Taxation and Labor Supply of Married Women across Countries: A Macroeconomic Analysis

Alexander Bick
Arizona State University

Nicola Fuchs-Schündeln
Goethe University Frankfurt, CFS and CEPR *

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Abstract

We document contemporaneous differences in the aggregate labor supply of married couples across 18 OECD countries along the extensive and the intensive margin. We quantify the contribution of international differences in non-linear labor income taxes and consumption taxes, as well as gender wage gaps and educational premia, to the international differences in the data. Our model replicates the comparatively small cross-country differences of married men's hours worked very well. Moreover, taxes and wages account for a large part of the observed large differences in married women's labor supply between the US and Europe. The non-linearity of labor income taxes leads to substantially different effects of taxation on married men and women. We find that going to a system of strictly separate taxation would increase labor supply of married women by more than 100 hours annually in a third of our sample countries.

Keywords: Taxation, Two-Earner Households, Hours Worked

JEL classification: E60, H20, H31, J12, J22

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1 Introduction

Differences in aggregate labor supply across countries and over time have recently attracted a lot of attention in the literature. An active line of research traces these differences back to labor income taxation (Prescott (2004), Rogerson (2006), Rogerson (2008), Rogerson (2009), Ohanian et al. (2008), McDaniel (2011)), institutions (Alesina et al. (2005)), or social security systems (Erosa et al. (2012), Wallenius (2013)).

When trying to understand the underlying causes of the differences in hours worked, it is important to recognize that in all OECD-countries, more than half of the working age population are married. For these households, the decision of how much to work is a joint decision. Moreover, there are substantial international differences in the tax treatment of married couples, with the two extremes of completely joint and completely separate taxation of married couples. The tax treatment of married couples interacts with the progressivity of the tax system in affecting labor supply decisions of both spouses. In reality, countries most often have tax systems that contain elements of both extremes to a different degree, and the treatment of couples in both income taxes and social security payments leads to more significant non-linearities in the tax code than for singles. Therefore, when analyzing the effect of taxes on the labor supply of married couples, it is of paramount importance to take these non-linearities of the tax schedules in detail into account.

The goal of our paper is twofold. First, we combine different micro data sets to present new facts about the international aggregate labor supply of married couples. In the eighteen OECD countries in our sample, married women work on average more than 700 hours annually less than married men, and almost 200 hours less than single women. Apart from being the group with the lowest hours of work, married women are also the group that displays by far the largest heterogeneity of hours worked across countries. Secondly, we analyze to which extent international differences in taxation and wages can explain the observed differences in the data. To this end, we use the model of joint labor supply by married couples developed in Kaygusuz (2010), Guner et al. (2012a), and Guner et al. (2012b). Households differ by the education level of each spouse and face a utility cost of joint work, which induces an extensive and an intensive margin of female labor supply. We calibrate the model to match the labor supply behavior in the US in the 2000s, and show that it is able to provide a remarkably good fit also for the time series of labor supply in the US from the late 1970s on.

We then use the model to predict labor supply behavior in Europe. Four aspects of the economic environment vary internationally, namely non-linear labor income taxes, consumption taxes, wages, specifically the gender wage gap and educational premia, and the education distribution plus the degree of assortative matching into couples. For the non-linear labor income taxes, we use OECD tax modules which capture country specific features of average and marginal income tax rates of married couples in detail. Of the countries in our sample, Germany, Ireland, Norway, Poland, Portugal and the US use some variant of a system of joint taxation of married couples, and

France uses a system of family splitting. All the other countries have systems based on individual taxation of couples, which nevertheless often feature some elements of joint taxation through specific exemptions or alike.

We use our model to quantify by how much these four features can jointly and separately account for the cross-country differences of aggregate married couples' labor supply. We find that the model can explain cross-country differences of hours worked of married men very well. For married women, the model explains on average three quarters of the large hours worked per person difference between the US and Southern and Western Europe, whereas it somewhat overpredicts the hours differences to Scandinavia and Eastern Europe. Labor income taxes uniformly predict lower hours worked in Europe than in the US for married men, but show much more heterogeneous results for married women. We analyze the non-linear income tax system in more detail by differentiating between international differences in average tax rates as opposed to marginal tax rate schedules. As the previous literature has established, higher average tax rates in Europe than in the US lead to lower optimal hours in Europe, an effect which we find for both married men and married women. However, the tax rate schedule in fact predicts higher hours worked of married women in the majority of European countries than in the US, counteracting the effect of the average tax rate. The reason lies in the fact that the US features a system of joint taxation of married couples, which raises the marginal tax rate of married women substantially. In the European countries that feature instead a system of separate taxation, the marginal tax rate schedule is much more favorable to married women. We also investigate the degree of joint taxation of married couples in the sample countries by simulating the labor supply of married households under the assumption of strictly separate taxation, holding government revenues constant.

Our paper connects to the large literature documenting the increase in labor supply of married women in the US over the last decades, attributing it e.g. to technological improvement in the household sector (Greenwood and Seshadri (2002), Greenwood et al. (2005)), changes in the gender wage gap (e.g. Jones et al. (2003), Albanesi and Olivetti (2009), Knowles (2013)), changes in the return to experience for women (Olivetti (2006)), or improvements in maternal health and the introduction of infant formula (Albanesi and Olivetti (2009)). Guner et al. (2012a) and Guner et al. (2012b) focus explicitly on the issue of taxation of married women in the US. In a quantitative model, they find that going from joint to individual taxation would increase the labor supply of married women substantially. Some microeconomic studies analyze in a difference-in-differences approach the effect of the UK tax reform in 1989 involving a transition from joint to individual taxation (Crossley and Jeon (2007), Eissa (1995) and Eissa (1996)), concluding that such a tax reform increases labor supply of wives of well-earning husbands. Kaygusuz (2010) evaluates the effects of these tax reforms favoring married women in the US with a quantitative model. Last, our paper relates to the literature on the optimal taxation of married couples (e.g. Boskin and Sheshinski (1983), Apps and Rees (2007), Kleven et al. (2009)).

The strand of literature that motivates our paper analyzes international differences in trends of aggregate hours worked. A series of papers (Prescott (2004), Rogerson (2006), Rogerson (2008), Rogerson (2009), Ohanian et al. (2008)) have shown that differences in taxation can largely explain differences in the developments of total hours worked across European countries and the US. This literature focuses on differences in average marginal tax rates, and primarily explains not the cross-section across countries at one point in time, but the differences in the time series trends across countries.[1] McDaniel (2011) analyzes the cross-section of hours worked across 15 OECD countries in addition to the time series development. Her dynamic model incorporates home production and a subsistence level of consumption. She finds that labor income taxes are much more important than capital income taxes and productivity growth in explaining the different developments of total hours over time across countries. Ragan (2013), Erosa et al. (2012) and Wallenius (2013) analyze only the cross-country differences of hours worked; the first paper incorporates home production, while the latter two put a particular emphasis on the role of social security programs. The paper most closely related to ours is Chakraborty et al. (2012). They build a comprehensive life-cycle model with income risk to investigate the cross-country variation in hours worked for married and single men and women. The two features that vary internationally in their model are taxation and exogenous marriage and divorce probabilities,[2] while we focus on taxation and wage differences. While the treatment of consumption taxes is similar in our paper and Chakraborty et al. (2012), we focus much more than they do on exploring the full non-linearity of the labor income tax code. Chakraborty et al. (2012) estimate polynomial tax functions for married couples based on the sum of their earnings, and thus do not fully exploit the differential effects of tax progressivity vs. tax levels on husbands and wives, which are the focus of our analysis. This also does not allow them to talk about differences between current systems and systems of joint taxation.

The paper is organized as follows. The next section presents the micro data sources, explains the construction of the relevant data series, and presents our sample selection criteria. Section 3 shows some facts on the labor supply of married couples. The following section introduces the model, as well as its parametrization and calibration. Section 5 quantifies to which degree international differences in taxation and wages can explain differences in hours worked, and investigates the relative role of the various model inputs, specifically of the non-linear labor income tax schedule. Section 6 analyzes the country-specific consequences in going from the current tax system to one of strictly separate taxation of married couples. The next section compares our results explicitly to a more standard calibration in the literature that takes linear taxes as a model input. Section 8 shows that our results are robust to controlling for the presence of children in the household and a series of other robustness checks, and the last section concludes.

[1] Prescott (2004) calibrates his model to the average hours worked across seven countries and two time periods and can thus speak about cross-sectional results in addition to time-series results.

[2] Differences in divorce legislation and alimony regulations across countries are however not taken into account in Chakraborty et al. (2012).

2 Micro Data

2.1 Data Sets

We work with three different micro data sets to construct hours worked, namely the European Labor Force Survey, the Current Population Survey, and the German Microcensus. A detailed description of the data work, as well as a comparison of the resulting aggregate data to similar series from the OECD and the Conference Board, can be found in Bick et al. (2014).

2.1.1 European Labor Force Survey

The European Labor Force Survey (ELFS) is a collection of annual labor force surveys from different European countries, with the explicit goal to make them comparable across countries. Our ELFS sample comprises the Scandinavian countries Denmark, Norway, and Sweden, the Eastern European countries Czech Republic, Hungary, and Poland, the Southern European countries Spain, Greece, Italy, and Portugal, and the Western European countries Austria, Belgium, France, Ireland, Netherlands, and the UK.[3] The sample size of the ELFS varies across countries AND within a country over time, but is always of considerable magnitude, with the minimum annual sample size being more than 15,000 for Denmark, a country with roughly 5.5 million inhabitants. The weeks used as reference week in the survey vary from country to country and year to year, mostly covering a period of between 1 and 12 weeks in the first half of the year up to the year 2004, and the entire year from 2005 on. Appendix A.1 describes some data modifications that we have to apply to specific years and countries of the ELFS.

2.1.2 Current Population Survey

For the US, we use the Current Population Survey (CPS), which is a monthly survey of around 60,000 households. Specifically, we work with the CPS Merged Outgoing Rotation Groups data provided by the National Bureau of Economic Research.[4] This data set includes only those interviews in which the households are asked about actual and usual hours worked, namely the fourth and eighth interview of every household. The data cover the entire year, with the reference week always including the 12th of a month, and comprise individual data for about 300,000 individuals per year.

2.1.3 German Microcensus

The German Microcensus covers a one percent random sample of the population of Germany and is an administrative survey. Participation is mandatory. We use the scientific use files, which are a

[3]The ELFS covers even more transition countries as well as Finland and Switzerland, which we however exclude from the analysis because of data limitations along other dimensions.

[4]All information on these data files can be found on `http://www.nber.org/data/morg.html`.

70 percent random subsample of the original sample. This leaves us with a sample size of between 400,000 and 500,000 individuals per year. Until 2004, the Microcensus is carried out in the last week without a public holiday in April or the first week without a public holiday in May, and from 2005 on continuously over the year. East Germans are included in the sample from 1991 onwards.[5]

2.2 Calculation of Average Hours Worked per Person

For each individual, we have information on four key variables: usual hours worked in the main job during a working week, actual hours worked in the main job during a specific reference week, actual hours worked in additional jobs during the reference week, and reasons why the individual worked more or less hours than usual in the reference week.[6]

The main challenge in generating average annual hours worked per person lies in the fact that the reference weeks are not spread representatively across the entire year. This is especially a concern for vacation days and public holidays, which show systematic seasonal patterns. The reference weeks mostly exclude typical vacation periods and weeks with major holidays, which might lead to an overestimation of total hours worked.[7] Therefore, we collect information on the number of vacation days and public holidays by country and year from external data sources, which are listed in detail in the companion paper Bick et al. (2014). The main disadvantage from using external data sources is that we cannot account for heterogeneity in the population when it comes to vacation days.

To generate annual hours worked per person, we first construct individual weekly hours worked by adding actual hours worked in the reference week in all jobs. To make the data comparable across countries, we cap the sum of usual or actual hours worked in all jobs at 80, which is the largest possible value for usual or actual hours worked in the main job in the ELFS. For individuals who report having worked less hours than usual in the reference week due to vacation or public holidays, we use usual hours worked instead of actual hours worked. We then multiply these weekly hours worked by 52 minus the weeks lost due to vacation days and public holidays, i.e. the number of these days divided by five, in the respective country, and then averages over all individuals.[8]

[5] From 2002 on, data from the German Microcensus are used also as input into the European Labor Force Survey, but before 2002 Germany is missing from the anonymized ELFS available to researchers.

[6] For the CPS, we have usual hours worked in the main job and actual hours worked in all jobs in the reference week, i.e. we cannot distinguish between overtime work in the main job and actual hours worked in any additional job in the reference week.

[7] Even during the years in which reference weeks ought to cover the entire year, we find evidence that vacation days and public holidays are underreported, for more information see Bick et al. (2014).

[8] In Bick et al. (2014), we construct hours worked for all individuals aged 15 to 64, and compare average hours worked per employed and employment rates generated from our micro data sets to the data series provided by the OECD and the Conference Board. Overall, we fit the macro data quite well: deviations in the employment rate amount to less than 2 percentage points in most cases, and deviations in hours worked per employed to less than 5 percent. As described in Bick et al. (2014), capping the data does not have a large impact on the overall average of hours worked.

2.3 Sample Selection

We include only married individuals into the sample. There are a few countries which differentiate between marriage and civil union, e.g. the Netherlands. In this case, the ELFS makes it explicitly clear that every respondent who is treated for tax purposes as "married" should indicate married as the civil status.[9] Next, we include only individuals for which both partners are observed and fit our sample restrictions. Since clear identifiers for husbands and wives are missing for many years and countries, we define couples consistently as two people of opposite sex who are both married and live in the same household, and drop households in which more than two married adults live. We focus on couples in which both husband and wife are aged 25 to 54. Since we are mainly interested in the role of taxation in explaining international differences in hours worked of married women, we focus on the core age group and avoid discussing international differences in the education systems, degrees of youth unemployment, and early retirement programs.[10] We concentrate on the sample period 2001 to 2008. We use a sample period of more than one year and do not further analyze the time series in order to avoid that cross-country differences might be driven by uncorrelated business cycles. The choice of the exact sample period is caused by the availability of the OECD tax modules. Last, since we model heterogeneity through differences in education levels, we exclude individuals with missing information on own education or partner's education.

There are three reasons why a married individual aged 25 to 54 might be dropped from our sample, namely first because we cannot identify the partner due to more than 2 married adults or no other married adult living in the household, second because the partner might be younger than 25 or older than 54, and third because education information might be missing for the respondent or the partner. Table A.1 in the appendix reports the percentage of observations dropped because of these restrictions. The percentage is always larger for women than for men, because it is more likely for women that the partner is older than 54. Variation across countries arises because of variation in the number of missing education observations, variation in the age structure in marriage and age at marriage, and variation in the number of married adults living in one household.[11][12]

[9] E.g. in the case of the Netherlands, this would include individuals in a civil union.

[10] Wallenius (2013) analyzes the labor supply effects of international differences in social security programs. She finds that effects of retirement programs arise almost exclusively through the extensive margin, i.e. the working hours of the core working age population are basically unaffected by international differences in social security programs.

[11] E.g. Poland, which has the largest number of observations dropped, exhibits an unusually large percentage of individuals married to someone younger than 25, as well as an unusually large number of households consisting of three or more married adults.

[12] In the data for the Scandinavian countries, it is in most years impossible to identify married couples. Therefore, the only reasons why married individuals might be dropped is missing information on their education leading to the small fraction of dropped observations in Table A.1.

