) and Atkinson and Stiglitz (1972) frameworks, also adopted in this paper. The elasticity of labor supply is also a key parameter in the Mirrlees (1971) framework. For an ambitious paper that takes the latter approach see Kleven, Kreiner and Saez (2006). We discuss below how GBT would look in a Mirrleesian framework.

[9]Weinzierl (2008) analyzes the benefits of age based taxation which is related but not equivalent to other tags such as gender or height. Mankiw and Weinzierl (2007) apply the idea of tagging to height and discuss the validity of the welfarist approach to optimal taxation.

account. In that respect our (long run) model is in line and reinforces the conventional wisdom.[10]

The third strand of literature attempts to explain gender differences in labor markets. For example, Albanesi and Olivetti (2009) propose that gender differences can be supported by firms' expectations that the economy is on a gendered equilibrium in a model with incentive constraints. More traditional theories assume that females have a comparative advantage in home production and males in market production, but Albanesi and Olivetti (2007) show that improved medical capital and the introduction of the infant formula has reduced the importance of this factor. In Becker (1985) gender differences in earnings arise from the fact that females undertake tiring activities that reduce work effort. So, workers with the same level of human capital, earn wages that are inversely related to their housework commitment. The substitutability between home duties and market earnings also arises in our model, although we consider the effect of an investment in costly effort as well.

Regarding the elasticity of labor supply, Goldin (2006) documents that the fast rise of female's labor supply elasticity in the 1930-1970 period was the result of a declining income effect and a rising, due to part time employment, substitution effect. During the last thirty years, she argues, females started viewing employment as a long term career rather than as a job, and this caused a decline in the substitution effect and the labor supply elasticity. This interpretation is consistent with how we model, in our long run setting, the elasticity effect of a commitment to stay in the labor market in order to take advantage of the opportunities offered by it. Blau and Khan (2007) also document and quantify the reduction in the labor elasticity of married women in the US, which however remains well above that of men, at a ratio of about 4 to 1. Even in Sweden, where gender differences in labor market outcomes are arguably less dramatic than elsewhere, Gelber (2007) estimates that the elasticity of women is twice that of men.[11]

[10]Brett (1998) is an important earlier paper discussing intrahousehold redistribution. See also Apps and Rees (1999a, 2007) for models with household production. Gugl (2004) analyzes in detail positive aspects of the joint vs. separate taxation of couples.

[11]Gelber's (2007) results are also important because they analyze the responses to the very large Swedish Tax Reform of 1991 and therefore represent a rare example of causal identification and

3 Exogenous Elasticities

3.1 Setup of the Model

A family consists of a male and a female who participate in market and home activities. A costly investment in training makes a person more productive for the market. While we call it "training" we do not have an intertemporal model of investment in human capital so the word training could be used interchangeably with the word "effort". For the moment we let all household activities in the background and treat them as exogenous. The index $j = m, f$ identifies the gender. The utility function of gender j is given by:

$$U_j = C_j - \frac{1}{a_j} L_j^{a_j} - \frac{1}{2}\tau_j^2 \tag{1}$$

where C_j is consumption of a private good, $\frac{1}{a_j} L_j^{a_j}$ represents the disutility of supplying L_j units of labor, and $\frac{1}{2}\tau_j^2$ is the utility cost of training. We set $a_j > 2$, which guarantees a well behaved problem. Each person is endowed with one unit of time for work, so $L_j \leq 1$. The quasi-linearity with respect to consumption allows us to obtain conclusions without resorting to numerical simulations. In Section 6.2 we discuss how the specific utility functional form affects our conclusions.

The timing is as follows. First, the government sets labor income taxes. Then, the male and the female take as given the tax rates and decide individually the amount of consumption, labor supply and training (effort) to maximize their utilities. We start with a perfectly competitive labor market, constant returns to scale, and wages that equal marginal productivity:

$$W_j = \tau_j \tag{2}$$

Note that (2) implicitly assumes perfect substitutability between male and female employment. Spouse j maximizes utility in (1) subject to the budget constraint:

$$C_j = (1 - t_j) W_j L_j \tag{3}$$

and the fact that training increases wages, equation (2). The solution to the above

estimation of labor supply elasticities of household members.

maximization problem yields the labor supply and the training decision functions:

$$\begin{aligned} L_j &= (1-t_j)^{\frac{2}{a_j-2}} = (1-t_j)^{\frac{2\sigma_j}{1-\sigma_j}} \\ \tau_j &= (1-t_j)^{\frac{a_j}{a_j-2}} = (1-t_j)^{\frac{1+\sigma_j}{1-\sigma_j}} \end{aligned} \tag{4}$$

where:

$$\sigma_j = \frac{\partial L_j}{\partial W_j}\frac{W_j}{L_j} = \frac{1}{a_j - 1} \tag{5}$$

is the own elasticity of labor supply with respect to an exogenous variation in the wage rate. For this Section, cross elasticities are zero, but in Section 5.4 we show how non zero cross elasticities arise endogenously from the allocation of home duties.

Suppose now that for exogenous reasons we have $a_m > a_f$. For the moment we take this difference in preferences as primitive and do not explain it as it may come from innate gender characteristics or more likely historically induced gender roles which are especially strong in certain cultures (Alesina and Giuliano, 2007). Under $a_m > a_f$, but with a single tax rate, the prediction of the model is that males:

- work more in the market: $L_m > L_f$;
- have a lower elasticity of labor supply: $\sigma_m < \sigma_f$;
- invest more in training (i.e. what is needed to do well in the market): $\tau_m > \tau_f$;
- receive a higher wage: $W_m > W_f$.

These predictions are in line with what we observe in real life labor markets. In Figures 1 and 2 we depict the labor market equilibrium. Assuming that $a_m > a_f$, Figure 1 describes a situation in which males supply more labor than females. This happens for two reasons. First, given an exogenous wage rate, males participate more in the market. Second, they also invest more in training. In turn, investment in training endogenously shifts the labor demand curve up and increases the wage rate W. As a result the gender differential in labor market participation and earnings expands. In Figure 2 we describe an exogenous shift in the tax rate t_j for spouse j. Taxation distorts both the labor-consumption margin and the decision to invest in training, so that both the labor supply and the labor demand curve shift. The final equilibrium is characterized by lower participation in the labor market and lower pre-tax wage rate.

3.2 Gender Based Taxation

The planner sets taxes for the male and the female in order to raise revenues and finance a public good G. The public good does not provide utility to anyone and the proceedings are not rebated back.[12] In doing so, the planner anticipates the private market equilibrium. Let $U_m(t_m; a_m)$ and $U_f(t_f; a_f)$ denote the indirect utility function for the male and the female respectively. In this Section we assume that the planner weights people uniformly, but we revisit this issue in Section 6 where it matters more. Then, the planner solves:

$$\max_{t_m, t_f} \Omega = U_m(t_m; a_m) + U_f(t_f; a_f) \tag{6}$$

subject to the government budget constraint:

$$t_m W_m(t_m; a_m) L_m(t_m; a_m) + t_f W_f(t_f; a_f) L_f(t_f; a_f) \geq G \tag{7}$$

Proposition 1 ***GBT with Exogenous Elasticities:*** *The optimal gender-based tax system satisfies:*

$$\frac{t_m/(1-t_m)}{t_f/(1-t_f)} = \frac{(1+3\sigma_f)/(1-\sigma_f)}{(1+3\sigma_m)/(1-\sigma_m)} \tag{8}$$

Therefore, if $a_m \geq a_f$ *then* $\sigma_m \leq \sigma_f$, *and* $t_m \geq t_f$.

The proof of Proposition 1 follows from rearranging the necessary first order conditions for maximum in problem (6)-(7).[13] This result is an application of the Ramsey (1927) rule. At the optimum, the planner equalizes the marginal utility per unit of revenue across genders. Since tax revenues are easier to extract from the less elastic factor, it is welfare enhancing to tax more the less responsive type of labor supply.

In Table 2 we present the welfare gains when moving from a single tax to differentiated taxes by gender. In addition to satisfying Ramsey's principle of optimal taxation, Gender Based Taxation generates more equality in labor market outcomes and closes

[12] See Lundberg, Pollak and Wales (1997) for an natural experiment with intrahousehold lump sum transfers.

