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ABSTRACT

Optimal Income Taxation of Married Couples: An Empirical Analysis of Joint and Individual Taxation*

In this paper we develop a discrete model of optimal taxation of married couples and empirically discuss the optimality of income taxation for this group. To this end, we derive the social welfare function which guarantees that joint taxation of married couples is optimal. We will contrast this welfare function with the one that makes a system of individual taxation optimal. For the empirical application we use a static structural labor supply model to estimate the preferences of households. We find that the system of joint taxation is only optimal when the government has a high taste for redistribution towards one-earner couples and a very low or even negative taste for redistribution towards couples in which both partners earn a similar amount of income. In contrast, the optimality of individual taxation is less dependent of the working composition within the household.

JEL Classification: C25, H21, J22

Keywords: optimal taxation of married couples, joint taxation, labor supply estimation

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1 Introduction

It is the aim of the paper to provide empirical evidence about the optimal design of income taxation of married couples. Recent theoretical contributions on the optimality of income taxation of married couples, namely Alesina et al. (2007) and Kleven et al. (2008), provide evidence for the desirability of a negative jointness of income taxation of both spouses. This implies that it is optimal to design a tax schedule with lower marginal tax rates for the secondary earner. This is in strong contradiction to joint income taxation with full income splitting as implemented in several countries such as France or Germany (e.g. Apps and Rees (1999)). The design of income taxation in these countries imposes high marginal tax rates for the secondary earner.[1]

This contradiction motivates the central research question of this paper. It is the purpose of this analysis to empirically derive the government's social welfare function which guarantees that joint taxation of married couples is optimal. We will contrast this welfare function with the one that makes a system of individual taxation of married couples optimal. Hence, our analysis follows the work of e.g. Bourguignon and Spadaro (2008) who invert a model of optimal taxation to derive the welfare function and the redistributive taste of the social planner.

When studying optimal income taxation of married couples the redistributive taste of the government is quite complex. On the one hand, the government transfers money to married spouses with low household earnings and the progressivity of the tax schedule leads to higher taxation of richer households. On the other hand, relative to individual taxation, the system of joint income taxation *ceteris paribus* subsidies households with higher earnings. This splitting advantage depends on both, the total earnings, and the intra-household inequality of earnings which determines the share of the spouses on the total household earnings. *Ceteris paribus*, the higher the intra-household inequality, the larger is the splitting advantage. Thus, the central question of this study is to show in how far the government discriminates couple households by intra-household inequality when assuming that either joint income taxation or individual taxation is optimal according to the proposed framework of optimal taxation.

The theoretical framework which underpins our empirical application builds on the discrete model of optimal taxation of single agents suggested by Saez (2002). For our application it is necessary to explicitly model the utility maximization of households. We simplify the maximization

[1] For a more detailed discussion of the joint taxation systems in Europe see Dingeldey (2001).

problem of the household and assume the husband to be the first earner who has a fixed labor supply of full-time work. We allow for three different earnings types of men with different levels of yearly gross earnings. Given the earnings level of her husband, the wife optimally chooses her labor supply and can adjust her behavior flexibly along the extensive and the intensive margin.

The optimal design of income taxation crucially depends on the labor supply behavior of households. In this analysis we follow Blundell et al. (2006) and use a static structural labor supply model to estimate the household preferences which determine the labor supply behavior of the wife. This allows us to account for the heterogeneity of labor supply behavior by earnings and by other demographic characteristics. Moreover, for the comparison of joint and individual taxation, we can take account of the endogeneity of the female labor supply decision with respect to the tax regime. This is in contrast to most of the previous applications of the optimal tax theory which have been based on exogenously assumed labor supply elasticities.

In the empirical application of the theoretical model we draw on data from the German Socio Economic Panel (SOEP) and use the structural estimates of labor supply behavior together with a microsimulation model to analyze the optimality of joint taxation in Germany. We confront the optimal welfare weights for the German system of joint taxation with the optimal welfare weights we derive for a hypothetical scenario of individual taxation in Germany.

Several studies have discussed the fiscal, distributional and labor supply effects of joint income taxation with full income splitting relative to individual taxation. Steiner and Wrohlich (2004) find that in Germany joint taxation subsidizes married couples by roughly 20 billion Euro per year and that a shift to individual taxation would go along with a markable increase in female labor supply. These finding point in the same direction as the conclusions derived by Alesina et al. (2007) and Kleven et al. (2008).

We find that the marginal welfare weights that make a system of joint taxation optimal are quite different from those welfare weights that guarantee optimality for individual taxation. While overall in both systems the optimal marginal welfare weights tend to decrease with gross earnings of the secondary earner (in our application by assumption the wife), the shape of the welfare function is quite distinct. Under joint taxation the optimal marginal welfare weights at higher earnings of the wife are much lower that under individual taxation. This result is even re-enforced when deriving the marginal welfare weight by intra-household inequality. We show that the system of joint taxation is only optimal when the government has a high taste for redistribution towards

couples with a high intra-household inequality, i.e. where the secondary earner is not working, and a very low or even negative taste for redistribution when both partners earn a similar amount. Under individual taxation this is different. The optimal marginal welfare weights are only slightly decreasing with the inequality within the household. In other words, in this scenario the optimality depends less on the working composition within the household.

2 The theoretical model

The theoretical framework we develop builds on the discrete model of optimal taxation suggested by Saez (2002). We modify the model of Saez along several lines to make it appropriate for our research question. For our application it is necessary to explicitly model the utility maximization of households. In contrast to Alesina et al. (2007) who model the collective bargaining between the spouses and Kleven et al. (2008) who apply a unitary household model we simplify the household maximization problem and assume that the wife maximizes the household utility conditional on the husbands behavior, see e.g. (Killingsworth, 1983). In our framework the husband is assumed to work full-time.[2] This simplification together with the assumption of a discrete optimal tax model as in Saez (2002) allow us to combine the theoretical model directly with the structural estimation of the preferences of the household. We extend the model of Saez (2002) as we allow for flexible behavioral responses of the wife on both the extensive and intensive margin and by explicitly accounting for income effects.

2.1 The household problem

The economy consists of households indexed by $h \in H$. Households may differ by total household gross earnings, and by the working hours composition, which defines the relative share each spouse earns. A household h derives utility from the joint consumption level and disutility from the spouses' working hours where the labor supply of the husband L_m is exogenously given:

$$U^h = U(C^h, \overline{L^h_{m,}} L^h_f). \tag{1}$$

C^h is the vector of possible household consumption levels, which depends on the particular

[2] At first glance this often applied conditional utility maximization might seem restrictive. However, empirical evidence suggests that cross elasticities between spouses are either not significant or of little importance (Steiner and Wrohlich, 2004) and this provides evidence for the assumption of the exogeneity of male working behavior.

tax regime. We will denote by C_j^h the household consumption level under tax regime j, with j $\in \{joint, individual\}$ taxation respectively.

We assume that labor earnings are the only source of income and that households do neither save nor borrow. When married couples are taxed jointly with full income splitting, the budget constraint for a household can be written as:

$$C_{joint}^h = \omega_f^h L_f^h + \omega_m^h \overline{L_m^h} - 2T^h(\frac{\omega_f^h L_f^h + \omega_m^h \overline{L_m^h}}{2}), \tag{2}$$

where ω_m *and* ω_f are the wages of the husband and the wife and L_m and L_f are the hours of work of each spouse, husband and wife respectively. T^h is the net tax which includes transfers (TR), social security contributions (SSC) and income taxation. Depending on the household earnings and the family composition the net tax be either positive or negative.

Under individual taxation the same household would face the following budget constraint:

$$C_{individual}^h = \omega_f^h L_f^h + \omega_m^h \overline{L_m^h} - T(\omega_f^h L_f^h) - T(\omega_m^h \overline{L_m^h}) + TR^h(\omega_m^h \overline{L_m^h} + \omega_f^h \text{Ł}_f^h). \tag{3}$$

The household net income is now determined by the sum of the individual tax payments including SSC and the potential transfers which remain to be conditioned on the household level. Hence, the net tax is defined as $T^h = T(\omega_f^h L_f^h) + T(\omega_m^h \overline{L_m^h}) - TR^h(\omega_m^h \overline{L_m^h} + \omega_f^h L_f^h)$.

