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Gender based taxation.

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Gender Based Taxation and the Organization of the Family *

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Abstract

Gender Based Taxation (GBT) satisfies the Ramsey criterion of optimal taxation by taxing less the more elastic labor supply of (married) women. In this paper we endogenously derive differences in gender elasticities from a model in which spouses bargain over the allocation of home duties and family shocks. GBT changes spouses' implicit bargaining power and induces a more balanced allocation of house work and working opportunities between males and females. Because of decreasing returns to specialization in home and market work, social welfare improves by taxing conditional on gender. When income sharing within the family is substantial, both spouses may gain from GBT.

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1 Introduction

Optimal taxation theory prescribes that the 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 intuition is well known in the literature, but it is not taken seriously as a policy proposal. This is surprising since 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.[1] These gender based interventions become even more puzzling in light of the normal economic belief that it is better to affect the "price" (such as the tax rate) rather than the "quantity" (such as affirmative action or quotas) in the market.[2]

Perhaps the main reason why Gender Based Taxation (GBT) with lower income taxes on women is not taken into consideration is the endogeneity of labor supply elasticities. If the labor supply elasticity is taken as a primitive, exogenous parameter that differentiates genders, then the optimal taxation intuition goes through and women should be taxed at a lower schedule. If, however, one thinks that the labor supply elasticity is not genetically endowed to people, then the natural question is what determines the elasticity and how GBT affects the elasticity in long run. In addition, it is unclear how GBT would affect welfare if one takes into account not only market work but also the allocation of home duties, bargaining between spouses, leisure and the

[1]For instance, gender based affirmative action is common in the US, Spain has recently introduced stringent quotas for female employment in many sectors, Italy is moving in a similar direction and public support for child care is common in many European countries. Sweden has recently introduced paternal leaves policies to create incentives for males to stay home with children and induce a more continuous female labor market participation.

[2]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.

allocation of family income.

The purpose of this paper is to investigate these issues. We build a model that endogenously generates gender differences in labor supplies and their elasticities and therefore allows for a more microfounded welfare analysis of GBT, an analysis above and beyond the simple Ramsey principle with exogenous elasticities.

In our model, observed real life gender differences in the labor market behavior emerge if the intrahousehold allocation process favors the husband. If the male has a stronger bargaining power, then he assumes fewer unpleasant, tiring home duties. As a result, he participates more in the market, exercises more effort, and earns more than his female spouse.[3] Since the male participates more in the market, he also expects to receive a larger number of labor market shocks. This expected variability in the market increases the male's *expected* risk aversion with respect to deviations from a stable employment level. Because the male anticipates to face more variability *expost*, he commits to supply his labor less elastically *exante* and enjoys labor market opportunities with reduced variability. On the other hand, the female who is "busy" with home duties, participates less in the labor and training markets and expects to receive a smaller total number of market shocks. The smaller market variability makes the female more willing to respond to market incentives (wages and taxes) and raises her elasticity of labor supply. We note that the implied positive correlation between the amount of home duties and the elasticity of labor supply in our model accords well with recent empirical evidence.[4]

To the extent that the division of family chores remains unbalanced, GBT

[3] Cultural differences are important and in different countries female and male roles in the family vary substantially, a topic investigated empirically by Alesina and Giuliano (2007).

[4] Recent evidence by Aguiar and Hurst (2007) and Blau and Kahn (2007) documents a decline in both the ratio of female over male home duty and the ratio of female over male elasticity of labor supply in the last 50 years.

improves welfare. In addition to satisfying the Ramsey principle of optimal taxation, GBT generates a more equitable allocation of house versus market work. Because of decreasing returns to scale, reallocating "the last hour that the mother spends with the children to the father" is welfare improving for the family as a whole, and under certain conditions (uneven distribution of household chores) it can be welfare improving for *both* members of the family, wife and husband. Our numerical simulations show that with the estimated difference in the labor supply elasticities (which in the model map into a certain difference in the allocation of home duties), GBT implies rather different tax rates for husbands and wives and can substantially improve welfare and increase GDP and total employment.

Note that the present paper takes a different approach from the literature in modeling household production. The traditional approach builds on the Beckerian theory of allocation of time (1965), and assumes that household duty is an input to the family production function for the production of a household good. In the present model 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 intrahousehold process that transforms time input into a household good. Obviously the two approaches are not mutually exclusive and a more general model of household allocation of time and shocks could capture both aspects of family life.

Section 2 reviews the relevant literature. Section 3 discusses GBT holding the allocation of household duties and therefore the labor supply elasticities as constant. We can interpret this setup as the "short run". In Section 4 we endogenize the allocation of household chores. In this case the government sets GBT anticipating that the allocation of home duties, and therefore labor elasticities, reacts in response to GBT; we can interpret this situation as "the long run". The last Section concludes.

2 Related Literature

This paper lies at the intersection of three strands of literature. The first one is concerned with the structure of the family.[5] 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 study *intrahousehold* welfare analysis.[6] 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, taken first 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 and models the threat points as the utility levels under autarky. Lundberg and Pollak (1993), instead, argue that the threat point can be seen as a (possibly inefficient) non-cooperative equilibrium of the game.

The model that we consider is in the spirit of the collective approach with Nash-bargained household allocations. The difference with the above models is that the bargaining is not on the allocation of consumption, income and labor supply *per se*, but on the allocation of home duties. However, our model is set in stages and therefore the bargaining process internalizes the allocation of consumption, labor supply, training, and the sharing of

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

[6] 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 Thomas (1990), Browning, Bourguignon, Chiappori and Lechene (1994), Lundberg, Pollak and Wales (1997), and Browning and Chiappori (1998).

resources. We assume that a certain amount of resources is exogenously shared, and rationalize the sharing parameter as an externality that captures the non-excludable and non-rivalrous, at least to some extent, nature of the common consumption of goods within the family.[7] We study how changes in this parameter affect our results.

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 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) give intuitive and empirically plausible conditions under which it is optimal to tax males at a higher rate even with heterogeneous households. Second, Piggott

[7]For example, once the family purchases an electric appliance such as a refrigerator or a dishwasher it is difficult to imagine how a spouse can be excluded from its consumption. Or, the consumption of cable television from one family member does not restrict the consumption of the good by other members of the family.

[8]The point was raised using variants of the Diamond and Mirrlees (1971a and 1971b) and Atkinson and Stiglitz (1972) frameworks, also adopted in this paper. Using the Mirrlees (1971) approach, the elasticity of labor supply reappears in the optimal tax schedule, albeit in a less clear way. For an ambitious paper that takes the latter approach see Kleven, Kreiner and Saez (2006), or Kremer (2003) within an application to the problem of age based taxation.

[9]See Mankiw and Weinzierl (2007) for a recent application of this idea aimed at discussing the validity of the welfarist approach to optimal taxation.

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 intrahousehold allocation of resources cannot offset the gains from taxing on an individual basis according to the standard Ramsey principle.

Our interest lies in exploring the optimality of individual taxes in models where *within* household redistribution is explicitly taken into account. In that respect our model is in line and reinforces the conventional wisdom. Earlier models, including Apps and Rees (1988, 1999a, 2007), Brett (1998) and Gugl (2004), have emphasized that intrahousehold redistributional factors are important but are either concerned with the effects of taxation in models of across household heterogeneity or follow a policy reform approach when examining the desirability of differential tax treatment relative to the single tax rate case. The approach taken in this paper is more general, albeit in a more specific context, and explicitly considers the second best problem in search for the globally optimum set of individual tax rates. In doing so, our model focuses on the implications of intrahousehold heterogeneity abstracting from the interhousehold dimension.

The third strand of literature attempts to explain gender differences in labor market outcomes. For example, Albanesi and Olivetti (2006) propose that gender differences can be supported by firms' expectations that the economy is on a gendered equilibrium in a model with incentive problems. More traditional theories start by assuming 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 there is also a training in costly effort effect a la Mincer and Polachek (1974).

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 the elasticity effect of a commitment to remain to the labor market 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 remain well above that of men, a ratio of about 4 to 1.

3 Exogenous Allocation of Family Duties

In this Section we present the basic model taking as given the allocation of home duties between spouses. This model can be interpreted as the "short-run" when the government cannot affect the structure of the family.

3.1 The Setup of the Model

A family consists of a male and a female who

i. Invest in training and become more productive for the market.

ii. Share a fraction of the income they produce with market work.

iii. Decide how to allocate home duties (for example, the care of children).

The timing of the game under an exogenous allocation of family duties is the following. 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 to maximize their expected utility. A perfectly competitive, constant-returns to scale firm pays workers a wage rate equal to their marginal productivity and makes zero profits. Finally, the labor market shock is realized. A commitment device constraints the ability of the government to reoptimize once the shock is realized.

The allocation of home duties, taken as exogenous for now, affects the utility of working in the market. Specifically, we assume that there are $2A$ family duties to be undertaken. 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. The argument is similar to that of Becker (1985) who posits that the spouse who does more homework has less "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. $x_i \sim \chi_1^2$. 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 duty 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 $E(\omega_f) = 2a_f$. Expost utility for spouse $j = m, f$ is defined over bundles of consumption, labor and training and given by

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

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 $L_j < 1$.

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.).[10] 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 the utility of working in the market. To put it differently (and with a slight abuse of language), there are days in which a spouse is *not* in charge of the kids, 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 no upside options.[11]

The expost 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 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 exante utility function. Using the moment generating function

[10] In this sense one cannot "quit a child" while can quit a second job.

[11] The abuse of language is that we do not model energy explicitly; instead taking less home duties directly implies the possibility or receiving more positive shocks.

of a chi-squared random variable with $2a_j$ degrees of freedom we obtain [12]

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

The "χ^2-CARA" expost representation of preferences in (1) allows us to work with the familiar CRRA-power expression for labor supply in (2). Our derivation based on household duties allows us to provide a microfoundation for this CRRA function and exploit its implications when we consider how members of the family bargain over the allocation of family chores.

3.2 Labor Supply, Training and Wages

At the last stage of the game, the perfectly competitive, constant-returns to scale firm produces a homogeneous consumption good and pays workers the value of their marginal productivity. The price of the consumption good is one and the production function for worker j is

$$Q_j = \tau_j L_j \tag{3}$$

Therefore, the wage rate W_j equals τ_j. Before the realization of the shocks, spouse j maximizes expected utility taking as given the labor income tax rate t_j and the other spouse's decisions

$$\max_{C_j, L_j, \tau_j} U = C_j - \frac{1}{a_j} L_j^{a_j} - \frac{1}{2}\tau_j^2 \tag{4}$$

subject to

$$C_j = s(1-t_j)W_j L_j + (1-s)(1-t_k)W_k L_k \tag{5}$$

$$W_j = \tau_j \tag{6}$$

where k is the other spouse and $1/2 \leq s \leq 1$ is the sharing parameter. Within a single tax regime, s has the interpretation of an intrahousehold inequality

[12]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 $M_\omega(q) = E_\omega(e^{q\omega_j}) = \left(\frac{1}{1-2q}\right)^{a_j}$.

parameter. When $s = 1/2$, then the family fully pools its resources and the ratio consumption levels C_j/C_k equals 1. When $s = 1$, the ratio of consumption levels is pinned down by the ratio of gross incomes, $\frac{C_j}{C_k} = \frac{W_j L_j}{W_k L_k}$, and there is no sharing of resources. Finally, note that in deciding the level of training, workers internalize that a higher level of investment increases their productivity and therefore their wage rate.

The solution to the above maximization problem yields the labor supply and the training decision functions (see the Appendix to Section 3.2 for details)

$$\begin{aligned} L_j &= (s(1-t_j))^{\frac{2}{a_j-2}} = (s(1-t_j))^{\frac{2\sigma_j}{1-\sigma_j}} \\ \tau_j &= (s(1-t_j))^{\frac{a_j}{a_j-2}} = (s(1-t_j))^{\frac{1+\sigma_j}{1-\sigma_j}} \end{aligned} \quad (7)$$

where

$$\sigma_j = \frac{\partial L_j}{\partial W_j}\frac{W_j}{L_j} = \frac{1}{a_j - 1} \quad (8)$$

is the own elasticity of labor supply with respect to an exogenous variation in the wage rate. For this Section, cross elasticities are zero because we have assumed quasilinear preferences. In Section 4 with endogenous allocation of home duties, we endogenize non zero cross elasticities.