[13] Equations (6) and (7) is not a concave program, but one can show that the first order condition describes a maximum because the objective function is less convex than the budget constraint at the optimal point. See Diamond and Mirrlees (1971b) and Myles (1995, pp 113-114) for this standard issue in second best problems.

the gender gap in labor supply, training and wages. This shows that GBT can potentially substitute if not for all, then certainly for most of other gender based policies, such as gender based affirmative action, quotas, wage subsidies, child care subsidies, and maternal leaves, that are geared towards improving gender equity, and at a lower cost since the improvement in government finances is exclusive to our proposal. As Table 2 shows, for conservative values of the elasticity ratio such as $\sigma_m/\sigma_f = 2/3$, GBT raises GDP by more than 1%.[14] Naturally, the benefits from GBT increase when the elasticity ratio decreases, and the fiscal pressure G rises.

3.3 Discussion

We choose the Ramsey framework with linear taxes in a representative family model because our argument concerns mostly efficiency and not redistribution across genders or households, and the framework with linear taxes shows transparently our results. As we discussed in the previous paragraph and in more detail in Section 6.1, GBT also creates redistributive "side effects" as it closes the gender gap in labor market participation and income. These effects would further improve social welfare if society is interested in expanding women's labor market opportunities.

In the light of our results, it seems natural to wonder how GBT would look in a world with heterogeneous families and gender specific linear taxes. As we discussed in Section 2, the conclusion of the literature is that GBT does not oppose the progressivity of the tax system, and under plausible conditions (namely, positive assortative matching in wages) higher taxes for men can also be efficient in redistributing across households. Since the novel element of our analysis is the issue of intrahousehold allocation of chores in response to taxation, we leave this interesting extension for future research.

How, instead, would our results change in a Mirrleesian framework with arbitrary non linear taxes, if the planner could condition tax schedules on gender? First, all else equal, the optimal tax formula would support a uniformly lower marginal tax rate for women because of the inverse elasticity rule (see e.g. Diamond, 1998). In addition,

[14]For cross-country evidence on the gender differential on labor supply elasticities see Alesina, Glaeser and Sacerdote (2005), Blau and Kahn (2007), Blundell and MacCurdy (1999).

there is one more factor in favor of GBT: since the female distribution of income has more mass concentrated towards the low income levels, its hazard rate is typically higher and therefore marginal tax rates for females should be lower.[15] We also note that other policies, e.g. gender specific commodity taxation, could redistribute across genders. However, their efficiency properties are largely unknown since they require information on gender estimates of elasticities of demand. On the other hand, GBT of labor income only requires that women's labor supply is more elastic, which is a well established empirical regularity.

3.4 Extension: Imperfect Substitutability

Thus far we have assumed a flat labor demand by gender. Although in modern workplaces such as the service sector, male and female employment of equal ability should be very close to perfect substitutes, a less than perfect substitutability between the two factors of production will introduce a downwards sloping labor demand. For instance, assume that the production function is CES:

$$Y = \left(\tau_m L_m^{\rho} + \tau_f L_f^{\rho}\right)^{\frac{1}{\rho}} \tag{9}$$

where $\epsilon = \frac{1}{1-\rho} > 0$ denotes the elasticity of substitution between male and female employment. GBT has then two opposing effects on women's pre-tax wages. Holding constant female's productivity τ_f, an upward sloping labor supply and a downward sloping labor demand function, imply a fall in pre-tax wages when t_f falls. But lower taxes for females will also increase female's productivity and endogenously shift the labor demand to the right, thus making the overall change in pre-tax wages theoretically ambiguous. In Table 2 we present some numerical calculations. Under our specific functional form assumptions, the second effect dominates and women's wage rises with GBT. The lower is the elasticity of substitution, the stronger are the effects of a shifting labor demand, and the higher are the welfare effects of GBT.

[15] Kremer (2003) exploits this feature of the Mirrleesian model to argue in favor of age based taxation, with young workers taxed less. Cremer, Gahvari and Lozachmeur (2008) develop analytical results for income tagging with two groups that differ in their ability distribution.

4 The Organization of the Family

Thus far we have assumed that different labor market behavior of men and women derive from exogenous differences in preferences and attitudes. That is, we have taken the key parameters a_m and a_f as our primitives. In what follows we propose a formalization of the household allocation of home duties which derives these parameters endogenously.

A family has to undertake $2A$ family duties, or chores. Each duty is performed by one spouse. When a spouse performs one home duty she/he gets nothing while the other spouse gets a *positive* shock in the labor market. We can interpret the latter as an increase in the probability of a promotion, a benefit from enjoying work more, being less stressed at work etc. The argument is similar to that of Becker (1985) who posits that the spouse who does more homework has fewer "energy units" to allocate into the market.

Therefore, there are $2A$ corresponding labor market shocks that hit the family. The shocks are assumed to be *i.i.d.* and denoted as x_i. Each random variable x_i is distributed as a chi-squared with one degree of freedom, i.e. $x_i \sim \chi^2_1$. Let $2a_m$ be the number of x_i shocks that the male absorbs; each shock corresponds to one unit "off-duty" that he gets. $2a_f = 2(A - a_m)$ is the amount of home duties that the *male* gets, and therefore it is also the number of labor market shocks that the female absorbs. By the properties of the χ^2 distribution we can define an "aggregate shock" for the male as $\omega_m = \sum_{i=1}^{2a_m} x_i$, with support in $[0, \infty)$ and expected value $E(\omega_m) = 2a_m$. Similarly for the female we have that $\omega_f = \sum_{i=2a_m+1}^{2A} x_i$, with support in $[0, \infty)$ and $E(\omega_f) = 2a_f$. Ex post utility for spouse $j = m, f$ is defined over bundles of consumption, labor and training and given by:

$$V_j = C_j - \frac{1}{a_j} e^{v(L_j)\omega_j} - \frac{1}{2}\tau_j^2 \tag{10}$$

where C is consumption, L is labor supply in the market, and τ is amount of training. The subutility of labor is given by $v(L_j) = \frac{1}{2}\left(1 - \frac{1}{L_j}\right) < 0$, with $v' > 0$, $v'' < 0$ and $L_j < 1$. This specific "χ^2 shocks - exponential utility" environment is adopted to obtain the more familiar power representation of the (ex ante) utility function that we

used in Section 3.

To fix ideas about the nature of the shocks, consider the situation where the male and the female decide how to allocate home duties over a period of two weeks. Specifically, for each weekday, one of the two spouses *must* be in "charge of the kids" (i.e. take them to school, make sure that they have their time after school organized etc.).[16] This hypothetical situation can be mapped in our notation as follows. $2A = 10$ is the total number of days in which one parent has to take the kids to school while the other is exempted from these home duties. $2a_m$ is the number of days that the male is *not* in charge of the kids and therefore $2a_f$ is the total number of days where the male is in charge of the kids. For each of the $i = 1, ..., 2a_m$ days where the father is not in charge of the kids and works in the market, there is a positive shock x_i that affects his utility of working in the market. To put it differently (and with a slight abuse of language), in the days in which a spouse is *not* in charge of kids, she/he has more energy and can make "things happen" at work and get a positive utility reward. There are also days in which the spouse is in charge of the children and work provides only the basic wage with maximum disutility and no upside options.[17]

The ex post utility of working in the market for spouse j is given by the term $-\frac{1}{a_j}e^{v(L_j)\omega_j} < 0$. Given a realization of ω_j, a higher amount of labor supply decreases utility. For given amount of labor supply, a favorable realization of ω_j increases the utility of working in the market (or decreases the disutility of working). Since the shock ω_j has not been realized when spouses decide how much to consume, supply labor and invest in costly training, we need to work with the ex ante utility function. Using the moment generating function of a chi-squared random variable with $2a_j$ degrees of freedom we obtain: [18]

$$U_j = E_{\omega_j} V_j = C_j - \frac{1}{a_j} L_j^{a_j} - \frac{1}{2}\tau_j^2 \tag{11}$$

[16] In this sense one cannot "quit a child" and home duty in our model is intrinsically different from having a second job.

[17] The abuse of language is that we do not model energy explicitly. Instead, taking fewer home duties directly implies the possibility or receiving a higher labor market shock.

[18] We have that for a random variable $\omega_j \sim \chi^2_{2a_j}$ the moment generating function evaluated at some $q < 1/2$ is given by $M_\omega(q) = E_\omega(e^{q\omega_j}) = \left(\frac{1}{1-2q}\right)^{a_j}$.

The ex post representation of preferences in (10) allows us to work with the familiar power expression for labor supply in (11), which is the utility function used in Section 3. The mathematical details of our argument in the next Sections do not depend on this specific derivation (since we start from U directly), but with this formulation we intend to provide a rationale for the key parameter a_j, in line with real life gender differences in household and labor markets. While in the previous Section gender differences were "innately" built in preferences (so that a_m and a_f were "genetically" or "culturally" fixed in a permanent way), in Section 5 we develop a bargaining game which delivers the equilibrium division of chores between the two spouses and ultimately determines endogenously their market participation and elasticity.