The joint household gross income y^h is the sum of both spouses' gross earnings, in particular $y^h = \omega_f^h L_f^h + \omega_m^h \overline{L_m^h}$. We will define an intra-household inequality degree, θ as follows:

$$\theta^h = \frac{\omega_m^h \overline{L_m^h}}{y^h}, \tag{4}$$

which is the relative share of the male's gross earnings over the household gross earnings. If $\theta = 1$, then the woman does not work, if $\theta = 0.5$ both spouses work and contribute the same amount to the total gross income. When income taxation is progressive it becomes obvious that the higher the inequality of the gross earnings of the spouses, the larger the gain from income splitting relative to individual taxation. For a married household in which both spouses work the same amount of hours at the same wage rate, ($\theta = 0.5$), the gain from income splitting is zero. In other words the government does not subsidize married households with identical spouses in the system of joint taxation.

The household problem consists of choosing the optimal labor supply behavior which maximizes the utility of the household given the budget constraint. As mentioned above we assume that the husband has a fixed labor supply at full time work. To allow for heterogeneity between the husbands earnings we distinguish between three earning levels for the man, the high-earner, the medium-earner and the low-earner, where wages are denoted by $\omega_m^{high} > \omega_m^{medium} > \omega_m^{low}$ respectively. In the following we will analysis the three earnings scenarios separately and compare the results. This allows us to derive results with respect to the overall household income.

The wife maximizes the household utility and chooses her optimal labor supply conditional on the labor supply of her partner. The maximization program of each household with respect to the above defined budget constraints under joint (Equation 2) or individual (Equation 3) taxation can be formally stated as:

$$\underset{L_f^h}{Max} U^h(C^h, L_f^h, \overline{L_m^h}). \tag{5}$$

The first order condition w.r.t the labor supply of the female determines the interior solution:

$$\frac{\partial U^h}{\partial C^h}\frac{\partial C^h}{\partial L_f^h} = 0.$$

We define the indirect utility of household type h, V^h as the utility obtained in the household optimum given the optimal labor supply decisions of the spouses:

$$V^h = U^h(L_f^{h*}, \overline{L_m^h}). \tag{6}$$

The woman has the possibility of deciding not to work. This is the corner solution that optimality condition for the interior solution does not reflect. If the difference between the household utility level when the woman works and when she does not is very small or even negative the wife may decide to stay at home. In particular we will talk about some reservation utility level that can be related to the value of the woman's home production. If this value for a particular household exceeds some threshold R, it may not be optimal for the household that the wife participates on the labor market. Formally we write this condition as a participation constraint for the wife:

$$V_i^h - V_0^h \geq R,$$

where V_0^h represents the household indirect utility when the woman does not work and V_i^h is the indirect utility when the woman works some positive amount of hours.

Finally, given the wages and the fixed labor supply of the husband, the chosen labor supply of the women defines the optimal intra-household inequality θ which is:

$$\theta^* = \frac{\omega_m^h \overline{L_m^h}}{y^h}. \tag{7}$$

2.2 The government problem

As mentioned above, we analyze the optimal taxation of married couples in each particular scenario, i.e. separately for each earning group defined by the husband's earnings. More precisely, we assume that the government maximizes a social welfare function and sets optimally the net tax payment for households depending on the earnings of the husband $z \in \{low, medium, high\}$ and the wife's earnings. The social welfare function, W^z, is a weighted sum of indirect utilities of all household within an earnings group given the gross household income. For each group there are continuous earnings possibilities at the household level whose lower bound is defined by the gross earnings of the male in this group (Y_z). The husband's gross earnings are exogenously determined, while the wife's earnings are the combination of her labor supply decision and the exogenous wage she may receive. In particular we assume there is some given density of woman's earnings denoted by $f(\omega_f)$.[3] The social welfare function can be written as:

$$W^z = \int_{Y_z} \mu^h V^h f(\omega_f) d\omega_f. \tag{8}$$

The social welfare weights μ^h measure the redistributive taste of the social planner with respect to the household type h. When studying the optimal taxation of married couples the redistributive taste of the government is quite complex. On the one hand, the government transfers money to married spouses with low household earnings and the progressivity of the tax schedule leads to higher taxation of richer households. On the other hand, relative to individual taxation, the system of joint income taxation may provide subsidies for households with higher earnings. This splitting advantage depends on the total earnings and on the working distribution within the household. This implies, a household with a high wage husband and a non-working wife has *ceteris paribus* a

[3] We could say without lose of generality that the woman has to choose between several occupations with different earnings, this is exactly what is assumed in Saez (2002).

higher gain from joint taxation than the same household with a medium or low income husband. In our framework, the intra-household inequality index is directly related to the female earnings as the men's gross earnings are fixed. The comparison between the different earnings groups will allow to disentangle the splitting advantage by the intra-household inequality and by gross earnings.

The government may consider only I household categories indexed by gross household income in each sector of the economy[4], so that there exists a discrete number of net tax payments in this economy and the government's budget constraint can be written as:

$$\sum_{i=0}^{I} T_i^z s_i^z = B^z, \tag{9}$$

where s_i are the population shares of each particular household category considered by the government for each earnings group, which satisfies $\sum_{i=0}^{I} s_i^z = 1$. The shares will be affected by the net income of the household and hence by the tax system. In other words, any change in the tax schedule may affect the proportion of households in each particular category. Therefore we model the shares as a function of the possible net income levels in the economy.

Given the I different earnings points the government chooses $T_i^z \in \{T_0^z, ..., T_I^z\}$ subject to the budget constraint. These tax rates define the household income $C_i^z \in \{C_0^z, ..., C_I^z\}$. Following Saez (2002) we assume that net household income is increasing with gross earnings of the wife, that is $C_0^z < C_1^z < C_2^z < ... < C_I^z$. The T_0^z, represents the net income taxation for households where the wife does not work and the total household gross earning is provided by the man.

The government problem can be formally stated as:

$$\begin{aligned} &\underset{\{T_0^z,...,T_I^z\}}{Max} \int_{Y_z} \mu_h V^h f(\omega_f) d\omega_f \\ &s.t. \sum_{i=0}^{I} T_i^z s_i^z = B^z \text{ with } \sum_{i=0}^{I} s_i^z = 1 \text{ for } z \in \{high, medium, low\} \end{aligned} \tag{10}$$

The Lagrangian expression would then be:

$$L = \int_{Y_z} \mu_h V^h f(\omega_f) d\omega_f + \lambda [\sum_{i=1}^{I} T_i^z s_i^z - B^z] \tag{11}$$

with the following I first order conditions for each net tax payment per household type:

[4]Each category i may include more than one type h of households in the economy.

$$\frac{\partial L}{\partial T_0^z} = -\int_{Y_0^z} \mu_h(\frac{\partial V_h}{\partial C_0}) f(\omega_f) d\omega_f + \lambda[s_0^z - \sum_{j=0}^{I} T_j^z \frac{\partial s_j^z}{\partial C_0^z}(\frac{\partial C_0^z}{\partial L_0^f})] = 0,$$

$$\frac{\partial L}{\partial T_1^z} = -\int_{Y_1^z} \mu_h(\frac{\partial V_h}{\partial C_1}) f(\omega_f) d\omega_f + \lambda[s_1^z - \sum_{j=0}^{I} T_j^z \frac{\partial s_j^z}{\partial C_1^z}(\frac{\partial C_1^z}{\partial L_1^f})] = 0$$

...

$$\frac{\partial L}{\partial T_I^z} = -\int_{Y_I^z} \mu_h(\frac{\partial V_h}{\partial C_I}) f(\omega_f) d\omega_f + \lambda[s_I^z - \sum_{j=0}^{I} T_j^z \frac{\partial s_j^z}{\partial C_I^z}(\frac{\partial C_I^z}{\partial L_I^f})] = 0.$$

The first order condition w.r.t to the tax rate in a particular category can be interpreted in terms of two effects induced by taxation: the equity effect and the efficiency effect. The equity effect is the first part of the condition, where the marginal utility of income is weighted by the redistributive taste of the government μ^h. The efficiency effect measures the marginal cost of increasing the tax at a particular category i which is the behavioral response of the household given a change in taxation weighted by λ. Realize that in our model the household net income depends on the female working hours since the labor supply decision is endogenous, and therefore the first order conditions depend on the partial derivative $\frac{\partial C_j^z}{\partial L_j^f}$.