Suppose now that for exogenous reasons the male takes less home duties than the female, i.e. we have $a_m > a_f$. Then 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: $\tau_m > \tau_f$;
- 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 take less home duties and therefore participate more in the market (Becker 1985). Second, since males take less home duties and face a lower cost of supplying labor, they also invest more in training. In turn, investment in training endogenously shifts the labor demand curve up and increases the wage rate W (Mincer and Polachek 1974). 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.

A final word about training. 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 comparative advantage in working and absorbing fewer home duties. This interesting extension could be discussed in an even more general model in which the marriage market is also endogenized.

3.3 Foundations of Labor Supply and its Elasticity

The allocation of home duties, a_j, affects the expected utility from working and its derivatives. For spouse j and given a specific realization of the labor market shock ω, we define $u = -\frac{1}{a}e^{v(L)\omega}$ to be the expost disutility from labor supply. The curvature functions $r_\omega = -\frac{u_{\omega\omega}}{u_\omega}$ and $r_L = \frac{u_{LL}}{u_L}$ measure the attitude towards risky realizations of ω and L respectively.[13] The expected marginal utility of working is given by

[13]We don't have a minus in the definition of r_L because labor is a "discommodity", i.e. $u_L < 0$.

$$U_L = -L^{a-1} \qquad \text{with } a > 2 \text{ and } L < 1. \tag{9}$$

so that fewer home duties (higher a) increase the expected marginal utility of working for spouse j. Because the latter expects a higher realization of the labor market shock ω, he or she works more, invests more in human capital and earns a higher wage rate. This means that home duties and participation in the market are *substitutes.*[14]

At the same time, taking less home duties implies a higher elasticity of expected marginal utility of working with respect to labor supply

$$\varepsilon_{U_L,L} = \frac{U_{LL}L}{U_L} = (a_j - 1) = \frac{1}{\sigma_j} \tag{10}$$

Since for fewer home duties the marginal utility of working is more sensitive 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.

The gender gap in labor supply elasticities can be traced back to the attitudes of the two spouses towards risk. In the Appendix to Section 3.3 we show that

$$\frac{\partial r_\omega}{\partial L} = -\frac{\partial r_L}{\partial \omega} = -v'(L) < 0 \tag{11}$$

The first part of the symmetry condition (11) states that a spouse who participates more in the labor market is less risk averse to stochastic realizations of ω. We can think of this third-order cross partial effect as a diversification motive. High realizations of L cause spouse j to be less averse to ω-uncertainty since uncertainty "per unit" of labor decreases. The second part of equation (11) states that a spouse getting a good realization of ω is

[14]This substitutability resembles Becker's (1985) assumption that the utility cost of effort is increasing in home hours. For a recent discussion of the implications of this assumption see Albanesi and Olivetti (2006).

more risk averse in stochastic realizations of participating in the market L.[15] The intuition is that as the number of shocks and therefore the variability in the market increase, spouse j becomes more willing to commit his labor supply to a stable level.

Given that economic decisions are formulated without knowledge of ω, what matters for the (expected) elasticity of labor supply is the expected attitude towards risk. Using the properties of a chi-squared random variable with $2a$ degrees of freedom, we obtain

$$\frac{\partial E_{\omega}(r_L)}{\partial Var(\omega)} = \frac{1}{4L^2} > 0 \tag{12}$$

so that a spouse j who expects to get more shocks in the labor market, also expects to be expost more sensitive in labor supply movements.

For example, when $a_m > a_f$, males participate more in the market ($L_m > L_f$ and $\tau_m > \tau_f$) because they expect a higher realization of the labor market shock ($E(\omega_m) > E(\omega_f)$) and face a lower expected cost of supplying labor. Given that $L_m > L_f$, males are less risk averse in ω-uncertainty because they spread their risks into more units of L (that is, $(r_{\omega})_m < (r_{\omega})_f$), and *expect* to be more risk averse in L-uncertainty because they face a more volatile labor market shock ω (i.e. $E(r_L)_m > E(r_L)_f$). Since males expect to be more averse to deviations from a stable employment level *expost*, they commit *exante* to supply their labor more inelastically. For a foundation of the cross elasticities of labor supply see Section 4.3.

[15] Here the wording "more risk averse" can be rephrased as "less risk lover" because expost r_L can be negative or positive depending on the particular realization of ω. However $E_{\omega}r_L$ is always positive so that every spouse always *expects* to be an expost risk averse person in L.

3.4 Gender Based Taxation: The Short Run

The planner sets taxes for the male and the female in order to raise revenues and finance a public good G.[16] In doing so, the planner anticipates the private market equilibrium. Let $U_m(t_m, t_f, a_m, s)$ and $U_f(t_m, t_f, a_m, s)$ denote the indirect expected utility function for the male and the female respectively. Without loss of generality, we assume that the planner weights people uniformly.[17] Then, the planner solves

$$\max_{t_m,t_f} \Omega = U_m(t_m, t_f; a_m, s) + U_f(t_f, t_m; a_m, s) \tag{13}$$

subject to the constraint

$$t_m W_m L_m + t_f W_f L_f \geq G \tag{14}$$

Proposition 1 *If $\sigma_m \leq \sigma_f$, then $t_m \geq t_f$.*

The proof of Proposition 1 and the intermediate derivations are presented in the Appendix to Section 3.4. This is an application of a standard Ramsey (1927) rule. It is welfare enhancing to tax less the "commodity" which is supplied with higher elasticity. The intuition is straightforward. Starting from $a_m > a_f$, females take more home duties than males, supply less labor and invest less in training. At the same time females are more elastic, so distorting their labor and training decisions is more costly for the society. In other words, starting from a single tax rate we can always reduce distortions in the labor and the training markets by increasing a little bit t_m and decreasing t_f by more.

[16]We assume that the public good does not provide utility to anyone and the proceedings are not rebated back. This is without loss in generality since the nature of the results (throughout the paper) does not change when we allow for revenues to be distributed in a lump sum way. See Lundberg, Pollak and Wales (1997) for an natural experiment with intrahousehold lump sum transfers.

[17]Under $\Omega = \frac{1}{1-e}(U_m^{1-e} + U_f^{1-e})$ with inequality aversion ($e > 0$), the difference in the resulting tax rates is even more profound. The same holds for the analysis in Section 4.

In Table 1 we present the welfare gains when moving from a single tax to differentiated taxes by gender. Gender Based Taxation (GBT) is not only welfare enhancing but also brings more equality in labor market outcomes. Importantly, if the ratio of elasticities is $\frac{\sigma_m}{\sigma_f} = 1/4$, as in the US according to Blau and Kahn (2007), GBT raises welfare by 1.4% and GDP by 1.8%.[18] Naturally, GBT is more efficient the higher is the level of distortions (i.e. the higher is public expenditure G).

A crucial point for the political sustainability of any policy reform is the design of a "compensation scheme" where the winners can compensate the losers. For the case of GBT, the compensation from females to males is more natural and easy to imagine than in other policies (e.g. opening up to free trade). If people do not live in families, then GBT makes males worse off and females better off. However, when people share resources within the family, it is possible that GBT makes *both* spouses better off. The reason is that with a relatively low t_f, females participate more in the labor and training markets and bring home more income. If resource sharing within the family is important, males may be better off even with a higher t_m. We further analyze this point in Section 4.[19]

4 Endogenous Allocation of Family Duties

In this Section we endogenize the allocation of family jobs and rederive the optimality of Gender Based Taxation in a setting with endogenous "long run" elasticities.

[18]For further evidence on the gender differential on labor supply elasticities see Alesina, Glaeser and Sacerdote (2005) and Blundell and MacCurdy (1999).

[19]However, this says nothing about singles, which we believe is a fruitful topic for further research.

4.1 Government's Intervention

As we discussed above, GBT is optimal if men assume fewer home duties than women, in a model where women have no comparative advantages in home duties.[20] A biased allocation of home duties in favor of the male accords well with our a priori intuition and our empirical observation.[21] In this Section we also show that it accords well with a situation in which spouses bargain over the allocation of home duties and men have a stronger bargaining power, an assumption that seems consistent with survey evidence. For instance, Friedberg and Webb (2006) use data from the Health and Retirement Study and document that nearly 31% of the 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. In this situation the crucial question is how the society (i.e. the social planner in our context) should evaluate the utility of husbands and wives. A natural premise is that the social planner evaluates people equally, that is we adopt the utilitarian welfare function, $\Omega = U_m + U_f$.

We assume that the male has a greater decision making power, maybe because in the past physical power mattered and there are persistent cultural forces in the formation of the family.[22] If and only if there is a "social dissonance" (Apps and Rees 1988) between the preferences of the society and the

[20] Extensions that allow for this possibility are left for future research. Note that Ichino and Moretti (2006) find that biological differences explain a large part of the gender differential in absenteeism which translates in a 12% fraction of the earning gap. Albanesi and Olivetti (2007) point out that technological improvements have certainly reduced women's comparative advantage in household production and duties.

[21] See Aguiar and Hurst (2007) for recent evidence. Although the difference between male and female housework has decreased in the last 50 years, females perform nearly twice as much house work as males.

[22] 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). Their result suggest that one should be cautious in applying to different countries and cultures the same set of preferences on the issue of gender roles.

equilibrium result of an intrafamily game in which one party has a disproportionate share of power, there is a justifiable reason for the government to intervene in ways which, in addition to financing the public good, affect the intrafamily bargaining process.

Note that in this model if the government could choose directly the allocations of home duties and then set taxes to raise a pre-specified amount of revenues, then the *ungendered* equilibrium ($a_m = a_f, t_m = t_f$) would be the first best and there would be no need for GBT. In Figure 3, we depict this Edgeworth's (1897) "egalitarian" solution: remember that we have no comparative advantages of any gender in market or non market activities and we have decreasing marginal utilities. So, starting from a gendered equilibrium ($a_m > a_f$), we can allocate one more unit of home duty to the male from the female and increase social welfare because there are "decreasing returns to specialization".[23] In other words, the first hour that the father spends with his children is more productive than the female's last hour.[24] This is true because starting from $a_m > a_f$ we have

$$\frac{\partial \Omega}{\partial a_m} = \frac{\partial U_m}{\partial a_m} + \frac{\partial U_f}{\partial a_m} < 0 \tag{15}$$

The government, however, cannot dictatorially impose a balanced intrahousehold allocation of shocks; instead it must respect the private sector's equilibrium.[25] The main message of our analysis however is that, the government can alter the intrahousehold allocation process and achieve a more

[23] Even though a_m and a_f can take only integer values, for expository reasons we discretize the total number of shocks A into non-integer values and treat them as continuous variables when conducting comparative statics. Alternatively, we could increase A to create meaningful variations in a_m, a_f, but at the expense of calibrating the elasticities and burdening the notation.

[24] Concavity of the indirect utility functions with respect to a_m is not a global property, but it always holds for the Pareto efficient allocations that we examine. See the Appendix to Section 4.1 for details.

[25] Affecting a_m and a_f, at least to some extent, could be the role for parental leave policies, which, however, can hardly be enforced in reality. See, for example, Friebel, Eckberg and Erickson (2005).

ungendered equilibrium through gender specific taxes.

The timing of the game now becomes as follows. First, the government sets taxes. Then, the male and the female take as given the tax rates and bargain over the allocation of home duties anticipating the resulting labor market equilibrium (as described in Sections 3.2 and 3.3). Next, spouses individually optimize expected utility taking as given the allocation of home duties. Then, the perfectly competitive, constant-returns to scale firm pays each worker its marginal productivity and makes zero profits. Finally, the labor market shocks are realized.