Table 1: Cross-Country Statistics on Annual Hours Worked by Gender and Marital Status (Ages 25-54)

	Men		**Women**	
Country	Married	Single	Married	Single
Mean	1761.6	1484.5	1028.2	1217.0
Standard Deviation	104.2	108.8	179.5	96.6
Coefficient of Variation	0.059	0.073	0.175	0.079
Var(log hours)	0.003	0.005	0.033	0.006

3 Hours Worked of Married Couples

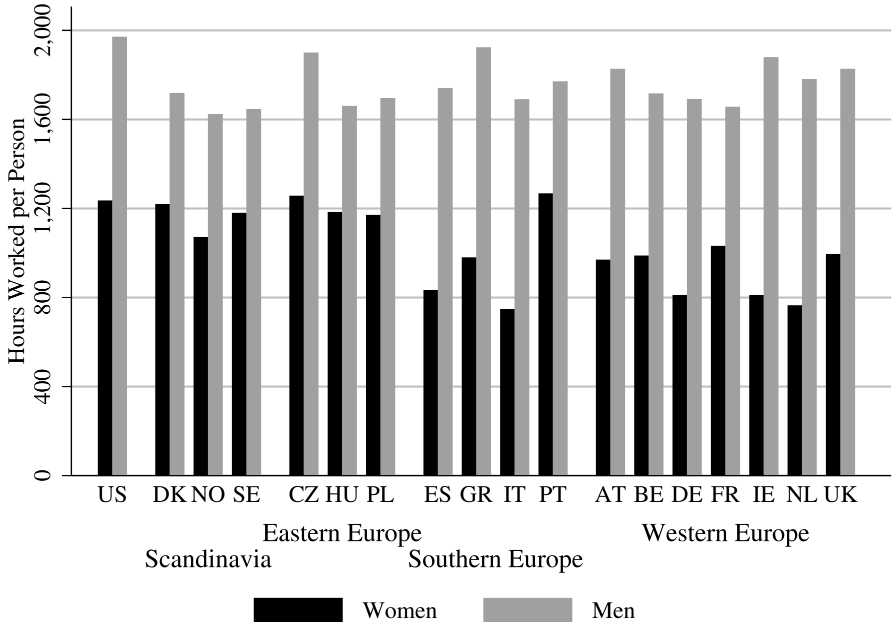
Table 1 shows some statistics on hours worked per person by gender and marital status over the 18 sample countries and covering the period 2001 to 2008. On average, married men aged 25 to 54 work around 700 hours more than married women in the same age group. Single women work 190 hours more than married women, and single men 280 hours less than married men.[13] While married women are thus clearly the group with the lowest hours worked, they exhibit the largest standard deviation in mean hours worked per person across countries: in fact, the standard deviation of hours worked of married women is more than 70 percent higher than the ones of the other three demographic groups, while the coefficient of variation is even more than twice as large, and the variance of log hours an order of magnitude bigger. Married women contribute on average 23 percent of total hours worked, but account for 29 percent of the variance of total hours worked across countries. Moreover, the international correlation of hours worked of married men with the one of single men or single women is 0.75 and 0.70, respectively, while the correlation with hours worked of married women amounts only to 0.05. Thus, there is clearly something special about married women, and married women are an interesting group to look at if one wants to understand international differences of hours worked.

Since from now on we focus on married couples, the issue of selection into marriage arises. While we do not model this selection, we report in Figure A.1 in the Appendix the fraction of women in the core age group who are married. It amounts on average to 64 percent, with a standard deviation of 0.075. The extremes are Sweden with 48 percent of women being married, and Poland with 77 percent. For the majority of countries, the fraction of married women lies between 60 and 70 percent.

Figure 1 shows average hours worked of married women (dark bars) and men (light bars) aged 25 to 54 over the period 2001 to 2008 for all eighteen countries in our sample in a bar chart. The countries are grouped into five regions, namely the US, Scandinavia (Denmark, Norway, Sweden), Eastern Europe (Czech Republic, Hungary, Poland), Southern Europe (Spain, Greece,

[13] The difference in hours worked between single and married women persists regardless of the presence or absence of children or preschool children, but is smaller for women with children than for women without children.

Figure 1: Average Annual Hours Worked Per Person of Married Women and Men (Ages 25-54)

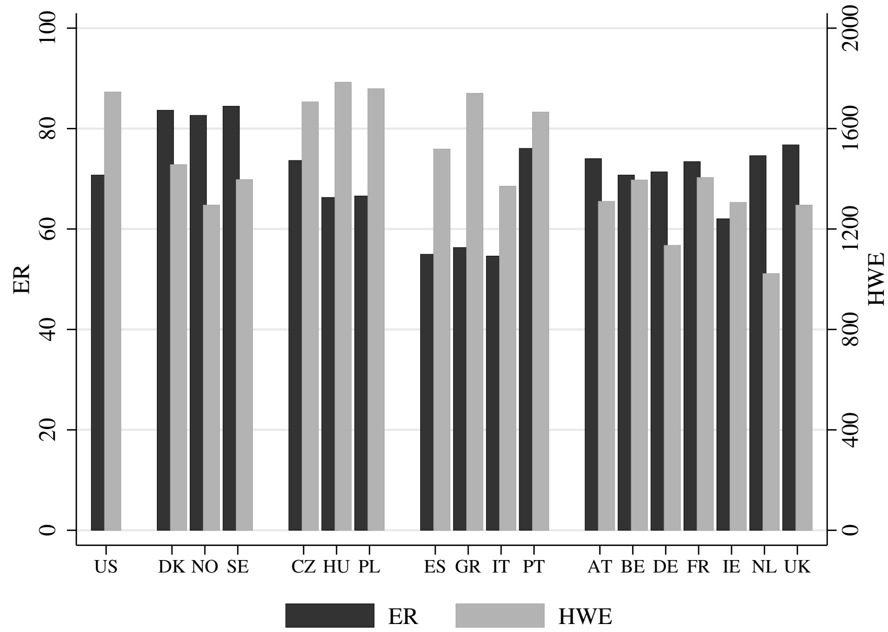


Italy, Portugal), and Western Europe (Austria, Belgium, Germany, France, Ireland, Netherlands, United Kingdom). The ordering of the regions is according to the mean hours worked per person of married women, and the countries within each region are ordered alphabetically.

Hours worked of married men are highest in the US, followed closely by Greece, the Czech Republic, and Ireland. At the lower end of the sample are Norway, Sweden, Hungary, and France. Norwegian married men work 350 hours less than, or only 82 percent of, US married men. There is no clear pattern in terms of married men's hours worked among Western, Southern, Eastern, and Northern European countries.

By contrast, for married women there is a clear regional pattern of hours worked per person, which are high in the US, Scandinavia, and Eastern Europe with 1240, 1160 and 1200 hours, respectively, and much lower in Southern and Western Europe with 960 and 910 hours. Portugal is a notable exception, which despite being a Southern European country actually features the highest hours worked of married women. Western Europe is somewhat divided with Germany, Ireland and the Netherlands having relatively low hours worked, comparable to Italy and Spain, whereas France, Belgium, Ireland and the UK having higher hours worked which still are all below the Scandinavian and Eastern European countries. Overall, the lowest hours worked arise in Italy with 750 hours, 490 hours less than, or only 61 percent of, US married women. The graph reflects the finding of Table 1 that the differences in hours worked of married women are much larger than for married men. In Section 8.1 we show that the differences in married women's hours worked

Figure 2: Average Employment Rates and Hours Worked per Employed of Married Women (Ages 25-54)



across countries are not primarily driven by a differential presence of children in households or differential effects of children on married women's labor supply across countries.

Figure 2 decomposes hours worked per person of married women into the extensive margin, i.e. the employment rate, and the intensive margin, i.e. hours worked per employed. An interesting pattern emerges here: regions with high employment rates, especially Scandinavia and Western Europe, tend to have low hours worked per employed, while regions with low employment rates, such as Eastern Europe and especially Southern Europe, exhibit high hours worked per employed married woman. While Scandinavia and Eastern Europe thus both exhibit high hours worked of married women, they show very different behavior in the decomposition into an intensive and an extensive margin. The same is true for Southern and Western Europe, which both exhibit low hours worked per married woman, but again are clearly distinguishable in the decomposition into an intensive and an extensive margin. Figure A.2 in the appendix shows the same decomposition into both margins for married men. There is little variation in employment rates of married men, which lie always around 90 percent. The only exceptions are Hungary and Poland, where lower employment rates are driven by older married men and probably a phenomenon of the transition from Socialism to Capitalism. As a consequence of this relative homogeneity and the high employment rates of married men, we do not model an extensive margin for married men explicitly, and report the decomposition into both margins from now on only for women.

4 Model

4.1 A Model of Joint Household Labor Supply

We build a static model for married couples whose members jointly maximize the utility of the household by determining male and female labor supply along the lines of Kaygusuz (2010).[14]

There is a continuum of married households of mass one. Each household member exhibits one of three possible education levels, denoted by $x \in \{l, m, h\}$ for women and by $z \in \{l, m, h\}$ for men, which determine the offered wages $w_f^i(x)$ and $w_m^i(z)$, which may vary across countries and is therefore indexed by i. We denote the fraction of households of type x, z by $\mu^i(x, z)$ with

$$\sum_x \sum_z \mu^i(x, z) = 1. \tag{1}$$

Households draw a utility cost q from a distribution $\zeta(q|z)$ which depends on the husband's education level. These costs are only incurred if the wife participates in the labor market, and they thus introduce an extensive margin choice for women. We abstract from modeling an explicit extensive margin choice for men since their participation rates in our sample are above 90 percent and display only little variation across the countries under consideration. The draw q can be interpreted as a utility loss due to joint work of two household members, originating from, for example, inconvenience for scheduling joint work, home production and leisure activities, or spending less family time with children, see Kaygusuz (2010). It captures residual heterogeneity across households - conditional on the husband's education level - regarding the participation choice. For each household x, z, there exists a threshold level $\bar{q}(x, z)$ from which onwards the utility costs of working are so high that the woman chooses $h_f = 0$.

The household faces two types of taxes, namely a consumption tax τ_c and a non-linear labor income tax τ_l, which depends on both spouses' gross incomes, as well as the number of children in the household k. The maximization problem of a type $\{x, z\}$ household in country i is given by

$$\max_{h_m, h_f} \left\{ \ln c - \alpha_m \frac{h_m^{1+\frac{1}{\phi_m}}}{1+\frac{1}{\phi_m}} - \alpha_f \frac{h_f^{1+\frac{1}{\phi_f}}}{1+\frac{1}{\phi_f}} - q \mathbf{I}_{h_f>0} \right\} \tag{2}$$

$$\text{s.t. } c = \frac{y_{hh} - \tau_l}{(1+\tau_c^i)} + T \tag{3}$$

$$y_{hh} = w_m^i(z) h_m + w_f^i(x) h_f \tag{4}$$

$$\tau_l = \tau_l^i(w_m^i(z) h_m, w_f^i(x) h_f, k^i) \tag{5}$$

[14] Guner et al. (2012a), and Guner et al. (2012b) embed the same preference structure in a life-cycle setting to evaluate different tax policies with in the US.

where $\mathbf{I}_{h_f>0}$ takes the value one if the wife is working, and zero otherwise, c represents household consumption, y_{hh} represents gross household income, and τ_l the household's income tax liability. T represents a lump-sum transfer from the government which redistributes a share $\lambda^i \in [0,1]$ of all government revenues:

$$T = \frac{\lambda^i}{1+\tau_c^i} \sum_x \sum_z \mu^i(x,z) \left[\int_{-\infty}^{\infty} \tau_l^i(w_m^i(z)h_m^*(q), w_f^i(x)h_f^*(q), k^i)\zeta(q|z)dq \right. \\ \left. + \tau_c^i \int_{-\infty}^{\infty} \left(w_m^i(z)h_m^*(q) + w_f^i(x)h_f^*(q)\right)\zeta(q|z)dq \right], \tag{6}$$

where * denote the optimal hours choice given the draw of q.[15] As e.g. in Prescott (2004) and Rogerson (2008), households do not internalize that their choices affect the transfer, but their expectation about the transfer is consistent with the realization.

As usual in the literature explaining aggregate hours differences between Europe and the US - even with agents with heterogenous education choices as in Guvenen et al. (2011) -, consumption and labor supply are assumed to be separable, and utility from consumption is logarithmic. α captures the relative weight on the disutility of work, and ϕ determines the curvature of this disutility. Both parameters are gender-specific and thus potentially differ for men and for women. Preference differences by gender can capture effects like differential impact of children on the labor supply of men and women, conditional on working.[16,17]

Guner et al. (2012a) and Guner et al. (2012b) use a similar preference structure in a dynamic setting in which households have children during the course of their life. In there, small children impose a fixed time cost which increases the marginal disutility of work of mothers. We refrain from modeling children here for two reasons, which we will both show explicitly in Section 8.1, which deals explicitly with children. First, even though there are some cross-country differences in the tax treatment of children, the effects are rather small. We explain further below how we nevertheless capture these effects in our quantitative analysis. Second, the fraction of women with small children in out entire sample is relatively small as well. Last, reliable cross-country estimates on child care costs are not available, e.g. the fraction of children taken care of in non-paid child care arrangements even among working women varies a lot between countries, and some countries

[15] Equation (6) is dervied as follows. For ease of exposition, assume there would be just one household consisting of a single member. Total government revenues R are the sum of the revenues from the labor income tax and from the consumption tax, i.e. $R = \tau_l + \tau_c^i(c-T)$. T is subtracted in this calculation as the transfer is not subject to the consumption tax. Replacing the budget constraint $c = \frac{1}{1+\tau_c^i}(y_{hh} - \tau_l) + T$, yields $R = \frac{1}{1+\tau_c^i}\left[\tau_l + \tau_c^i y_{hh}\right]$. The transfer T is then the fraction λ^i from government revenues R.

[16] With the gender wage gap alone, we cannot explain the hours worked difference of 735 hours between married men and women in the US, our baseline country.

[17] We solve the model numerically, allowing men to choose from an hours grid ranging from 0 to 3000 annual hours, with a step size of 10 hours for the range from 1200 to 2200 hours. The grid for female hours worked also ranges from 0 to 3000 hours, with a step size of 10 hours between 500 and 1500 hours. Outside these ranges, step sizes amount to 50 hours.

like Germany subsidize child care heavily but limit the supply, see e.g. Bick (2013).

4.2 Model Inputs

As inputs into the model, we need country-specific information on male hourly wages by education, female hourly wages by education, non-linear labor income taxes, and consumption taxes. Last, we calibrate the four preference parameters in the utility function. When used in the model, wages and taxes are converted into 2005 US-Dollars, using PPP-adjusted exchange rates obtained from the Penn World Table.

4.2.1 Hourly Wages

To calculate hourly wages, we have to divide earnings by hours. Unfortunately, the ELFS does not provide earnings data, and the German Microcensus only net data. Therefore, we recur to the EU Statistics of Income and Living Conditions (EU-SILC), which is a European household data set that captures income and hours.[18] We then calculate country- and year-specific mean wages for married men aged 25 to 54 in the EU-SILC and the CPS for three different education groups, namely low, medium, and high education.[19] For comparability reasons, we cap hours and earnings in the EU-SILC as in the CPS, and then construct hourly wages by dividing gross annual individual earnings by annual hours. We construct annual hours by multiplying usual weekly hours with 52 minus vacation/public holiday weeks from external data sources. Last, we drop observations with wages less than half the minimum wage (as in the Review of Economic Dynamics 2010 special issue on cross-country heterogeneity facts), and the top 1 percent of observations, which are mostly driven by low hours rather than high earnings and seem to be due to measurement error. The EU-SILC starts only in 2004, and for some sample countries even later; we extrapolate wages for the missing years based on Eurostat growth rates of mean wages.

For married women, the issue of self-selection into employment arises. If high ability women of each education group are more likely to join the labor force, then observed wages overestimate the distribution of offered wages (see e.g. Olivetti and Petrongolo (2008)). We therefore apply a simple two-stage Heckman procedure to impute wages of non-working women. The exclusion restrictions are that the income of the husband as well as the presence of children do not influence directly the wage of a woman.

The last three columns of Table 2 show the corresponding mean gender wage gap in each country, as well as the education premia (defined as the ratio of wages for high and low educated people) for men and women. The gender wage gap is quite similar across regions, though with some differences across countries. The educational premia tend to be higher for both genders in Eastern

[18] However, the sample size of EU-SILC is two orders of magnitude lower than of the ELFS.

[19] Low education is defined as primary and lower secondary education, medium education as upper secondary and non-tertionary post-secondary education, and high education is any tertionary education.

and Southern Europe, as well as the US, than in Western Europe, and are lowest in Scandinavia.