The condition for the Lagrange multiplier implies that the budget constraint is satisfied:

$$\frac{\partial L}{\partial \lambda} = \sum_{i=0}^{I} T_i^z s_i^z - B^z = 0 \rightarrow \sum_{i=0}^{I} T_i^z s_i^z = B^z.$$

Following Saez (2002) we define the marginal social welfare weight of each household type given the earnings group, g_i^z, as:

$$g_i^z = \frac{1}{\lambda s_i} \int_{Y_i^z} \mu_h(\frac{\partial V_h}{\partial C_i}) f(\omega_f) d\omega_f. \tag{12}$$

The marginal social welfare weight has to be interpreted as the value for the government of redistributing an extra unit of money uniformly to the households included in category i. In other words, the marginal social welfare weights represent the government's attitude toward redistribution among household types in a given earnings group. The marginal social weight depends directly on the marginal utility of income for households of different types h included in category i and on the

original social weight, μ^h. Moreover, it depends inversely on the marginal social cost (the Lagrange multiplier) of increasing the net tax payment at the category i and on the population share of this particular group.

Substituting equation 12, the first order conditions for any T_i^z can be rewritten as:

$$(1 - g_i^z)s_i^z = \sum_{j=1}^{I} T_j^z \frac{\partial s_j^z}{\partial C_i^z}(\frac{\partial C_i^z}{\partial L_i^f}). \tag{13}$$

2.3 Mobility elasticities and marginal welfare weights inference

We define *mobility elasticities* to describe the behavioral responses of households given a change in the tax system. For the empirical application of the model these elasticities can be estimated using a static structural labor supply model. In our particular setting the husband has no behavioral response; he is assumed to be always a full-time worker. On the contrary, the woman may decide to stay at home (not to work) or to work at different points along her gross earnings distribution. Hence, the woman can react along the extensive and intensive margin of her labor supply. In this respect we extend the model of Saez (2002) and allow the woman to choose and move to all discrete earnings points at the intensive margin and not only at the adjacent points.

We define $\varphi_{i,j}$ to be the mobility elasticity of the behavioral response between point i and j, where j stands for all other I-1 points:

$$\varphi_{i,j}^z = (\frac{C_j^z - C_i^z}{s_i^z} \frac{\partial s_i^z}{\partial (C_j^z - C_i^z)}) \frac{\partial C_i^z}{\partial L_i^f}. \tag{14}$$

This elasticity measures the relative change of the share from point i to point j given a relative increase in the income difference between point j and i. For each earning point i there exist I-1 elasticities. The model of Saez is therefore nested in the framework when we would allow only for the changes on the extensive margin and between the adjacent points on the intensive margin.

We further define the marginal tax rate between point i and j as:

$$MTR_{i,j} = \frac{T_j^z - T_i}{C_j^j - C_i^z}. \tag{15}$$

Then it can be shown that in the optimum the marginal social welfare weight for each category of households i conditional on the group z has the following form:

$$g_i^z = 1 - [-\sum_{j=1}^{I-i} \frac{MTR_{i+j,i}^z \varphi_{i+j,i}^z s_{i+j}^z}{s_i^z} + \sum_{j=1}^{i} \frac{MTR_{i,i-j}^z \varphi_{i,i-j}^z s_{i-j}^z}{s_i^z}]. \tag{16}$$

Proof. Equation (16) can be obtained in the following way. Given the assumption that the women can move to all discrete earnings points, the share at a given category can be written as, $s_i = s(C_I - C_i, ..., C_{i+1} - C_i, C_i - C_{i-1}, ..., C_i - C_1, C_i - C_0)$. The first order conditions w.r.t. T_i can now be expressed as:

$$\begin{aligned}(1 - g_i)s_i = &\sum_{j=1}^{I-i} -T_j \frac{\partial s_j}{\partial(C_{i+j} - C_i)} - \sum_{j=1}^{I-i} T_{i+j} \frac{\partial s_{i+j}}{\partial(C_{i+j} - C_i)} \\ &+ \sum_{j=1}^{i} T_j \frac{\partial s_j}{\partial(C_i - C_{i-j})} + \sum_{j=1}^{i} T_{i-j} \frac{\partial s_{i_{-j}}}{\partial(C_i - C_{i-j})}.\end{aligned} \tag{17}$$

For clarity in the proof we do not explicitly write the derivative of net income w.r.t labor, since it does not affect the result.

We make use of the symmetry of the marginal derivatives of the share w.r.t. the net income, that is $\frac{\partial s_{i+j}}{\partial(C_{i+j} - \mathrm{Ci})} = -\frac{\partial s_i}{\partial(C_{i+j} - C_i)}$. We rearrange terms and express (17) as:

$$(1 - g_i)s_i = -\sum_{j=1}^{I-i}(T_{i+j} - T_j)\frac{\partial s_{i+j}}{\partial(C_{i+j} - C_i)} + \sum_{j=1}^{i}(T_i - T_{i-j})\frac{\partial s_{i_{-j}}}{\partial(C_i - C_{i-j})}. \tag{18}$$

Then, introducing the definitions of the mobility elasticities defined above we obtain expression (16). ■

3 Empirical Analysis

In order to empirically discuss the optimal design of income taxation it is necessary to empirically solve the household's maximization problem (Equation 5). We follow the procedure of Blundell et al. (2006) applied as well in Haan and Wrohlich (2007) and use a static structural labor supply model to estimate the household's preferences for income and leisure. Based on these estimated preferences it is then possible to derive the mobility elasticities defined above that determine the optimal tax schedule. The striking advantage of deriving the elasticities based on estimated preferences is the possibility of accounting for the heterogeneity of behavior conditional on demographic characteristics by different earning points. Moreover, the structural estimates allow us to model

potential labor supply responses of women when analyzing the hypothetical tax system of individual taxation.[5]

3.1 Estimation of the household preferences

We estimate the household preferences in a static structural discrete choice labor supply model, similar as Aaberge et al. (1995) or van Soest (1995). The central advantage of a discrete specification over the continuous framework is the possibility to account for the non-linearities in the budget set and to cope with the endogeneity of net-household income in a relative straight forward way. In the discrete choice framework it is assumed that households receive utility from consumption and leisure as defined above in Equation (1) and from a random error term ϵ_{ik}. Since we assume that the labor supply of the husband is given, the parameter of interest are the preference of the wife's leisure and the preference of the household for consumption which equals the disposable income:

$$V_{ik} = U(C_{ik}, L_{fik}, \overline{L_m}, X_i) + \epsilon_{ik}. \tag{19}$$

According to the empirical distribution of female working hours we define $K = 5$ discrete working alternatives for the women. Note, the K discrete working alternatives differ from the I gross earnings points the government chooses for the optimal tax schedule. Below, we will discuss the difference in more detail.

For the empirical estimation we specify the utility function as a linear quadratic function in consumption and female leisure and allow for interactions:

$$U_{ik} = \alpha_c C_{ik} + \alpha_{cc} C_{ik}^2 + \alpha_{lf} Lf_{ik} + \alpha_{lf^2} Lf_{ik}^2 + \alpha_{clf} C_{ik} Lf_{ik}.$$

We assume that preferences vary across households through taste-shifters on consumption and leisure coefficients:

$$\begin{aligned} \alpha_c &= \alpha_{c0} + \alpha_{c1} X_1, \\ \alpha_{lf} &= \alpha_{lf0} + \alpha_{lf1} X_2, \end{aligned} \tag{20}$$

[5]Our procedure differs from Aarberge and Colombino (2008) and Blundell and Shephard (2008). The authors use a more general specification of a static structural labor supply model than applied here and identify directly (expressed as a utility function) the tax rule that maximizes a given welfare function.

where X_1 and X_2 are vectors including age, number and age of children, and region of residence. In addition we include dummy variables for the part time categories which might be interpreted as fixed costs of these working arrangements.[6] We use the microsimulation model STSM (Steiner et al. 2008) to derive the potential consumption level at each discrete hours working alternative. More precisely, for each discrete hours point we calculate the gross household earnings which is the sum of the observed earnings of the husband and the state specific earnings of the wife. The gross earnings of the women are simply the state specific hours multiplied by her expected market wage. For the working women we take the observed wage information as their market wage while for the non-working we impute their expected market wage using a wage estimation with selection correction.[7] The gross earnings information is the key input for the microsimulation model which describes in detail all relevant transfer programmes, the SSC and income taxation. Hence it is possible to calculate the required state specific net-household income C_{ik}. The leisure time at each hours point is simply the time endowment $T = 80$ minus the defined working time.

