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**A cross country comparison of
the
Impact of labor income tax on
female labor supply**

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A Cross-Country Comparison of the Impact of Labor Income Tax on Female Labor Supply

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Abstract

Macroeconomists have long been interested in understanding differences in hours worked across countries. Prescott (2004) shows that differences in labor income tax explain the majority of the difference in hours worked between the United States and European countries. In this paper we go one step further in quantifying the impact of labor income tax on differences in hours worked between the United States and European countries. First, we decompose hours worked by gender and marital status, and we find that females are responsible for more than half of the difference in hours worked. Within females, we find that married females are responsible for more than half of the difference in hours worked. Second, given these findings, we quantify the impact of differences in labor income tax in explaining differences in aggregate hours worked. The main contribution of this paper is that we do not restrict the analysis of differences in labor income tax to differences in the progressivity of the tax schedule, but we also incorporate differences in the treatment of secondary earners across countries. As a result, we find that differences in labor income tax explain two thirds of the difference in aggregate hours worked across countries, and we also find that differences in the treatment of secondary earner explain two thirds of the difference in hours worked between married and single females.

JEL: E60, H20, J22

Um Estudo Sobre o Efeito de Diferenças em Impostos ao Trabalho entre Países na Decisão das Mulheres de Trabalhar

Resumo

Existe uma considerável diferença em horas trabalhadas entre países. Atualmente, em média um Americano trabalha 204 horas a mais que um Europeu por ano, de acordo com dados da OECD. Esta diferença em horas trabalhadas sempre despertou o interesse de Macroeconomistas, trabalhos como o de Prescott (2004) demonstraram que diferenças em impostos ao trabalho podem explicar a maior parte da diferença em horas trabalhadas entre os Estados Unidos e países Europeus. Em este trabalho, nós realizamos uma análise nos dados decompondo diferenças em horas trabalhadas através de gênero e também de estado civil. Esta análise nos revela que as mulheres são responsáveis pela maior parte da diferença em horas trabalhadas entre Europa e Estados Unidos, e que, entre as mulheres, as casadas são responsáveis pela maior parte da diferença em horas trabalhadas. Tendo em mão este resultado, nós quantificamos o impacto das diferenças em impostos ao trabalho nas diferenças em horas trabalhadas levando em consideração diferentes tratamentos tributários entre casados e solteiros. Este estudo demonstra que diferenças em impostos explicam dois terços da diferenças em horas trabalhadas e que diferenças no tratamento tributário entre pessoas casadas e solteiras explicam três quartos das diferenças em horas trabalhadas entre mulheres casadas e solteiras.

1 Introduction

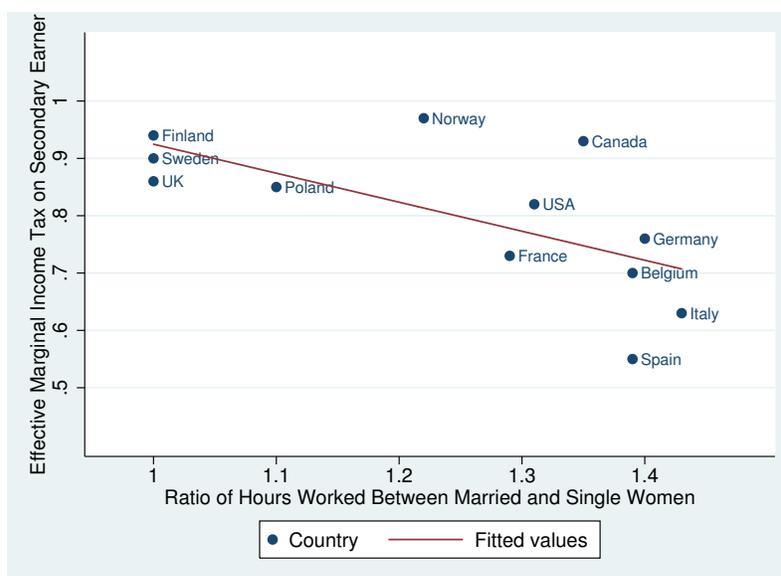
Macroeconomists have long been interested in understanding differences in hours worked across countries. Prescott (2004) shows that differences in labor income tax account for the majority of the difference in hours worked between the United States and selected European countries. Ohanian, Raffo, and Rogerson (2008) using a larger set of countries arrive in the same conclusion. In this paper we go one step further in quantifying the impact of labor income tax on differences in hours worked across countries. First, we decompose hours worked by gender and marital status, and we find that differences in hours worked between females constitute more than half of differences in aggregate hours. In addition, within females, married females are the most important group. Second, given these findings, we quantify the impact of differences in the progressivity of the labor income tax and in the treatment of secondary earner in explaining differences in aggregate hours worked between the United States and Europe. We find that differences in labor income tax explain two thirds of difference in hours worked across countries, and they also explain two thirds of differences in hours worked between married and single females.