4.2.2 Non-Linear Labor Income Taxes and Consumption Taxes

The non-linear labor income tax system is captured by the OECD Taxing Wages tax modules. The OECD tax codes calculate annual household net income based on the respective country's and year's tax laws, taking income taxes plus employees' social security contributions as well as cash benefits into account. Tax modules are available online from the year 2001 on. Using these codes, we can assign an annual net household income to each combination of male and female annual earnings. We calculate the exact values for an earnings grid with 101 steps for men, ranging from 0 earnings to four times the average annual earnings in the country, and for an earnings grid with 201 steps for women, ranging from 0 earnings to three times the average annual earnings in the country.[20] We then linearly interpolate in two dimensions to assign a net annual household income to each possible annual hours choice of husband and wife. One additional input into the tax codes are the number of children. From the micro data, we calculate the percentage of married couples with 0, 1, 2, 3, or 4+ children,[21]

The first three columns of Table 2 give an overview of the model inputs relating to labor income taxation. Clearly, it is impossible to summarize the complex non-linear labor income tax systems in a few numbers. We want to stress that we are exploiting the full non-linearity of the tax code in our exercise, and here just present some suggestive numbers of the tax code. Columns 1 to 3 show three possible measures that reflect two aspects of the labor income tax schedule: column 1 ($\tau_l(0)$) shows the country-specific average tax rate evaluated at US mean hours worked of married men, assuming that the man is earning the country-specific mean male wage the woman does not work, and thus gives one of many possible measures of an average tax rate. Column 2 ($\tau_l'(1/2h_f^{US})$) shows the average marginal tax rate if the woman starts working, earns the country-specific mean female wage and works half the mean hours of US married women, thereby capturing one possible measure of progressivity.[22] The third column then shows the same concept of an average marginal tax rate if the wife goes from not working to working the average hours of US married women. We use both for men and women the corresponding US hours to show the average/marginal tax rates faced at the mean-country-specific wages for the same hour choices across all countries.

The US average tax rate as calculated in column 1 amounts to 20.5%, whereas the corresponding Danish married couple would have to pay an average tax rate of 38.9%, and the Irish couple a tax

[20] For women, we thus put in as many steps as the OECD taxing wages module allows. To give a specific example, for the US for the year 2005 the difference between two annual earning levels for men amounts to 2297 US-Dollars and for women to 689 US-Dollars.

[21] We do not have any information on children in Scandinavian countries for our sample period. For these countries, we calculate the distribution of children from the EU-SILC data. This data starts only in 2004, so we use the 2004 value for 2001-2003.

[22] We define this average marginal tax rate as $[\tau_l(w_m h_m^{US}, w_f 1/2h_f^{US}) - \tau_l(w_m h_m^{US}, 0)]/[w_f 1/2h_f^{US}]$. All tax rates in this table are calculated for couples without children. Children decrease $\tau_l(0)$ via tax credits etc., but hardly affect $\tau_l'(1/2h_f^{US})$ and $\tau_l'(h_f^{US})$.

Table 2: Model Inputs

Country	$\tau_l(0)$	$\tau_l'(1/2h_f^{US})$	$\tau_l'(h_f^{US})$	τ_c	$\frac{w_f}{w_m}$	$\frac{w_m^{high}}{w_m^{low}}$	$\frac{w_f^{high}}{w_f^{low}}$
Denmark	38.9	49.4	48.7	32.0	0.80	1.4	1.3
Norway	28.1	29.8	31.6	24.3	0.78	1.4	1.1
Sweden	32.8	24.8	30.1	32.5	0.76	1.4	1.2
Mean	*33.3*	*34.7*	*36.8*	*29.6*	*0.78*	*1.4*	*1.2*
Czech Republic	21.1	22.0	23.7	14.8	0.76	2.0	1.8
Hungary	26.8	15.6	22.6	23.6	0.82	2.4	2.0
Poland	28.7	30.6	32.4	18.6	0.80	2.3	3.8
Mean	*25.5*	*22.8*	*26.2*	*19.0*	*0.79*	*2.3*	*2.5*
Spain	17.4	21.2	20.4	15.9	0.68	1.7	2.6
Greece	24.6	16.0	16.4	14.9	0.71	1.9	2.5
Italy	28.8	25.2	31.4	22.1	0.88	1.8	1.6
Portugal	21.1	22.2	28.5	19.0	0.83	2.9	2.7
Mean	*23.0*	*21.2*	*24.2*	*18.0*	*0.77*	*2.1*	*2.3*
Austria	31.0	20.3	28.8	18.7	0.76	1.6	1.7
Belgium	33.5	42.0	50.0	20.7	0.85	1.4	1.6
France	23.6	33.1	33.0	23.8	0.79	1.5	1.7
Ireland	14.9	11.1	23.1	24.0	0.71	1.8	2.6
Germany	31.0	48.1	50.3	15.4	0.73	1.7	1.5
Netherlands	29.5	31.2	38.3	21.3	0.76	1.6	1.5
United Kingdom	25.9	12.1	22.5	17.1	0.74	1.8	2.1
Mean	*27.1*	*28.3*	*35.1*	*20.1*	*0.76*	*1.6*	*1.8*
United States	20.5	29.1	29.1	7.4	0.77	2.1	2.2

Note: $\tau_l(0)$ is the country-specific average tax rate evaluated at the average US annual hours worked by married men, assuming the man is earning the country-specific mean male wage and the wife does not work. $\tau_l'(1/2h_f^{US})$ is the average marginal tax rate if the wife starts working at the country-specific mean female wage and works half the average hours of US married women, i.e. $[\tau_l(w_m h_m, w_f 1/2h_f^{US}) - \tau_l(w_m h_m, 0)]/[w_f 1/2h_f^{US}]$. $\tau_l'(h_f^{US})$ similarly represents the average marginal tax rate if the wife starts working at the country-specific mean female wage and works the average hours of US married women. All tax rates are calculated for couples without children. τ_c are consumption taxes as calculated by McDaniel (2011). w_f/w_m is the average gender wage gap. w_m^{high}/w_m^{low} is the male education premium (i.e. the wage of high educated men divided by the wage of low educated men). w_f^{high}/w_f^{low} is the same statistic for women. All hourly wages are given in 2005 real, PPP adjusted US Dollars.

rate of only 14.9%. The average tax rates are lowest in the US and Southern Europe, followed by Eastern and Western Europe, and highest in Scandinavia. The measure of progressivity shown in column 2 amounts to 29.1% in the US, peaking at 48.1% in Germany, a country with high progressivity and joint taxation of married couples. This measure is again on average lowest in Southern Europe, with similar low levels in Eastern Europe, significantly higher in Western Europe and the US, and highest in Scandinavia. Column 3 shows that the average marginal tax rate for a married woman who goes from not working to working the average hours of a US married women exceeds 50 percent in Germany and Belgium.[23]

Consumption tax rates for our sample countries are provided by McDaniel (2012), who calculates consumption tax rates from NIPA data. The advantage of these tax rates over simple value added tax rates is that they also capture excise taxes, exemptions from the value added tax, etc. They are shown in column 4 of Table 2. Differences in consumption tax rates are large between the US and Europe, amounting to more than 10 percentage points, and consumption taxes are highest in Scandinavia, where they can exceed 30 percent.

4.2.3 Educational Composition and Matching into Couples

We take the percentage of husbands and wives per education group, as well as their matching into couples, directly from the data. We then assign each individual the gender-specific mean wage by education that we estimated from the EU-SILC and CPS. The demographic composition is shown in Appendix Table A.4. The first four columns show the percentage of men and women with low or high education, respectively, omitting the group of medium education, and the last column shows a simple correlation coefficient of the matching into couples between the three education groups. While the degree of assortative matching is relatively homogeneous across countries,[24] there are substantial differences in the educational composition: in Southern Europe, more than half of the population exhibit low education, while in Eastern Europe and the US only around 10 percent do. Higher education rates are largest in the US with around 45 percent, followed by Scandinavia and Western Europe, and smallest in Eastern and Southern Europe with between 15 and 20 percent.

4.2.4 Redistribution of Government Revenues

The government redistributes a fraction $\lambda^i \in [0, 1]$ of all government revenues back to the households in a lump-sum fashion independent of a household's income. Similar to Prescott (2004), we set λ^i =1-twice the share of expenditures on military from all government expenditures.

4.2.5 Calibration of Preference Parameters

As Kaygusuz (2010), we set the labor supply elasticity $\phi_h = \phi_f = 0.5$, which is consistent with the estimates surveyed in Blundell and MaCurdy (1999), Domeij and Flodén (2006), and Keane

[23] Note that the average marginal tax rates for the US do not change when the female hours are doubled as household income remains in the same tax bracket.

[24] Naturally, assortative matching is more prevalent in countries in which a large share of the population has the same education level.

(2011). The utility weights on leisure are calibrated to match average hours worked per person by men (recall that we do not model an explicit intensive margin for them) and female hours worked per employed woman, and take the values $\alpha_m = 0.523$ and $\alpha_f = 0.458$. The lower disutility weight for women reflects the fact that lower female wages plus the higher implied female marginal tax rates due to joint taxation together would overpredict the difference in hours worked compared to married men, if we would constrain α_f to be equal to α_m. Thus, a lower disutility weight for women is needed to counteract this. Note that this is partly driven by the fact that we match hours worked per person for men, but hours worked per employed for women; using hours worked per employed for men as well would generate a larger gender difference in hours in the data for $\alpha_f = \alpha_m$.

Again, following Kaygusuz (2010), Guner et al. (2012a) and Guner et al. (2012b), the utility cost parameter is distributed according to a flexible gamma distribution, with the shape parameter k_z and scale parameter θ_z being conditional on the husband's type:

$$q \sim \zeta(q|z) \equiv q^{k_z - 1} \frac{\exp(-q/\theta_z)}{\Gamma(k_z)\theta_z^{k_z}}, \tag{7}$$

where $\Gamma(\cdot)$ is the Gamma function. For each husband's education level z, we select the parameters k_z and θ_z to match as closely as possible the female labor force participation rates by their wives' three own education levels $x \in \{l, m, h\}$.

For given preference parameters α and ϕ, and conditional on being married to a type z husband, the three different education levels x and implied wages generate three different threshold levels $\bar{q}(x, z)$ at which a woman of type x is indifferent between working and not working. Assume for simplicity that all type z husbands work the same amount of hours. Women with more education, i.e. a higher wage, will have a higher threshold q, and therefore a higher labor force participation rate, for any given distribution of q. The parameters k_z and θ_z are then selected to ensure that the mass of women below these thresholds corresponds to the empirically observed participation rates of the women's labor force participation by their own education conditional on the husband's education.

Table 3 shows how the model matches the extensive and the intensive margins for married women by education group. Note that none of these education-specific statistics are explicitly targeted by the model, while the averages across education groups are.[25] The model captures the gradient in the employment rate and hours worked per employed by education very well. Along the intensive margin, the model slightly overestimates the variability by education, predicting lower hours than in the data for the low education group, but higher hours for the high education group.

[25] Table A.5 in the appendix records the fit of female employment rates by education of the husband and education of the wife. The average female employment rate by education of the husband, which is as well not explicitly targeted, is matched almost perfectly.

Table 3: Model Match: Some Statistics for Married Women

	Data	**Model**	**Difference***
Employment Rate			
Low education	44.9	46.8	1.9
Medium education	69.4	66.6	−2.8
High education	76.5	78.0	1.5
Mean	*70.7*	*70.3*	*-0.5*
Hours Worked per Employed			
Low education	1682.9	1589.8	−5.5
Medium education	1739.8	1706.7	−1.9
High education	1757.6	1819.3	3.5
Mean	*1746.3*	*1749.1*	*0.2*

Note: Difference*: Percentage point difference for employment rate, percentage difference for hours worked per employed.

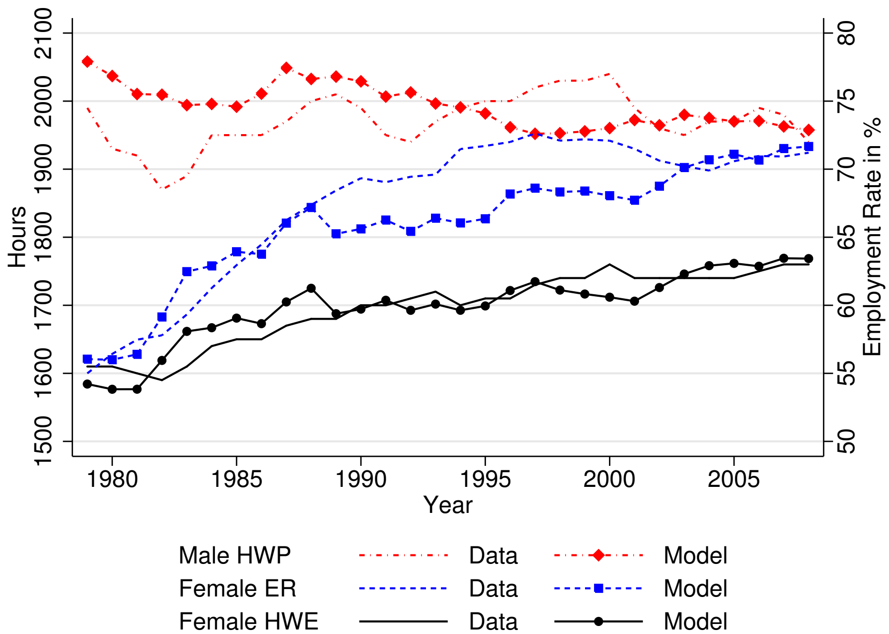
4.3 Time-Series Performance of the Model

While the goal of the paper is to use the model to evaluate in how far differences in taxes and wages can explain cross-country differences in hours worked of married women and men, we can evaluate the predictive power of the model also by analyzing its performance in replicating the US time series of hours worked of married couples. To do that, we generate the US-specific model inputs back to the year 1979 and plug them into the model, keeping the preference parameter values fixed.[26] As later on in the cross-country comparisons, we take the actual matching of men and women of the three education groups into couples from the data and replicate it in the model. As Figure 3 shows, the model correctly predicts hardly any change in hours worked of married men over the period of three decades. While hours worked per married man increase by 1 percent in the data, the model predicts a decrease of 3.5 percent. For married women, the model captures both the increase in the employment rate and in hours worked per employed very well. The employment rate increases in both model and data from 55 to over 70 percent from 1979 to 2008, with some deviations in the 1990s, when the model predicts an increase in the late 90s rather than in the early 90s. Especially the increase in the 1980s, when several tax reforms favored married women (see also Kaygusuz (2010)), is captured correctly by the model. The match for hours worked per employed is almost perfect, indicating an increase from 1580 hours to 1760 hours over the sample period.

To understand which input factor is responsible for the success of the model in replicating the

[26] For the labor income taxes in the US, we can use the NBER TaxSim module, which goes back to the 70s. As done in the OECD TaxBen module, the state taxe is taken from Michigan, which is close to the average across US states, and the city tax is taken from Detroit.

Figure 3: Time-Series Predictions for the US



rise in female employment rates and hours worked per employed in the US, we also let only the labor income taxes, only wages, or only the educational composition plus matching into couples vary over time, while holding everything else constant.[27] Labor income taxes and wages both separately can explain around one third of the rise in the female employment rate, and one half of the rise in female hours worked per employed. For the employment rate, the remaining third of the increase is explained by changes in the educational composition and matching into couples. Thus, changes in the tax code over time are as important as changes in the gender and educational wage gaps in explaining the rise in both the intensive and extensive margins of female labor supply in the US from the late 1970s to the late 2000s. Non-linearities between the different factors are relatively weak. Detailed results are available from the authors upon request.

5 Results

Keeping the preference parameters fixed across countries, we use country-specific taxes, wages, and the demographic composition (i.e. the educational distribution by gender and the degree of assortative matching) in order to obtain predicted hours worked of married couples across countries. We first present the cross-sectional predictions of hours worked per person of married men and women, before we decompose hours worked of married women further into an extensive and an

[27] Consumption taxes are almost constant over the time period in question anyway.

intensive margin. Using the US as the benchmark country, we always compare deviations from US hours in model and data. In a decomposition analysis, we evaluate the relative importance of wages and taxes in explaining the cross-country variations of married individuals' hours worked. Last, we further analyze the effects of labor income taxes by decomposing them into differences in tax levels and differences in marginal tax rate schedules.