In order to estimate the preferences for consumption and leisure we assume that the error terms ϵ_{ik} are i.i.d and follow an extreme value distribution. This gives us an expression of the probability for each discrete working alternative which results in the well known conditional logit framework that can be estimated by maximum likelihood.

Descriptive statistics

The empirical estimation is based on the German Socio Economic Panel Study (SOEP) which is a representative household survey for Germany with all necessary information to estimate labor supply behavior (Haisken De-New and Frick, 2005). For this analysis we make use of data collected in 2005 which yields the information for the tax year 2004. As mentioned above, we define $K = 5$ discrete working alternatives to describe the working behavior of the married women. We restrict the sample to households with a wife aged between 20 and 60 who is not self-employed, retired or in full-time education. This gives us a sample of 2106 households. The following table yields the overall distribution of the households at the defined working alternatives with the average working

[6] For practical reasons we make several assumptions and simplifications in the estimation procedure. We do not account for unobserved heterogeneity and do not model potential restrictions on the labor market such as Aaberge et al. (2006) or Bargain et al. (2008). Haan (2006) has shown that unobserved heterogeneity does not significantly affect the labor supply elasticities when using a similar specification with cross sectional data. The findings of Bargain et al. (2008) imply that demand side constraints in particular bias elasticities for men and single women, and tend to be less severe for the labor supply decision of married women.

[7] Estimation results can be obtained by the authors upon request.

hours and the average monthly net household income at each point.

[Table 1 : about here]

As well documented in the literature participation rates of married women are relatively low in Germany. On average, roughly 30% of the women in our sample do not work. Moreover, part time work is very popular amongst German women. We find that the majority of the working women works less than full time. About 15% of women work less than 15 hours and close to 30% work between 16 and 34 hours. Slightly less than 20% of women work full-time and only 6% over-time. Even for households with non-working women the average net household income amounts to 2800 Euro per month. This is partly due to child related benefits and to the male gross earnings. For the population of interest means-tested transfers are only of minor importance since for the large majority of the households these transfers are withdrawn given the husbands earnings. Moreover, as we will discuss below the marginal tax rates a household with a non-working wife faces are relatively low due to the joint income taxation. This, on the other hand leads to a relatively moderate increase of the average net income with increasing working hours of the wife.

In Table 2 we present the distribution of households conditional on the earnings of the husband. We define three earnings intervals of the full-time working men, < 30000; 30000-50000; > 50000.

[Table 2 : about here]

Disaggregating the female working distribution by the earnings level of her husband, we find a fairly similar pattern. Interestingly, women married to a man with high earnings tend to have the lowest participation rates going along with high rates of part time work. One reason for that could be an income effect, yet as shown in Table 3, important demographic characteristics differ between the three groups.

[Table 3 : about here]

As expected we find the highest share of East Germans (40%) among the households with low earnings. Only 11% and 6% of the medium or high earning households are east German. As female labor supply is still higher in the eastern part, this is the main reason for the higher participation rate of women married to a husband with low earnings. On the contrary women in this group tend to be younger and are more likely to have a child younger than 6 years which should reduce their participation rate.

Estimation results

In the Appendix we present the estimation results of the discrete choice labor supply model. Due to the non-linearities and the multiple interactions in the specification, the interpretation of the coefficients is not too meaningful. Instead we derive *standard labor supply* elasticities with respect to changes in gross wages. It is important to stress that these elasticities differ from the elasticities derived in the theoretical model which we labeled mobility elasticities. The standard labor supply elasticities we present in the following table are simply seen as specification check of the model and are not used for the simulation of the optimal tax rule.

In the discrete choice model elasticities cannot be derived analytically. Therefore, we apply a numerical procedure. More precisely, we predict the labor supply behavior before and after a 1% change in gross wages. The relative increase in working hours and in the participation rate given the wage increase measures the labor supply behavior. We disentangle the effect with respect to working hours and derive elasticities on the intensive and the extensive margin, where the latter captures the behavioral effect of the women out-of work and the former of those in-work. Again, we show the average effects conditional on the earnings level of the husband.

[Table 4 : about here]

Overall the elasticities are in line with those found in previous studies for Germany as well as for other European countries, e.g. Aaberge et al. (1995), Bonin et al. (2003), Bargain and Orsini (2006), or Haan and Steiner (2005). In line with the distribution of working hours (Table 1) we find fairly similar elasticities by subgroups. A 1% increase in gross wages leads in all groups to a relative increase of the female participation rate by 0.2%. With respect to working hours the relative effects differ between 0.34% and 0.39%. Interestingly we find very similar effects on the intensive and the extensive margin. At first glance this seems surprising as it has been shown that responses at the extensive margin tend to dominate (Heckman, 1993). However, given the extreme large share of women working only very few hours per week, this result is plausible. When disentangling the working hours effect by non-work, part-time and full-time/over-time work, we find the well known effect that workers in regular full-time jobs hardly adjust their working behavior.

4 Numerical Simulation

In the following, we apply the above derived framework of optimal taxation jointly with the estimated preferences and simulate the optimal marginal welfare weights for a tax system which taxes married household jointly. In other words, we derive the marginal welfare weights that make the given tax system optimal. For the analysis we use the German tax and transfer system in which married couples file their taxes jointly.[8] We compare the results for the joint tax system with the marginal welfare weights derived in a hypothetical tax and transfer system with individual taxation. More precisely, we derive the net income for married couples in Germany assuming individual taxation and derive the welfare function that makes this system optimal. For the analysis of individual taxation we allow for the endogeneity of labor supply and estimate the counterfactual shares of households at the discrete earnings point.

The German tax and transfer system with joint taxation

The German transfer system consists of several different income-support programs.[9] These programmes have different target groups and vary in their design. All out-of work benefits are targeted at households and benefits are strongly withdrawn with family earnings. Therefore, married households with one full-time working spouse are in general not eligible for theses transfers. Only households with numerous children and low wages might still receive some transfers even with a full time working family member. In Germany, child benefits are unconditional on earnings and for each dependent child a household receives about 150 Euro per month.

For our application the design of income taxation is more important. In theory, the German income tax is based on the principle of comprehensive income taxation. That is, the sum of a household's income from all sources is taxed at a single rate after several deductions have been applied. The tax schedule is linear progressive with a top marginal rate of 45%. In contrast to other European countries, such as the UK, in Germany, married couples are taxed jointly. This implies that the income tax of a married couple is calculated by applying the tax function to half of the sum of the spouses' incomes; this amount is then doubled to determine the tax amount of the couple. Steiner and Wrohlich (2004) provide a detailed discussion and analysis of the German

[8] Married couples have the possibility to choose between joint and individual taxation, yet as only for very few households there would be an advantage of individual taxation, we assume that all married couples file jointly.

[9] In line with the data, we describe the tax and transfer legislation of the year 2004.

system of joint taxation and calculate the splitting advantage, that is the tax reduction of joint taxation relative to individual taxation. Due to the progressivity of the income taxation this advantage is increasing with household gross earnings and is highest for households where only one spouse works.

In addition to taxes, working people pay social security contributions (SSC). These include, unemployment (6.5% of gross earnings) and health insurance (about 17% of gross earnings) and pension contributions (19.5% of gross earnings). In general, employer and employee pay half of the contributions. The so called Mini/Midi-Job programm excludes individuals with earnings lower than 400/800 euros from the SSC contributions. Moreover, below this threshold individuals are either exempted from income taxation or pay a reduced tax rate. Above this threshold, individuals pay the full amount of SSC and income taxation which creates very high effective marginal tax rates. This is in particular true for the secondary earner due to the system of joint taxation.[10]

A hypothetical German tax and transfer system with individual taxation

For this hypothetical scenario we assume that the transfer system in not affected and the SSC remain the same. Moreover, the same tax function is applied. The only difference in this scenario is that married spouses are taxed individually.