4.2 Bargaining over Home Duties

At the second stage of the game spouses decide whether to marry and allocate home duties or not marry. In doing so, they both rationally anticipate the resulting labor market equilibrium. The utility of a spouse j when married is given by the indirect utility function at stage 3, as described by the maximization of (4) subject to the constraints (5) and (6) (see the Appendix to Section 4.2 for details). We assume that the autarky utility level of each spouse (the threat point), is given by the value function of the following program

$$\max_{C_j, L_j, \tau_j} T_j = C_j - \frac{1}{\phi} L_j^{\phi} - \frac{1}{2}\tau_j^2 - z \tag{16}$$

subject to

$$C_j = (1 - t_j) W_j L_j \qquad \text{and} \qquad W_j = \tau_j \tag{17}$$

This specification of the threat point implies that there is a disutility z of being alone. On the other hand a single does not share resources so he or she gets a "full share of a smaller pie". Importantly, a single has a shock $\omega_s \sim \chi^2_{2\phi}$ with $\phi = A$, which means that singles have less home duties than a married person, for instance because they have no children.[26] Translated

[26]This assumption can be relaxed. Even when a single has the same amount of home

into the words of the example in Section 3.1, a single person never has to drive the kids to school.

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

$$[U_m(a_m; t_m, t_f, s) - T_m(t_m, \phi, z)]^{\gamma} [U_f(a_m; t_f, t_m, s) - T_f(t_f, \phi, z)]^{1-\gamma} \quad (18)$$

where $\gamma > 1/2$ is the bargaining power of the male.

While our marriage specification is, admittedly, simplified, it well captures the importance of the threat points for GBT. There is a feedback effect from government policy to the intrahousehold allocation of bargaining power because the outside option of a spouse j depends on the tax rate t_j. When for example the tax rate decreases, spouse j acquires more implicit bargaining power through increased training, wage rate and market participation.[27] In Section 5 we discuss proposed extensions of the marriage market along more realistic lines including a situation where both married couples and singles can exist in equilibrium.

4.3 The Bargaining Solution

We consider the properties of the solution mapping $a_m(t_m, t_f) : [0, 1]^2 \mapsto (2, A - 2)$. The bargaining solution prescribes how the family allocates home duties for any pair of tax rates, given parameters γ, s, A and z. We don't have closed-form expressions for the solution $a_m(t_m, t_f)$ and its comparative statics, but we can discuss intuitively (and establish numerically) two important properties of the bargaining solution. For more details see the Appendix to Section 4.3.

duty with a married person *on the equilibrium path*, the results do not change. See the Appendix to Section 4.3.

[27] Pollak (2005) argues 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.

First, the sharing parameter affects the allocation of home duties. Specifically for given (t_m, t_f), an increase in s, i.e. less resource sharing, makes the allocation of shocks more unbalanced, $\frac{\partial a_m}{\partial s} > 0$. We call this the *sharing effect* and depict it in Figure 4. This Figure plots the male's indirect utility function $U_m(a_m)$ as a function of home duties. When the male makes take it or leave it offers to the female (equivalent to $\gamma = 1$) and there is no income sharing, he chooses the maximum feasible level of a_m, that is he chooses not to take any home duties. As the sharing of resources becomes important (s decreases) the male decides to take some amount of homework, even though he has the maximum level of bargaining power. When income is shared, it is never individually optimal for the male to have the female not working in the market. The same intuition applies for any level of $1/2 < \gamma < 1$. As income pooling becomes more important the intrahousehold allocation process becomes more balanced. At some level s_E, resource sharing is so important that the allocation of shocks is completely balanced, even without government intervention.

The sharing of resources implies that there is an externality in the model. Inspection of the solution (7) suggests that as resource sharing increases, both spouses participate less in market activities because they lose part of their individual claims over the market product.[28] For extreme levels of sharing, $s < s_E$, the male with the bargaining power is better off by staying at home and having the female working and sharing her income with him (this is Area 1, in Figure 5). This prediction is not realistic and from now on we restrict attention to $s \geq s_E$.

Even though, for given allocation of home duties, a spouse works and trains less the greater is the sharing of resources, the intrahousehold allocation process is always efficient because the Nash bargaining process is Paretian. Referring back to Figure 3, note that the allocation of resources always

[28] In that sense this model is a little more individualistic that the collective family model of Chiappori (1988, 1992).

lies on the Pareto frontier because we cannot make better off one spouse without making worse off the other (see also equation (15)).

The second property of the bargaining solution can be examined by increasing the tax rate for the male t_m and keeping fixed the female's tax rate t_f and the level of sharing s. Then, from inspection of the Nash product (18) there are three direct effects going in different directions:

- *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).
- *Cross Redistribution Effect*: $\frac{\partial U_f}{\partial t_m} < 0$. Because spouses share resources inside the marriage, a higher t_m makes the female worse off inside the marriage. In order to "stay in the contract" she must be compensated with less home duties (lower a_m).

We can show (see the Appendix to Section 4.3) that the threat effect always dominates the redistribution effect. That is, a higher tax rate brings a more balanced allocation, $\frac{\partial a_m}{\partial t_m} < 0$ because [29]

$$\frac{\partial U_m}{\partial t_m} - \frac{\partial T_m}{\partial t_m} > 0 \tag{19}$$

which holds if (but not only if) $s < 1$ and $a_m < \phi$. Similar reasoning (but not symmetric because $\gamma > 1/2$) holds for varying the female's tax rate and $\frac{\partial a_m}{\partial t_f} > 0$.

[29] See the Appendix to Section 4.3 for the robustness of this result after considering the second order effects.

Finally, we note that with endogenous allocation of home duties the cross elasticities of labor supply are not zero as in Section 3. When t_j changes for spouse j, the allocation of home duties changes endogenously and both spouses adjust their labor supplies. We can write for spouse k

$$e_{L_k,t_j} = \frac{\partial L_k}{\partial t_j}\frac{t_j}{L_k} = \left(\frac{\partial L_k(\bar{a_k})}{\partial t_j} + \frac{\partial L_k}{\partial a_k}\frac{\partial a_k}{\partial t_j}\right)\frac{t_j}{L_k} \tag{20}$$

The first term in (20) is zero because preferences are quasilinear and the budget constraint is separable in spouses' net incomes. The second term 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 relative bargaining power of the female. As a result, the female takes less home duties (a_f increases), and the cross elasticity of labor supply with respect to her spouse's *tax rate* is positive.[30]

4.4 Gender Based Taxation: The Long Run

The planning program can be written as

$$\max_{t_m,t_f} \Omega = U_m(t_m, t_f; a_m, a_f, s) + U_f(t_f, t_m; a_f, a_m, s) \tag{21}$$

subject to the constraint

$$t_m W_m L_m + t_f W_f L_f \geq G \tag{22}$$

The difference with Section 3.4 is that now the allocation of home duties is endogenous and the government anticipates that by setting taxes it affects the private sector's equilibrium

$$a_m = a_m(t_m, t_f; \gamma, s, z)$$

[30] 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.

$$a_f = a_f(t_f, t_m; \gamma, s, z).$$

$$W_j = W_j(t_j, a_j(t_j, t_f))$$

$$L_j = L_j(t_j, a_j(t_j, t_f))$$

for $j = m, f$.

We first examine government's incentives. Starting from a single tax rate, the government can induce a more balanced allocation by differentiating taxes and setting $t_m > t_f$. As long as labor supply elasticities remain different ($\sigma_f > \sigma_m$), GBT also reduces fiscal distortions as in Section 3.4.

There is an implicit cost, however, of taxing the male on a higher schedule. By taxing the male at a higher rate not only we distort his labor supply and training decisions (as in Section 3.4) but also we force him endogenously to take more home duties (lower a_m) which *further* reduces the government's ability to extract revenues from the primary earner. This "Laffer curve" effect appears in the first order conditions and increases the ratio of the female over the male marginal revenue (see Appendix to Section 4.4 for further discussion). It can be inspected by looking at the bliss point of spouse j under exogenous and endogenous bargaining. For the former case, the peak of the Laffer curve is given at the point where the elasticity of earnings with respect to the tax rate equals -1

$$t_{j,BLISS} = \frac{E_j}{-\frac{dE_j}{dt_j}} = \frac{a_j - 2}{2a_j} = \frac{1-\sigma_j}{2(1+\sigma_j)} \tag{23}$$

where $E_j = W_j L_j$ are pre-tax earnings. Notice that if a higher t_j reduces a_j, then the peak of the Laffer curve shifts to the left. Then, for the endogenous bargaining case we have that

$$t_{j,BLISS2} = \frac{E_j}{-\frac{\partial E_j}{\partial t_j} - \frac{\partial E_j}{\partial a_j}\frac{\partial a_j}{\partial t_j}} \tag{24}$$

with $t_{j,BLISS2} < t_{j,BLISS}$ as long as $\frac{\partial E_j}{\partial a_j} > 0$ and $\frac{\partial a_j}{\partial t_j} < 0$ as it is the case for the male.

In Figure 5 we depict the solution for the ratio of optimal gender based taxes $\frac{t_m}{t_f}$ as a function of the sharing parameter s. There are three areas of interest. In Area I the externality is so high ($s < s_E$) that the male decides to stay at home. The female works more, earns more, is less elastic and the male enjoys resources mainly from his spouse's income. As mentioned before, this case does not accord with real life labor markets and we can safely dismiss it.[31] In Area II, the male has the bargaining power and without extreme sharing of resources he prefers to assume fewer home duties. As a result he works, invests and earns more than the female. The analysis of Section 3.3 applies, so the male is also less elastic. In Figure 5 we depict the ratio of labor supply elasticities (that move in the opposite direction of the ratio of home duties) under a single and gender based taxes together with the ratio $\frac{t_m}{t_f}$. Gender based taxes induce a more balanced allocation of home duties and bring closer to 1 the ratio of elasticities because they increase the implicit bargaining power of the female. Moreover as long as $\sigma_f > \sigma_m$, the conventional Ramsey principle applies and GBT reduces fiscal distortions. Note that with endogenous bargaining and starting from $\gamma > 1/2$, it is relatively more costly for the society to tax the female than it is in the exogenous bargaining case. The reason is that every extra unit of tax revenues that the government raises from the female further deteriorates her implicit bargaining power and results in a more gendered allocation (see Appendix to Section 4.4 for this argument).

In Area III, $t_m > t_f$ is still optimal. But here with less resource sharing, given the intuition of the sharing effect in Section 4.3, the ratio of home duties and the ratio of elasticities diverge even more. However, the ratio of tax rates starts to decline. The intuition for this result can be found

[31] See also the references for the empirical failure of the income pooling hypothesis given in Section 2.

in Figure 6, after recalling that taxing at a higher tax rate the primary earner endogenously shifts his Laffer curve to the right. This Figure depicts the ratio of wage rates (or training levels) $\frac{W_m}{W_f}$ as a function of the sharing parameter s under a single and gender based taxes. Notice that the ratio of optimal taxes $\frac{t_m}{t_f}$ traces the inequality in the household $I = \frac{W_m}{W_f}$ that prevails under a single tax. Inequality under a single tax rate peaks at approximately $s_M = .92$. Since the market by its own reduces inequality in earnings and since it is costly for the government to further increase the elasticity of the male, there is no reason why the ratio of taxes should continue to diverge for $s > s_M$. The reason why resource sharing and inequality under a single tax rate exhibit an inverted U-shaped relationship is the following. Under a high level of resource sharing, both the male and the female participate less in the market, and the inequality ratio is low. As resource sharing declines (s increases) both partners participate more, but the male at an increasing rate and therefore inequality starts to rise. Under extremely low levels of income pooling the female starts to participate at an increasing rate, so inequality begins to fall. Even for no resource sharing, i.e. $s = 1$, we always have $W_m > W_f$, so there is always incentive for the government to set $t_m > t_f$. See Appendix to Section 4.4 for more details on this argument.