The marginal utility of working is given by:

$$U_{L_j} = -L_j^{a_j - 1} \qquad \text{with } a_j > 2 \text{ and } L_j < 1 \tag{12}$$

so that fewer home duties (higher a_j) increase the marginal utility of working for spouse j. Because the latter expects a higher realization of the labor market shock ω_j, he or she works more, invests more in training and earns a higher wage rate. This means that home duties and participation in the market are Beckerian (1985) *substitutes*. Meanwhile, assuming fewer home duties implies a higher elasticity of the marginal utility of working with respect to labor supply:

$$\varepsilon_{U_{L_j}, L_j} = \frac{U_{LL} L}{U_L} = (a_j - 1) = \frac{1}{\sigma_j} \tag{13}$$

Since the lower the amount of home duties the more sensitive is the marginal utility of working to movements in the supply of labor, a given change in the wage rate W_j meets with a smaller movement in labor supply L_j in order to restore the first order condition for labor supply. This implies that spouse j has a less elastic labor supply.

Thus, the gender gap in labor supply participation and elasticities can be traced back to differences in access to labor market opportunities which is determined by the bargained allocation of home duties. If, for reasons that we analyze in Section 5, men assume fewer unpleasant, tiring home duties, then they participate more in the market, exert more effort, and earn more than their female spouses. This expectation of

favorable labor market opportunities (higher realization of ω_m) is an expected intrinsic benefit from working. It allows men to engage in careers that offer "upside potential" in terms of wages and promotions. So men prefer to commit to a larger amount of labor, which is also more stable because it is calibrated not only on the wage but also on the intrinsic expected benefit of working. When the wage changes, this commitment makes them less willing to adjust their labor supply. For women, it is the opposite. Because they basically work only for their compensation, changes in the wage stimulate large responses in their labor supply.

5 Household Bargaining

In this section we discuss the allocation of household duties in an efficient bargaining game between spouses. We set up the game first and then we consider two polar cases. One in which men and women are ex ante identical but men have a stronger bargaining power for historical or cultural reasons, so that women end up with more chores. The other case is one in which women have a comparative advantage in household chores. These two cases summarize the main channels through which GBT affects an economy encompassing a wider set of possible reasons for gender differences.

5.1 The Bargaining Game

The timing is as follows. First the government sets the tax rate(s). If a male and a female marry, then they bargain over the allocation of home duties, $A = a_m + a_f$.[19] A married couple also shares the consumption of a household good, K, which for instance, can represent the companionship of marriage. Instead, singles derive utility exclusively from the consumption of the private good. Next, labor supply decisions are taken, wages paid, shocks realized and private and family consumption take place. The government cannot change the tax rates after family bargaining decisions are made or

[19] In our derivation in Section 4, $2a_m$, necessarily takes integer values. Since, only the interpretation of a_m—and not the mathematical details of our argument—depends on the specific nature of this derivation, in our comparative statics we treat a_m as a continuous variable, while still referring to it as the amount of home duties. For notational convenience we work with $A = a_m + a_f$ instead of $\tilde{A} = 2A = 2a_m + 2a_f$.

after the realization of labor market shocks.

The bargained allocation of home duties then maps into allocations of consumption and labor supplies goods through the mechanisms analyzed in Section 3 where a_j enters as a parameter.[20] Note that spouses are forward looking, so their utility in the bargaining stage derives from the anticipated allocation of commodities; therefore, the bargaining process covers the entire bundle of family goods. Because in our model the bargained allocation of home duties a_j is the deeper determinant of the allocation of commodities and labor supplies, if $a_m > a_f$, then we match the empirical evidence where men work less at home but more in the market and have a lower elasticity of the labor supply than their spouses.

$U_j(a_m; t_j)$ is the utility of spouse j as a function of home duties, a_m, when married. This is the indirect utility function at stage 3 of the game, given by the maximized value of (1) subject to the budget constraint (3) and the labor demand function (2). Therefore, the indirect utility includes the utility from the private consumption of goods and the disutility from working more in the market. To this term we add the term associated with the consumption of the household good K, which enters separably into the utility function. U_m increases in a_m, because men face more favorable labor market opportunities, the smaller the amount of home duties they perform. U_f, decreases in females' amount of home duties, a_m. Importantly, both value functions are concave, provided that the government revenue requirement is not too high.[21]

[20] For the consumption of the household good see Section 5.3.

[21] By the Envelope Theorem $\partial U_m/\partial a_m = \frac{1}{a_m} L_m^{a_m} \left(\frac{1}{a_m} - \ln L_m\right) > 0$. The second partial derivative $\partial U_m^2/\partial a_m^2$ is the sum of three terms: (i) $-\frac{2}{(a_m-2)^2} U_m(\frac{1}{a_m} - \ln L_m) < 0$, (ii) $\frac{2}{a_m-2}\frac{\partial U_m}{\partial a_m}\left(\frac{1}{a_m} - \ln L_m\right) > 0$ and (iii) $\frac{2}{a_m-2} U_m \left(-\frac{1}{a_m^2} - \frac{1}{L_m}\frac{\partial L_m}{\partial a_m}\right) < 0$. A sufficient but not necessary condition for the concavity of U_m is that the first term more than offsets the second term. Applying the relationship $\partial U_m/\partial a_m = \frac{2}{a_m-2} U_m(\frac{1}{a_m} - \ln L_m)$ to these two terms, concavity is ensured if $\ln(1-t_m) > \frac{-(a_m-2)^2}{4a_m}$. For G sufficiently low relative to a_m, this condition always holds. For U_f a similar reasoning applies.

For future reference, we now show that the same condition is also sufficient for the concavity of the gross earnings function $Y_j = W_j L_j$ with respect to a_m. For the male, we have $\partial Y_m/\partial a_m = -Y_m \ln(1-t_m)\frac{4}{(a_m-2)^2} > 0$. The second derivative can be shown to be proportional to the term $\ln(1-t_m)\frac{2}{a_m-2} - 1$, which is negative if $\ln(1-t_m) > 1 - \frac{a_m}{2}$. It is straightforward to verify that the condition $\ln(1-t_m) > -\frac{(a_m-2)^2}{4a_m}$ is also sufficient for the latter. Similarly, one can show that Y_f is decreasing and concave in a_m.

Therefore, in the absence of any comparative advantage, there are decreasing marginal returns to avoiding family chores. We discuss in Section 5.3 the introduction of female comparative advantage in the production of the household good.

Next we turn to the specification of the outside options. We assume that j's outside option in the Nash bargaining program is given by his or her utility when single. The threat point depends on the tax system in operation, t_j, and given by the value function of the following program:

$$\max_{C_j, L_j, \tau_j} T_j = C_j - \frac{1}{\phi} L_j^{\phi} - \frac{1}{2}\tau_j^2 \tag{14}$$

subject to:

$$C_j = (1 - t_j) W_j L_j \qquad \text{and} \qquad W_j = \tau_j \tag{15}$$

We discuss below the robustness of our results to the specification of the threat points. For our comparative statics, we impose the following key restriction in the parameters of our problem:

$$\phi \geq \max\{a_m, A - a_m\} \tag{16}$$

Equation (16) implies that a single person takes fewer home duties than a married person, for instance because he or she has no children.[22] Therefore, (16) is in line with the conventional explanation that the gender gap in labor market participation and elasticities is mainly driven by married women. In fact single women would have a lower elasticity of the labor supply since they take on fewer home duties than married women.

Given this specification of the utilities in marriage and in autarky, for any pair of taxes (t_m, t_f), the maximization of the Nash product delivers the allocation of home duties:

$$\max_{a_m} \left\{ [U_m(a_m; t_m) + K - T_m(t_m, \phi)]^{\gamma} [U_f(A - a_m; t_f) + K - T_f(t_f, \phi)]^{1-\gamma} \right\} \tag{17}$$

where γ is the bargaining power of the husband. If the benefits from the consumption of the household good are sufficiently high, the two spouses marry and derive positive

[22] But remember that a single person also does not benefit from the good K which may include the joy of having children.

surplus. Note that the effective implicit bargaining power, that derives from the combined effects of γ and the threat points, is endogenous and indeed depends on GBT. There is a feedback effect from government policy to the intra-household allocation of bargaining power because the outside option of a spouse j depends on the tax rate t_j. For example when the tax rate t_j decreases, spouse j acquires more implicit bargaining power through increased training, wage rate and market participation.[23]

5.2 Asymmetric Bargaining Power

We consider first the possibility that $\gamma > 1/2$, namely a case where men have more bargaining power, perhaps as a result of the historical inheritance from a time in which physical power mattered, and with cultural forces determining the organization of the family.[24] Given the concavity of the utility functions, the Nash product is strictly concave and the bargaining solution is unique.