5.1 Hours Worked per Person in Model and Data

Table 4 shows in the first column the percent difference in married men's hours worked per person between the respective country and the US in the data, and in the second column the model predicted percent difference. Similarly, the third and fourth columns show differences to the US in data and model for married women.

Differences in taxation, wages, and the demographic composition explain the cross-country variation in married men's hours worked very well. On average, the model slightly underpredicts the differences to the US. While married men in Scandinavia work 16 percent less than married men in the US in the data, the model predicts on average a difference of minus 13 percent. Similarly, for Eastern and Western Europe, the model predicts 7 and 8 percent lower hours than in the US, while the difference in the data amounts to 11 and 10 percent, respectively. Only for Southern Europe does the model explain only half of the difference to the US. However, this is almost entirely driven by the bad match for Spain, which exhibits 12 percent lower male hours worked than the US, while the model predicts the same hours as in the US. Focusing on individual countries, for 12 countries the differences between prediction and data amount to 5 percentage points or less, and for 9 countries even to 3 percentage points or less. Overall, the correlation between male hours worked per person in data and model amounts to 0.45.

We now turn to hours worked of married women, in the last two columns of Table 4. Scandinavian married women work on average 6 percent less than US ones in the data, while the model generates a difference of minus 16 percent. This overprediction of the difference is mostly driven by Denmark, where the model generates a difference of minus 29 percent, but the true differences is only minus 1 percent. Ragan (2013), Rogerson (2007) and Olovsson (2009) show that modelling home production helps in generating the high average hours worked of the entire population in Scandinavia. Two further features are particularly important in Scandinavia: first, many transfers rely on the working status of the individual, rather than being simple lump-sum transfer, and secondly, many transfers come in the form of subsidized goods in the service sector (especially subsidized child care). Adding these extensions to the basic model would give additional incentives for the individual to work and enjoy these transfers, and would thus improve our model fit for Denmark and Sweden, though not for Norway.

Similarly to Scandinavia, for Eastern Europe the model generates too low hours relative to the US, i.e. differences are overpredicted. Eastern European married women work 3 percent less than

Table 4: Male and Female Hours Worked per Person: Differences Relative to the US

	Men		**Women**	
Country	**Data**	**Model**	**Data**	**Model**
Denmark	−0.13	−0.16	−0.01	−0.29
Norway	−0.18	−0.10	−0.13	−0.08
Sweden	−0.16	−0.13	−0.05	−0.11
Mean	*-0.16*	*-0.13*	*-0.06*	*-0.16*
Czech Republic	−0.04	−0.02	0.02	−0.06
Hungary	−0.16	−0.12	−0.04	−0.05
Poland	−0.14	−0.05	−0.05	−0.17
Mean	*-0.11*	*-0.07*	*-0.03*	*-0.09*
Greece	−0.02	−0.04	−0.21	−0.09
Italy	−0.14	−0.13	−0.39	−0.14
Portugal	−0.10	−0.04	0.03	−0.21
Spain	−0.12	0.00	−0.33	−0.22
Mean	*-0.10*	*-0.05*	*-0.23*	*-0.17*
Austria	−0.07	−0.11	−0.22	−0.10
Belgium	−0.13	−0.15	−0.20	−0.31
France	−0.16	−0.03	−0.16	−0.16
Germany	−0.14	−0.09	−0.34	−0.32
Ireland	−0.05	−0.06	−0.34	−0.23
Netherlands	−0.10	−0.10	−0.38	−0.17
United Kingdom	−0.07	−0.04	−0.19	−0.13
Mean	*-0.10*	*-0.08*	*-0.26*	*-0.21*
Correlation	0.45		0.30	

US married women, but the model predicts a difference of 9 percent. Like all former Socialist countries, Eastern Europe exhibited very high female employment rates during Socialist times, and relics of this might still be visible today in the data.

For Southern Europe, the model explains on average three quarter of the difference in hours worked relative to the US, predicting 17 percent lower hours than in the US, while in the data Southern European married women work 23 percent less than their US counterparts. Yet, this good average fit is driven by the outlier Portugal: Portuguese married women work 3 percent more than

US married women, but the model predicts 21 percent less, similar to the other Southern European countries. Without Portugal, the model matches on average half of the difference between Southern Europe and the US.

For Western Europe the model explains three quarters of the observed large difference in married women's hours worked of minus 26 percent in the data. The fit is perfect for France and very good for Germany, with a deviation between model and data of only 2 percentage points. This excellent fit is quite remarkable, given that married women work 200 and 425 hours less, respectively, in these two countries than in the US. Only for the Netherlands and Austria, where married women work 38 percent and 22 percent, respectively, less than in the US, can the model explain slightly less than half of the difference. For Belgium, the model overshoots in predicting the difference.

Summarizing, the model explains on average three quarters of the large differences in hours worked per married woman between the US and Western and Southern Europe (one half for Southern Europe if we exclude Portugal), but overpredicts the differences for Scandinavia and Eastern Europe nearly by a factor of three. Although this number seems large in relative terms, it is not in absolute terms because hours differences in the data between the US and these regions are small. Put differently, the model predicted differences are on the same magnitude in absolute terms as for the other two country groups (with the exception of Denmark).

For 7 of the 17 European countries, the difference between model and data predictions is less than 8 percentage points, comprising two countries each from Scandinavia and Eastern Europe, and 3 countries from Western Europe. Given that on average European married women work 18 percent less than US married women, this is a decent fit. The correlation between married women's hours worked per person in model and data amounts to 0.3. Also, the model is able to replicate the low correlation of male and female hours worked per person in the data: while the correlation is slightly negative with -.11 in the data, it is slightly positive with .18 in the model.

Thus, we conclude that differences in taxes, wages, and the educational composition are able to explain three quarters of the large hours worked differences between Western Europe and the US. For Scandinavia and Eastern Europe, differences in taxes and wages overpredict hours worked differences relative to the US, but still generate a decent fit. For Southern Europe excluding Portugal, the model can explain half of the observed hours worked per person differences, while the model is quite far off for Portugal. Omitting Portugal and Denmark, the two countries that exhibit high married women's hours worked per person while the model predicts significantly lower ones than in the US, increases the correlation between hours worked in model and data to 0.58. Thus, overall the static model which allows for variation across countries only in taxes, wages, and demographic composition, performs well in replicating the large differences of married women's hours worked per person between Europe and the US, as well as the variation within Europe.

Table 5: Female Employment Rates and Hours Worked per Employed: Differences Relative to the US

Country	ER		HWE	
	Data	Model	Data	Model
Denmark	0.13	−0.15	−0.17	−0.10
Norway	0.12	−0.03	−0.26	−0.04
Sweden	0.14	−0.04	−0.20	−0.05
Mean	*0.13*	*-0.07*	*-0.21*	*-0.06*
Czech Republic	0.03	−0.04	−0.02	−0.01
Hungary	−0.04	0.01	0.02	−0.07
Poland	−0.04	−0.09	0.01	−0.05
Mean	*-0.02*	*-0.04*	*0.00*	*-0.04*
Greece	−0.14	−0.06	0.00	−0.01
Italy	−0.16	−0.09	−0.22	−0.02
Portugal	0.05	−0.13	−0.05	−0.02
Spain	−0.16	−0.15	−0.13	−0.02
Mean	*-0.10*	*-0.11*	*-0.10*	*-0.02*
Austria	0.03	−0.02	−0.25	−0.08
Belgium	0.00	−0.14	−0.20	−0.14
France	0.03	−0.09	−0.20	−0.04
Germany	0.01	−0.15	−0.35	−0.14
Ireland	−0.09	−0.10	−0.25	−0.10
Netherlands	0.04	−0.09	−0.41	−0.05
United Kingdom	0.06	−0.05	−0.26	−0.07
Mean	*0.01*	*-0.09*	*-0.27*	*-0.09*
Correlation	0.12		0.46	

5.2 Extensive and Intensive Margins of Married Women's Hours Worked

For married women, we can further look at the performance of the model in explaining extensive and intensive margin differences to the US. Table 5 shows the corresponding results. While the first two columns show employment rate differences to the US in the data and the model, respectively, the next two columns exhibit hours worked per employed differences.

The model generates a decent fit on both margins for Eastern and Southern Europe, but does not do a good job in the decomposition for the two regions that exhibit high employment rates but low hours worked per employed relative to the US, namely Scandinavia and Western Europe. For Eastern Europe, the model slightly overestimates the difference to the US in both margins, on average by 2 percentage points in the extensive margin and 4 percentage points in the intensive margin, while for Southern Europe the model produces an almost perfect match on the extensive margin (10 percent difference to the US in the data and 11 percent predicted by the model), but underestimates the difference in the intensive margin with 2 percent relative to 10 percent in the data. Even if Portugal is excluded, the model can explain two thirds of the difference in the extensive margin (15 percent in the data vs. 10% in the model).

Western Europe and Scandinavia exhibit higher employment rates of married women than the US, namely 1 percent and 13 percent higher ones, respectively. By contrast, the model predicts lower employment rates by 9 and 7 percentage points, respectively. Regarding hours worked per employed, the opposite picture arises, with large negative differences in the data, namely 21 percent for Scandinavia and 28 percent for Western Europe, but smaller predicted negative differences by the model, namely 6 and 9 percent, respectively. For Scandinavia and Western Europe, the model thus has difficulties explaining the decomposition of hours worked per married woman into an intensive and an extensive margin.

Overall, the model underestimates intensive margin differences to the US, but overestimates extensive margin ones. However, it does a good job in establishing the relative ordering of countries in hours worked per employed differences relative to the US: the correlation between model and data amounts to 0.46. For employment rate differences, the correlation is low with only 0.12.

Note that the model allows full flexibility in choosing individual hours worked. In the model, the fixed costs of joint work deter women from entering in the market and working very few hours, thereby creating meaningful intensive and extensive margins. These fixed costs are calibrated to the US and kept constant across countries, as all other preference parameters. In Bick et al. (2014), we present some evidence suggesting that there exists in fact a scarcity of part-time jobs relative to their demand in Eastern and Southern Europe, compared to Western Europe and Scandinavia. The US resembles Eastern and Southern Europe more in its decomposition of married women's hours worked into an extensive and intensive margin. A scarcity of part-time jobs in the US, Eastern and Southern Europe relative to Western Europe and Scandinavia could be modeled either by introducing specific fixed cost of part-time work which would be lower in the latter regions than in the former ones, or by introducing a part-time wage penalty which would again be lower in the latter regions than in the former ones. Either modeling choice would improve the fit of the model in explaining differences along the extensive and intensive margins across regions. Note that focusing only on the two regions with high employment rates Scandinavia and Western Europe, the correlation in the employment rate between model and data increases from 0.12 in the full sample to 0.32.

We also compare the correlation between hours worked of married men and the extensive and intensive margins of married women in data and model. In the previous subsection, we already reported that the model qualitatively matches the almost zero correlation between male and female hours worked per person. Similarly, the model matches qualitatively the negative correlation between male hours worked per person and female employment rates (-.29 in the data and -.05 in the model), as well as the positive one between the former and female hours worked per employed (.14 in the data vs. .56 in the model). However, in quantitative terms again this match is not perfect. Most importantly, the model cannot match the negative correlation of -.28 between married women's employment rates and hours worked per employed in the data, but instead features a positive correlation of .33. In the model, the positive correlation arises from the fact that the forces which reduce female labor supply work similarly along the extensive and intensive margins. In the data, the negative correlation can arise because of two possible reasons. First, as described above, a scarcity of part-time jobs in some countries could lead to high hours worked per employed but low employment rates there, as women who would want to work few hours instead stay out of the labor market. Or secondly, the marginal woman entering the labor market might exhibit lower labor productivity and therefore optimally choose to work less. We already discussed that any scarcity of part-time jobs is not captured by our model. The second effect could in principle be present. However, the heterogeneity in productivity in our model is quite limited, being restricted to three education levels. Thus, the heterogeneity of fixed costs of joint work plays a much larger role in determining the marginal woman entering employment than her own labor productivity. The marginal woman will thus work just as much as her counterparts already in the labor market.

5.3 Decomposition Analysis

To understand the relative importance of wages and taxes in explaining the cross-country differences, we simulate the model setting only one input factor country-specific and leaving all other input factors at the respective US level.[28] Results from this decomposition analysis are shown in Table 6. We present the results here only for the country groups; detailed country results are shown in Appendix tables A.6 to A.9. Columns "Data" and "Model" in Table 6 replicate the results from Tables 4 and 5, in which we set in the model all input factors described in Equations (1) to (6) specific to country i. The next three columns set only one single element in Equations (1) to (6) specific to country i, namely non-linear labor income taxes (τ_l), consumption taxes (τ_c), or wages (w), while keeping all others at the US level.

The first column shows the results if the tax system is set country-specific, while gross household

[28]Transfers are adjusted in these decomposition analyses such that the government always maintains a balanced budget.

income y_{hh} remains at the US level, i.e.

$$y_{hh} = w_m^{US}(z)h_m + w_f^{US}(x)h_f. \tag{8}$$

Progressive tax systems are in some way defined relative to the income level in a country. E.g., the US mean wage is around four times higher than the mean wage in Hungary (which has the lowest wage). Simply applying the Hungarian tax system one to one to the US would imply that the average household would end up in a range of the tax code featuring a much higher progressivity than the average Hungarian household. We account for this in the following way. First, we calculate for any combination of male and female hours choices the country-specific tax rate using the US gender-specific education premia and the country-specific mean wage. Second, we apply the resulting average tax rate to the corresponding US household income to obtain the household's income tax liability τ_l, and set Equation (5) equal to:

$$\tau_l = y_{hh} \frac{\tau_l^i \left(\frac{w_m^{US}(z)}{\bar{w}^{US}} \bar{w}^i h_m, \frac{w_f^{US}(x)}{\bar{w}^{US}} \bar{w}^i h_f \right)}{\frac{w_m^{US}(z)}{\bar{w}^{US}} \bar{w}^i h_m + \frac{w_f^{US}(x)}{\bar{w}^{US}} \bar{w}^i h_f} \tag{9}$$

in the household optimization problem.

We proceed in a similar fashion when we analyze the effects of country-gender-specific education premia. Household income in Equation (4) in this case is replaced by

$$y_{hh} = \frac{w_m^i(z)}{\bar{w}^i} \bar{w}^{US} h_m + \frac{w_f^i(x)}{\bar{w}^i} \bar{w}^{US} h_f, \tag{10}$$

and the household's income tax liability in Equation (5) by

$$\tau_l = \tau_l^{US} \left(\frac{w_m^i(z)}{\bar{w}^i} \bar{w}^{US} h_m, \frac{w_f^i(x)}{\bar{w}^i} \bar{w}^{US} h_f \right). \tag{11}$$

The last column shows the predicted differences to the US if these three factors are jointly set country-specific; what then still remains at the US level is the heterogeneity in education and the matching by male and female education levels into couples. The table exhibits four panels, each comprising the four European regions. The first two panels show differences to the US in male and female hours worked per person, respectively, while the last two panels decompose female hours worked per person into an extensive and an intensive margin.