In Figure 7 we depict the gains in welfare, GDP and employment when moving from a single to gender based taxes as a function of s. The gains are maximized when pre-gender based inequality is maximized and start to fall when gender based taxation becomes less necessary in Area III. Finally, in Figure 8 we depict the possibility that both spouses gain under gender based taxation.[32] If resource sharing is important, both spouses gain when moving from a single to gender based taxes because the female starts to work, train and earn more.

[32]While the previous qualitative results are robust to changes in the calibration, Figure 8 is just illustrative. Gender based taxation theoretically may make both spouses better off, but this need not always be the case. For easiness of exposition in Figure 8 we have assumed take it or leave it offers.

5 Conclusions

In this paper we argue that Gender Based Taxation should be taken into consideration as a potential tax policy . Our main contribution is to evaluate this possibility in a model in which labor supply, their elasticities and the bargaining between spouses are derived endogenously.

If the bargaining power within the family favors the male, GBT with lower tax rates for females is superior to an ungendered tax rate. In what we 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 reoptimizing their bargaining over household duties, GBT leads to a more equitable distribution of household chores and market activities. To the extent that this reallocation does not produce complete equity between male and female and therefore the supply elasticities remain different, GBT is optimal. The reallocation towards more equality of household duties is an additional welfare improving effect if society evaluates the welfare of males and females equally. 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 our model GBT is optimal for the couple with both members weighted equally and, for some parameter values, for *both* members of the couple individually.

Rather than reviewing in more details our results it is worth discussing several important avenues for future research. First we have not considered the possibility of a comparative advantage of females in home production. Although recent empirical evidence (Albanesi and Olivetti, 2007) suggests that gender-specific technological progress makes this assumption less relevant in modern times, it is still "a possibility on the table". Related to that we have not allowed for learning by doing and specialization in household chores. Second, 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 model. 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. An answer to this question would depend undoubtedly on the redistributive properties across families, that the latter solution would imply. 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. Finally, we believe that a comparison of Gender Based Taxation with other gender and family policies, like 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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Appendix

In this Appendix we provide some useful derivations, results and technical details.

Appendix to Section 3.2

Equation (7) is derived by substituting constraints (5) and (6) into the objective function (4), taking the first order conditions with respect to L and τ and solving the resulting system of equations. The second order sufficient conditions for this maximization problem hold, as $U_{LL} < 0$, $U_{\tau\tau} < 0$, $U_{LL}U_{\tau\tau} - U_{L\tau}^2 > 0$ (U is globally strictly concave in (L, τ)).

Equation (8) gives the elasticity of labor supply with respect to an exogenous variation in the wage rate. This is derived from the first order condition with respect to labor supply (for given amount of training), $s(1 - t_j)W_j - L_j^{a_j - 1} = 0$.

The comparative statics on wages, labor supply, elasticities and training, starting from $a_m > a_f$ follow directly from inspection of (7) and (8) because $s(1 - t_j) < 1$, $\frac{\partial \frac{2}{a-2}}{\partial a} < 0$ and $\frac{\partial \frac{a}{a-2}}{\partial a} < 0$.

Appendix to Section 3.3

We have defined $U = E_\omega V = C - \frac{1}{a}L^a - \frac{1}{2}\tau^2$ as the expected utility function which is derived under the properties of the chi-squared distribution. Then, equations (9)-(10) are obvious. $u = -\frac{1}{a}e^{v(L)\omega}$ is the expost disutility from labor supply (in $V = C + u - \frac{1}{2}\tau^2$), where $v(L) = \frac{1}{2}(1 - \frac{1}{L})$, with $v' > 0, v'' < 0, v''' > 0$. We also define the curvature functions $r_\omega = -\frac{u_{\omega\omega}}{u_\omega} = -v(L)$ and $r_L = \frac{u_{LL}}{u_L} = \frac{v''(L)}{v'(L)} + v'(L)\omega$. While we have that $r_\omega > 0$, so spouses are always risk averse in ω-variations, $r_L > 0$ only for $\omega > 4L$. However, every spouse *expects* to be expost averse to L-variations because $E_\omega r_L = \frac{v''(L)}{v'(L)} + 2av'(L) > 0$. r_ω is constant in ω (hence the terminology "CARA") but changes with L. r_L is not constant but depends on L and ω. For the third order effect $\frac{\partial r_L}{\partial L}$, a sufficient, but not necessary, condition for this to be negative ("risk prudence") is that $a_j > 3$.

What matters for our results is the, in expectation, variation of r_L with ω. More specifically, $E_\omega r_L$ is positively correlated with the $Var(\omega)$ as in equation (12). For (12) we also need that the variance of a chi-squared random variable with $2a$ degrees of freedom equals $4a$. (12) says that the spouse who gets a higher number of shocks, i.e. faces more variability in the labor market, expects to be expost more concave in L. This flattens the (exante) utility contours (in the (C, L) space) and lowers the elasticity of labor supply.

Appendix to Section 3.4

We first substitute the solution (7) and the constraints (5) and (6) into the objective function (4) and derive the indirect utility function. For example, for the male with home duties equal at some generic level $a_m = a$, the value function is $U_m(t_m, t_f; a, s) = \frac{a-2}{2a}(s(1-t_m))^{\frac{2a}{a-2}} + (1-s)(1-t_f)(s(1-t_f))^{\frac{A-a+2}{A-a-2}}$. Similarly for the female we have $U_f(t_m, t_f; a, s) = \frac{A-a-2}{2(A-a)}(s(1-t_f))^{\frac{2(A-a)}{A-a-2}} + (1-s)(1-t_m)(s(1-t_m))^{\frac{a+2}{a-2}}$. Denote $R_m = t_m L_m(t_m; a, s) W_m(t_m; a, s)$ and $R_f = t_f L_f(t_f; a, s) W_f(t_f; a, s)$ the revenues collected from the male and the female respectively evaluated at the solution (7). Then we can write the planning program as

$$\max_{t_m, t_f} \Omega = U_m(t_m, t_f; a, s) + U_f(t_f, t_m; a, s) \tag{25}$$

subject to the constraint

$$R = R_m + R_f \geq G \tag{26}$$

A standard complication in public economics (Diamond and Mirrlees 1971b, Myles 1995, pp 113-114) arises from the fact that the above maximization problem is not sufficiently "smooth". The problem arises in the dual approach because the consumer's indirect utility function is quasiconvex in prices (and income). The program can be turned into a concave problem for a social welfare function of the form $\Omega(U_m, U_f)$, with Ω being sufficiently concave (high inequality aversion), but in general the transformation of a concave with a convex function is not guaranteed to be concave. In our case, with quasilinear preferences and the utilitarian welfare (i.e. $\Omega_{U_m} = \Omega_{U_f} = 1$), welfare is strictly convex in the tax rates. This means that we cannot simply invoke standard sufficient conditions from the theory of concave programming.

Now we establish the sufficiency of the first order conditions for the above problem. We also can show that this is true for any welfare function that is more concave than the utilitarian case (which is the least concave welfare function).

First, from the definition of U_m (or the application of the Envelope Theorem) we get that $\frac{\partial U_m}{\partial t_m} = -s\tau_m L_m < 0$, i.e. utility strictly decreases in the tax rate (because labor supply and training are always in the interior, all inequalities are strict).[33] Also, $\frac{\partial U_m}{\partial t_f} = -(1-s)(\frac{2(A-a)}{A-a-2})\tau_f L_f < 0$ for any $s < 1$, i.e. male's utility strictly decreases with the tax rate of his spouse because the couple shares resources. Then, we have that $\frac{\partial^2 U_m}{\partial t_m^2} = -s(\tau_m \frac{\partial L_m}{\partial t_m} + L_m \frac{\partial \tau_m}{\partial t_m}) > 0$ and $\frac{\partial^2 U_m}{\partial t_f^2} = -s(\frac{2(A-a)}{A-a-2})(\tau_f \frac{\partial L_f}{\partial t_f} + L_f \frac{\partial \tau_f}{\partial t_f}) > 0$ from inspection of (7). So, U_m is strictly convex

[33] Throughout the Appendix all derivatives are evaluated at the optimum, i.e. at (7).

in (t_m, t_f) as the sum of two strictly convex (univariate) functions. The properties of U_f are similarly derived.

Given the properties of the two indirect utility functions, $\Omega = U_m + U_f$ is strictly decreasing in t_m, strictly decreasing in t_f and strictly convex in (t_m, t_f). So, in the (t_m, t_f) space, the gradient vector $\nabla\Omega$ points towards the origin $(0, 0)$ and the lower contour set of the social indifference curve $\Omega(t_m, t_f) = \bar{\Omega}$ is strictly convex.

Second, consider the revenue function for the male, R_m. We have that $\frac{\partial R_m}{\partial t_m} = \tau_m L_m + t_m L_m \frac{\partial \tau_m}{\partial t_m} + t_m \tau_m \frac{\partial L_m}{\partial t_m}$. Using (7) this is equal to $\frac{\partial R_m}{\partial t_m} = sL_m^2[1 - t - t(\frac{a+2}{a-2})]$. The peak of the Laffer curve for the male comes at the tax rate where the elasticity of earnings with respect to the tax rate is minus unity, so that $t_{m,BLISS} = \frac{a-2}{2a}$. Similarly, for the female we have $t_{f,BLISS} = \frac{A-a-2}{2(A-a)}$. Now we also have that $\frac{\partial^2 R_m}{\partial t_m^2} = sL_m^2[-1 - \frac{a+2}{a-2}] + 2sL_m \frac{\partial L_m}{\partial t_m}[1 - t - t(\frac{a+2}{a-2})]$. The first term is negative while the second term is negative if $\frac{\partial R_m}{\partial t_m} > 0$. So, the revenue function for the male is concave if (but not only if) we are at the upwards sloping part of his Laffer curve. The same holds for the female.

Given the properties of R_m and R_f, total revenues $R = R_m + R_f$ are strictly increasing in each of t_m and t_f and strictly concave in (t_m, t_f) if (but not only if) $(t_m, t_f) < (t_{m,BLISS}, t_{f,BLISS})$. This means that in the (t_m, t_f) space the gradient vector of the revenue function ∇R points towards the bliss point and the upper contour set of the revenue isolevel $R = G$ is strictly convex in that region. Notice if $a_m > a_f$, the bliss point lies above the 45 degree line which signals that $t_m > t_f$ holds in the solution.[34] Also define G_{max} to be the maximum sustainable level of public expenditure with $G_{max} = R(t_{m,BLISS}, t_{f,BLISS})$.

Next, it is easy to show that $t_m > t_{m,BLISS}$ or $t_f > t_{f,BLISS}$ can never solve the program. By contradiction and without loss of generality assume that $t_m > t_{m,BLISS}$ holds in the solution. Then we can find a $t_{m,1} < t_m$ such that welfare is higher ($W_{t_m} < 0$) and the constraint is relaxed ($R_{t_m} < 0$).

Therefore without loss in generality we now restrict attention to the set $D = [(t_m, t_f) : t_m \in [0, t_{m,BLISS}], t_f \in [0, t_{f,BLISS}], G_{max} \geq R \geq G]$. Since D is a compact set and Ω is a continuous function, by Weierstrass Theorem, a global maximum exists in D (and a global minimum, which is given by the bliss point for any $G < G_{max}$).

Next, it is easy to show that the constraint always binds at the optimum. Suppose not, i.e. there exists vector (t_m, t_f) such that $R(t_m, t_f) > G$ that maximizes welfare. But then we can increase welfare by decreasing some tax rate, while still satisfying the constraint $R(t_m, t_f) \geq G$.

[34] So, if the government wants to extract the maximum revenue the solution is $t_m = t_{m,BLISS} > t_f = t_{f,BLISS}$.