4.1 Discrete Earnings Points

In line with the empirical distribution of female yearly gross earning we define the following I discrete yearly gross earnings points for the wives: 0, 10000, 20000, 30000, 40000, 55000. We hardly observe households in which the women earns more than her full-time working husband. Therefore, for the numerical simulations we assume that the wife can not earn more than her husband. This implies that we allow the intra-household inequality degree θ to take values only between 1 and 0.5.

The following table shows the relative shares at the earnings points conditional on the earnings of the husband. These are the observed shares in the data which correspond to the system of joint taxation. In addition, we present for each subgroup the monthly net tax rates, the household income

[10] In contrast to the above mentioned transfers, the subsidy for the Mini-job is provided at the individual level. As the SSC contributions can be seen as an individual insurance it is not straight-forward to allocate the contributions to the household. This is in particular true for the unemployment insurance. Only the working spouses profits from this insurance. Parts of the pensions go to the non-working spouse in terms of a widowers pension which is significantly lower than the own pension. Only the health insurance does cover both partners. There is an upper-bound of contributions. Therefore one-earner households with high earnings might slightly benefit from the design of SSC contribution on the top of joint taxation. This will not be analyzed in this study.

and the marginal tax rates. We derive average net tax payments. That implies the demographic characteristics - most important number of children - at all earnings points of the wife are the same and the only difference is due to income taxation at the different earnings.

[Table 5: about here]

Given the restriction about the wife's earning we define 4 earnings points for the households with a low-earnings husband, 5 points for the medium and 6 for the households where the husband has high earnings. In line with the working behavior shown in Table 1, we find in each group a large proportion of households at the lowest earnings point at which the wife is not working. On the contrary, only relatively few women reach similar earnings as their partners do. In the last 3 columns we show the effect of joint income taxation which is best summarized by the marginal tax rates (MTR). Note, as the households conditional on the husbands earnings differ by demographic characteristics the MTR are not comparable between groups but only within groups. For all points we find relatively high effective marginal tax rates. This is the well understood effect of the SSC contributions and the income tax payments in the German system. Most interesting is the high marginal tax rate at the first earnings point of the wife. Although she has very low individual gross earnings the wife is confronted with high marginal tax rates since she pays from the beginning the same marginal tax rate as her full-time working husband. This is the effect of joint taxation.

The difference between joint and individual taxation is shown in Table 6 where we present the simulated effects of the hypothetical system of individual taxation.

[Table 6: about here]

For this hypothetical scenario, we cannot observe the shares at the discrete earnings points. Therefore, we use the structural estimates and predict the shares at each point under individual taxation using a calibration technique described in the following section. In line with Steiner and Wrohlich (2004), we find a strong increase in participation rate in the system of individual taxation relative to joint taxation. This effect in particular pronounced for women married to a husband with high earnings. The MTRs in the last column highlight the difference between the two tax regimes. When assuming individual taxation we find markedly lower marginal tax rates at the low earnings points which increase with the individual gross earnings of the wife.

4.2 Mobility Elasticities

Based on the estimated preferences we can derive the mobility elasticities for the wives as defined above in the theoretical model. For consistency several assumptions and clarifications need to be stressed. These assumptions are necessary as the I discrete earnings points defined by the government might differ from the K discrete working hours of the women used in the labor supply estimation. First of all, we need to assume that there exists a continuous distribution of working hours and that the estimated preferences for consumption and leisure hold over the whole distribution and not only at the defined discrete working hours. Further, individuals differ in their gross hourly wages. Therefore, women might work different hours in order to reach the defined I earnings points. Depending on the wage this might even restrict the set of earnings points for some women since we assume a maximum labor supply of 60 hours per week. More precisely, women with low wages can never reach high earnings points. The mentioned assumptions and simplifications can be relaxed by increasing the number of discrete earnings points and modelling further individual hours constraints similar to Aaberge et al. (2005).

As defined in Equation 14, we need to derive the mobility elasticity between all discrete combinations of the I earnings points. $\varphi_{i,j}$ measures the relative shift of women from point i to point j given a marginal increase in the work incentives. More precisely, we increase the income at given point j by adding 1% of the absolute difference $C_j - C_i$, which is equivalent to a marginal increase in the budget line between these two points. Given the change in the work incentives we predicted the relative share of women who adjust their labor supply and switch from point i to point j. Hence, $\varphi_{i,j}$ only affects the behavior of women at points i and j. However, since we derive $ixI-1$ mobility elasticities our specification is flexible as conditional on the above mentioned restriction of women with low wages, wives can adjust and switch between any discrete point.

Technically, we derive the elasticities in the following way. Based on the estimated preferences and calibrated draws from the extreme value distributed error terms ϵ_{ik} we simulate the observed shares of households at each discrete earnings point. This calibration technique, e.g. Duncan and Weeks (1997), provides a vector of error terms that guarantee that the observed choice is yields the maximal utility. In order to provide robust results we derive a large number R of optimal extreme value draws (R=100).

Based on the estimated preferences and the R draws from the extreme value distribution we predict for any mobility elasticity $\varphi_{i,j}$ the relative share at the two points i and j before and after

the change in work incentives. The average of the relative transitions from point i to j measure the mobility elasticity. Note, as the mobility elasticity is based on a relative concept the size of the elasticity does not only depend on the structural preferences and the slope of the budget line but as well on the relative shares of each group.

The matrix of the mobility elasticities is presented in the Appendix. In addition to the mobility elasticities for the scenario of joint taxation, we present as well the mobility elasticities in a hypothetical scenario of individual taxation. Since we simulate the shares at the discrete earnings points for the system of individual taxation we account for the endogeneity of labor supply with respect to the tax regime.

4.3 Marginal welfare weights

Based on the estimated mobility elasticities and the shares and tax payments at the discrete points we can simulate the system of equations defined in Equation (16) to obtain the marginal welfare weights which make a given tax system optimal. It is important to stress again that we analyze the optimal marginal welfare weights in a partial setting since we assume that taxation of all other groups remains constant. Moreover, as discussed above, the government chooses the tax rates to maximize a welfare function given the behavior of the households. In this sense the government knows the structural preferences of the women at the different earnings points and thus it understands the mobility elasticities. Therefore, the government has a clear idea about the distortions and inefficiency of income taxation induced by the behavioral responses of households.

The key question we want to study in this empirical application is how the optimal marginal welfare weights differ between joint and individual taxation with respect to the intra-household inequality index θ. As defined above we measure θ as the relative share of the husband's earnings on the total household earnings. As in our setting the earnings of the husband are exogenously given, θ is directly linked to the wife's earnings points.

In our framework it is difficult to derive conclusions about the optimal marginal welfare weights by joint household earnings and about the optimal degree of progressivity in a tax system. We compare three different household groups separately, and as mentioned above comparison between the groups are not possible because of the different demographic composition of the groups. Therefore, we can only derive conclusions about the welfare function by female gross earnings conditional on the husbands earnings. While this analysis yields interesting findings with respect to the taxation

of the secondary earner, it is less informative for the analysis of progressivity which needed to be based on the joint household earnings.

Marginal welfare weights by female gross earnings

Before comparing the marginal welfare weights by intra-household inequality between the two tax regimes, we present the welfare weights by the above defined gross earnings points of the wife. As mentioned above we restrict the gross earnings points for the wives not to be higher than the earnings of her husband and therefore we observe a different number of discrete earnings points by earnings group.

[Figure 1: about here]

Overall, we find for the three earnings groups a fairly similar distribution of the marginal welfare weights that make joint taxation optimal. For all groups the marginal weights for households with non-working wives are relatively large and with increasing gross earnings of the wife the marginal weights tend to decrease.

Two specific results are important to discuss. First, we find an interesting dip in the welfare function at the first hours point at 833 Euro per month. This dip is in line with the withdrawal design of the subsidies provided by the Mini/Midi Jobs programm. As discussed, above the threshold of 800 Euros households face a fairly high marginal tax rate. *Ceteris paribus*, this design of the tax and transfer system is only optimal if the government has a relatively low welfare weight for this group. The second striking result is that for the higher earnings points we find relative low or even negative marginal welfare weights. This implies that, given the behavioral responses of the women, the German system of joint taxation is only optimal if the government has little or even a negative value for given an extra Euro to married households in which the women has relatively high gross earnings. In other words, the welfare function of the government would increase if *ceteris paribus* women would decrease their labor supply and reduce their gross earnings.