When analyzing the decomposition of the different input effects on hours worked per person of married men and women in the first two panels, it becomes apparent that for men labor income taxes play the largest role in explaining low hours worked relative to the US, while for women consumption taxes are the main factor driving European female hours worked down. While labor

Table 6: Decomposing Hours Worked Differences Relative to the US

	Country Group	**Data**	**Model**	τ_l	τ_c	**w**	$\tau_l + \tau_c + w$
$\mathbf{HWP}_m$	Scandinavia	−0.16	−0.13	−0.08	−0.04	0.00	−0.12
	Eastern Europe	−0.11	−0.07	−0.04	−0.02	−0.03	−0.07
	Southern Europe	−0.10	−0.05	−0.03	−0.02	−0.01	−0.06
	Western Europe	−0.10	−0.08	−0.06	−0.03	−0.01	−0.08
$\mathbf{HWP}_f$	Scandinavia	−0.06	−0.16	−0.05	−0.11	0.04	−0.10
	Eastern Europe	−0.03	−0.09	0.02	−0.06	0.00	−0.05
	Southern Europe	−0.22	−0.17	0.06	−0.06	−0.05	−0.03
	Western Europe	−0.26	−0.21	−0.06	−0.07	0.03	−0.10
$\mathbf{ER}_f$	Scandinavia	0.13	−0.07	−0.01	−0.05	0.02	−0.04
	Eastern Europe	−0.02	−0.04	0.02	−0.03	0.00	−0.01
	Southern Europe	−0.10	−0.11	0.04	−0.02	−0.02	0.00
	Western Europe	0.01	−0.09	−0.01	−0.03	0.01	−0.03
$\mathbf{HWE}_f$	Scandinavia	−0.21	−0.06	−0.04	−0.04	0.01	−0.05
	Eastern Europe	0.00	−0.04	0.00	−0.02	0.00	−0.03
	Southern Europe	−0.10	−0.02	0.00	−0.02	−0.02	−0.03
	Western Europe	−0.27	−0.09	−0.06	−0.03	0.01	−0.06

Note: For the decomposition in columns 4 to 6, exactly one model input is set country-specific, and the rest are left unchanged at their US values. For the decomposition in column 7, three model inputs are set country-specific, and only the educational composition and matching are left unchanged at their US values. The country-specific results are shown in Tables A.6 to A.9 in the Appendix.

income taxes uniformly predict lower hours worked of married men in Europe than in the US by 3 to 8 percent, they in fact predict lower hours worked for married women than in the US only for Scandinavia and Western Europe, but higher ones for Eastern and Southern Europe. Only for Western Europe is the effect of labor income taxes of roughly the same size as the effect of consumption taxes. Thus, the results for married men are in line with the previous results in the literature (e.g. Prescott (2004), Ohanian et al. (2008), and McDaniel (2011)) that labor income taxes are the main driving force for low hours worked in Europe, while the results for married women are in apparent contrast. We will further analyze the reason for this in the next Subsection 5.4, which looks further into the non-linearity of the tax codes in our analysis.

Not surprisingly, the disincentive effects of consumption taxes on hours worked of both married men and women are largest for Scandinavia, where consumption taxes are highest. Consumption taxes alone would predict that Scandinavian married women should work 11 percent less than US ones. For all other European regions, the effects of consumption taxes alone on married women's labor supply are also sizeable, predicting around 6 percent lower hours worked than in the US. For married men, the disincentive effects of European consumption taxes are smaller, with around 2 to 4 percent. This is ue to the implicit higher female elasticity of labor supply due to lower wages. While consumption taxes are thus the main factor for explaining lower female hours worked in Europe than in the US, they have low predicted power for explaining variations in female hours worked within Europe: the correlation between model and data when only consumption taxes are set country specific is in fact negative with -.25 for female hours worked per person, while it is positive with .15 when only labor income taxes are set country specific. For men, this result is exactly the other way round: consumption taxes alone generate a correlation of 0.52 between hours worked of married men in model and data, while labor income taxes alone generate a correlation of 0.33.

The effect of the country-specific gender and educational wage premia on hours worked in Europe is relatively small. It is largest for Scandinavian married women, for which the Scandinavian wages alone in fact predict 4 percent higher hours worked than in the US, in contrast to lower hours worked in the data; and for Southern Europe, for which on opposite wages alone predict 5 percent lower hours worked than in the US. Southern Europe is the only region where the wage effect goes in the same direction as the data, namely predicting lower hours worked in Europe than in the US. As Table 2 shows, in fact the gender wage gap is more favorable on average in Scandinavia and Eastern Europe than in the US, and very similar in Southern and Western Europe.

Column 5 shows the joint effect of taxation and wages, setting labor income and consumption taxes as well as wages country-specific. The joint effect is smaller in absolute terms than the sum of the three individual effects, pointing to some interaction effects. Compared to the full model predictions, the educational composition and the matching into couples are still at the US level here. Comparing the results with the full model predictions, one can see that for women the demographic composition is a further factor in explaining lower hours worked in Europe than in the US. This is especially true for Southern Europe, where the percentage of low-educated women is much larger than in the US.

The last two panels of Table 6 further decompose hours worked per person of married women into an extensive and an intensive margin. In Section 5.2, we already discussed that the model predictions are similar across the extensive and the intensive margin. Here, one can see that this is also true for the single input factors. The different model predictions for intensive and extensive margin differences to the US for Southern Europe are in fact driven by the demographic composition. Labor income taxes are quite successful in explaining intensive margin variations across Europe and the US: the correlation between model and data for married women's hours worked per employed is .55 when only labor income taxes are set country-specific. However, as discussed before, employment rate differences seem to be driven by other factors than taxation: wages have some explanatory power in explaining cross-country variations in female employment rates, generating a correlation of .38 between model and data, but both consumption and labor taxes in fact generate a negative correlation between model and data.

Summarizing, the decomposition analysis shows that labor income taxes are of great importance in explaining the lower hours worked of married men in Europe than in the US, while consumption taxes are the main driver of low hours worked of married women in Europe. By contrast, when focusing on the full variation across countries, labor income taxes are more successful than consumption taxes in explaining hours worked for married women, and the other way round for married men. The effect of wage differences on hours worked differences is relatively small for both men and women.

5.4 The Role of Non-Linear Labor Income Taxes

One can conceptually distinguish two components of the labor income tax code that can potentially differ between the US and other countries, namely the average tax rate, i.e. the level of the tax schedule, and the actual marginal tax schedule, which defines how marginal tax rates change with income, and reflects among other things the progressivity of the tax system.[29] In the previous subsection, we saw that labor income taxes uniformly predict lower hours worked in Europe than in the US for married men, but for married women in Eastern and Southern Europe they actually predict higher hours worked than in the US, and in general the effect for married women is less negative than for married men. In this subsection, we derive more insights into why this is the case by further decomposing the actual non-linear labor income tax schedule into the average tax rate and the marginal tax schedule. To distinguish between these two, we conduct the following

[29] Note that the actual marginal tax schedules, taking exemptions, caps on taxable income for social security contributions, etc., into account, often exhibit income ranges where marginal tax rates are falling instead of rising, such that a standard definition of progressivity, namely that marginal tax rates are rising with income, does not apply over the entire income range.

Table 7: The Effect of Tax Structure and Average Tax Rates on Hours Worked Differences Relative to the US

	Country Group	Data	τ_l	Tax Structure	Tax Level
HWP$_m$	Scandinavia	−0.16	−0.08	−0.01	−0.06
	Eastern Europe	−0.11	−0.04	−0.02	−0.02
	Southern Europe	−0.10	−0.03	0.00	−0.02
	Western Europe	−0.10	−0.06	−0.02	−0.04
HWP$_f$	Scandinavia	−0.06	−0.05	0.10	−0.15
	Eastern Europe	−0.03	0.02	0.07	−0.05
	Southern Europe	−0.22	0.06	0.10	−0.05
	Western Europe	−0.26	−0.06	0.04	−0.10
ER$_f$	Scandinavia	0.13	−0.01	0.06	−0.07
	Eastern Europe	−0.02	0.02	0.04	−0.02
	Southern Europe	−0.10	0.04	0.06	−0.02
	Western Europe	0.01	−0.01	0.03	−0.04
HWE$_f$	Scandinavia	−0.21	−0.04	0.02	−0.06
	Eastern Europe	0.00	0.00	0.02	−0.02
	Southern Europe	−0.10	0.00	0.02	−0.02
	Western Europe	−0.27	−0.06	−0.01	−0.05

Note: Columns 4 and 5 add up to Column 3. Column 3 corresponds to column 4 in Table 6. The country-specific results are shown in Tables A.11 to A.14 in the Appendix.

experiment. We calculate the taxes implied by the country-specific tax code as in Equation (9), but then levy an additional linear tax or subsidy such that government revenues are left unchanged at the US level. Put differently, one may think of this experiment as a reform which implements a different tax structure but is required to be revenue neutral.[30] The effect of the country-specific average tax rate, or the level, is then indirectly inferred by the difference in hours worked between setting the entire labor income tax schedule country specific, or shifting it up or down to match the US government revenues.[31]

Table 7 shows the resulting decomposition of the labor income tax effect into the tax structure and the average tax rate. As in the previous table, the first panel shows results for hours worked per

[30] We do not use the opposite approach, namely adjusting the US tax schedule while keeping constant the country-specific government revenue, since we do not match hours in all countries well, resulting in imprecise estimates of the country-specific average tax rate.

[31] As an alternative to adding a linear tax in order to shift the average tax rate, we follow Guvenen et al. (2011), who require that for any gross income level z the following condition has to be satisfied: $\frac{1-\tilde{\tau}_l'(z)}{1-\tau_l'(z)} = (1-\kappa)\forall z$, where τ_l' is the marginal tax rate of the original tax schedule, $\tilde{\tau}_l'$ is the marginal tax rate of the schedule allowing for a different average tax rate, and κ is a constant. Results using this approach are quantitatively similar and are shown in the Appendix in Table A.10.

person of married men. For this group, the average tax rate is the main driving force of lower hours worked in Europe than in the US, while the tax structure plays a relatively minor role. Only for Eastern Europe are both effects of the same size. This indicates that, while a higher progressivity of taxes in Europe than in the US creates some disincentives on men's hours worked Eastern, Western Europe, and Scandinavia, the higher tax rate per se is the main driving force of lower hours worked of European men.

For married women, this distinction is much starker than for married men. In fact, the average tax rate would predict between 5 and 15 percent lower hours worked per married woman in Europe than in the US. The region ordering of the effect of average tax rates is the same for men and women: the largest disincentive effects relative to the US arise in Scandinavia, followed by Western Europe, and the smallest effects arise in Easern and Southern Europe. This ordering is in line with the measure of the average tax rate shown in Table 2, which was highest in Scandinavia, followed by Western Europe, then Eastern and Southern Europe, and lowest in the US. Yet, the effects are larger for women than for men, due to the higher implied female labor supply elasticity. This is similar to the results that we found for consumption taxes.

By contrast, the tax structure itself predicts uniformly *higher* hours worked of married women in Europe than in the US. This opposing effect is smallest in Western Europe, for which the tax structure alone would predict 4 percent higher hours worked per married woman than in the US, and highest in Southern Europe and Scandinavia, where it amounts to 10 percent. Thus, the overall negative effect of labor income taxes on hours worked in Scandinavia is driven by the large effect of the average tax rate, while for Western Europe it is the combination of the comparably large average tax rate effect and a small countervailing effect of the tax structure. In fact, as Table A.12 in the appendix shows, there are only three single country for which the tax structure alone would predict lower hours worked of married women in Europe than in the US, namely Germany, Ireland, and Belgium, all located in Western Europe.

The reason behind this positive effect of the tax structure on married women's hours worked in Europe compared to the US lies in the joint taxation of married couples in the US. Joint taxation leads to the fact that the marginal tax rate that a secondary income earner faces depends also on the income of the partner. E.g. in Germany, which has a relatively pure system of joint taxation, half of the couple's joint income is assigned to each partner when determining his or her taxes. As a result, if a woman starts working she faces a relatively high marginal tax rate, which is increasing in her husband's income. Table 2 presented two exemplary measures of the marginal tax rate if a woman starts working, namely the increase in household taxes relative to her income if she works half of the hours of a typical US woman, or if she works the same hours as the average US woman. In fact, both these numbers were close to 50 percent for Germany. The US features a similar system of joint taxation, which thus provides disincentives to work for the secondary income earner compared to a system of strict separate taxation, while many European countries feature systems closer to separate taxation. Section 6 provides further insights into this issue. Joint taxation raises the marginal tax rate of the secondary income earner more, the more progressive the income tax schedule is,[32] which explains the larger disincentive effect of the tax schedule on married women's hours worked in Germany than in the US.

Thus, the decomposition of the labor income tax into the tax schedule and the average tax rate makes it clear that the average tax rate alone is not a good approximation of the incentive effects of income taxes on married women's labor supply, as will be discussed further in Section 7. Comparing the extensive and the intensive margin, the tax structure itself matters more on the extensive margin, and predicts between 3 and 6 percentage points higher employment rates in Europe than in the US.

6 Joint vs. Separate Taxation

In this section, we get further insights into the degree of individual vs. joint taxation in the sample countries, and the potential disincentive effects of the current systems of (joint) taxation on married women's labor supply, by comparing two singles living together in one household with a married couple living in one household. To avoid further complications, we analyze the case of no children. Both households share the same utility function, but have different budget constraints, since the members of the first household are taxed as singles, while the members of the second household are taxed as a married couple. For the household with two singles, the budget constraint becomes

$$c = \frac{1}{(1+\tau_c)} \left[w_m(z)h_m - \tau_l(w_m(z)h_m) + w_f(x)h_f - \tau_l(w_f(x)h_f) \right] + T. \tag{12}$$

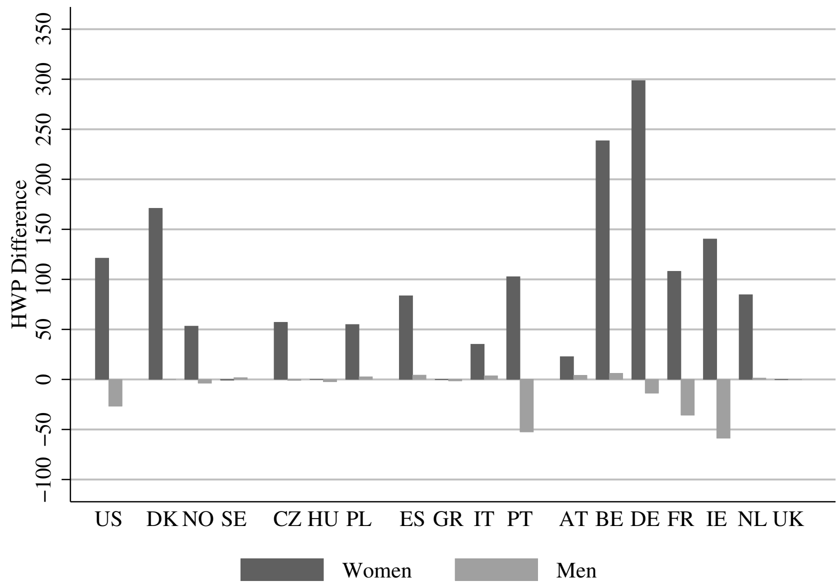
The net income in the household with two singles is equal to the sum of the net incomes of the two household members, both taxed as singles. We add a proportional tax/subsidy rate θ as in Section 5.4 when going from the current system to a system of strictly separate taxation, such that tax revenues are kept constant in both cases. In countries with joint taxation, going from the current system to one of separate taxation lowers the marginal tax rates of married women, but increases the ones of married men.

Figure 4 shows the effect of going from the current system to one of strict separate taxation of married couples on hours worked per person of married women (dark bars) and married men (light bars). For six of the 18 countries, female labor supply increases by less than 50 hours. For Sweden, Hungary, Greece, and the UK, effects are basically zero, indicating that these countries exhibit strict systems of individual taxation.[33] For a further 5 countries, female hours worked increase by between 50 and 100 hours. The remaining 7 countries show significant effects on female

[32] In a linear tax system, it does not matter whether couples are taxed joint or separately.

[33] The caveat applies that this is at least true for the nine couple types that we consider, but might not be entirely true if we would allow for more heterogeneity.