Although many papers in the literature have studied the importance of labor income tax progressivity in explaining differences in hours worked across countries, the impact of differences in the treatment of secondary earner is a topic that has not received much attention. Differences in the treatment of secondary earners arise mostly through the choice of the unit of taxation. Countries can have the individual or the family as the unit of taxation. When the family is the unit of taxation, changes in marital status affect individuals marginal income tax, more precisely, after marriage, primary earners face a lower marginal income tax, while secondary earners face higher marginal income tax. By contrast, when the individual is the unit of taxation, changes in marital status do not affect individual's marginal income tax. Although many countries officially have the individual as the unit of taxation, in reality married and single individuals do not face the same labor income tax. This is the result of labor income tax benefits that are given to one-earner families. In countries in which these benefits are significant, individuals in two-earner families face the same tax schedule as single individuals, while individuals in one-earner families face a different tax schedule. As a result, married individuals, in fact, face a different tax schedule than singles.

In order to illustrate the potential effect of differences in the treatment of secondary earners in explaining differences in aggregate hours worked, we elaborate figure 1. In this figure we plot the ratio of average hours worked of single females to average hours worked of married females against the ratio of labor income tax of singles to the effective labor income tax of secondary earners.¹ The average effective labor income tax of secondary earner is calculated assuming that primary earners receive the

¹The effective secondary earner average labor income tax is the ratio between the increase in labor

Figure 1: Ratio of Hours Worked Between Married and Single Women and Ratio of Average Tax Between Married and Single Women



average labor income in the country and secondary earners receive 67 percent of the average labor income, for singles we assume that they also receive 67 percent of the average labor income.²

From figure 1 it is clear that there is a negative relationship between average labor income tax of secondary earners and the ratio of hours worked between married women to single women, that is in countries in which secondary earners face a higher average effective labor income tax than singles, married women work less hours than single women. Taking this finding as a strong evidence that choice of the unit of taxation is also an important force in explaining differences in hours worked across countries, we incorporate both differences in the progressivity and in the treatment of secondary earner in our analysis.

To quantify the impact of labor income on hours worked across countries, we develop a heterogeneous agent model, where agents differ in their wages and marital status. The model is calibrated to match key moments for the United States economy, and then we replace labor income tax of the United States for the labor income tax of selected European countries taking into account differences in the treatment of the secondary earner.

income tax paid by a couple when the secondary earner decides to participate in the labor force ($\tau^{se} = \frac{\text{Couple's total tax paid when secondary earner participates} - \text{Couple's total tax paid when secondary earner does not participate}}{\text{Secondary earner labor income}}$)

²The average labor income is from Organisation for Economic Co-operation and Development (OECD) in 2003.

The explanatory power of differences in labor income tax in explaining differences in hours worked varies across countries. For Germany and France, that like the United States, have the family as the unit of taxation, differences in income taxation and social security contribution are able to explain 96 percent of differences in hours worked between American women and French women, and they are also able to explain 75 percent of the difference between French and American men. For Germany differences in labor income taxes explain 99 percent of differences in hours worked between both men and women. For the group of countries that have the individual as the unit of taxation, differences in labor income tax can explain most of differences in hours worked for women, and some of the difference in hours worked for men. United Kingdom is the exception, where differences in taxation are not able to explain differences in hours worked both for men and women.