Proposition 2 ***Gender Roles:*** *If $\gamma = 1/2$, then $a_m = A/2$. For $\gamma > 1/2$, the bargaining solution $a_m(t_m, t_f, \gamma)$ satisfies:*

i. a_m increases in γ.

ii. If $t_f \geq t_m$, then $a_m > A/2$.

iii. $\partial a_m/\partial t_m < 0$ and $\partial a_m/\partial t_f > 0$.

The first and second parts of the Proposition show that for $\gamma > 1/2$ and no GBT (or when females are taxed at a higher rate), the allocation of home duties remains

[23]Pollak (2007) argues convincingly that the wage rate and implicitly the level of human capital should determine the outside option of a spouse. Our specification addresses, at least partly, this concern because taxes distort the training decision and endogenously shift the labor demand curve.

[24]The effects and causes of different family structures with specific reference to the role of women and allocation of home duties has been the subject of empirical cross country research by Alesina and Giuliano (2007), and Fernandez (2007). Friedberg and Webb (2006) use survey data from the Health and Retirement Study and document that nearly 31% of males believe that "they have the final say in major decisions" while only 12% believe that their spouse is in the same condition. At the same time, approximately 31% of the females admit that their husband has the final say while only 16% believe to have the final say in major decisions. On the other hand, Browning, Chiappori and Lewbel (2006) estimate the collective family model to Canadian data and find a sharing rule that favors the women.

biased in favor of the male. By increasing the tax rate for the male t_m and keeping fixed the female's tax rate t_f, we can examine the third property of the bargaining solution. Three are the relevant effects: [25]

- *Redistribution Effect*: $\frac{\partial U_m}{\partial t_m} < 0$. When t_m increases, the male is worse off inside the marriage and demands a lower amount of home duties (higher a_m) in order to "stay in the contract".

- *Threat Effect*: $\frac{\partial T_m}{\partial t_m} < 0$. When t_m increases, the male is worse off outside the marriage and his implicit bargaining power decreases. This means that he is willing to accept a higher amount of home duties (lower a_m) in order to "stay in the contract".

- *Efficient Reallocation Effect*: $\frac{\partial^2 U_m}{\partial a_m \partial t_m} = -\frac{\partial (W_m L_m)}{\partial a_m} < 0$. A higher t_m lowers husband's marginal return from avoiding one unit of home duty, the gross earnings from working at the market. Since this extra unit of market work is taxed at a higher rate, the family efficiently allocates more market opportunities to the female.

Under assumption (16), the threat effect always dominates the redistribution effect, and $\partial U_m/\partial t_m - \partial T_m/\partial t_m > 0$. Intuitively, singles perform fewer family chores, but participate more in the market, which implies that the utility outside the marriage declines faster as the tax rate increases. Therefore, the overall effect is that a_m decreases in t_m. A similar reasoning applies for women's taxes, and a lower t_f increases their implicit bargaining power, thereby decreasing the equilibrium value of a_m. [26]

[25] Denote $S_j = U_j + K - T_j \geq 0$ the marriage surplus. Then, $\partial a_m/\partial t_m$ is proportional to the term $\frac{\partial^2 U_m}{\partial a_m \partial t_m} S_m - \frac{\partial U_m}{\partial a_m}\left(\frac{\partial U_m}{\partial t_m} - \frac{\partial T_m}{\partial t_m}\right)$. The first term, by virtue of Young's and the Envelope Theorem, equals $\frac{\partial U_m}{\partial t_m \partial a_m} = -\frac{\partial Y_m}{\partial a_m} = \frac{4}{(a_m-2)^2}(1-t_m)^{\frac{a_m+2}{a_m-2}} \ln(1-t_m) < 0$.

[26] As we discussed in Section 2, our model extends the approach first taken by Manser and Brown (1980) and McElroy and Horney (1981). Lundberg and Pollak (1993), instead, argue that threat points are internal to the marriage and can be seen as (possibly inefficient) non-cooperative equilibria of the marriage game. While the literature is not conclusive as to the most appropriate specification, we expect the qualitative implications of our model to go through in this alternative environment. From the derivation of the three relevant effects, it is clear that an analogous to (16) condition would be that spouses do not assume more family chores under the non-cooperative solution. This condition

5.3 Comparative Advantage

The second source of gender differences that we consider is the possible comparative advantage of women in performing household chores. We model this through an effect on the value of the household good, K. Suppose that K is produced with the home duty of the two spouses. Female higher productivity in home duties is equivalent to:

$$K'(a_m) \geq 0 \tag{18}$$

Suppose that K represents the utility from having children but such benefits requires chores, as every parent knows. In this case, (18) implies that the couple is more efficient in taking care of children's needs as the women share of duty in child rearing increases relative to men's share. The other aspects of the model remain the same, and spouses are otherwise identical, including innate ability of producing in the market and explicit bargaining power.

Proposition 3 ***Comparative Advantage:*** *If $\partial U_f/\partial a_m + K'(a_m) > 0$ at all a_m, then the couple maximizes the joint product by completely specializing, $a_m \to A-2$. Otherwise, the bargaining solution $a_m(t_m, t_f, K')$ satisfies:* [27]

i. a_m increases in the strength of comparative advantage K'.

ii. If $t_f \geq t_m$, then $a_m > A/2$.

iii. $\partial a_m/\partial t_m < 0$ and $\partial a_m/\partial t_f > 0$.

If wives's utility from taking fewer chores and working more in the market does not offset the increased utility from the consumption of the common good, then the efficient allocation involves the complete specialization of spouses. On the other hand, if despite the more efficient provision of the household public good, the female (individually) prefers taking fewer chores because this increases her market income, then

would hold if, for instance, the number of children declines in the non-cooperative equilibrium and therefore spouses work more at the market. Importantly, since the reallocation effect is free from assumptions regarding the outside option, this condition is only sufficient and certainly not necessary for our results.

[27] Note that we are assuming the concavity of the Nash product. $K'' \leq 0$ is sufficient but not necessary for concavity.

the bargaining solution lies in the interior as there is conflict over the equilibrium allocation of family chores. Given, however, that women are more efficient in producing at home, if men and women are taxed on an equal rate (or females are taxed at a higher rate), then $a_m > A/2$. Naturally, the stronger the comparative advantage of women, the more unbalanced is the allocation of family chores. The third part of the Proposition shows that, similarly to the case of uneven bargaining power, gender based taxes also move the allocation closer to the ungendered equilibrium, as the family recognizes the increased efficiency from rebalancing the opportunities of working in the market between men and women.

5.4 Cross Elasticities

In all cases analyzed, with an endogenous allocation of home duties the cross elasticities of labor supply are not zero as in Section 3. We can write for spouse k:

$$e_{L_k,t_j} = \frac{\partial L_k}{\partial t_j}\frac{t_j}{L_k} = \left(\frac{\partial L_k(\bar{a_k})}{\partial t_j} + \frac{\partial L_k}{\partial a_k}\frac{\partial a_k}{\partial t_j}\right)\frac{t_j}{L_k} \tag{19}$$

The term $\frac{\partial L_k(\bar{a_k})}{\partial t_j}$ in (19) is the response of k's labor supply to j's tax rate for a given allocation of home duties. This is zero as in Section 3. The term $\frac{\partial L_k}{\partial a_k}\frac{\partial a_k}{\partial t_j}$ appears because the allocation of home duties is endogenous and responds to variations in the tax rate. For instance, a higher tax rate for the male t_m, increases the implicit bargaining power of the female. As a result, the female takes fewer home duties (a_f increases), and the cross elasticity of labor supply with respect to her spouse's *tax rate* is positive. This is in line with the empirical evidence, see for example Aaberge and Colombino (2006) for negative cross wage elasticities in Norway and Blau and Kahn (2007) for the US.

6 Gender Based Taxation with Endogenous Elasticities

The social planning program is:

$$\max_{t_m,t_f} \Omega = \omega\left[U_m(t_m,a_m) + K(a_m)\right] + (1-\omega)\left[U_f(t_f,a_m) + K(a_m)\right] \tag{20}$$

subject to the constraint:

$$t_m W_m L_m + t_f W_f L_f \geq G \tag{21}$$

The difference with respect to Section 3.2 is that now the allocation of home duties is endogenous to the tax policy, and the government anticipates it. That is:

$$a_m = a_m(t_m, t_f)$$

$$W_j = W_j(t_j, a_m(t_j, t_k))$$

$$L_j = L_j(t_j, a_m(t_j, t_k))$$

for $j = m, f$.