Fix an arbitrary level of public expenditure $G \leq G_{max}$. The next step is to establish that for $a_m > a_f$, i.e. $\sigma_f > \sigma_m$, the solution $t_f > t_m$ is never optimal. Let's call C the point along the 45 degree line where $R(t_m, t_f) = G$, for $t_m = t_f$. Let's call B the point $(t_m, t_{f,BLISS})$ that achieves the same level of G. Hence, we want to show that the solution never lies on the CB segment. To show that this is true, it suffices to show that the slope of the welfare function in the (t_m, t_f) space is always greater in absolute value than the slope of the revenue function at every point along the segment CB. This immediately implies that starting from $t_f > t_m$ we can decrease t_f, increase t_m, increase welfare (since we are below the $t_m = t_f$ line) and still satisfy the budget constraint. In other words, $t_f > t_m$ is never optimal because the relative marginal cost of taxing a female is higher than the relative marginal revenue and we can improve welfare by reducing t_f.

The slope of the revenue function is given by $-\frac{R_{t_f}}{R_{t_m}} = -\frac{sL_f^2[1-t_f-t_f(\frac{a_f+2}{a_f-2})]}{sL_m^2[1-t_m-t_m(\frac{a_m+2}{a_m-2})]}$ and the slope of the welfare indifference curve by $-\frac{\Omega_{t_f}}{\Omega_{t_m}} = -\frac{sL_f^2(1-t_f)[s+(1-s)(\frac{2a_f}{a_f-2})]}{sL_m^2(1-t_m)[s+(1-s)(\frac{2a_m}{a_m-2})]}$. Now starting from $a_m > a_f$ ($\sigma_f > \sigma_m$) and $t_f > t_m$ we have that $\frac{s+(1-s)(\frac{2a_f}{a_f-2})}{s+(1-s)(\frac{2a_m}{a_m-2})}$ is larger than one larger than $\frac{1-\frac{t_f}{1-t_f}(\frac{a_f+2}{a_f-2})}{1-\frac{t_m}{1-t_m}(\frac{a_m+2}{a_m-2})}$ for all s, so that the welfare indifference curve is steeper than the revenue level at any point along CB.

Similarly, we can establish that the only point where we cannot increase welfare without violating the constraint is the tangency point (notice however that we had to go through this argument first). In that point the welfare indifference curve is *less convex* than the budget constraint and the optimal taxes satisfy the condition

$$\frac{s+(1-s)(\frac{2a_f}{a_f-2})}{s+(1-s)(\frac{2a_m}{a_m-2})} = \frac{1-\frac{t_f}{1-t_f}(\frac{a_f+2}{a_f-2})}{1-\frac{t_m}{1-t_m}(\frac{a_m+2}{a_m-2})} \tag{27}$$

Equation (27) establishes that if $\sigma_f > \sigma_m$ then $t_m > t_f$. The tangency condition is unique because the expected utility function is strictly concave. This ensures that the objective function (25) is strictly convex and the constraint (26) is strictly concave in the tax rates.

Appendix to Section 4

We denote $a_m = a$ and $a_f = A - a$. We calibrate the total number of home duties to be 20 ($A = 10$). This delivers elasticities of labor supply around .2 for the male and .3 for the female under no resource sharing. The bargaining power γ is set at 3/4 because (i) with resource sharing and (ii) spouses being "risk averse in a", the allocation of resources is quite balanced. For example, with $s = 1$ (i.e. the male willing to take as less home duties as possible) and $z = .2$, the male extracts a little more than 60% of the marriage surplus. For $s < 1$ this is even smaller and changing the bargaining power does not create significant variation in the results. Similarly for z (subject to maintaining strong individual rationality).

In drawing Figures 5-8 we keep constant public expenditure as a percentage of GDP. The reason is that GDP falls quickly with a declining s (both spouses work less), and therefore holding constant the level of public expenditure G results in unmeaningful comparisons. G/GDP is set at 20%.

Appendix to Section 4.1

We don't have an analytic expression for the solution of the bargaining program. Working numerically and intuitively, the first point is that U_m is not globally concave in a. Taking the second order derivative with respect to a we have, for example for the male, that $\frac{\partial^2 U_m}{\partial a^2} = aL^{a-1}[\frac{1}{a^2} - \frac{lnL}{a^2}] + L^a[-\frac{2}{a^2} - \frac{\frac{\partial L}{\partial a}a^2\frac{1}{L} - 2alnL}{a^4}] + (1-s)(1-t_f)\frac{\partial^2 E_f}{\partial a^2}$, where $E_f = W_f L_f$ are the female's earnings. The first term is positive, the second and the third terms negative. However, except for very extreme levels of a (close to 2 or close to A-2), concavity is ensured. In our simulations, U_m is concave in a everywhere in the Pareto efficient area (i.e. when (15) holds, see Figure 3). Similarly for the concavity of U_f. Since the Nash-bargained allocations are by assumption Pareto efficient, concavity in the area of interest is assured, and the bargaining solution is well defined.

Appendix to Section 4.2

In (18) U_m and U_f are given by the same value functions as in the Appendix to Section 3.4 with the difference that now a_m and a_f are viewed as endogenous variables. T_m and T_f, the utility functions under autarky, are given by $T_j = \frac{\phi-2}{2\phi}(1-t_j)^{\frac{2\phi}{\phi-2}} - z$ for any $j = m, f$. The parameter z ensures that strong individual rationality holds in equilibrium.

Appendix to Section 4.3

The derivative of the indirect utility function for the male with respect to a is given by $\frac{\partial U_m}{\partial a} = \frac{1}{a}L^a[\frac{1}{a} - lnL] + (1-s)(1-t_f)\frac{\partial E_f}{\partial a}$, where $E_f = W_f L_f$ are female's earnings. In the absence of sharing we have $\frac{\partial U_m}{\partial a} > 0$. In the presence of sharing, the second term tends to lower $\frac{\partial U_m}{\partial a}$ because the male loses consumption by forcing the female to stay at home. For extreme levels of sharing, $\frac{\partial U_m}{\partial a} < 0$. This is Area

I in Figure 5. Similarly for the female. From now on we restrict the discussion in Areas II and III, with $\frac{\partial U_m}{\partial a} > 0$ and $\frac{\partial U_f}{\partial a} < 0$.

Write the first order condition for the maximization of (18) as $F(a, t_m, t_f, s, \gamma) = \gamma \frac{\frac{\partial U_m(.)}{\partial a}}{U_m(.)-T_m(.)} + (1-\gamma)\frac{\frac{\partial U_f(.)}{\partial a}}{U_f(.)-T_f(.)} = 0$. Differentiating this identity with respect to a we get that $-\frac{\partial F}{\partial a} = \gamma[\frac{\partial U_m \backslash \partial a}{U_m - T_m}]^2 - \gamma \frac{\frac{\partial^2 U_m}{\partial a^2}}{U_m - T_m} + (1-\gamma)[\frac{\partial U_f \backslash \partial a}{U_f - T_f}]^2 - (1-\gamma)\frac{\frac{\partial^2 U_f}{\partial a^2}}{U_f - T_f}$. Since strong individual rationality holds ($U_m > T_m$ and $U_f > T_f$), a sufficient but not necessary condition for $-\frac{\partial F}{\partial a} > 0$ is that U_m and U_f are concave in a, which is true in the Pareto area (see Appendix to Section 4.1) - the second order condition holds.

Differentiate the first order condition with respect to γ and get that $\frac{\partial F}{\partial \gamma} = \frac{\frac{\partial U_m}{\partial a}}{U_m - T_m} - \frac{\frac{\partial U_f}{\partial a}}{U_f - T_f} > 0$. Therefore, using the second order condition $\frac{\partial a}{\partial \gamma} = \frac{\frac{\partial F}{\partial \gamma}}{-\frac{\partial F}{\partial a}} > 0$, and naturally the male gets less home duties the larger is his bargaining power.

For the sharing effect the second-order effects are too complicated to yield a meaningful comparative static. However, in all our simulations the first order effect, i.e. that as sharing increases, the male wants to induce work effort from the female and takes more home duties, always dominates (see Figure 4 for an example) and $\frac{\partial a}{\partial s} > 0$.

What matters for the argument that gender based taxes change the implicit bargaining power is that $\frac{\partial a}{\partial \frac{t_m}{t_f}} < 0$. However, the intuition may well be inspected by changing one tax rate at the time.

The redistribution, threat and cross redistribution effects follow from simple inspection of the utilities under marriage and under autarky. That the threat effect dominates the redistribution effect can be established by differentiating U_m and T_m to obtain $\frac{\partial U_m}{\partial t_m} - \frac{\partial T_m}{\partial t_m} = -(s(1-t_m))^{\frac{a_m+2}{a_m-2}} - (-(1-t_m)^{\frac{\phi+2}{\phi-2}}) > 0$ which holds if (but not only if) $s < 1$ and $a_m < \phi$. A weaker sufficient condition is that a single person takes less home duties than a married person, which we believe is a reasonable condition. This condition becomes sufficient and necessary for no resource sharing, $s = 1$.

That $\frac{\partial U_m}{\partial t_m} - \frac{\partial T_m}{\partial t_m} > 0$ is "almost" sufficient for $\frac{\partial a_m}{\partial t_m} < 0$ can be established as follows. We want to show that $\frac{\partial F}{\partial t_m} < 0$. For this write $\frac{\partial F}{\partial t_m} = \gamma \frac{-\partial U_m \backslash \partial a}{[U_m - T_m]^2}[\frac{\partial U_m}{\partial t_m} - \frac{\partial T_m}{\partial t_m}] + \gamma \frac{\frac{\partial^2 U_m}{\partial a \partial t_m}}{U_m - T_m} + (1-\gamma)\frac{-\partial U_f \backslash \partial a}{[U_f - T_f]^2}[\frac{\partial U_f}{\partial t_m}] + (1-\gamma)\frac{\frac{\partial^2 U_f}{\partial a \partial t_m}}{U_f - T_f}$. We have that $\frac{\partial U_m}{\partial a} > 0$ and $\frac{\partial U_f}{\partial a} < 0$. Now the term $\frac{\partial U_m}{\partial t_m} - \frac{\partial T_m}{\partial t_m}$ is positive because the threat effect dominates the redistribution effect. The term $\frac{\partial U_f}{\partial t_m}$ is the cross redistribution effect and it is negative. The term $\frac{\partial^2 U_m}{\partial a \partial t_m}$ by virtue of the Envelope and Young's Theorems can be written as $\frac{\partial^2 U_m}{\partial a \partial t_m} = -s\frac{\partial E_m}{\partial a}$ and it is negative as earnings decrease with home duties.

Finally, the term $\frac{\partial^2 U_f}{\partial a \partial t_m} = -(1-s)[\frac{\partial E_m}{\partial a} - (1-t_m)\frac{\partial^2 E}{\partial a \partial t_m}]$ may be either positive or negative, depending on the elasticity of earnings with respect to home duties. If it is negative, which holds for s not very large (say in Area II), then $\frac{\partial F}{\partial t_m} < 0$ as wanted. If it is positive, then $\frac{\partial F}{\partial t_m} < 0$ cannot be established analytically, but in our numeric simulations the last effect never dominates the three first effects. The reason is that for s very large which is necessary for $\frac{\partial E_m}{\partial a} - (1-t_m)\frac{\partial^2 E}{\partial a \partial t_m} < 0$ to hold, $(1-s)$ times $\frac{\partial E_m}{\partial a} - (1-t_m)\frac{\partial^2 E}{\partial a \partial t_m}$ becomes negligible. In the absence of sharing, $s = 1$, $\frac{\partial F}{\partial t_m} < 0$ always holds because the first and the second terms are always negative, and therefore $\frac{\partial a}{\partial t_m} < 0$. $\frac{\partial a}{\partial t_f} > 0$ can be examined similarly.