My work here is closely related to Prescott (2004), Rogerson (2006) and others that explore differences in taxation to explain differences in hours worked between the United States and Europe. It is also related to Alesina, Glaeser, and Sacerdote (2006) that finds that differences in unions and labor market regulation can explain differences in hours worked. My work here is also closely related to Guner, Kaygusuz, and Ventura (2008) analyzes the effect of tax reforms on household labor supply, focusing on married females' extensive margin and with Kaygusuz (2010) that analyzes the impact of the Tax Reform Act of 1981 and the Tax Reform Act of 1986 on female labor supply. Kaygusuz (2010) finds that changes in the tax structure introduces by these laws can explain 20% of the increase in married female labor force participation between 1980 and 1990. Reinforcing this finding, Eissa (1995) concludes that the labor supply from high-income married women increased in response to the Tax Reform Act of 1986.

This paper is organized as follows. In Section 2 I quantify the importance of each demographic group in explaining differences in aggregate hours worked. In Section 3, I describe the economic environment. In Section 4, I discuss the calibrated model and the quantitative properties of the economy. The main findings of the paper are presented in Section 5, where I quantify the impact of labor income taxation on female labor supply across countries. Section 6 concludes the paper.

2 Measuring Differences in Hours Worked

In order to decompose differences in aggregate hours between the United States and European countries, we use data on time allocation from the Multinational Time Use Study (MTUS). MTUS main objective is to create a harmonized time use data that is comparable across countries. The data is collected from daily time use diaries in each country. The selected European countries are France, Germany, Italy, The Netherlands, Norway, and The United Kingdom. Data for The United States is also from the

MTUS. For each country the sample is restricted to males and females aged 25-65 to avoid differences in the average age of first marriage.

We divide each country's sample into gender and marital status, and then we decompose differences in aggregate hours worked in differences in hours and in differences in demographic composition. Individuals in the MTUS can have one of the three marital statuses: singles, married, or cohabitating. Let H^{us} be the aggregate hours worked in the US and let H^j be the aggregate hours worked in county j , then differences in hours worked can be written as:

$$H^{us} - H^j = \sum_{i=1}^n \omega_i^{us} h_i^{us} - \sum_{i=1}^n \omega_i^j h_i^j = \sum_{i=1}^n \omega_i^{us} (h_i^{us} - h_i^j) + \sum_{i=1}^n h_i^j (\omega_i^{us} - \omega_i^j) \quad (1)$$

The first term in the summation of the final equation captures differences in aggregate hours due to differences in hours and the second term in the summation captures differences in hours worked due to differences in the demographic composition. Table 1 presents the contribution of the most important demographic groups in explaining differences in aggregate hours. Since cohabitation is not an important factor in explaining differences in hours worked, it is not showed in the table below. Cohabitation explains at most 7% of the differences in hours worked in the most favorable case, which is Norway.

Table 1: Differences in Hours Worked

Country	Females			Males			Differences Due to Hours
	Married	Singles	Total	Married	Singles	Total	
France	0.41	0.17	0.60	0.09	0.32	0.42	1.03
Germany	0.44	0.14	0.59	0.29	0.10	0.40	0.99
Italy	0.67	0.21	0.91	0.10	-0.05	0.03	0.94
Netherlands	0.49	0.25	0.76	0.22	0.04	0.26	1.02
Norway	0.08	0.58	0.71	0.14	0.10	0.26	0.98
United Kingdom	0.37	0.32	0.72	0.23	0.14	0.34	1.05

This table represents the share of each element in equation 1 divided by the difference in aggregate hours between the United States and each European country

From the last column of table 1 we can conclude that differences in the demographic composition do not explain differences in aggregate hours worked. Differences in the demographic composition explain at most 6% of differences in hours worked, which is the case of Italy, where marital rates are much higher than in the United States. For some countries the demographic composition has a negative impact on aggregate hours, this is the case of France, the Netherlands, and the United Kingdom.

This is mainly because of differences in cohabitation, which are much higher in these countries than in the United States.

Also from table 1, we can conclude that females are the most important group in explaining differences in aggregate hours. Almost all the difference in aggregate hours between the United States and Italy is driven by women, 91%, and in Germany, where females are less significant, differences in hours worked between females account for 59% of the difference in aggregate hours worked. Within females, married females are more important than singles in explaining differences in hours worked in almost all countries, with the exception of Norway, where almost all the differences in hours worked between females are driven by singles.