6.1 GBT with Asymmetric Bargaining Power

Note that with equal bargaining power, $\gamma = 1/2$, and no comparative advantages in home duties, $K'(a_m) = 0$, there is no need for GBT since spouses are identical in their market and home behavior.[28] If $\gamma > 1/2$ there are two reasons why the planner might choose GBT. One is the usual Ramsey principle: with $\gamma > 1/2$ the elasticity of the labor supply of men is lower than that of women, a fact that the household does not internalize when bargaining over the allocation of family chores. The second one arises if the social planner allocates gender weights that differ from the ones implied by the intrahousehold bargaining. For instance if the social planner weights men and women equally, $\omega = 1/2$, there would be a "social dissonance" (Apps and Rees 1988) between the preferences of society (with equal weights between husbands and wives) and the equilibrium result of an intrafamily game in which the husband has more power than the wife.[29]

[28] Hence, GBT in our model does not correct for some pre-existing "household failure" and does not make both partners better off, because our bargaining game is efficient. While we are not denying the possible existence of such inefficiencies, introducing household failures likely biases the results in favor of GBT. The reason is that if women's labor market participation is suboptimally low *because of some household imperfection*, then GBT with $t_f > t_m$ would correct for this inefficiency, potentially making both spouses better off. Of course, if society perceives the gender gap in labor market participation as *too low*, then optimality would require lower taxes on men. However, this case seems implausible as so many gender policies show.

[29] The asymmetry arises exclusively in our bargaining model, and would not arise if the preferences of the household are described instead by a unitary model. In this latter case, the planner would

We first focus on the case of equal abilities in the market and at home across genders, i.e. set $K' = 0$ in (20).

Proposition 4 ***GBT with Asymmetric Bargaining Power:*** *For any feasible tax system with $t^* = t_f^* = t_m^*$, if $\gamma > 1/2$, and $\omega \leq \omega^*(\gamma, t^*)$, then we can find $t_m > t_f$ such that: (i) the new tax system is budget feasible, (ii) aggregate distortions decrease and (iii) social welfare increases. The threshold satisfies $\omega^* > 1/2$ and is strictly increasing in γ.*[30]

This Proposition argues for the optimality of GBT based on the efficiency properties of differential taxation. It emphasizes that GBT is optimal even if society has the same type of cultural bias that leads the household to uneven bargaining power. Therefore, the reason why $\gamma > 1/2$ sustains the optimality of GBT is not redistribution across genders, but rather the fact that uneven bargaining power leads to unbalanced elasticities and market participations, thus creating aggregate inefficiencies not internalized by the household members at the bargaining stage. If in addition society perceives this asymmetry as "unfair" and chooses $\omega = 1/2$, GBT is also desirable because it promotes equity. The upper bound ω^* is loose (i.e. our condition is sufficient and not necessary), is expressed in terms of the exogenous parameters t^* and γ and it may not necessarily coincide with γ (for reasons that we explain later). However, for our argument the exact value of the threshold is not important; what matters is that ω^* always exceeds $1/2$ and increases monotonically with γ. That is, we can allow the cultural bias in the household to comove positively with society's weight on men. Specifically, the threshold is given by:

$$\omega^*(t^*, \gamma) = \min\{\tilde{\omega}, \bar{\omega}\} = \min\left\{\frac{\eta_m^*}{\eta_m^* + \eta_f^*}, \frac{\gamma}{\gamma + (1-\gamma)\frac{S_m^*}{S_f^*}}\right\} \tag{22}$$

maximize the unitary household utility function, and planner's and household's preferences would necessary coincide.

[30] Using numerical methods, one can strengthen the general conclusion of the Proposition to "any $t_f^* \geq t_m^*$ can be improved by setting $t_m > t_f$", thus showing the global optimality of GBT. The difference between the equality and the inequality case arises from analytically tedious and not particularly interesting secondary effects.

where $S_j^* = S_j(t^*, t^*, \gamma)$ denotes the marriage surplus of spouse j in the initial tax equilibrium, and $\eta_j^* = \eta_j(t^*, t^*, \gamma) > 0$ denotes one minus the elasticity of gross earnings with respect to taxes (which must be positive for the initial tax system to be on the "right side" of the Laffer curve). Intuitively, setting $\omega = \tilde{\omega} > 1/2$ excludes the gains from Ramsey taxation under exogenous elasticities, while $\omega = \bar{\omega} > 1/2$ eliminates any gains from the convergence of marginal utilities. Our condition is sufficient but not necessary, because we are then left with the gains from the endogenous expansion of the tax base due to the more efficient organization of the family. What would happen when $\bar{\omega} < \omega < \tilde{\omega}$ or $\tilde{\omega} < \omega < \bar{\omega}$? In the first case the convergence of marginal utilities decreases social welfare, as the planner cares excessively about men's welfare. This cost has to be weighted against (i) the benefits of Ramsey taxation holding constant the elasticities at their initial level and (ii) the benefits from the endogenous expansion of the tax base as the family reallocates efficiently markets opportunities to spouses. In the second case, holding constant the benefits from the convergence of marginal utilities and the expansion of the tax base, the planner of Section 3 (i.e. under exogenous a_m) would not use GBT. In other words, the gains from the inverse elasticity rule with exogenous elasticities are smaller than the costs on men's utility which now weight excessively in the welfare function.

It is worthwhile to show the steps of the proof for this Proposition, since these reveal the very basic economic motivation behind GBT. They also clarify our assumptions, and reveal our argument later when we consider the case of women comparative advantage. We will show that starting from any feasible single tax rate $t^* = t_m^* = t_f^*$, we can find $dt_m > 0$ and $dt_f < 0$, such that the new tax rates, $t_f = t^* + dt_f$ and $t_m = t^* + dt_m$, satisfy the three conclusions of Proposition 4. Under a single tax rate, but with $\gamma > 1/2$, Proposition 2 implies that $a_m > A/2 > a_f$. We denote by $Y_j = W_j L_j$ the gross earnings of spouse j. Consider the effects of a variation of the two tax rates around the single tax rate on the government budget constraint. Any such variation will be feasible, i.e. maintain a balanced budget constraint, if:

$$\frac{dt_m}{dt_f} = -\frac{\left[Y_f + t^* \frac{\partial Y_f}{\partial t_f}\right] + t^* \frac{\partial a_m}{\partial t_f}\left(\frac{\partial Y_m}{\partial a_m} + \frac{\partial Y_f}{\partial a_m}\right)}{\left[Y_m + t^* \frac{\partial Y_m}{\partial t_m}\right] + t^* \frac{\partial a_m}{\partial t_m}\left(\frac{\partial Y_m}{\partial a_m} + \frac{\partial Y_f}{\partial a_m}\right)} \tag{23}$$

where all functions are evaluated at the initial tax rate, t^*, and the resulting household allocation of duties and elasticities, $a_m(t^*, t^*, \gamma)$, and therefore depend only on exogenous variables (t^* and γ). We require the initial tax rate to lie below the peak of the Laffer curve so that increasing it would increase government revenues. This means that the numerator and the denominator in (23) are strictly positive. Consider first the numerator. The first bracketed term represents the revenues extracted from the female as we increase t_f, holding constant the allocation of the home duties. The first bracketed term in the denominator is the corresponding effect for the male. The essence of Ramsey taxation with exogenous elasticities is that this term is smaller for females than for males.[31]

The last terms in the numerator and denominator capture the effects of the reallocation of home duties. Remember from Proposition 2, that a_m rises with t_f and declines with t_m. The (identical) terms in parenthesis at the numerator and denominator are negative because, starting from $a_m > A/2$, the reallocation of market opportunities in favor of the female decreases male's income by less than the increase in female's income—that is, Y_j is increasing and concave for the male and decreasing and concave for the female. As a result, the numerator decreases relative to the case of exogenous elasticities, and the denominator increases. GBT under endogenous elasticities, therefore, implies that a given decrease in female's tax rate $dt_f < 0$ can be matched with an even smaller increase in male's tax rate $dt_m > 0$, relative to the case of exogenous elasticities, while maintaining constant government revenues. This benefit stems from the more efficient reallocation of home duties, the increase in total family income and the corresponding expansion in the tax base. Since, the fraction in (23) is smaller than unity, it follows that $dt_m + dt_f < 0$ and average fiscal distortions decrease relative to the single tax rate (and relative to the case of exogenous elasticities).