Note, the downward sloping marginal welfare weights do not per-se reveal a high taste for redistribution of the government since the equality concept is based on equivalized household earnings and not on the individual earnings of one parter. However, the shape of the welfare function in terms the wife's gross earnings can be interpreted relatively to her husbands earnings to derive conclusions about the taste of the government for the intra-household inequality. This will be discussed

in detail in the next section.

[Figure 2: about here]

The shape of the marginal welfare function with respect to female gross earnings that would make individual taxation optimal looks quite different. Still, we find for all three groups the highest marginal welfare weights for households in which the wife is not working. However, the marginal welfare weights for the households with a working wife are much more similar to those of households where the women stays at home. The dip at the first earnings point is still visible, however less pronounced. In contrast to joint taxation, the optimality of individual taxation does not imply negative marginal welfare weights at higher earnings points.

Marginal welfare weights by intra-household inequality

In the following we analyze the optimal marginal welfare weights by the intra-household inequality for joint and individual taxation. In Figure 3 - 5 we present the shape of the two marginal welfare functions separately for the defined earnings groups of the husband. This comparison between the groups allows us to shed some light on the effect of the splitting advantage - the gain from joint taxation relative to individual taxation - by the intra-household inequality and by household gross earnings.

[Figure 3: about here]

For women married to a husband with low earnings we find a fairly similar structure of the optimal marginal welfare function for joint and individual taxation. As highlighted above, for households in which the wife is out-of-work the marginal welfare weight needs to be higher in order to make both tax systems optimal. On the other hand, the optimal marginal welfare weights for the households with a working women are higher under individual taxation. At $\theta = 0.5$, that is the point where both spouses have identical earnings, the optimal marginal welfare weight for individual taxation is about 0.6 and for joint taxation is amounts to 0.2.

As discussed above, if $\theta = 0.5$ joint and individual taxation do not differ. Therefore, we could expect that at this point the marginal welfare weights in the two regimes are identical. The difference we find has several reasons. Most important the welfare weights at one specific discrete point depend on the net tax rates at all other points. Therefore the implication for joint and individual taxation

must be different even at $\theta = 0.5$. Moreover, the marginal welfare weights depend on the shares at the discrete points and the mobility elasticities in each regime. As shown, the shares and the mobility elasticities differ quite markedly between the two tax regimes.

[Figures 4 and 5: about here]

We have shown that joint taxation for households with men working for medium or high earnings is only optimal if at high earnings points the marginal welfare weights are very low or even negative. This is depicted by the marginal weights for joint taxation at θ close to 0.5. On the contrary, at θ =1, we find the highest optimal marginal welfare weights.

Differently for individual taxation: the inequality index does only moderately affect the optimal marginal welfare function. For θ =1, we find lower optimal marginal welfare functions than under joint taxation. On the other hand, the marginal weights for households with working women are always positive. In line with the findings for the households with low earnings this implies that individual taxation is optimal without a strong discrimination by the intra-household inequality.

Comparing the results by earnings groups we find that the differences between joint and individual taxation are strongest for women married to husbands with high earnings. The difference between the marginal welfare weights at θ= 0.5, is for the low earnings group about 0.4, for the medium group, 0.5 and for the highest group it is close to 0.8. The ranking is similar at other values of θ.

This variation is in line with the design of the splitting advantage. As discussed the splitting advantage does not only depend on the intra-household inequality but as well of the joint household earnings. The higher the joint household earnings, the higher is the marginal tax rate and thus, the advantage of joint versus individual taxation.

5 Conclusion

In this paper we have empirically derived the government's marginal welfare function that guarantees that joint taxation of married couples is optimal. This marginal welfare function has been compared to the welfare function required to make individual taxation optimal.

The theoretical framework behind our analysis is a discrete optimal tax model similar to Saez (2002) with a simplified utility maximization in which the wife conditions her labor supply behavior on the employment of the men. In the empirical application we estimate the behavior of the wife

using a static structural labor supply model. Based on the estimated preferences we derive the required mobility elasticities for solving the theoretical model of optimal taxation. Therefore, our framework accounts for the heterogeneity of labor supply behavior.

Applying the optimal tax model for Germany, we find that the marginal welfare weights that make a system of joint taxation optimal are quite different from those marginal welfare weights that guarantee optimality for individual taxation. While overall in both systems the optimal marginal welfare weights tend to decrease with gross earnings of the secondary earner (in our application by assumption the wife), the shape of the welfare function is quite distinct. Under joint taxation the optimal marginal welfare weights at higher earnings of the wife are much lower that under individual taxation. This result is even re-enforced when deriving the marginal welfare weights by the intra-household inequality. We show that the system of joint taxation is only optimal when the government has a high taste for redistribution towards couples with a high intra-household inequality, i.e. where the secondary earner is not working, and a very low or even negative taste for redistribution when both partners earn a similar amount. Under individual taxation this is different. The optimal marginal welfare weights are only slightly decreasing with the inequality within the households. In other words in this scenario the optimality depends less on the working composition within the household.

In line with previous studies (e.g. Steiner and Wrohlich (2004)), which show that in particular households with high earnings benefit from joint taxation, we find that the difference between the optimal marginal welfare function for joint and individual taxation is strongest for households with high earnings.

It is important to stress that our findings are not only the results of the mechanical effect of this hypothetical tax reform. The optimal tax model accounts as well for the behavioral effect induced by the reform measured by the mobility elasticity and the endogeneity of female labor supply.

We see our results as complementary to the findings of Alesina et al. (2007) or Kleven et al. (2008). Whereas these papers provide theoretical arguments against the optimality of joint taxation assuming a welfare function of the government our results are more descriptive. We show that joint taxation is only optimal if the government strongly differentiates by intra-household inequality and this favors an economy where the secondary earner does not work. In contrast individual taxation is optimal without strongly discriminating the working composition within the household.

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Appendix

Estimation Results

, [**Table 7 : about here**]

Mobility Elasticities between Discrete Earnings Points

Conditional on the husband's earnings we calculate the mobility elasticities between the discrete points which are shown in the following Tables. We derive the mobility elasticities separately for the scenario of joint and individual taxation.

[**Table 8: about here**]

As mentioned above, the mobility elasticities measure the relative change from point i to point k given a marginal increase in the income at point k. Given the different share at the points these elasticities are by definition not symmetric. *Ceteris paribus*, the higher the share at point i the larger the elasticity. Moreover, the taste for income and leisure and the tax system define the behavioral changes. In general, we find high responses to neighboring categories and on average higher behavioral effects at lower earning points.

[**Table 9: about here**]

The mobility elasticities differ between individual and joint taxation as the relative shares and the work incentives are different. Overall, the structure is fairly similar with high elasticities at the lower earning points.

Table 1: Discrete Employment States

Employment	Share (%)	Hours Women (per week)	Net income (in Euro)
0	29.06	0	2803
1	18.00	10	3164
2	29.01	23	3454
3	18.33	38	3860
4	5.60	42	3997

The following working hours (weekly) classifications are used: 0, 0-14, 15-34, 35-40, >40. Net household income (monthly) is calculated on basis of the microsimulation model STSM. The net household income is the mean income in the given alternative.

Source: SOEP, wave 2005, STSM.

Table 2: Discrete Employment States by Earnings Groups

Employment	All	Low earnings	Medium earnings	High earnings
0	29.06	24.55	30.17	34.11
1	18.00	13.95	20.25	19.72
2	29.01	28.31	30.58	26.68
3	18.33	25.94	14.30	14.62
4	5.60	7.25	4.70	4.87

The following working hours (weekly) classifications are used: 0, 0-14, 15-34, 35-40, >40. Earnings groups are defined according to the full-time gross earnings of the husband, < 30000; 30000-50000; > 50000.

Source: SOEP, wave 2005.

Table 3: Discrete Employment States by Earnings Groups

Earnings groups	All	Child 0-6	Child 7-16	East German
Low	41.4	19.10	37.79	40.44
Medium	42.3	18.05	45.30	11.48
High	44.6	15.31	47.33	6.03
All	42.5	17.85	43.16	20.22

Earnings groups are defined according to the full-time gross earnings of the husband, $<$ 30000; 30000-50000; $>$ 50000. Child 0-6 indicates the percentage of households with at least one child younger than six, Child 7-16 with at least one child between seven and sixteen. East is an indicator for the share of households in a group living in East Germany.