3 The Economic Environment

The economy is populated by a continuum of males and a continuum of females. The total mass of each gender is normalized to one. Agents are born with a wage w_g , that depends on gender. In addition, agents are born with a fixed marital status. Let $S(w_g)$ denotes the fraction of single and divorced agents with wage w_g , and let $M(w_h, w_f)$ be the fraction of married agents, in which the husband has a wage w_h and the wife has a wage w_f . Each agent is endowed with one unit of time that can be allocate to market work l_1 , home production l_2 , and leisure. Following Becker (1965), I assume that there is a home production function that uses market goods c_M and time l_2 to produce a final consumption good c_{HP} . Agents differ in their home production productivity θ_g , that is gender specific. Market goods c_M are purchased with labor l_1 for a wage w_g . Income is taxed $T(\cdot)$ and this tax function is estimated to each country.

Single and Divorced Households Singles and divorced agents maximize their consumption of the final good c_{HP} and leisure $1 - l_1 - l_2$ subject to their budget constraint. The single and divorced agent maximization problem is given by:

$$\begin{aligned} \max_{c_M, c_{HP}, l_1, l_2} \quad & \alpha \log(c_{HP}) + (1 - \alpha) \frac{(1 - l_1 - l_2)^{1-\sigma}}{1 - \sigma} \\ \text{s.t} \quad & c_{HP} = (\psi c_M^\eta + (1 - \psi)(\theta_g l_2)^\eta)^{\frac{1}{\eta}} \\ & c_M \leq w l_1 - T(w l_1) \\ & l_1 + l_2 \leq 1 \\ & l_1 \geq 0, l_2 \geq 0 \end{aligned}$$

Married Households Married agents maximize consumption of the final good c_{HP} and the combined husband leisure' and wife leisure'. The parameter ζ measures the elasticity of substitution between the wife and the husband leisure in the couple utility function. In addition, a married couple consume a final consumption good using market good and time. The time of the husband and the wife at home production is combined using CES aggregator, in which the parameter χ captures the elasticity of substitution between the husband and the wife time at home. Married couples also enjoy a return of scale ϕ in consumption and leisure, and they face an income tax $T(\cdot, \cdot)$ that depends on the earning of the wife and the earnings of the husband. This tax function is estimated to each country.

$$\begin{aligned}
& \max_{c_{HP}, c_M, l_m^1, l_f^1, l_m^2, l_f^2} \alpha \log \left(\frac{c_{HP}}{2^\phi} \right) + \frac{(1-\alpha)}{1-\sigma} \left((1-l_m^1-l_f^1)^\zeta + (1-l_m^2-l_f^2)^\zeta \right)^{\frac{1-\sigma}{\zeta}} \\
& \text{s.t} \\
& c_{HP} = (\psi c_M^\eta + (1-\psi)(\theta_m(l_m^2)^\chi + (1-\theta_m)(l_f^2)^\chi)^{\frac{\eta}{\chi}})^{\frac{1}{\eta}} \\
& c_M \leq w_m l_m^1 + w_f l_f^1 - T(w_m l_m^1, w_f l_f^1) \\
& l_m^1 + l_m^2 \leq 1 \\
& l_f^1 + l_f^2 \leq 1 \\
& l_m^1 \geq 0, l_m^2 \geq 0, l_f^1 \geq 0, l_f^2 \geq 0
\end{aligned}$$

Equilibrium The equilibrium is very simple, households maximize utility subject to the relevant budget constraint.

4 Calibration

The equilibrium is calibrated to match patterns of time allocation in the United States in 2003. With this objective the United States demographic distribution and wages are estimated from the data. Then, given wages, and labor income tax, the economy is calibrated to match time allocation patterns. After the calibration, the United States income tax and social security contribution is replaced by the income tax and social security contribution of the selected country.

Hours Data on time allocation is obtained from the Multinational Time Use Study (MTUS). MTUS main objective is to create a harmonized time use data that is comparable across countries. The data is collected from daily time use diaries in each country. In this paper the latest version available of the MTUS is used for the selected

countries: France (1998), Germany (2001), Italy (2002), The Netherlands (2000), Norway (2000), The United Kingdom (2000), The United States (2003). For each country the sample is restricted to males and females aged 20-65.

The time allocation at the MTUS is divided in 41 daily activities represented in table 2. I divide this 41 categories in three groups: market work, home production, and leisure. Market work consists of mainly activities for which individuals are paid to perform. Home production are activities that it is easier to find a substitute in the market, as an example you can cook your own food or you can buy it in a restaurant. The last category is leisure, which is the complement of market work and home production, in general activities in these category follow the third-part rule, meaning you can not pay an individual to perform it in your place.