Now consider the effects on welfare. Totally differentiating the welfare function we

[31]Proof: $Y_j + t_j \frac{\partial Y_j}{\partial t_j} = Y_j[1 - e_{Y_j,t_j}] = Y_j \eta_j$. For $a_m \geq a_f$ and $t_m \leq t_f$, females earn less and their elasticity $e_{Y_j,t_j} = \frac{t_j}{1-t_j} \frac{a_j+2}{a_j-2}$ is higher. The elasticity is necessarily less than one, otherwise, the numerator in (23) is negative and the initial tax rate lies above the peak of the Laffer curve.

obtain:

$$d\Omega = \left[\omega \frac{\partial U_m}{\partial t_m} + \frac{\partial a_m}{\partial t_m}\Delta\right] dt_m + \left[(1-\omega)\frac{\partial U_f}{\partial t_f} + \frac{\partial a_m}{\partial t_f}\Delta\right] dt_f \tag{24}$$

where we define:

$$\Delta = \omega \frac{\partial U_m}{\partial a_m} + (1-\omega)\frac{\partial U_f}{\partial a_m} \tag{25}$$

To see the intuition behind the term Δ, suppose initially that $\omega = 1/2$. Since at the single tax rate t^* the allocation of family duties is biased in favor of men, $a_m > A/2$, the concavity of U_j implies that:

$$\Delta(1/2) \propto \frac{\partial U_m}{\partial a_m} + \frac{\partial U_f}{\partial a_m} < 0 \tag{26}$$

Next, $dt_m > 0$ and $dt_f < 0$ and the fact that a_m decreases in t_m but increases in t_f, imply that $\frac{\partial a_m}{\partial t_m}\Delta dt_m > 0$ and $\frac{\partial a_m}{\partial t_f}\Delta dt_f > 0$. These terms therefore increase welfare formalizing Edgeworth's (1897) egalitarian principle of equalizing marginal utilities. More in general, suppose $\omega \neq 1/2$. Denoting S_j spouse j's marriage surplus, we define:

$$x(\gamma, t^*, t^*) := \frac{\gamma}{1-\gamma}\frac{S_f(\gamma, t^*, t^*)}{S_m(\gamma, t^*, t^*)} > 1 \tag{27}$$

where all functions are evaluated at the initial allocation, and the inequality follows from the first order conditions of the Nash Bargaining solution and the concavity of the utility functions. We also note that x increases in γ.[32] Next define the upper bound:

$$\bar{\omega}(\gamma, t^*, t^*) := \frac{x}{x+1} = \frac{\gamma}{\gamma + (1-\gamma)\frac{S_m}{s_f}} \tag{28}$$

with $\bar{\omega}_\gamma(\gamma, t^*, t^*) > 0$ and $\gamma \geq \bar{\omega} \geq 1/2$, with strict equalities if and only if $\gamma = 1/2$ or $\gamma = 1$. The upper bound on men's weight is defined such that:

$$\omega \leq \bar{\omega} \Longrightarrow \Delta(\omega) \leq 0 \tag{29}$$

i.e. is the weight the planner allocates to men without reversing the principle of equalizing marginal utilities. For $\omega = \bar{\omega}$ we take $\Delta = 0$ and social welfare does not improve from the convergence of marginal utilities. The reason why $\bar{\omega}$ does not exactly coincide

[32] At $a_m(t^*, t^*, \gamma) > A/2$ we have $-(\partial U_f/\partial a_m)/(\partial U_m/\partial a_m) = x > 1$ since U_j is concave in a_m. From Proposition 2 we know that $\partial a_m/\partial \gamma > 0$, so $\partial x/\partial \gamma > 0$, as the allocation becomes more biased.

with γ is that in the Nash bargaining solution the implicit Pareto weights derive both from the explicit weights γ and the endogenous surpluses S_j. Therefore, our definition of $\bar{\omega}$ captures both the explicit and the implicit allocation of bargaining power and equals men's effective bargaining weight.

Finally, using the fact that dt_m and dt_f must be budget feasible according to (23) and the Envelope Theorem ($\frac{\partial U_j}{\partial t_j} = -Y_j$), welfare increases if: [33]

$$\frac{Y_f[1 - e_{Y_f,t_f}] + t^* \frac{\partial a_m}{\partial t_f}\left(\frac{\partial Y_m}{\partial a_m} + \frac{\partial Y_f}{\partial a_m}\right)}{Y_m[1 - e_{Y_m,t_m}] + t^* \frac{\partial a_m}{\partial t_m}\left(\frac{\partial Y_m}{\partial a_m} + \frac{\partial Y_f}{\partial a_m}\right)} < \frac{(1-\omega)Y_f - \frac{\partial a_m}{\partial t_f}\Delta(\omega)}{\omega Y_m - \frac{\partial a_m}{\partial t_m}\Delta(\omega)} \tag{30}$$

where $e_{Y_j,t_j} < 1$ is the (absolute value of the) elasticity of gross earnings with respect to the tax rate, evaluated at t^* and γ. In the initial allocation, $a_m > a_f$, males are less elastic than females, $e_{Y_m,t_m} < e_{Y_f,t_f}$, and earn more, $Y_m > Y_f$. Since $\Delta'(\omega) > 0$ and a_m rises with t_f and falls with t_m, the right hand side of the inequality is strictly decreasing in ω. The left hand side is constant in ω, as revenues are collected independently of the welfare weights. Therefore, under $\omega \leq \bar{\omega}$, the sufficient but not necessary condition for increase in welfare is:

$$\frac{Y_f[1 - e_{Y_f,t_f}] + t^* \frac{\partial a_m}{\partial t_f}\left(\frac{\partial Y_m}{\partial a_m} + \frac{\partial Y_f}{\partial a_m}\right)}{Y_m[1 - e_{Y_m,t_m}] + t^* \frac{\partial a_m}{\partial t_m}\left(\frac{\partial Y_m}{\partial a_m} + \frac{\partial Y_f}{\partial a_m}\right)} < \frac{(1-\omega)Y_f}{\omega Y_m} \tag{31}$$

It is easy to see that *not accounting* for the last terms in the numerator and the denominator of the left hand side, makes the inequality more difficult to hold. Eliminating these terms, we see that $\omega < \tilde{\omega}$ is sufficient for the increase of social welfare. When $\omega > \tilde{\omega}$ and abstracting from the terms associated with the endogenous bargained allocation (i.e. set $\partial a_m / \partial t_j = 0$ in (30)), we conclude that the planner of Section 3 does not implement GBT. In the case with endogenous allocations (i.e. allowing for the family to reorganize), $\omega < \tilde{\omega}$ is only sufficient and not necessary, as the resulting expansion in the tax base creates further benefits for the society. Finally, from the definition of $\tilde{\omega} = \eta_m/(\eta_m + \eta_f)$ we see that (i) it exceeds 1/2 as men are less elastic

[33] This assumes that the first bracket in (24) is negative. If it is not, then $d\Omega > 0$ follows directly from inspection of (24).

than women whenever $\gamma > 1/2$; (ii) it increases in γ because the elasticity gap increases in γ.

In the absence of a "long run" response of the family to the fiscal pressure, GBT is beneficial only because it satisfies Ramsey's inverse elasticity rule (as long as the planner does not care excessively about men, i.e. $0 < \omega \leq \tilde{\omega}$, with $\tilde{\omega} > 1/2$). Our analysis highlights two novel additional benefits of GBT that arise exclusively from the endogenous response of intra-familiar bargaining to the tax rates. The first comes from the more equal *market* participation of spouses. If men's income decreases less than the increase in women's earnings, then the tax base expands and average distortions per unit of government revenue decrease. The second comes from the more equal *non-market* participation of spouses. If the first hour that the father spends with his children is more beneficial for the family as a whole than the female's last hour, then the rebalancing of the non-market work across genders will also increase welfare (as long as the planner does not care excessively about men, i.e. $0 < \omega \leq \bar{\omega}$ with $\bar{\omega} > 1/2$).

6.2 Discussion

We conclude the asymmetric bargaining case with some comments regarding the generality of our argument. The above result builds on two main assumptions: (1) the concavity of utility and income with respect to home duties and (2) that home duties are negatively related to tax rates and positively related to the elasticity of labor supply. Regarding the first point, we note that the above proof requires information on the monotonicity and concavity properties of $U_j(a_j)$ and $Y_j(a_j)$, but not more specific assumptions regarding their functional form. It is then apparent that any functional form delivering decreasing returns in home duties will support the same conclusion—our functional form in (1) is just one illustrative and admittedly tractable case.[34] The monotonicity properties can be rationalized by the arguments given above, in the spirit of Becker (1985). In the next section we show how to relax the important concavity

[34]Relaxing the quasilinearity in (1) is likely to create one more benefit from GBT if the marginal utility of consumption is declining and household members do not share all of their resources with their spouse. Essentially, decreasing marginal utility of consumption creates an extra source of demand for equity.

assumptions by introducing comparative advantage.