Source: SOEP, wave 2005.

Table 4: Female Labor Supply Elasticities

Earnings group	Participation	Hours	Extensive	Intensive
Low	0.18	0.34	0.17	0.16
Medium	0.21	0.39	0.22	0.17
High	0.20	0.35	0.21	0.18
All	0.20	0.36	0.20	0.17

Earnings groups are defined according to the full-time gross earnings of the husband, $<$ 30000; 30000-50000; $>$ 50000. Female elasticities are numerically derived with respect to a 1% increase in female gross wage. Participation measures the relative (%) increase in the participation rate and Hours the relative increase in weekly working hours. Extensive measures the relative increase in working hours due to the new participants, Intensive the increase due to the women already working.

Source: SOEP, wave 2005.

Table 5: Earnings Points: Joint Taxation

Earnings Points	Share	Gross Earnings	Net Tax Payments	Net Income	MTR.
			Low Earnings		
0	0.24	2021.68	264.96	1756.73	-
1	0.35	2855.02	640.78	2214.23	0.45
2	0.23	3688.35	1062.01	2626.34	0.51
3	0.18	4521.68	1491.50	3030.19	0.52
			Medium Earnings		
0	0.30	3191.10	814.98	2376.12	-
1	0.35	4024.43	1209.74	2814.68	0.47
2	0.18	4857.76	1647.48	3210.28	0.53
3	0.10	5691.10	2102.58	3588.52	0.55
4	0.06	6524.43	2567.78	3956.65	0.56
			High Earnings		
0	0.35	5172.93	1695.55	3477.38	
1	0.25	6006.27	2129.09	3877.18	0.52
2	0.16	6839.60	2601.71	4237.89	0.57
3	0.13	7672.93	3095.92	4577.01	0.59
4	0.05	8506.27	3611.05	4895.22	0.62
5	0.06	9756.27	4360.49	5395.78	0.60

Earnings groups are defined according to the full-time gross earnings of the husband, $<$ 30000; 30000-50000; $>$ 50000. Earnings points are related to the following gross female earnings 0, 10000, 20000, 30000, 40000, 55000. The MTR. is the effective marginal tax rate computed as the difference in the household tax payments w.r.t. the increase in the gross earnings. All information are in Euro per months

Source: SOEP, wave 2005.

Table 6: Earnings Points: Individual Taxation

Earnings Points	Share	Gross Earnings	Net Tax Payments	Net Income	MTR.
			Low Earnings		
0	0.21	2021.68	474.95	1546.74	-
1	0.37	2855.02	702.95	2152.07	0.27
2	0.24	3688.35	1064.18	2624.17	0.43
3	0.18	4521.68	1496.13	3025.55	0.52
			Medium Earnings		
0	0.24	3191.10	1137.06	2054.04	-
1	0.38	4024.43	1320.46	2703.97	0.22
2	0.20	4857.76	1676.82	3180.94	0.43
3	0.11	5691.10	2105.53	3585.57	0.51
4	0.06	6524.43	2568.32	3956.11	0.56
			High Earnings		
0	0.26	5172.93	2237.86	2935.07	
1	0.29	6006.27	2415.78	3590.49	0.21
2	0.19	6839.60	2771.04	4068.56	0.43
3	0.14	7672.93	3199.27	4473.67	0.51
4	0.06	8506.27	3661.79	4844.48	0.56
5	0.06	9756.27	4363.64	5392.62	0.56

Earnings groups are defined according to the full-time gross earnings of the husband, $<$ 30000; 30000-50000; $>$ 50000. Earnings points are related to the following gross female earnings 0, 10000, 20000, 30000, 40000, 55000. The MTR. is the effective marginal tax rate computed as the difference in the household tax payments w.r.t. the increase in the gross earnings. All information are in Euro per months

Source: SOEP, wave 2005.

Table 7: Female Labor Supply Elasticities

	Coefficients	Standard Error
Consumption*Age1 of Man	5.2266	3.8401
Consumption*Age2 of Man	-0.1139	0.3762
Consumption*Age3 of Man	-0.0745	0.2483
Consumption*Age4 of Man	-0.1293	0.1966
Consumption*Age1 of Woman	-1.3763	3.0311
Consumption*Age2 of Woman	0.0507	0.7822
Consumption*Age3 of Woman	0.0891	0.6088
Consumption*Age4 of Woman	0.4139	0.5723
Consumption*Child 0 - 6	0.7873	0.3637
Consumption*Child 7 - 16	0.1021	0.3270
Consumption	2.1445	0.6780
Consumption^2	-0.1101	0.0401
Leisure*Age1 of Woman	-5.8432	6.5536
Leisure*Age2 of Woman	-5.0614	2.1939
Leisure*Age3 of Woman	-4.7448	1.8370
Leisure*Age4 of Woman	-2.3867	1.7590
Leisure*Child 0 - 3	10.0970	0.9209
Leisure*Child 4 - 6	6.4909	1.1483
Leisure*Child 7 - 16	4.0376	1.0052
Leisure*German	-0.4337	0.5967
Leisure*East	-4.8290	0.4770
Leisure	101.0114	8.2137
Leisure^2	-76.7582	6.5103
Leisure*Consumption	-0.0571	0.2877
Part-time 1	-2.4412	0.1976
Part-time 2	-2.1455	0.2433
Log likelihood	-2831.1381	

The following age groups have been defined: Age1 (< 25), Age2 (25 - 35), Age3 (35 - 45), Age4 (45 - 55), Age5 (> 55) is the base category.
Source: SOEP, wave 2005.

Table 8: Mobility Elasticities: Joint Taxation

Earnings Points	0	1	2	3	4	5
			Low Earnings			
0	-	0.6315	0.3893	0.2125	-	-
1	0.1898	-	0.2291	0.1463	-	-
2	0.1962	0.1000	-	0.1652	-	-
3	0.0871	0.0427	0.0726	-	-	-
			Medium Earnings			
0	-	0.4589	0.2240	0.1404	0.0565	-
1	0.2222	-	0.1281	0.0870	0.0328	-
2	0.2881	0.1438	-	0.1108	0.1097	-
3	0.1879	0.0848	0.1303	-	0.0768	-
4	0.0817	0.0483	0.0650	0.0250	-	-
			High Earnings			
0	-	0.2099	0.1599	0.1322	0.0493	0.0213
1	0.2622	-	0.0856	0.0964	0.0279	0.0192
2	0.3261	0.1058	-	0.1043	0.0928	0.0638
3	0.1500	0.0571	0.0571	-	0.0375	0.0917
4	0.0773	0.0636	0.1318	0.0864	-	0.1350
5	0.0001	0.0222	0.0074	0.0407	0.0037	-

Earnings groups are defined according to the full-time gross earnings of the husband, $<$ 30000; 30000-50000; $>$ 50000. Mobility elasticities are derived based on the estimated coefficients and calibrated draws from the extreme value distributed error terms.

Source: SOEP, wave 2005.

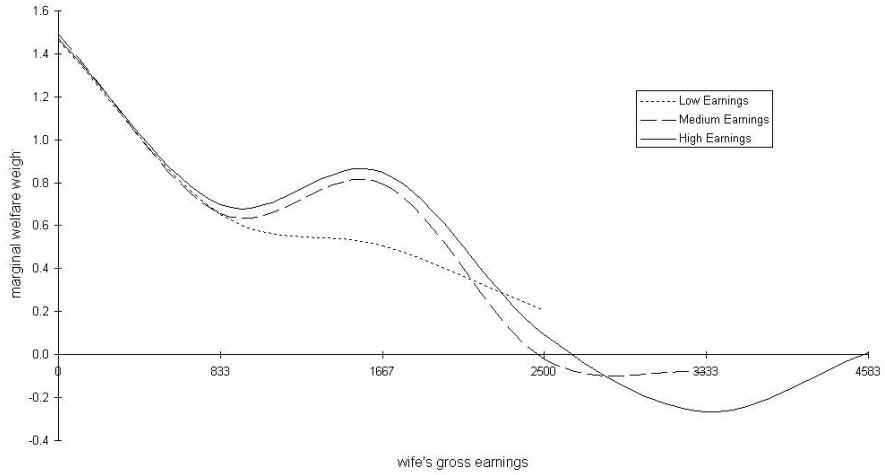
Table 9: Mobility Elasticities: Individual Taxation