Table 2: MTUS Activities

Activity Code	Activity	Activity Code	Activity
AV1	Paid Work	AV21	Walking
AV2	Paid Work at home	AV22	Religious activity
AV3	Paid Work, second job	AV23	Civic activities
AV4	School, classes	AV24	Cinema or Theater
AV5	Travel to/from work	AV25	Dancers or Parties
AV6	Cook, wash up	AV26	Social clubs
AV7	Housework	AV27	Pubs
AV8	Odd jobs	AV28	Restaurants
AV9	Gardening	AV29	Visit friend at their home
AV10	Shopping	AV30	Listen to radio
AV11	Childcare	AV31	Watch television or video
AV12	Domestic Travel	AV32	Listen to records, tapes, cds
AV13	Dress/personal care	AV33	Study, homework
AV14	Consume personal services	AV34	Read books
AV15	Meals and snacks	AV35	Read papers, magazines
AV16	Sleep	AV36	Relax
AV17	Free time travel	AV37	Conversation
AV18	Excursions	AV38	Entertain friends at home
AV19	Active sports participation	AV39	Knit,sew
AV20	Passive sports participation	AV40	Other leisure
AV41	Unclassified time		

Preferences There are three utility function parameters to be calibrated: (i) the elasticity of labor supply σ , (ii) the elasticity of substitution between the leisure of the wife and the leisure of the husband ζ , and (iii) the household weight α on leisure and consumption. The preference parameters are calibrated to match the average hours worked per female, which is 24.20 in the United States, and the average hours worked per male, which is 36.03 in the United States, both from the MTUS. The other moment

Table 3: Main Activities

Activity	MTUS Category
Market Work	AV1-3
Home Work	AV5-11
Leisure	All other activities

calibrated is the fraction of two-earner households among married households. This moments is very important to measure the impact of tax on one-earner versus two-earner households, and it is calculated from the 2003 Integrated Public Use Microdata Series - Current Population Survey (IPUMS-CPS) for the same age group.

Home Production The elasticity of substitution between market goods and home production time η is from the work of McGrattan, Rogerson, and Wright (1997). The difference in home productivity across gender θ and the weight on market goods and home time ψ on the home production are calibrated to match the average time on home production for males (13.18) and females (21.09) from the MTUS. The return of scale on consumption ϕ for married households is from the Organization for Economic Co-operation and Development (OECD) and it is equal to 0.77.

Demographics The demographic distribution in the United States in the year of 2003 is calculated from the IPUMS-CPS . The population is divided in 8 demographic groups. First, each gender is divided in two educational groups, one for college educated agents, which in the data corresponds to individuals with at least 3 years of college education, and one for high school educated agents, which in the data correspond to individuals with less than 3 years of college education. Then, individuals are divided by marital status. Table 4 summarizes the demographics distribution.

Table 4: Demographic's Distribution

	Proportion
Single and Divorced Agents	
College-Educated Females	0.07
College-Educated Males	0.06
High-School-Educated Females	0.25
High-School-Educated Males	0.26
Married Agents	
College-Educated Husband, College-Educated Wife	0.15
College-Educated Husband, High School-Educated Wife	0.06
High-School-Educated Husband, College-Educated Wife	0.05
High-School-Educated Husband, High-School-Educated Wife	0.39

Wages Wages are from the IPUMS-CPS in 2003. They are hourly-wages³ and restricted to those in the civilian labor force, who make at least half of the minimum wage, and to those who worked at least 10 hours per week. Hourly wages are assumed to have a log-normal distribution. There are four wage distributions, one for each education and gender group. Table 5 summarizes the main statistics of the wage distribution.

Table 5: Wage Distribution

Category	Parameter Values	
Female College	$\mu_{f,c} = 2.94$	$\sigma_{f,c} = 0.33$
Male College	$\mu_{m,c} = 3.25$	$\sigma_{m,c} = 0.46$
Female Non-College	$\mu_{f,nc} = 2.45$	$\sigma_{f,nc} = 0.27$
Male Non-College	$\mu_{m,nc} = 2.72$	$\sigma_{m,nc} = 0.36$

Income Tax The income tax schedule is estimated from the publication (?) from the Organization for Economic Co-operation and Development (OECD) and follows the methodology developed by Guvenen, Kuruscu, and Ozkan (2009). In this publication, the OECD provides information on income tax paid by workers and social security contributions levied on employees in OECD countries. Based on this information, I estimated an income tax schedules to each country, that also contains state and local tax. The social security contribution is also considered, but separately.