Second, the intermediate result that home duties and tax rates are negatively related (shown in Section 5) is in line with the literature on collective household labor supply. In our model, from the point of view of the household, tax rates have two roles. First, they change the household budget constraint. Second, they act as a distribution factor, i.e. an exogenous factor not related to preferences or budgets that affects household behavior. This is because in our model, taxes change the outside option of the family members and therefore directly affect their bargaining power. If we accept that utility increases in the amount of labor market opportunities a_j, then a distribution factor that favors the one spouse (lower tax rates), will change the intrahousehold allocation of duties in favor of this spouse. This is what we called the threat effect in Section 5.2.[35] Last, the assumption that home duties and elasticity of labor supply are negatively related can be rationalized by recent evidence in Aguiar and Hurst (2007) and Blau and Kahn (2007). These authors document a decline both in the ratio of female over male home duty and in the ratio of female over male elasticity of labor supply in the last 50 years, so the correlation is positive.

6.3 GBT under Comparative Advantage

Suppose now that $K'(a_m) > 0$, and that in all other respects spouses are identical, including the bargaining power i.e. $\gamma = 1/2$. We also assume that $\omega = 1/2$ and therefore planner and household weight equally the two spouses.

Proposition 5 ***GBT with Comparative Advantage:*** *For any feasible tax system with $t^* = t_f^* = t_m^*$ that satisfies:*

$$\frac{Y_f[1-e_{Y_f,t_f}]+t^*\frac{\partial a_m}{\partial t_f}\left(\frac{\partial Y_m}{\partial a_m}+\frac{\partial Y_f}{\partial a_m}\right)}{Y_m[1-e_{Y_m,t_m}]+t^*\frac{\partial a_m}{\partial t_m}\left(\frac{\partial Y_m}{\partial a_m}+\frac{\partial Y_f}{\partial a_m}\right)} < \frac{Y_f-\frac{\partial a_m}{\partial t_f}\left(\frac{\partial U_m}{\partial a_m}+\frac{\partial U_f}{\partial a_m}+2K'(a_m)\right)}{Y_m-\frac{\partial a_m}{\partial t_m}\left(\frac{\partial U_m}{\partial a_m}+\frac{\partial U_f}{\partial a_m}+2K'(a_m)\right)} \tag{32}$$

we can find $t_m > t_f$ such that: (i) the new tax system is budget feasible, (ii) aggregate distortions decrease and (iii) social welfare increases.

[35] The role of taxes on the budget constraint is what we call the efficient redistribution effect.

Note that all functions in (32) are evaluated at the initial tax system t^* and the resulting intrahousehold allocation, i.e. $a_m(t^*, t^*, K(a_m(t^*, t^*))$, $Y_j(t^*, a_m^*)$ etc., and therefore this condition involves only exogenous variables. This condition differs with respect to (30) when $\omega = 1/2$ only in one term that illustrates the key considerations when GBT introduces a distortion in the production of the household good. Specifically, if the first hour that the father spends with his children is not as beneficial as women's last hour, the rebalancing of household work introduces a cost for the family. Formally, starting from a single tax rate with an uneven allocation of home duties, the term $\Delta = \partial U_m/\partial a_m + \partial U_f/\partial a_m + 2K'(a_m)$ is always positive, and therefore a $dt_m > 0$ and a $dt_f < 0$ would tend to decrease welfare.[36] But the overall effect on social welfare is ambiguous because these costs have to be weighted against the benefits of the reduction in tax distortions due to the Ramsey principle.

It is important to realize that once we endogenize the labor supply elasticities, as women become more productive at home, the case in favor of GBT may become even stronger. This is surprising because initially one might think that the stronger the comparative advantage of women the weaker is the argument in favor of GBT. Suppose that women's comparative advantage in home duties, K', increases and therefore according to Proposition 3 the allocation of home duties becomes more unbalanced. On the one hand, the term $\Delta = \partial U_m/\partial a_m + \partial U_f/\partial a_m + 2K'(a_m)$ becomes more positive and condition (31) is harder to satisfy, formalizing the increasing costs in the production of the household good internalized by the family. However, one must also consider the effects of the increasing women comparative advantage on government revenues. When the allocation of home duties becomes more unbalanced, market participations and labor supply elasticities diverge even more. Both effects tend to make (31) easier to satisfy because: (i) GBT equalizes market participations and expands the tax base (the term $\partial Y_m/\partial a_m + \partial Y_f/\partial a_m$ becomes more negative) and (ii) the Ramsey channel is endogenously strengthened (e_{Y_f,t_f} increases and e_{Y_m,t_m} decreases). These

[36]The proof follows from the first order conditions of the Nash bargaining program, assuming that the family does not specialize. We have that $-\frac{\partial U_m/\partial a_m + K'(a_m)}{\partial U_f/\partial a_m + K'(a_m)} = \frac{U_m + K - T_m}{U_f + K - T_f}$. This fraction evaluated at $a_m > A/2$ and $t_m = t_f$ and from the positive monotonicity of U_m in a_m and of U_f in $A - a_m$, exceeds unity. Rearranging terms produces the statement.

effects are not internalized by the family when allocating home duties among its members, and therefore GBT may be beneficial even in the presence of women comparative advantage in household chores. In other words, as women's comparative advantage becomes stronger, spouses internalize the benefits of women accepting a higher amount of household chores a_m through the increased production of the household public good K. However, they do not internalize the costs of this allocation for government revenues, the tax base and ultimately their own welfare.

6.4 Other Sources of Gender Based Differences

Suppose that for some reason, women earn less, all else equal, than men in the market. This could occur because of statistical discrimination in the labor market, in which case labor demand and not labor supply becomes the root of gender differences.[37] This asymmetry in the labor market would then map into our household allocation of chores in Section 5, and the household would efficiently allocate more labor market opportunities to the spouse who earns more, also decreasing his elasticity of labor supply. Our analysis shows that on the one hand, GBT may be costly for the tax base as it allocates more market opportunities to the spouse who is persistently discriminated. On the other hand if discrimination in the market is the original friction that causes the unequal allocation of household chores, then the differences in elasticities of labor supplies determines the benefit of GBT because of the Ramsey principle.

An alternative interpretation of the model under comparative advantage is the following. If men and women have for some reasons different preferences from taking household chores, then the addition of the $K(.)$ function on women's utility can be interpreted as women's increased utility from doing family chores. This rationalization of gender differences is consistent with the view that some household activities may represent leisure and household production at the same time (e.g. time spent with children). Then our model would predict that if women have for some reason an increased preference for taking family chores, the allocation of home duties is biased

[37] See Arrow (1973), Coate and Loury (1993), Francois (1998), de la Rica, Dolado and Garcia-Penalosa (2008), and Albanesi and Olivetti (2009) for the microfoundations of statistical discrimination.

in favor of men, and GBT on one hand introduces a distortion on women's utility, but on the other it endogenously expands the tax base assuming equal innate abilities of working in the market across genders.

7 Conclusions

In this paper we begin to analyze the effects of Gender Based Taxation as a potential tax policy. We considered two polar cases in the organization of the family. In the first case, for cultural reasons the intrafamily bargaining process favors the husband and GBT with lower tax rates for females is superior to an ungendered tax rate. In what one could label the "short run", namely before the family organization adjusts to the new tax regime, GBT reduces tax distortion because of the Ramsey principle according to which one should tax less commodities with higher supply elasticities. When the spouses react to GBT by re-bargaining over household duties, GBT leads to a more equitable distribution of household chores and market activities. In the "long run", the welfare gains of GBT derive both from the Ramsey principle and from a more efficient organization of the family that takes into account the decreasing marginal benefits in home versus market activities. In the second case the wife spends more time doing chores because she has a comparative advantage in household activities. In this case, GBT with lower taxes for women may again be optimal for two reasons. One is a more equitable allocation of market opportunities that reduces the difference in gross earnings between men and women produced by the Nash bargaining game at home, and which expands the tax base. Second, the family does not internalize the Ramsey gain which prescribes different tax rates under different labor supply elasticities. Contrary to what one would expect, a larger comparative advantage of women at home may be associated with more GBT as this case is associated with divergent market participation and elasticities of labor supply and thus larger Ramsey gains.