Figure 4: Current System vs. System of Strictly Separate Filing: HWP



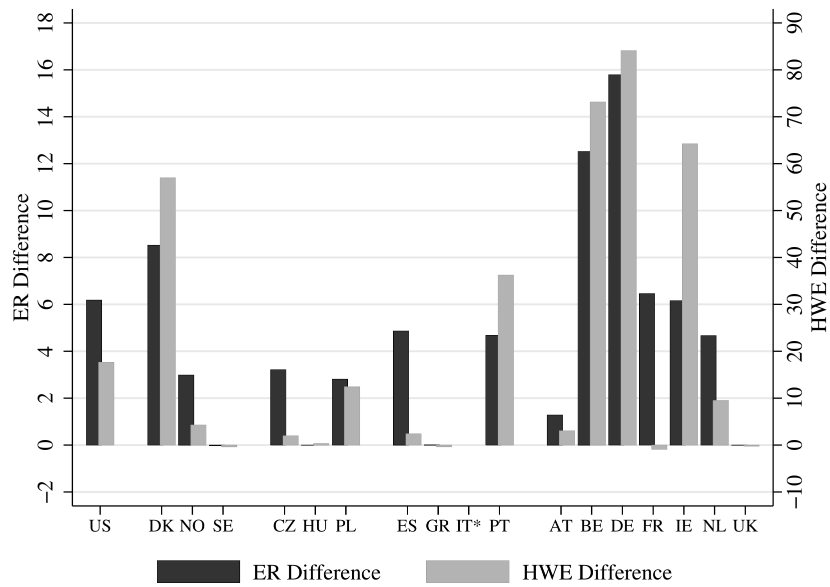
Note: This figure shows the predicted changes in hours worked per person when going from the current country-specific system of filing to a system of strictly separate taxation of married couples, keeping government revenues constant.

labor supply: in Portugal and France, female hours worked would increase by slightly more than 100 hours, in the US and Ireland by 120 and 140 hours, respectively, in Denmark by 170 hours, in Belgium by 240 hours, and in Germany by even 300 hours. These are very large effects, as 300 hours correspond to almost two months of full-time work, and would increase hours worked of married German women by 31 percent. As going from the current system to one of separate taxation in these countries raises the marginal tax rate for married men, male hours worked would fall, but the effect is much smaller than for women due to the lower implied labor supply elasticity and the higher wages: the fall in men's hours worked reaches 50 hours maximum, and the net effects remain large in the countries with large increases in female hours worked. Our results are in line with the description of tax systems shown in Pearson and Binder (2011) based on OECD data. Of the countries in our sample, France, Germany, Ireland, Norway, Poland, Portugal, and the US exhibit a system of joint taxation of married couples, while Greece, Hungary, Sweden and UK have a strict system of separate taxation. Indeed, for the latter four countries we find no effects of the proposed tax reform. The remaining countries have intermediate systems, which must create relatively large disincentive effects for women in Belgium and Denmark.

Figure 5 decomposes the effect of going to separate taxation on married women's labor supply into the extensive and the intensive margins.[34] The effects of going to a system of separate filing

[34] We omit Italy in this picture, as for Italy we get a negative effect on hours worked per employed of 40 hours.

Figure 5: Current System vs. System of Strictly Separate Filing: Female ER and HWE



Note: This figure shows the predicted changes in the female employment rate and female hours worked per employed when going from the current country-specific system of filing to a system of strictly separate taxation of married couples, keeping government revenues constant. Italy is omitted (see footnote 34 for an explanation.)

work along both margins, but the employment rate effects are mainly responsible in quantitative terms for the increase in female hours worked. For the US, the model predicts an increase in the employment rate of married women by 6 percent, and an increase in hours worked per employed by less than 20 hours. For Germany, the country with the largest overall increase, the employment rate is predicted to rise by almost 16 percent, and hours worked per employed by 80 hours. Note that our results are roughly similar to and only slightly smaller than the results of going to a system of separate taxation in the US in Guner et al. (2012a), who set up a rich general equilibrium life-cycle model that features marriage and fertility, a social security system, and labor income risk, and calibrate it in detail to the US economy. While Guner et al. (2012a) find that the employment rate of married women would increase by 10.4 percent, we find an increase of 8.6 percent,[35] and their predicted increase in hours worked per employed married woman of 0.3 percent compares to ours of 0.11 percent. It is quite reassuring that our static model gets similar results for the US than their richer one, and the comparison confirms that our results of the labor market effects from going to separate taxation of married couples are not unrealistically large. Figures A.3 and A.4 in the

This effect is not robust, as it does not appear in the results with country-specific calibration in Figure A.4 in the appendix, and thus likely results from the fact that female hours worked are exactly at a non-monotonicity point in the tax code.

[35]Note that Figure 5 shows percentage point increases, but Guner et al. (2012a) report percent increases.

appendix show analogous results to Figures 4 and 5 if we calibrate each country separately to match hours worked and female employment rates there, i.e. without keeping preferences at the baseline calibration. This might be interesting, as we do not get a good hours match for all countries in our baseline calibration. Overall, results are very robust. The most notable change comes in Belgium, where the increase in hours worked per married woman becomes almost 350 hours when going to separate taxation, compared to 240 hours in the US calibration.

7 Actual vs. Linear Taxes

The major novelty of our study is that we use actual non-linear tax systems rather than average marginal tax rates as model inputs in order to predict hours worked. To understand how important this is, we compare our results to results from a model where simple linear taxes are used as inputs. Specifically, we compare our results from the ones that we would obtain if we would use the linear tax rates calculated by Ohanian et al. (2008) as model inputs.[36] When we use these linear taxes, we recalibrate the model in order to still match the moments for the US.

As Table 8 shows in the first panel, predicted hours worked of married men are very similar whether we use the full schedule of non-linear or simple linear labor income taxes. This confirms that simple linear labor income taxes are in fact a good approximation of the actual income taxes faced by married men. This is not surprising, given that married men make up the majority of the workforce.

For women, however, results are very different whether we use the actual non-linear tax code or simple linear taxes. The model with linear taxes always predicts larger hours worked differences between Europe and the US than the model with actual taxes. This is not surprising, since our decomposition in Table 7 showed significant disincentive effects of average tax rates in Europe also for married women. The countervailing effects of the tax structure are missing entirely when we use simple linear tax rates.[37] As a consequence of the larger predicted differences, the model with linear taxes performs much worse than the benchmark model in replicating female hours worked in Scandinavia, Eastern, and Southern Europe, but performs slightly better only in Western Europe.[38] Overall, it does a worse job in explaining cross-country differences: the correlation in female hours worked per person between data and model amounts to only .06 when linear taxes are applied, as compared to 0.30 in the benchmark case. Since the model with linear taxes predicts larger

[36] Prescott (2004) and McDaniel (2011) multiply these average tax rates by a factor of 1.6 in order to convert them into average marginal tax rates. When we do that, results barely change for men but are even stronger for women than without the multipliciation by 1.6.

[37] A second, less important, effect leading to larger differences between Europe and the US in the model with linear taxes lies in the recalibration: if we apply linear rather than actual taxes in the US, a country of joint taxation of married couples, this provides more incentives for women to work. Consequently, the recalibration leads to a higher disutility of work to still match the actual labor supply of US married women.

[38] However, even for Western Europe, the model with linear taxes does not outperform the benchmark model when we look at average absolute deviations between model and data.

Table 8: Actual vs. Linear Taxes

	Country Group	Data	Benchmark	Linear Taxes
$\mathbf{HWP}_m$	Scandinavia	−0.16	−0.13	−0.11
	Eastern Europe	−0.11	−0.07	−0.08
	Southern Europe	−0.10	−0.05	−0.06
	Western Europe	−0.10	−0.08	−0.09
$\mathbf{HWP}_f$	Scandinavia	−0.06	−0.16	−0.26
	Eastern Europe	−0.03	−0.09	−0.21
	Southern Europe	−0.23	−0.17	−0.32
	Western Europe	−0.26	−0.21	−0.28
$\mathbf{ER}_f$	Scandinavia	0.13	−0.07	−0.13
	Eastern Europe	−0.02	−0.04	−0.10
	Southern Europe	−0.10	−0.11	−0.19
	Western Europe	0.01	−0.09	−0.15
$\mathbf{HWE}_f$	Scandinavia	−0.21	−0.06	−0.10
	Eastern Europe	0.00	−0.04	−0.08
	Southern Europe	−0.10	−0.02	−0.08
	Western Europe	−0.27	−0.09	−0.10

hours difference relative to the US, it performs on average slightly better than the actual tax rates in explaining intensive margin differences (fourth panel), but significantly worse in explaining extensive margin differences (third panel).

We also compare the US time-series prediction of the model with linear taxes to the benchmark model (results available from the authors upon request). Contrary to the data, the model with linear taxes predicts a significant decrease in male hours worked of 6 percent. The match for the female employment rate is also worse than in the benchmark model: in the data, the employment rate is 15 percentage points higher in the late 2000s than in the 70s, which is perfectly matched by the benchmark model, while the model with linear taxes would predict an increase of only 11 percentage points. The match of hours worked per employed is similar to the benchmark model.

8 Robustness Checks

In this section, we carry out a number of robustness checks. In all of them, we recalibrate the model to match the targeted moments.

8.1 The Effect of Children

A worry about our analysis might be that many married women have children, which might affect their labor supply differentially across countries. So far, children only entered the analysis through their effect on taxes in the tax code, which is however relatively minor. Table 9 repeats in columns 2 and 3 the benchmark results, and compares them in columns 4 and 5 to data and model controlling for children. To generate the data for column 4, we regress in each country the respective hours measure on the individual level on the presence of preschool (aged 0-4) and school (aged 5-14) children in the household, and then get predicted hours controlling for children by setting the children dummies equal to zero. In the model, we then also assume that no children are present in the household when calculating taxes. Since for Scandinavia we do not have information on children in the household, we have to omit the Scandinavian countries from this analysis.

As a comparison of columns 2 and 4 shows, the differences in hours worked relative to the US do not change much when we control for children. The largest difference arises for hours worked per married women in Eastern Europe, where after controlling for children married women work 5 percent more than married women in the US, compared to 3 percent less without controlling for children, and Western Europe, where the respective numbers are 19 vs. 26 percent less. This indicates that the negative "effect" of children on married women's hours worked is larger in Western Europe, where it is driven entirely by the intensive margin, and Eastern Europe than in the US.[39] The model results remain virtually unchanged, as the only effect of children in the model comes through their effect on taxes, which leads to minor changes in the incentives to work. Overall, the model fit thus remains similar, slightly worsening for women in Eastern Europe, but improving for women in Western Europe through an improvement along the intensive margin.

8.2 Further Robustness Checks

We perform two further robustness checks. First, we change the female parameter γ_f, which in the benchmark analysis has the same value as the male parameter, namely $\gamma_f = \gamma_m = 0.5$, to $\gamma_f = 1$ and $\gamma_f = 1.5$, respectively, thereby increasing the female labor supply elasticity. Table A.15 in the appendix shows the results. Changing the female elasticity has almost no effect on male labor supply. For married women, increasing the elasticity increases the effects of any cross-country differences, and therefore increases the difference between hours worked in the US and Europe. This leads to a worsening of the fit for Scandinavia and Eastern Europe, but an improved fit for Southern and Western Europe. Interestingly, the effect of the elasticity on female hours worked comes almost exclusively through the intensive margin.

Secondly, we vary the redistribution scheme of government revenues. In the benchmark analysis, we use the same redistribution parameter as Prescott (2004), while in this robustness check

[39] These results are roughly in line with results in our companion paper Bick et al. (2014), in which we employ a less stringent sample selection.

Table 9: Hours Worked Differences Relative to the US, Without and With Controlling for the Presence of Children

	Country Group	Benchmark		Controlling for Children	
		Data	Model	Data	Model
HWP$_m$	Scandinavia	−0.16	−0.13	–	–
	Eastern Europe	−0.11	−0.07	−0.14	−0.07
	Southern Europe	−0.10	−0.05	−0.12	−0.05
	Western Europe	−0.10	−0.08	−0.11	−0.08
HWP$_f$	Scandinavia	−0.06	−0.16	–	–
	Eastern Europe	−0.03	−0.09	0.05	−0.09
	Southern Europe	−0.23	−0.17	−0.23	−0.17
	Western Europe	−0.26	−0.21	−0.19	−0.21
ER$_f$	Scandinavia	0.13	−0.07	–	–
	Eastern Europe	−0.02	−0.04	0.02	−0.04
	Southern Europe	−0.10	−0.11	−0.13	−0.11
	Western Europe	0.01	−0.09	0.01	−0.09
HWE$_f$	Scandinavia	−0.21	−0.06	–	–
	Eastern Europe	0.00	−0.04	0.03	−0.04
	Southern Europe	−0.10	−0.02	−0.07	−0.02
	Western Europe	−0.27	−0.09	−0.20	−0.09

we show the two extremes of no redistribution of government revenues at all, to full redistribution of government (as in Rogerson (2008)) revenues as lump-sum transfers to the households. Redistribution matters in the analysis, as the redistribution of tax revenues in a lump-sum fashion to households provides important income effects that lower the incentives to work.

As Table A.16 in the appendix shows, compared to the benchmark scenario a scenario with no redistribution of government taxes leads to significantly higher predicted hours worked in Europe, thereby lowering the US-Europe difference or even turning it positive for married women. The reason for this is that the income effect from redistribution is on average higher in Europe than in the US due to higher taxes and therefore higher government revenues in Europe, and thus the disincentive effect on work from redistribution is larger in Europe than in the US. By contrast, going from the benchmark redistribution to full redistribution has less of an effect on the results, only slightly decreasing the differences between Europe and the US. This decrease comes from the fact that in the benchmark scenario, less of the US government revenues are redistributed than of the European ones. Thus, in contrast to the no redistribution scenario, the relative share of government revenues seems to matter here more than their level. Comparing the benchmark to the full redistribution scenario, the fit is always slightly better in the benchmark scenario than in the full redistribution scenario for married men, and improves as well for married women in Southern and Western Europe, but is slightly worse for married women in Scandinavia and Eastern Europe.

9 Conclusion

Relying on three micro data sets, we document average hours worked of married couples for a sample of eighteen European countries and the US over the time period 2001 to 2008. We find that hours worked vary significantly across countries, and the largest variations can be found for married women: while US married women work 1250 hours annually, Italian married women only work 750 hours, i.e. barely 61 percent of their American counterparts.

We investigate in how far international differences in consumption taxes, labor income tax systems, gender wage gaps and educational premia, and the educational composition and matching into couples can quantitatively account for the international differences in hours worked by married couples in the context of a static model of joint labor supply, holding preferences constant across countries. The model can almost perfectly explain the observed international hours differences for married men. Moreover, it does a decent job in explaining international differences in aggregate hours worked of married women.

A decomposition analysis shows that consumption taxes offer significant disincentives to work in all European countries and for both sexes. The effect of non-linear labor income taxes is however much more complicated: while for married men, labor income taxes always predict lower hours worked in Europe than in the US, the same is not true for married women. While the on average higher tax rates in Europe also provide a disincentive effect for married women, the tax structure is often more favorable for European women than for US ones, since the US features a system of joint taxation of married couples. We find that going from the current tax system to a system of strictly separate taxation of married couples would increase hours worked of married women by around 300 hours in Germany, and by between 100 and 250 hours in Belgium, Denmark, Ireland, the US, France, and Portugal.

The model that we use in this paper is a very simple one. It does e.g. not incorporate a home production sector in competition with the service sector of the economy, or a subsistence level of consumption. Both are features that are generally included in models explaining hours worked differences (see e.g. Ohanian et al. (2008) and McDaniel (2011)).[40] The success of the model is thus quite remarkable. While the model results leave some scope for other factors explaining hours worked of married women, they come quite close to replicating the data. Taxes and wages thus have large explanatory power for international differences in hours worked of married women. As

[40] A subsistence level of consumption would likely not play a major role in our analysis, given that incomes are on average relatively high. It might however increase predicted hours worked of married women in Eastern Europe, where wage levels are lowest in our sample countries.

an open question remain the origins for the large extensive margin differences for married women in Europe. They seem to be driven by other factors than taxes and wages, and in our companion paper Bick et al. (2014), we indeed present some evidence that there is a scarcity of part-time jobs in Eastern and Southern Europe, which is in contrast to the continuous hours choices modeled in this paper.

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A Appendix

A.1 Data Issues

For data reasons detailed in Bick et al. (2014), we exclude the years 2001 for the UK and 2005 for Spain from the analysis. Furthermore, we exclude the year 2001 for Italy and the year 2008 for Ireland because the OECD TaxBen Module does not produce the corresponding tax rates. We exclude households in the ELFS of which at least one member lives in an institution, since the CPS does not cover individuals living in institutions. This leads to the deletion of a negligent number of observations. A detailed description of all issues involving setting up the data sets can be found in Bick et al. (2014).