Earnings Points	0	1	2	3	4	5
			Low Earnings			
0	-	0.5047	0.2927	0.0790	-	-
1	0.2679	-	0.1015	0.0692	-	-
2	0.2051	0.1424	-	0.1551	-	-
3	0.0834	0.0549	0.0867	-	-	-
			Medium Earnings			
0	-	0.4760	0.2568	0.0913	0.0263	-
1	0.2856	-	0.1084	0.0383	0.0142	-
2	0.3010	0.2104	-	0.0963	0.0754	-
3	0.1847	0.1236	0.1578	-	0.0727	-
4	0.1061	0.0701	0.0959	0.0294	-	-
			High Earnings			
0	-	0.4343	0.3025	0.1241	0.0322	0.0001
1	0.3607	-	0.1100	0.0400	0.0230	0.0079
2	0.3495	0.1679	-	0.0894	0.0540	0.0061
3	0.1627	0.0752	0.1231	-	0.0367	0.0265
4	0.1209	0.0679	0.1271	0.0852	-	0.0408
5	0.0074	0.0292	0.0147	0.0624	0.0184	-

Earnings groups are defined according to the full-time gross earnings of the husband, $<$ 30000; 30000-50000; $>$ 50000. Mobility elasticities are derived based on the estimated coefficients and calibrated draws from the extreme value distributed error terms.

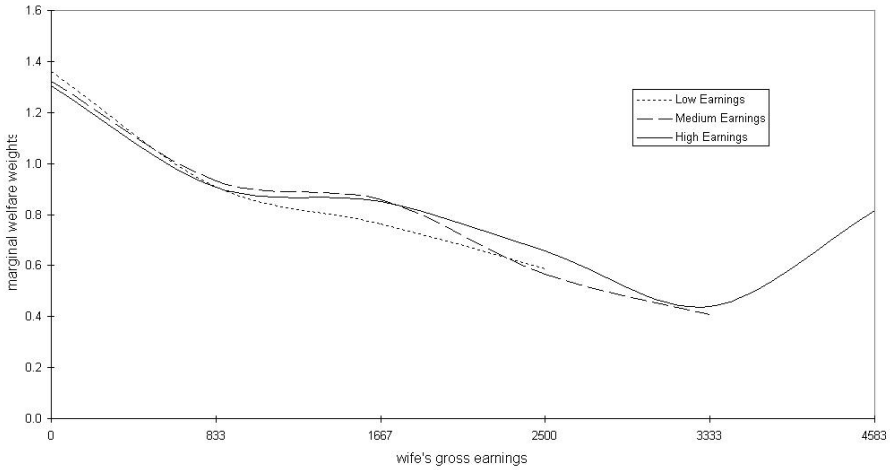
Source: SOEP, wave 2005.

Figure 1: Marginal Welfare Weights by Gross Earnings: Joint Taxation



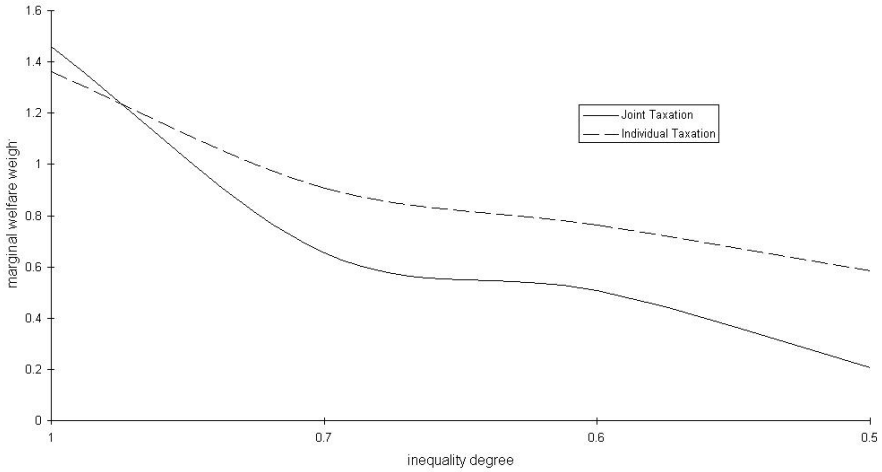
Notes: Gross earnings are the monthly earnings of the wife. Earnings groups low, medium and high, are defined according to the full-time gross earnings of the husband, $<$ 30000; 30000-50000; $>$ 50000.

Figure 2: Marginal Welfare Weights by Gross Earnings: Individual Taxation



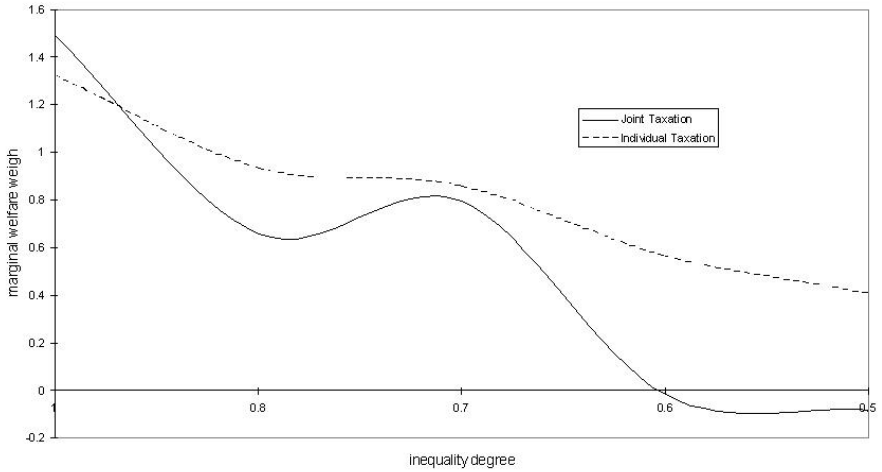
Notes: Gross earnings are the monthly earnings of the wife. Earnings groups low, medium and high, are defined according to the full-time gross earnings of the husband, $<$ 30000; 30000-50000; $>$ 50000.

Figure 3: Marginal Welfare Weights by Intra-Household Inequality: Low Earnings



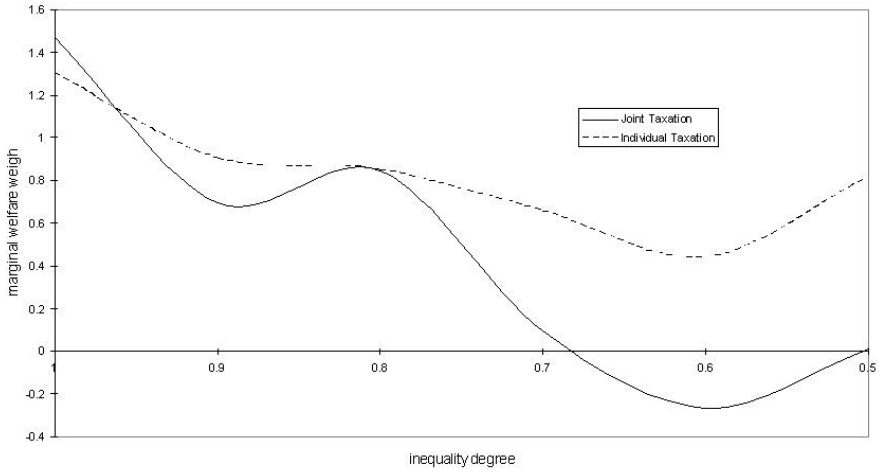
Notes: Intra-household inequality is defined as $\frac{\omega_m^h \overline{L_m^h}}{y^h}$, the male share of the overall earnings. The index is 1 if the wife is not working.

Figure 4: Marginal Welfare Weights by Intra-Household Inequality: Medium Earnings



Notes: Intra-household inequality is defined as $\frac{\omega_m^h \overline{L_m^h}}{y^h}$, the male share of the overall earnings. The index is 1 if the wife is not working.

Figure 5: Marginal Welfare Weights by Intra-Household Inequality: High Earnings



Notes: Intra-household inequality is defined as $\frac{\omega_m^h \overline{L_m^h}}{y^h}$, the male share of the overall earnings. The index is 1 if the wife is not working.