Rather than reviewing in more details our results it is worth discussing several important avenues for future research. First, our model does not allow for a realistic marriage market since it considers a society in which marriage is optimal for everybody along the equilibrium path. A proper discussion of the marriage market would require

the introduction of some heterogeneity within the pool of men and women and the consideration of a matching or a searching model. Second, in the present model the word "training" can be interchanged with "effort". The training decision is taken when the couple is already formed. Therefore, we cannot analyze a situation in which a man or a woman, when unmarried, invest in training as a commitment to gain bargaining power. This interesting extension could be discussed in an even more general model in which the marriage market is also endogenized. A key question that this analysis could help answering is whether or not GBT should refer to only married couples or to males and females regardless of their marriage status. Alternatively, if we allowed for different tax rates not only across genders but also within genders, our model would suggest that taxing single men at a higher rate might be a superior policy because it reduces directly the autarky utility of men, inducing them to accept more home duties in order to marry. An evaluation of these more complicated tax structures would depend undoubtedly on their redistributive properties in a world of heterogeneous households.

Third, our model does not distinguish between the intensive and extensive margins of labor supply decisions. There is instead an important discontinuity between starting to work from inactivity and increasing working time if someone is already active in the market. Fourth, we have not allowed for the fact that certain chores (but probably not all, at least for most families) can be purchased in the market. Fifth, a quantitative evaluation of the two channels (distortions in intrahousehold allocation vs. aggregate fiscal outcomes) can shed more light on the role of GBT. This exercise would require a richer framework where we allow for elasticity effects on the extensive margin of labor supply, and income effects on women's labor supply.

Finally, a comparison of Gender Based Taxation with other gender and family policies, such as quotas, affirmative action, forced parental leave and public supply of services to the families, is necessary within a unified theoretical framework in order to draw policy conclusions. We see no reason why GBT should not be an excellent "horse" in a race with all these alternative policies. In fact our basic economic intuition regarding the superiority of price incentives versus quantity restrictions or regulations would make GBT a favorite in the race, but we still have to run it.

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Table 1: OECD (2003): Marginal Tax Rates in 2001

Country	**Second Earner**	**Single**	**Ratio**	**Second Earner**	**Single**	**Ratio**	**Type of Taxation 99**
Canada	32	21	1.5	36	27	1.4	Separate
France	26	21	1.2	26	27	1.0	Joint
Germany	50	34	1.5	53	42	1.3	Joint
Italy	38	24	1.6	39	29	1.4	Separate
Japan	18	15	1.2	18	16	1.1	Separate
Spain	21	13	1.6	23	18	1.3	Separate/Joint
Sweden	30	30	1.0	28	33	0.9	Separate
UK	24	19	1.3	26	24	1.1	Separate
US	29	22	1.3	30	26	1.2	Joint/Optional
Average	28	21	1.4	31	25	1.2	

Notes: The relevant "marginal" tax rate for women's decision to participate in the labor market is the average tax rate on second earners. Husband: assumed to earn 100% of Average Productive Worker (APW). Family assumed to have 2 children. Women: Columns (2)-(4): earns 67% of APW; Columns (5)-(7): earns 100% of APW. Source: Jaumotte (2003), OECD Department of Economics.

Table 2: Welfare effects of Gender Based Taxation with Exogenous Elasticities

		Parameter values				Endogenous ratios			Gains (in %)			
Focus	Tax regime	$\frac{G}{GDP}$	$\frac{a_m}{a_f}$	$\frac{\sigma_m}{\sigma_f}$	ϵ	$\frac{L_m}{L_f}$	$\frac{W_m}{W_f}$	$\frac{t_m}{t_f}$	Ω	L	τ	GDP
Baseline	GBT	15%	1.38	0.66	∞	1.02	0.98	1.31	0.48	0.55	0.74	1.18
	single					1.06	1.06	1				
G	GBT	10%	1.38	0.66	∞	1.01	0.98	1.33	0.15	0.33	0.40	0.69
	single					1.04	1.04	1				
	GBT	20%	1.38	0.66	∞	1.04	0.97	1.28	1.32	0.88	1.36	2.04
	single					1.09	1.09	1				
$\frac{\sigma_m}{\sigma_f}$	GBT	15%	1.26	0.75	∞	1.02	0.98	1.21	0.22	0.26	0.35	0.56
	single					1.04	1.04	1				
	GBT	15%	1.72	0.50	∞	1.05	0.96	1.62	1.81	1.99	2.70	4.29
	single					1.13	1.13	1				
ϵ	GBT	15%	1.38	0.66	60	1.01	0.95	1.41	0.54	0.67	0.88	1.47
	single					1.06	1.06	1				
	GBT	15%	1.38	0.66	7	0.96	0.86	1.51	3.20	1.36	2.35	4.26
	single					1.02	1.01	1				

Notes: In the baseline case, elasticities of labor supply are approximately $\sigma_m = .21$ and $\sigma_f = .31$. For the comparative statics with respect to the σ_m/σ_f ratio, we set approximately $\sigma_m = .22$ and $\sigma_f = .29$ in the first row and $\sigma_m = .19$ and $\sigma_f = .37$ in the second row.

Figure 1: The Labor Market

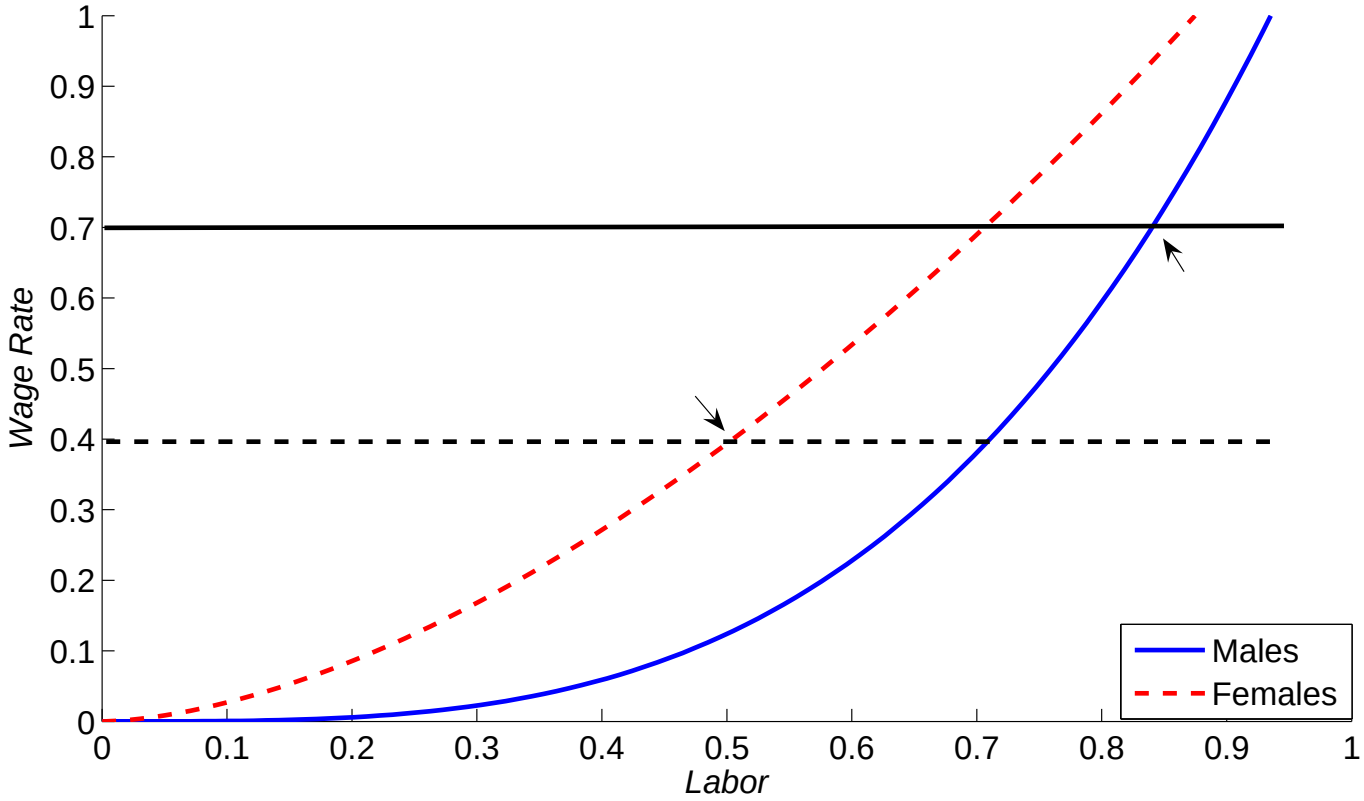

Figure 2: The Effects of Taxes on the Labor Market