A.2 Figures

Figure A.1: Fraction of Married Women (Ages 25-54)

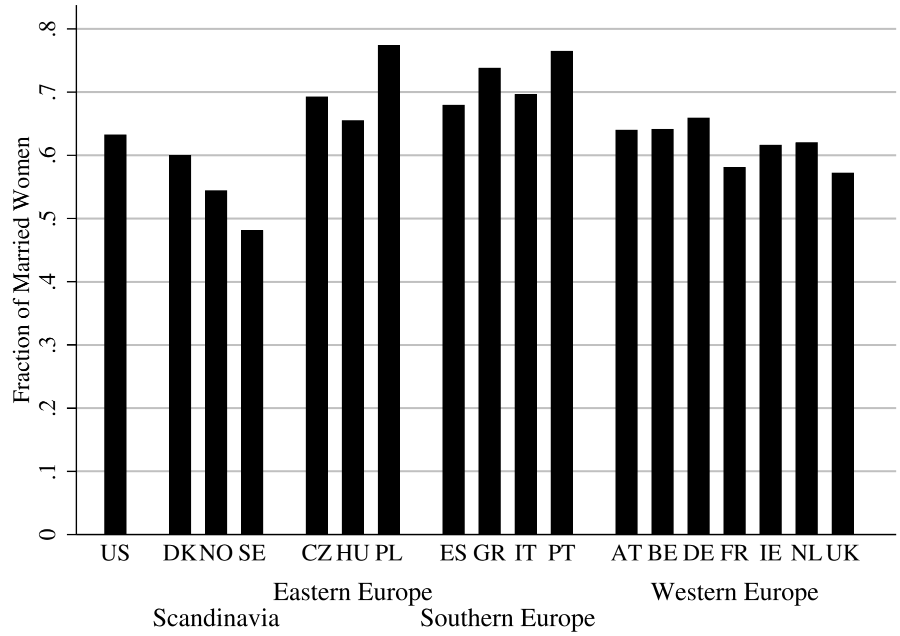


Figure A.2: Employment Rates and Hours Worked per Employed for Married Men (Ages 25-54)

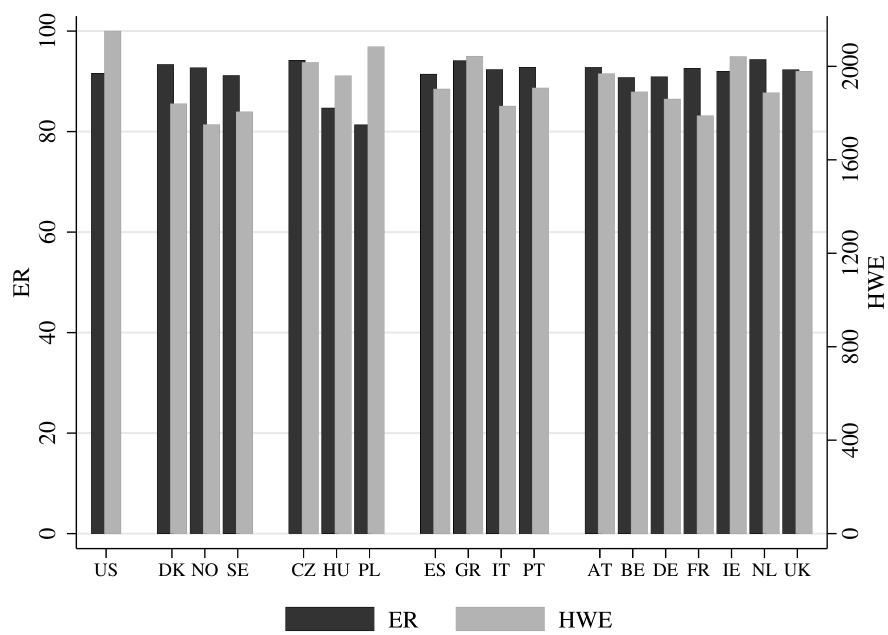


Figure A.3: Joint vs. Separate Filing: Hours Worked per Person, Country Calibration

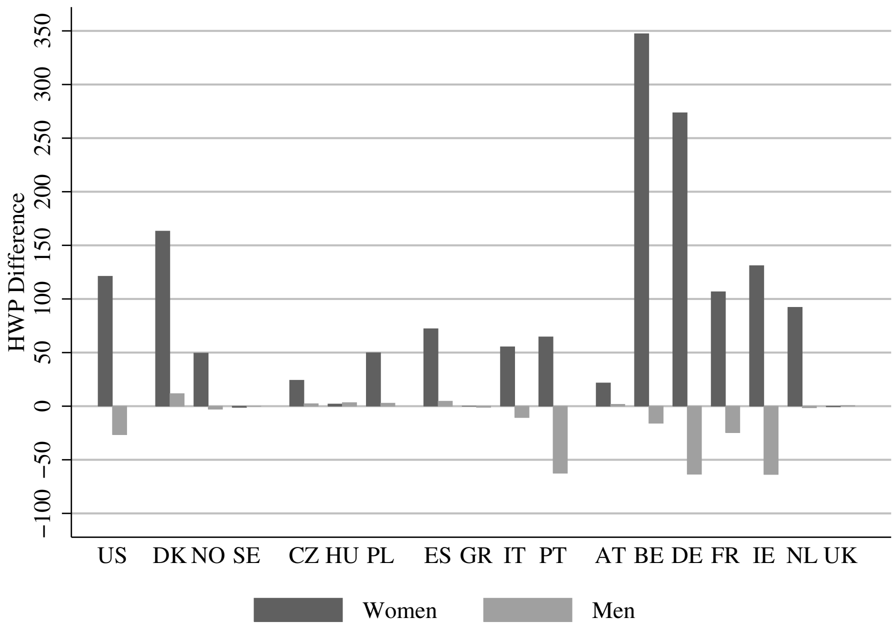
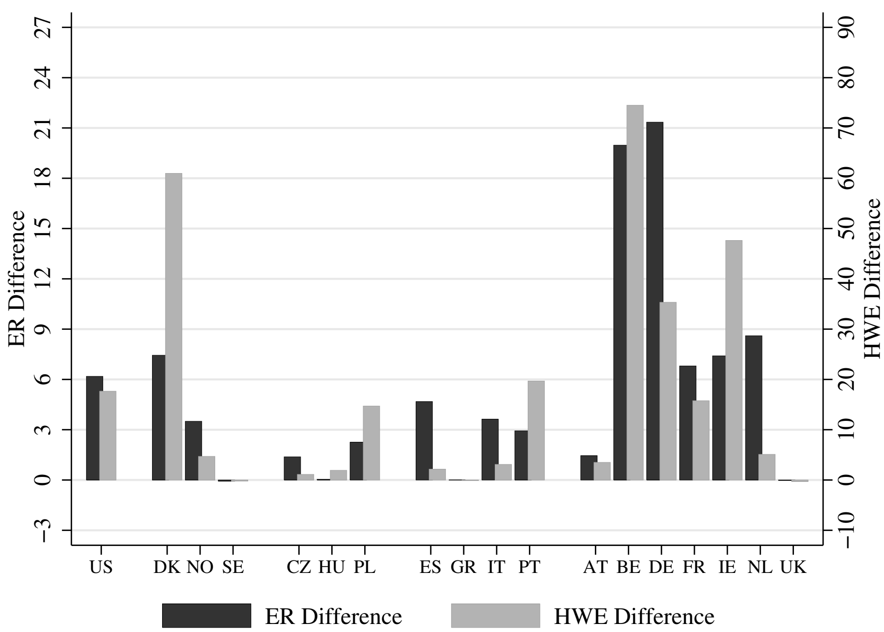


Figure A.4: Joint vs. Separate Filing: Female ER and HWE, Country Calibration



A.3 Tables

Table A.1: Percentage of Observations Dropped from the Sample

Country	Men	Women
Denmark	0.007	0.006
Norway	0.012	0.017
Sweden	0.005	0.005
Mean	*0.008*	*0.010*
Czech Repbulic	0.056	0.125
Hungary	0.066	0.133
Poland	0.135	0.193
Mean	*0.086*	*0.151*
Greece	0.052	0.183
Italy	0.047	0.146
Portugal	0.080	0.154
Spain	0.047	0.121
Mean	*0.057*	*0.151*
Austria	0.067	0.135
Belgium	0.073	0.146
France	0.044	0.095
Germany	0.079	0.147
Ireland	0.067	0.114
Netherlands	0.038	0.096
United Kingdom	0.086	0.135
Mean	*0.065*	*0.124*
United States	0.069	0.102

Table A.2: Hours Worked per Person by Gender and Marital Status

	Men		Women	
Country	Married	Single	Married	Single
Denmark	1717.7	1452.0	1218.3	1108.9
Norway	1622.9	1409.2	1070.7	1074.7
Sweden	1645.6	1475.5	1179.7	1153.4
Mean	*1662.1*	*1445.6*	*1156.2*	*1112.3*
Czech Repbulic	1899.6	1633.8	1256.7	1310.6
Hungary	1659.5	1460.6	1182.9	1298.0
Poland	1694.7	1301.7	1170.2	1210.0
Mean	*1751.3*	*1465.4*	*1203.3*	*1272.9*
Greece	1923.2	1628.0	979.3	1264.1
Italy	1689.7	1354.9	748.4	1041.7
Portugal	1770.3	1358.2	1266.9	1297.9
Spain	1740.0	1419.0	832.7	1212.8
Mean	*1780.8*	*1440.0*	*956.8*	*1204.1*
Austria	1826.4	1626.8	969.4	1296.2
Belgium	1716.1	1459.6	987.7	1180.6
France	1656.0	1398.2	1031.6	1113.3
Germany	1690.8	1400.5	809.8	1260.3
Ireland	1878.7	1619.5	809.8	1275.2
Netherlands	1780.3	1613.8	763.7	1216.6
United Kingdom	1826.6	1544.7	994.3	1170.2
Mean	*1767.9*	*1523.3*	*909.5*	*1216.1*
United States	1970.4	1565.3	1235.0	1422.0
Mean	*1761.6*	*1484.5*	*1028.2*	*1217.0*
Standard Deviation	*104.2*	*108.8*	*179.5*	*96.6*
Coefficient of Variation	*0.059*	*0.073*	*0.175*	*0.079*
Var(log hours)	*0.003*	*0.005*	*0.033*	*0.006*

Table A.3: Female Employment Rate and Hours Worked per Employed by Marital Status

	ER		**HWE**	
Country	Married	Single	Married	Single
Denmark	83.6	78.9	1456.5	1405.1
Norway	82.6	80.3	1295.5	1338.2
Sweden	84.4	81.9	1396.9	1407.3
Mean	*83.6*	*80.4*	*1383.0*	*1383.5*
Czech Repbulic	73.6	73.5	1706.4	1784.3
Hungary	66.3	71.0	1784.7	1827.7
Poland	66.6	68.1	1758.7	1776.2
Mean	*68.8*	*70.9*	*1749.9*	*1796.0*
Greece	56.3	70.7	1740.6	1787.8
Italy	54.6	66.9	1370.8	1556.4
Portugal	76.0	75.8	1665.9	1713.1
Spain	55.0	72.9	1518.5	1664.5
Mean	*60.5*	*71.6*	*1573.9*	*1680.4*
Austria	74.0	83.7	1310.2	1549.3
Belgium	70.7	75.7	1395.3	1559.0
France	73.4	76.3	1405.2	1460.1
Germany	71.4	81.2	1134.9	1552.2
Ireland	62.0	78.4	1306.0	1626.1
Netherlands	74.6	85.0	1022.4	1431.5
United Kingdom	76.8	74.6	1295.4	1568.0
Mean	*71.8*	*79.3*	*1267.1*	*1535.2*
United States	70.7	75.4	1745.8	1886.0
Mean	*70.7*	*76.1*	*1461.6*	*1605.1*
Standard Deviation	*9.2*	*5.1*	*227.3*	*163.1*
Coefficient of Variation	*0.130*	*0.068*	*0.155*	*0.102*
Var(log hours)	*0.018*	*0.005*	*0.025*	*0.010*

Table A.4: Demographic Composition

Country	Low Education Men	Low Education Women	High Education Men	High Education Women	Assortative Matching
Denmark	15.9	19.3	31.7	35.6	–
Norway	12.7	13.9	35.2	38.3	0.38
Sweden	16.8	13.9	27.9	37.1	–
Mean	*15.1*	*15.7*	*31.6*	*37.0*	*0.38*
Czech Repbulic	4.6	9.2	15.6	12.1	0.46
Hungary	14.1	20.8	16.5	18.9	0.55
Poland	9.8	10.8	14.9	18.9	0.52
Mean	*9.5*	*13.6*	*15.7*	*16.7*	*0.51*
Greece	38.4	34.4	23.3	21.4	0.63
Italy	50.7	45.8	10.7	12.1	0.54
Portugal	78.1	72.6	9.6	13.8	0.62
Spain	52.0	50.8	27.0	27.8	0.53
Mean	*54.8*	*50.9*	*17.6*	*18.8*	*0.58*
Austria	12.7	23.8	21.1	14.7	0.39
Belgium	32.0	28.7	31.4	34.7	0.55
France	28.1	29.7	24.8	28.0	0.48
Germany	10.5	16.4	31.6	20.5	0.50
Ireland	35.6	27.7	28.7	29.7	0.52
Netherlands	25.5	28.9	30.7	24.5	0.44
United Kingdom	22.1	29.4	33.0	33.0	0.40
Mean	*23.8*	*26.4*	*28.8*	*26.4*	*0.47*
United States	9.3	7.8	43.3	45.7	0.54

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.5: Targeted Female Employment Rates

	Data	Model	Data-Model
Low educated husband			
Low educated woman	42.4	44.3	−1.9
Medium educated woman	63.3	60.4	2.9
High educated woman	76.1	77.4	−1.3
Mean	*60.6*	*60.7*	*-0.1*
Medium educated husband			
Low educated woman	48.4	50.1	−1.8
Medium educated woman	71.2	68.6	2.6
High educated woman	83.2	85.6	−2.3
Mean	*67.6*	*68.1*	*-0.5*
High educated husband			
Low educated woman	49.6	51.7	−2.1
Medium educated woman	66.2	63.0	3.2
High educated woman	73.7	74.9	−1.2
Mean	*63.2*	*63.2*	*0.0*

Table A.6: Decomposition of Male Hours Worked per Person

Country	**Data**	**Model**	τ_l	τ_c	**w**	$\tau_l + \tau_c + w$
Denmark	−0.13	−0.16	−0.11	−0.05	0.00	−0.16
Norway	−0.18	−0.10	−0.06	−0.03	0.00	−0.09
Sweden	−0.16	−0.13	−0.07	−0.05	0.01	−0.12
Mean	*-0.16*	*-0.13*	*-0.08*	*-0.04*	*0.00*	*-0.12*
Czech Republic	−0.04	−0.02	0.00	−0.01	−0.01	−0.03
Hungary	−0.16	−0.12	−0.11	−0.03	−0.03	−0.12
Poland	−0.14	−0.05	−0.01	−0.02	−0.03	−0.05
Mean	*-0.11*	*-0.07*	*-0.04*	*-0.02*	*-0.03*	*-0.07*
Spain	−0.12	0.00	0.00	−0.02	0.01	−0.01
Greece	−0.02	−0.04	−0.02	−0.02	0.00	−0.05
Italy	−0.14	−0.13	−0.08	−0.03	−0.03	−0.11
Portugal	−0.10	−0.04	−0.01	−0.02	−0.01	−0.06
Mean	*-0.10*	*-0.05*	*-0.03*	*-0.02*	*-0.01*	*-0.06*
Austria	−0.07	−0.11	−0.08	−0.02	−0.01	−0.11
Belgium	−0.13	−0.15	−0.12	−0.03	−0.02	−0.14
France	−0.16	−0.03	0.01	−0.03	−0.01	−0.03
Ireland	−0.05	−0.06	−0.04	−0.03	−0.01	−0.07
Germany	−0.14	−0.09	−0.06	−0.02	0.00	−0.07
Netherlands	−0.10	−0.10	−0.07	−0.03	0.00	−0.10
United Kingdom	−0.07	−0.04	−0.02	−0.02	0.01	−0.03
Mean	*-0.10*	*-0.08*	*-0.06*	*-0.03*	*-0.01*	*-0.08*