Appendix to Section 4.4

For the program (21)-(22) we work numerically. The first order necessary condition for interior local optimum is given by

$$\frac{\frac{\partial U_f}{\partial t_f} + \frac{\partial U_m}{\partial t_f} + (\frac{\partial a}{\partial t_f})[\frac{\partial U_m}{\partial a} + \frac{\partial U_f}{\partial a}]}{\frac{\partial U_m}{\partial t_m} + \frac{\partial U_f}{\partial t_m} + (\frac{\partial a}{\partial t_m})[\frac{\partial U_m}{\partial a} + \frac{\partial U_f}{\partial a}]} = \frac{E_f + t_f \frac{\partial E_f}{\partial t_f} + t_f \frac{\partial a}{\partial t_f}\frac{\partial E_f}{\partial a}}{E_m + t_m \frac{\partial E_m}{\partial t_m} + t_m \frac{\partial a}{\partial t_m}\frac{\partial E_m}{\partial a}} \tag{28}$$

where $E_j = W_j L_j$ are gross earnings. This condition says that at the optimum the female over the male ratio of social marginal cost should equal the ratio of marginal revenues that the government can extract from each spouse respectively. Multiplying by $\frac{1-t_m}{1-t_f}$ both sides we can rewrite the first order condition as

$$\frac{[\frac{1}{1-t_f}][\frac{\partial U_f}{\partial t_f} + \frac{\partial U_m}{\partial t_f}] + [\frac{1}{1-t_f}](\frac{\partial a}{\partial t_f})[\frac{\partial U_m}{\partial a} + \frac{\partial U_f}{\partial a}]}{[\frac{1}{1-t_m}][\frac{\partial U_m}{\partial t_m} + \frac{\partial U_f}{\partial t_m}] + [\frac{1}{1-t_m}](\frac{\partial a}{\partial t_m})[\frac{\partial U_m}{\partial a} + \frac{\partial U_f}{\partial a}]} = \frac{[\frac{1}{1-t_f}][E_f + t_f \frac{\partial E_f}{\partial t_f}] + [\frac{t_f}{1-t_f}]\frac{\partial a}{\partial t_f}\frac{\partial E_f}{\partial a}}{[\frac{1}{1-t_m}][E_m + t_m \frac{\partial E_m}{\partial t_m}] + [\frac{t_m}{1-t_m}]\frac{\partial a}{\partial t_m}\frac{\partial E_m}{\partial a}} \tag{29}$$

While certainly not sufficient this condition can shed some light in the workings of the solution. In the left hand side, the first terms in the numerator and the denominator are the same as in the case of the exogenous bargaining problem (as in equation (27)). The second terms in the numerator and the denominator appear because the government desires to affect the allocation of home duties. The term in the brackets $[\frac{\partial U_m}{\partial a} + \frac{\partial U_f}{\partial a}]$ is common in the numerator and the denominator. This would have been the first order condition if the government could affect a directly. Starting from $a > A - a$ (i.e. the male getting less home duties) this term is negative because of decreasing returns of specialization (at least, in the Pareto area). From the analysis in Section 4.3 and in this Appendix the term $\frac{\partial a}{\partial t_f}$ in the numerator is positive and the term $\frac{\partial a}{\partial t_m}$ in the denominator is negative.

Therefore, relative to the case with exogenous bargaining, the ratio of the female's to the male's social marginal cost of taxation $\frac{\partial W}{\partial t_f} \backslash \frac{\partial W}{\partial t_m}$ *increases*. With endogenous bargaining and starting from $\gamma > 1/2$ it is relatively more costly to tax the female than it is in the exogenous bargaining case. Every unit of tax revenues that the government raises from the female further deteriorates her implicit bargaining power and results in a more gendered allocation. This intuition is in the heart of the $t_m > t_f$ result in Section 4.4.

Things however get complexed by the fact that the ratio of marginal revenues also changes relative to the exogenous bargaining case. The difference stems from the last terms in the numerator and the denominator in (29). The term $\frac{\partial a}{\partial t_j} \frac{\partial E_j}{\partial a}$ measures the shift in the peak of the Laffer curve for spouse j due to the shift in the intrahousehold allocation of resources. For example, increasing the male's tax rate results in less bargaining power for the male who has to "settle in" with a smaller a. Then the male participates less in the labor market and becomes less risk averse, per the intuition of Section 3.3. This increases his labor supply elasticity, which poses an extra cost for the society since the government wants to tax the male. Relative to the exogenous bargaining case, the last terms in the numerator and the denominator, in general raise the female over the male ratio of marginal revenues. The reason why this appears to be true is that for $a_m > a_f$ we have that $\frac{\partial E_f}{\partial a}$ is greater than $\frac{\partial E_m}{\partial a}$ in absolute value because earnings are concave in a. Also in our simulations $\frac{\partial a}{\partial t_m}$ seems to be less responsive than $\frac{\partial a}{\partial t_f}$ due to the bargaining power of the male. If the ratio of the marginal revenues increases, then it is less easy to extract revenues from the male in the endogenous bargaining case. The simultaneous increase of the ratio of marginal costs and the ratio of marginal revenues under endogenous bargaining, prohibits us from comparing the optimal solution $\frac{t_m}{t_f}$ under the two regimes.

To solve the program (21)-(22) we first discretize the state space. We set up a nX1 grid for a and vX 1 grids for t_m and t_f. Then we set up the v^2X2 matrix t of all states $(t_m(i), t_f(i))$, $i = 1, ..., v^2$. To solve problem (18) we express the Nash product as a v^2Xn matrix where rows are states of taxes and columns allocation of home duties. For each row we maximize over columns and get the mapping $a(t)$, a v^2X1 matrix. Then, we insert the mapping $a(t)$ into the objective function and the constraints and initiate $Welfare$ and $Revenues - G$, two v^2X1 matrices, that give the social welfare and the extra revenues as a function solely of the state $(t_m(i), t_f(i))$, $i = 1, ..., v^2$. We exclude all negative elements from the matrix $Revenues - G$ and their corresponding elements from $Welfare$. Finally, we choose the best element from the reduced "feasible" matrix $Welfare$ and we check that individual rationality holds so that both spouses stay in the contract.

Finally, the relationship between pre-gender based taxation inequality and the sharing parameter s can be examined by writing the inequality ratio as

$$I = (s(1-t))^{\frac{a_m}{a_m-2} - \frac{A-a_m}{A-a_m-2}} \tag{30}$$

The first point is that since for $s = 1$ and $\gamma > 1/2$ we always have $a_m > A - a_m$, we get that $I(s = 1) > 1$. Second, for a given level of t that raises revenues equal to G, let's call $R(s) = \frac{a_m(s)}{a_m(s)-2} - \frac{A-a_m(s)}{A-a_m(s)-2}$. Since $a'_m(s) > 0$, we have that $R'(s) < 0$. The two opposite forces of s on I can been illustrated as follows. For given $R(s) < 0$, a higher s decreases I because the female participates more in order to balance the weaker sharing of resource. For given $s(1-t)$, a higher s causes $R(s)$ to become more negative and this tends to increase inequality I. This is because the male shares less resources with the female and "exerts" his bargaining power by choosing an even more unbalanced home duties ratio. The two forces exactly cancel out at point $s_M = .92$ in Figures 5 and 6.

Table 1: Welfare effects of Gender Based Taxation with exogenous bargaining

		Parameter values				Endogenous ratios				Gains (in %)			
Focus	Tax regime	$\frac{G}{GDP}$	$\frac{a_m}{a_f}$	$\frac{\sigma_m}{\sigma_f}$	s	$\frac{L_m}{L_f}$	$\frac{\tau_m}{\tau_f}$	$\frac{U_m}{U_f}$	$\frac{t_m}{t_f}$	Ω	L	τ	GDP
G	GBT	14%	1.77	0.53	0.75	1.05	0.99	1.07	1.39	0.20	0.21	0.26	0.36
	single					1.07	1.07	1.08	1				
	GBT	28%	1.77	0.53	0.75	1.08	1.01	1.07	1.20	0.66	0.31	0.58	0.69
	single					1.10	1.10	1.09	1				
s	GBT	23%	1.77	0.53	0.80	1.06	0.99	1.08	1.23	0.38	0.25	0.40	0.51
	single					1.08	1.08	1.12	1				
	GBT	23%	1.77	0.53	0.70	1.08	1.01	1.06	1.25	0.44	0.27	0.45	0.53
	single					1.10	1.10	1.06	1				
$\frac{\sigma_m}{\sigma_f}$	GBT	23%	1.90	0.50	0.75	1.05	1.00	1.05	1.20	0.22	0.15	0.24	0.30
	single					1.06	1.06	1.07	1				
	GBT	23%	3.62	0.25	0.75	1.13	1.00	1.14	1.53	1.36	0.90	1.44	1.78
	single					1.17	1.17	1.17	1				

Figure 1: The Labor Market

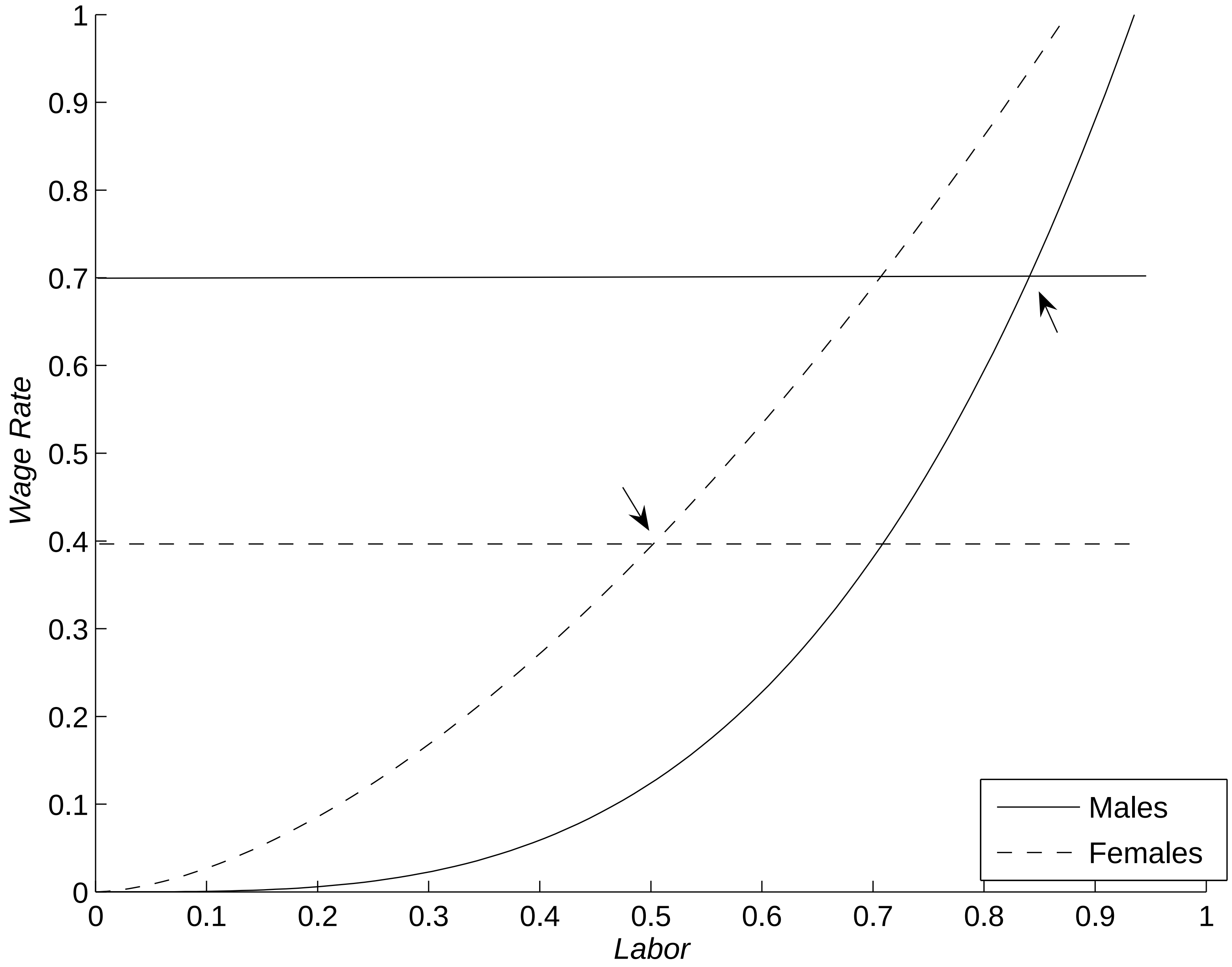

Figure 2: The Effects of Taxes on the Labor Market

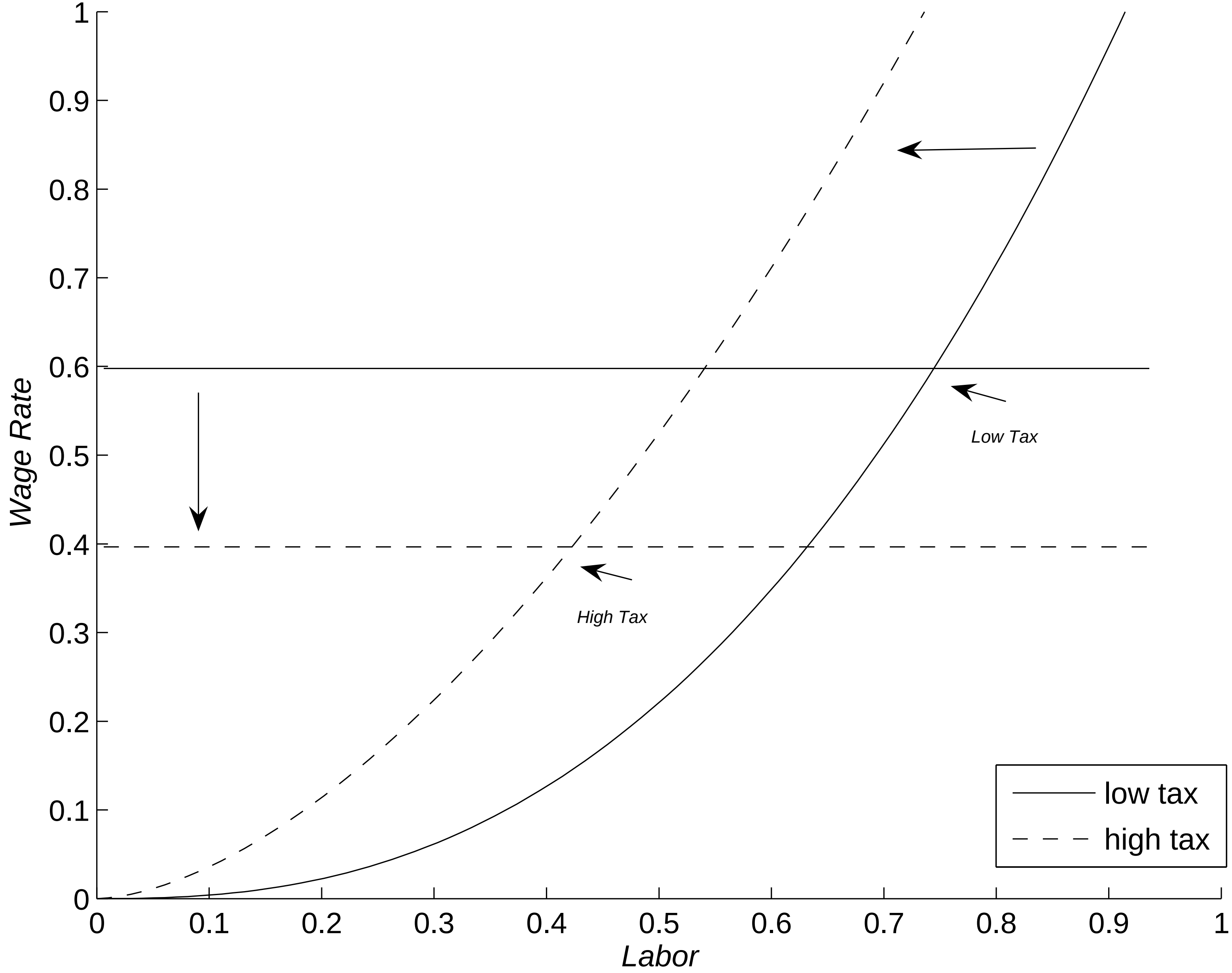

Figure 3: Ungendered Equilibrium is the First Best

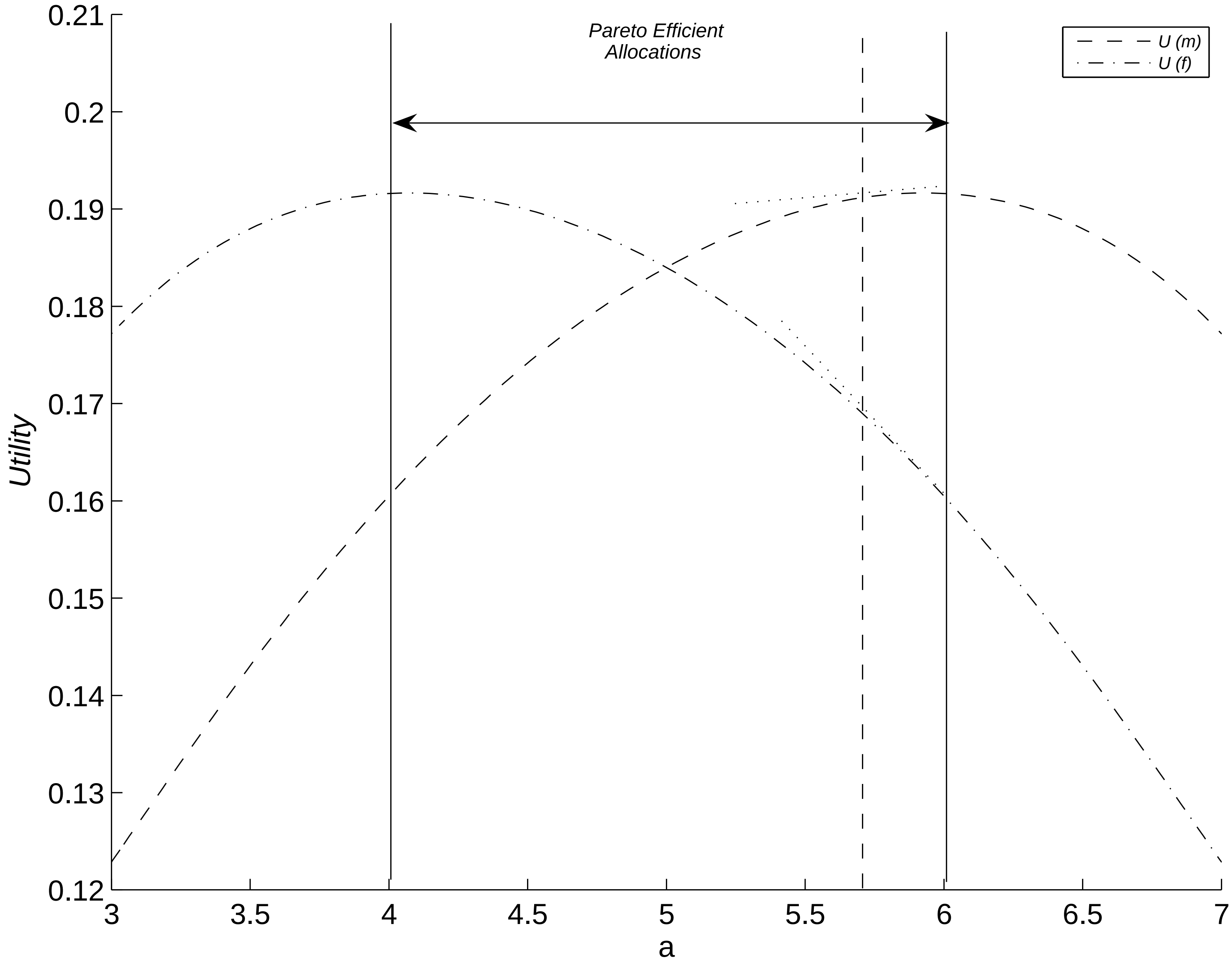

Figure 4: Sharing of Resources and Allocation of Shocks

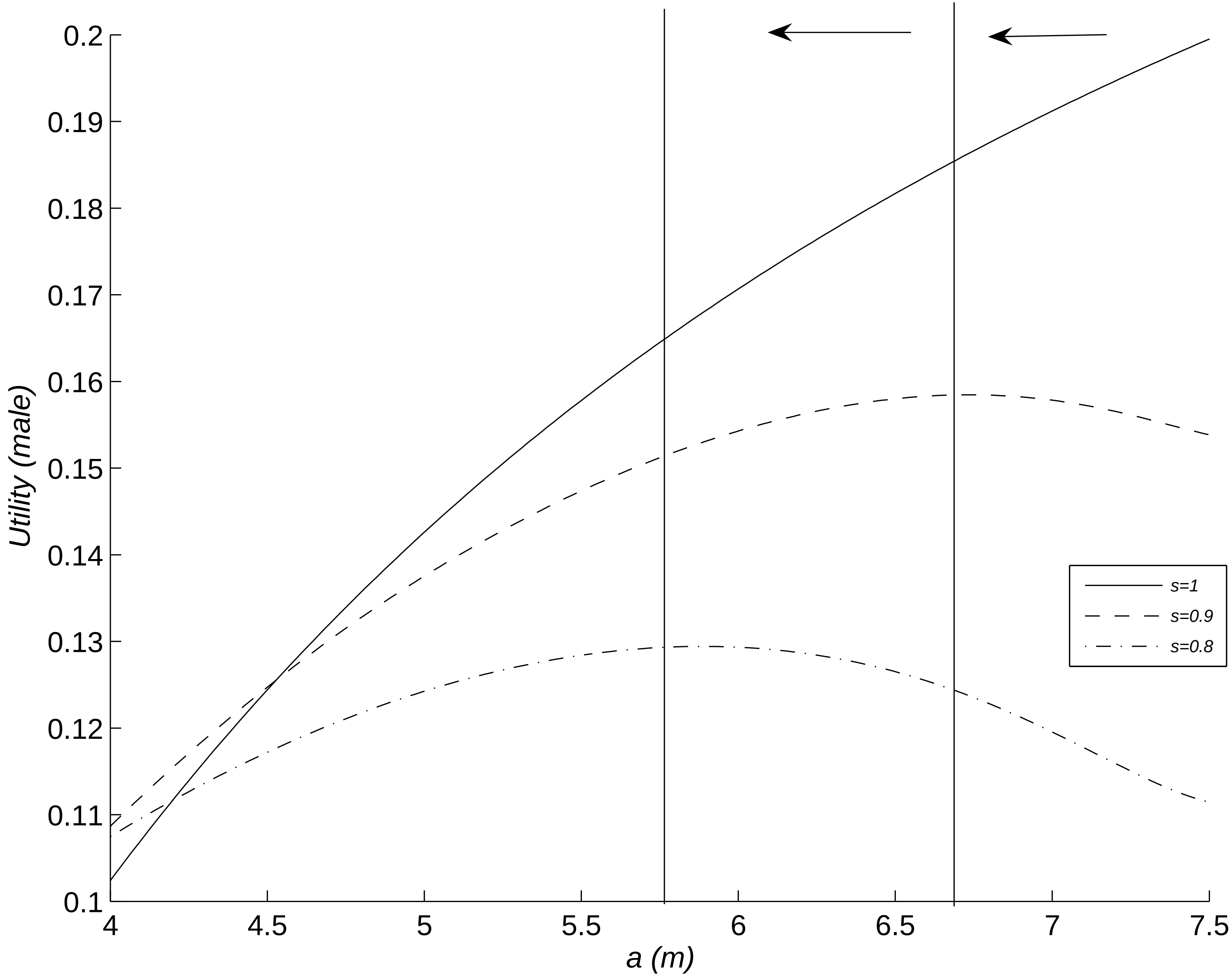

Figure 5: $\frac{t_m}{t_f}$, $\frac{\sigma_m}{\sigma_f}$ - s; $\gamma = 3/4, z = 0.2, \frac{G}{GDP} = 20\%$