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.7: Decomposition of Female Hours Worked per Person

Country	**Data**	**Model**	τ_l	τ_c	**w**	$\tau_l + \tau_c + w$
Denmark	−0.01	−0.29	−0.16	−0.12	0.06	−0.21
Norway	−0.13	−0.08	0.00	−0.09	0.04	−0.03
Sweden	−0.05	−0.11	0.02	−0.13	0.03	−0.06
Mean	*-0.06*	*-0.16*	*-0.05*	*-0.11*	*0.04*	*-0.10*
Czech Republic	0.02	−0.06	−0.01	−0.04	0.01	−0.01
Hungary	−0.04	−0.05	0.08	−0.08	0.02	−0.06
Poland	−0.05	−0.17	−0.01	−0.06	−0.02	−0.07
Mean	*-0.03*	*-0.09*	*0.02*	*-0.06*	*0.00*	*-0.05*
Spain	−0.32	−0.23	0.10	−0.04	−0.08	−0.01
Greece	−0.21	−0.09	0.11	−0.04	−0.08	0.03
Italy	−0.39	−0.14	−0.02	−0.08	0.07	−0.02
Portugal	0.03	−0.21	0.04	−0.06	−0.10	−0.13
Mean	*-0.22*	*-0.17*	*0.06*	*-0.06*	*-0.05*	*-0.03*
Austria	−0.22	−0.10	0.01	−0.06	0.04	−0.01
Belgium	−0.20	−0.31	−0.22	−0.07	0.09	−0.20
France	−0.16	−0.16	0.00	−0.08	0.04	−0.04
Ireland	−0.34	−0.23	0.00	−0.09	−0.03	−0.11
Germany	−0.34	−0.32	−0.23	−0.04	0.02	−0.26
Netherlands	−0.38	−0.17	−0.05	−0.07	0.03	−0.05
United Kingdom	−0.19	−0.13	0.04	−0.05	−0.01	−0.02
Mean	*-0.26*	*-0.21*	*-0.06*	*-0.07*	*0.03*	*-0.10*

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.8: Decomposition of Female Employment Rate

Country	**Data**	**Model**	τ_l	τ_c	**w**	$\tau_l + \tau_c + w$
Denmark	0.13	−0.15	−0.07	−0.05	0.03	−0.10
Norway	0.12	−0.03	0.02	−0.04	0.02	0.00
Sweden	0.14	−0.04	0.03	−0.06	0.02	−0.01
Mean	*0.13*	*-0.07*	*-0.01*	*-0.05*	*0.02*	*-0.04*
Czech Republic	0.03	−0.04	−0.01	−0.02	0.00	−0.01
Hungary	−0.04	0.01	0.07	−0.04	0.01	0.03
Poland	−0.04	−0.09	−0.01	−0.03	−0.01	−0.04
Mean	*-0.02*	*-0.04*	*0.02*	*-0.03*	*0.00*	*-0.01*
Spain	−0.16	−0.15	0.05	−0.02	−0.04	0.00
Greece	−0.14	−0.06	0.07	−0.02	−0.03	0.02
Italy	−0.16	−0.09	0.01	−0.03	0.03	0.01
Portugal	0.05	−0.13	0.03	−0.03	−0.05	−0.04
Mean	*-0.10*	*-0.11*	*0.04*	*-0.02*	*-0.02*	*0.00*
Austria	0.03	−0.02	0.04	−0.03	0.02	0.03
Belgium	0.00	−0.14	−0.07	−0.03	0.04	−0.07
France	0.03	−0.09	0.00	−0.04	0.02	−0.02
Ireland	−0.09	−0.10	0.04	−0.04	−0.02	−0.02
Germany	0.01	−0.15	−0.10	−0.02	0.01	−0.11
Netherlands	0.04	−0.09	0.00	−0.03	0.02	−0.02
United Kingdom	0.06	−0.05	0.04	−0.02	0.00	0.01
Mean	*0.01*	*-0.09*	*-0.01*	*-0.03*	*0.01*	*-0.03*

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.9: Decomposition of Female Hours Worked per Employed

Country	**Data**	**Model**	τ_l	τ_c	**w**	$\tau_l + \tau_c + w$
Denmark	−0.17	−0.10	−0.06	−0.05	0.02	−0.08
Norway	−0.26	−0.04	−0.03	−0.03	0.01	−0.02
Sweden	−0.20	−0.05	−0.03	−0.05	0.01	−0.04
Mean	*-0.21*	*-0.06*	*-0.04*	*-0.04*	*0.01*	*-0.05*
Czech Republic	−0.02	−0.01	0.00	−0.02	0.00	0.01
Hungary	0.02	−0.07	−0.01	−0.03	0.00	−0.09
Poland	0.01	−0.05	0.01	−0.02	−0.01	−0.02
Mean	*0.00*	*-0.04*	*0.00*	*-0.02*	*0.00*	*-0.03*
Spain	−0.13	−0.02	0.03	−0.02	−0.03	−0.01
Greece	0.00	−0.01	0.01	−0.02	−0.03	−0.01
Italy	−0.22	−0.02	−0.03	−0.03	0.02	−0.03
Portugal	−0.05	−0.02	0.00	−0.03	−0.04	−0.07
Mean	*-0.10*	*-0.02*	*0.00*	*-0.02*	*-0.02*	*-0.03*
Austria	−0.25	−0.08	−0.04	−0.02	0.01	−0.04
Belgium	−0.20	−0.14	−0.14	−0.03	0.03	−0.11
France	−0.20	−0.04	0.00	−0.03	0.01	−0.01
Ireland	−0.25	−0.10	−0.05	−0.03	−0.01	−0.09
Germany	−0.35	−0.14	−0.10	−0.02	0.00	−0.12
Netherlands	−0.41	−0.05	−0.05	−0.03	0.01	−0.02
United Kingdom	−0.26	−0.07	−0.01	−0.02	0.00	−0.03
Mean	*-0.27*	*-0.09*	*-0.06*	*-0.03*	*0.01*	*-0.06*

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.10: Decomposition: Tax Structure and Tax Level with κ

	Country Group	Data	τ_l	Tax Structure	Tax Level
$\mathbf{HWP}_{\boldsymbol{m}}$	Scandinavia	−0.16	−0.08	−0.03	−0.04
	Eastern Europe	−0.11	−0.04	−0.02	−0.02
	Southern Europe	−0.10	−0.03	−0.01	−0.01
	Western Europe	−0.10	−0.06	−0.03	−0.03
$\mathbf{HWP}_{\boldsymbol{f}}$	Scandinavia	−0.06	−0.05	0.08	−0.13
	Eastern Europe	−0.03	0.02	0.07	−0.04
	Southern Europe	−0.22	0.06	0.10	−0.04
	Western Europe	−0.26	−0.06	0.01	−0.07
$\mathbf{ER}_{\boldsymbol{f}}$	Scandinavia	0.13	−0.01	0.05	−0.06
	Eastern Europe	−0.02	0.02	0.04	−0.02
	Southern Europe	−0.10	0.04	0.06	−0.02
	Western Europe	0.01	−0.01	0.02	−0.03
$\mathbf{HWE}_{\boldsymbol{f}}$	Scandinavia	−0.21	−0.04	0.00	−0.04
	Eastern Europe	0.00	0.00	0.02	−0.02
	Southern Europe	−0.10	0.00	0.02	−0.02
	Western Europe	−0.27	−0.06	−0.02	−0.03

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.11: Decomposition of Male Hours Worked per Person: Tax Structure and Level

Country	**Data**	τ_l	**Tax Structure**	**Tax Level**
Denmark	−0.13	−0.11	−0.01	−0.10
Norway	−0.18	−0.06	−0.01	−0.04
Sweden	−0.16	−0.07	−0.02	−0.05
Mean	*-0.16*	*-0.08*	*-0.01*	*-0.06*
Czech Republic	−0.04	0.00	0.01	−0.01
Hungary	−0.16	−0.11	−0.12	0.00
Poland	−0.14	−0.01	0.04	−0.05
Mean	*-0.11*	*-0.04*	*-0.02*	*-0.02*
Spain	−0.12	0.00	0.01	0.00
Greece	−0.02	−0.02	0.00	−0.02
Italy	−0.14	−0.08	−0.02	−0.05
Portugal	−0.10	−0.01	0.00	−0.01
Mean	*-0.10*	*-0.03*	*0.00*	*-0.02*
Austria	−0.07	−0.08	−0.04	−0.04
Belgium	−0.13	−0.12	−0.04	−0.08
France	−0.16	0.01	0.03	−0.02
Ireland	−0.05	−0.04	−0.05	0.01
Germany	−0.14	−0.06	0.00	−0.06
Netherlands	−0.10	−0.07	−0.01	−0.06
United Kingdom	−0.07	−0.02	0.00	−0.02
Mean	*-0.10*	*-0.06*	*-0.02*	*-0.04*

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.12: Decomposition of Female Hours Worked per Person: Tax Structure and Level

Country	**Data**	τ_l	**Tax Structure**	**Tax Level**
Denmark	−0.01	−0.16	0.06	−0.22
Norway	−0.13	0.00	0.11	−0.11
Sweden	−0.05	0.02	0.14	−0.12
Mean	*-0.06*	*-0.05*	*0.10*	*-0.15*
Czech Republic	0.02	−0.01	0.01	−0.02
Hungary	−0.04	0.08	0.08	0.01
Poland	−0.05	−0.01	0.13	−0.14
Mean	*-0.03*	*0.02*	*0.07*	*-0.05*
Spain	−0.32	0.10	0.11	−0.01
Greece	−0.21	0.11	0.16	−0.05
Italy	−0.39	−0.02	0.08	−0.10
Portugal	0.03	0.04	0.07	−0.03
Mean	*-0.22*	*0.06*	*0.10*	*-0.05*
Austria	−0.22	0.01	0.09	−0.08
Belgium	−0.20	−0.22	−0.02	−0.20
France	−0.16	0.00	0.07	−0.07
Ireland	−0.34	0.00	−0.03	0.03
Germany	−0.34	−0.23	−0.06	−0.17
Netherlands	−0.38	−0.05	0.10	−0.15
United Kingdom	−0.19	0.04	0.11	−0.06
Mean	*-0.26*	*-0.06*	*0.04*	*-0.10*

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.13: Decomposition of Female Employment Rate: Tax Structure and Level

Country	**Data**	τ_l	**Tax Structure**	**Tax Level**
Denmark	0.13	−0.07	0.03	−0.11
Norway	0.12	0.02	0.06	−0.04
Sweden	0.14	0.03	0.08	−0.05
Mean	*0.13*	*-0.01*	*0.06*	*-0.07*
Czech Republic	0.03	−0.01	0.00	−0.01
Hungary	−0.04	0.07	0.06	0.00
Poland	−0.04	−0.01	0.05	−0.06
Mean	*-0.02*	*0.02*	*0.04*	*-0.02*
Spain	−0.16	0.05	0.05	0.00
Greece	−0.14	0.07	0.09	−0.02
Italy	−0.16	0.01	0.05	−0.04
Portugal	0.05	0.03	0.04	−0.01
Mean	*-0.10*	*0.04*	*0.06*	*-0.02*
Austria	0.03	0.04	0.07	−0.03
Belgium	0.00	−0.07	0.00	−0.07
France	0.03	0.00	0.03	−0.03
Ireland	−0.09	0.04	0.02	0.01
Germany	0.01	−0.10	−0.02	−0.08
Netherlands	0.04	0.00	0.06	−0.06
United Kingdom	0.06	0.04	0.06	−0.02
Mean	*0.01*	*-0.01*	*0.03*	*-0.04*

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.14: Decomposition of Female Hours Worked per Employed: Tax Structure and Level

Country	**Data**	τ_l	**Tax Structure**	**Tax Level**
Denmark	−0.17	−0.06	0.02	−0.08
Norway	−0.26	−0.03	0.02	−0.05
Sweden	−0.20	−0.03	0.02	−0.05
Mean	*-0.21*	*-0.04*	*0.02*	*-0.06*
Czech Republic	−0.02	0.00	0.01	−0.01
Hungary	0.02	−0.01	−0.01	0.00
Poland	0.01	0.01	0.06	−0.05
Mean	*0.00*	*0.00*	*0.02*	*-0.02*
Spain	−0.13	0.03	0.03	−0.01
Greece	0.00	0.01	0.03	−0.02
Italy	−0.22	−0.03	0.02	−0.05
Portugal	−0.05	0.00	0.01	−0.01
Mean	*-0.10*	*0.00*	*0.02*	*-0.02*
Austria	−0.25	−0.04	0.00	−0.04
Belgium	−0.20	−0.14	−0.02	−0.11
France	−0.20	0.00	0.03	−0.03
Ireland	−0.25	−0.05	−0.06	0.01
Germany	−0.35	−0.10	−0.03	−0.07
Netherlands	−0.41	−0.05	0.02	−0.07
United Kingdom	−0.26	−0.01	0.02	−0.03
Mean	*-0.27*	*-0.06*	*-0.01*	*-0.05*

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.15: Model Output: Different Female Elasticities

	Country Group	Data	Benchmark	$\gamma_f = 1.0$	$\gamma_f = 1.5$
$\mathbf{HWP}_m$	Scandinavia	−0.16	−0.13	−0.12	−0.12
	Eastern Europe	−0.11	−0.07	−0.06	−0.07
	Southern Europe	−0.10	−0.05	−0.05	−0.05
	Western Europe	−0.10	−0.08	−0.08	−0.07
$\mathbf{HWP}_f$	Scandinavia	−0.06	−0.16	−0.19	−0.22
	Eastern Europe	−0.03	−0.09	−0.11	−0.12
	Southern Europe	−0.23	−0.17	−0.18	−0.19
	Western Europe	−0.26	−0.21	−0.25	−0.28
$\mathbf{ER}_f$	Scandinavia	0.13	−0.07	−0.07	−0.07
	Eastern Europe	−0.02	−0.04	−0.04	−0.04
	Southern Europe	−0.10	−0.11	−0.11	−0.11
	Western Europe	0.01	−0.09	−0.09	−0.08
$\mathbf{HWE}_f$	Scandinavia	−0.21	−0.06	−0.10	−0.13
	Eastern Europe	0.00	−0.04	−0.07	−0.07
	Southern Europe	−0.10	−0.02	−0.03	−0.05
	Western Europe	−0.27	−0.09	−0.15	−0.19

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.

Table A.16: Model Output: No and Full Redistribution

	Country Group	Data	Benchmark	No Redistribution	Full Redistribution
$\mathbf{HWP}_m$	Scandinavia	−0.16	−0.13	−0.06	−0.12
	Eastern Europe	−0.11	−0.07	−0.03	−0.05
	Southern Europe	−0.10	−0.05	−0.01	−0.04
	Western Europe	−0.10	−0.08	−0.03	−0.07
$\mathbf{HWP}_f$	Scandinavia	−0.06	−0.16	0.09	−0.14
	Eastern Europe	−0.03	−0.09	0.02	−0.06
	Southern Europe	−0.23	−0.17	−0.10	−0.13
	Western Europe	−0.26	−0.21	−0.08	−0.18
$\mathbf{ER}_f$	Scandinavia	0.13	−0.07	0.04	−0.06
	Eastern Europe	−0.02	−0.04	0.02	−0.02
	Southern Europe	−0.10	−0.11	−0.08	−0.09
	Western Europe	0.01	−0.09	−0.04	−0.08
$\mathbf{HWE}_f$	Scandinavia	−0.21	−0.06	0.03	−0.05
	Eastern Europe	0.00	−0.04	0.00	−0.03
	Southern Europe	−0.10	−0.02	0.01	−0.01
	Western Europe	−0.27	−0.09	−0.03	−0.08

Note: The last column shows the correlation coefficient of a simple correlation between the education level of husbands and wives.