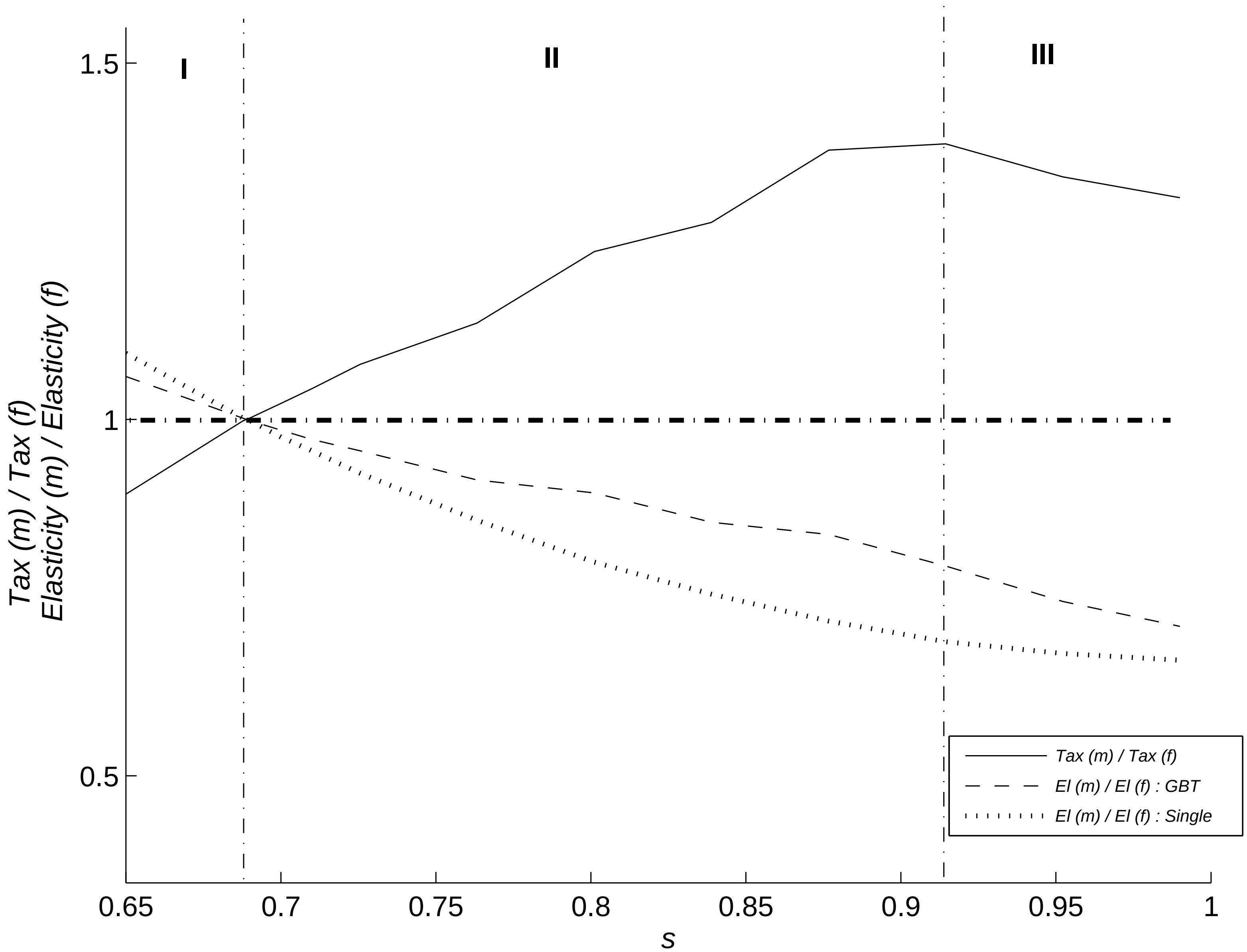

Figure 6: Wage Ratios - s; $\gamma = 3/4, z = 0.2, \frac{G}{GDP} = 20\%$

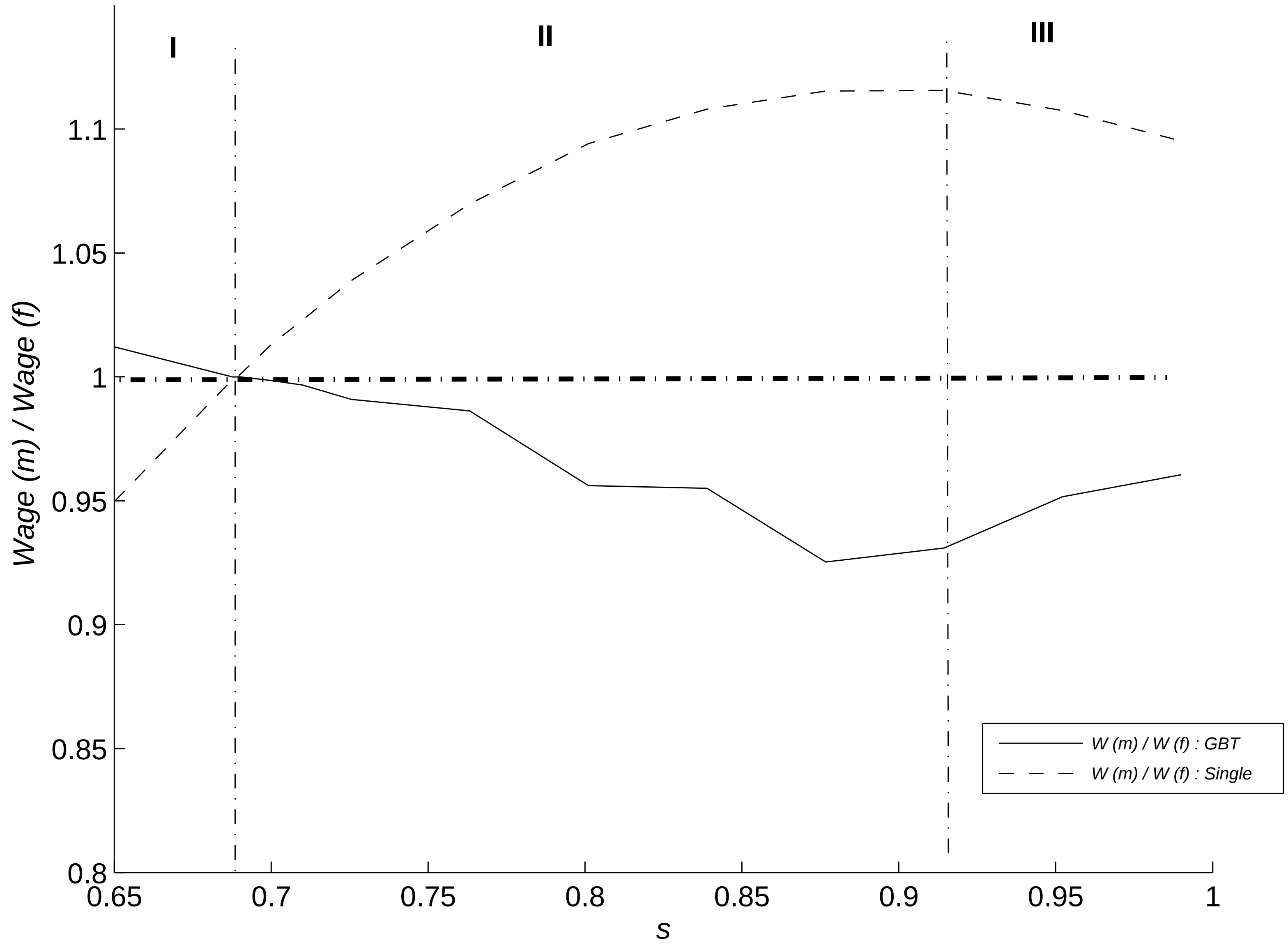

Figure 7: Gains - s; $\gamma = 3/4, z = 0.2, \frac{G}{GDP} = 20\%$

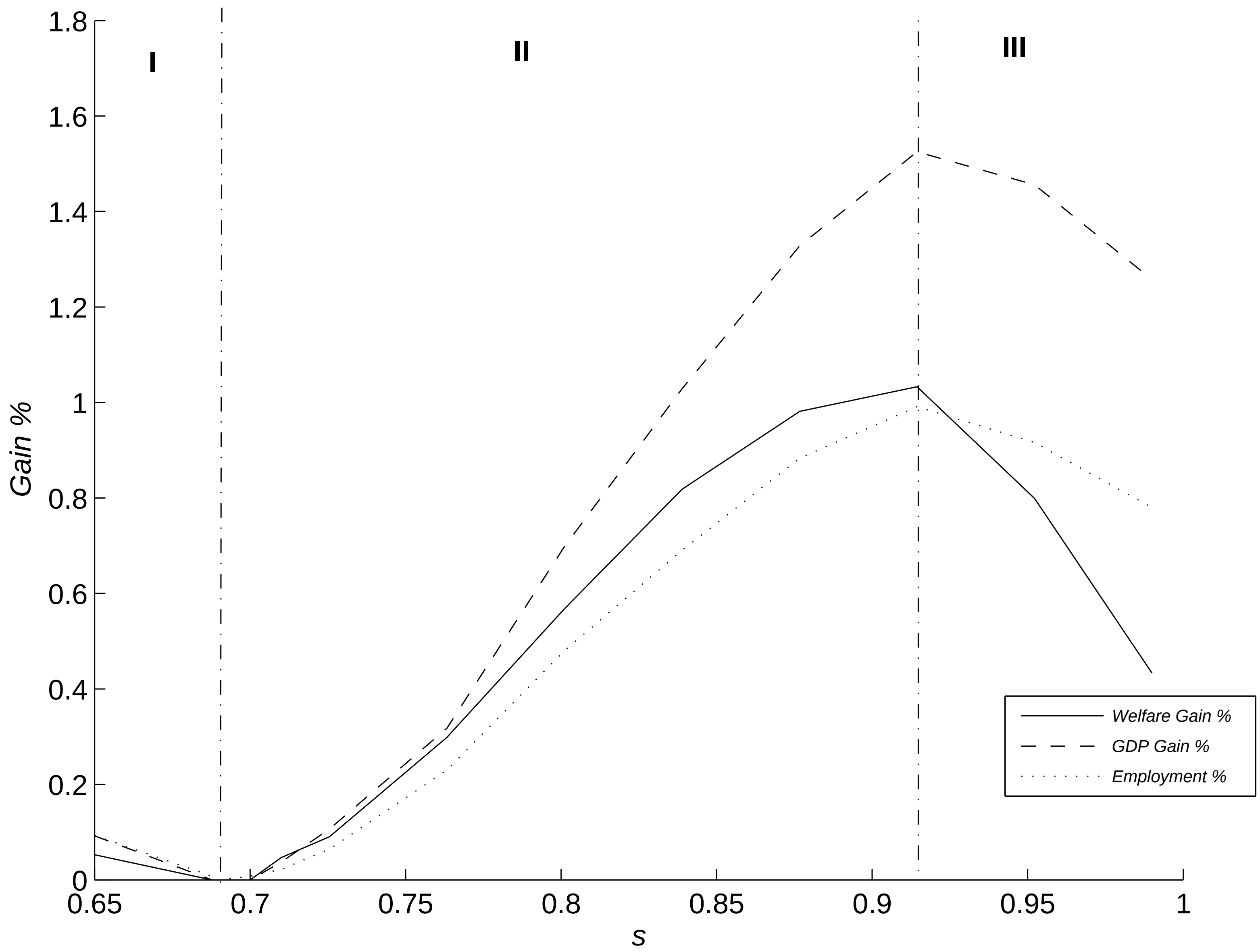

Figure 8: Both Spouses May Be Better Off with GBT