As mentioned before countries not only differ in the progressivity of the tax schedule, but also on the unit of taxation. Consequently, in many cases more than one income tax schedule is estimated to each country. For the countries where the unit of taxation is the family; United States, Germany, and France, two tax schedules are estimated one for single individuals and one for married individuals. In addition, for France and Germany a third tax schedule is estimated to married individuals, in which only one spouse participates in the labor force. This third tax schedule is estimated to consider some important tax benefits that exist to one-earner families in these two countries.

For the set of countries in which the unit of taxation is the individual, the same problem arises. In many cases, tax benefits to one-earner families are sizable and an extra tax schedule is estimated for this reason. For Norway, two tax schedules are estimated one for singles or married individuals filling separately, and one for married individuals filling jointly. For Netherlands, only one tax schedule is estimated. For Italy and UK, because of specific tax benefits for dependent spouses, two tax schedules are estimated to each country, one for single and married individuals, in which both spouses participate in the labor force, and one for married individuals, in which only one spouse participates in the labor force.

³Mean hourly wage = $\frac{\text{Income Wage}}{\text{Usual Hours Worked} \cdot \text{Weeks Worked}}$.

All tax schedule are estimated using the following functional form:

$$t(\text{income}) = a_0 + a_1 \left(\frac{\text{income}}{AI} \right) - \frac{a_2}{1 - \phi} \left(\frac{\text{income}}{AI} \right)^{1-\phi}$$

where AI stands for the average income for each country, which is from ?), and income is the income of the individual or in case of married agents filling jointly is the total income of the married couple. Table 6 presents all the parameters estimated for each country along its R^2 values.

Table 6: Income Tax Estimation

Country	Type	a_0	a_1	a_2	ϕ	R^2
France	Single Individuals	-0.0709	-0.0125	0.0952	0.5553	0.9936
	Married Individuals					
	Both Working In The Market	0.0392	0.0720	-0.0301	-0.2560	0.9949
	Only One Working In The Market	0.0436	0.0424	-0.0003	-0.8804	0.9908
Germany	Single Individuals	-1.7312	-0.0195	0.1751	0.9108	0.9932
	Married Individuals					
	Both In Working In The Market	-0.1187	-0.1052	0.2280	0.3052	0.9912
	Only One Working In the Market	-0.1290	-0.0858	0.2133	0.3475	0.9916
Italy	Single and Married Individuals	-1.2392	-0.0132	0.1283	0.9098	0.9921
	Both Working In The Market					
	Married Individuals Only One Working In The Market	-0.9432	-0.0014	-0.1354	0.8781	0.9870
Netherlands	All Individuals	-0.0744	0.4540	-0.3450	-0.1099	0.9820
Norway	Single and Married Individuals	-0.9031	-0.0133	0.1319	0.8830	0.9934
	Filling Separately					
	Married Individuals Filling Jointly	-0.2289	-0.0365	0.1643	0.5999	0.9935
United Kingdom	Single and Married Individuals	-0.5906	-0.0014	0.1253	0.8335	0.9916
	Both Working In The Market					
	Married individuals Only One Wroking In The Market	-0.4417	-0.0189	0.1334	0.7774	0.9876
United States	Single Individuals	-1.3059	-0.0050	0.0097	-0.9382	0.9936
	Married Individuals	-0.3920	-0.0052	0.8944	-0.8263	0.9899

Social Security Contribution The social security contribution is estimated from the publication ?). Based on this information, I estimated the social security contribution for employees in each country using the following functional form:

$$t(\text{income}) = a_0 + a_1 \left(\frac{\text{income}}{AI} \right) - a_2 \left(\frac{\text{income}}{AI} \right)^{1-\phi}$$

where AI is the average income for each country and income is the worker income. Table 7 presents all the parameters estimated for each country along its R^2 values.

Table 7: Social Security Contribution

Country	a_0	a_1	a_2	ϕ	R^2
France	0.1415	-0.0079	0.000	-4.2163	0.9813
Germany	0.2571	18.8405	-18.9045	0.0009	0.9736
Italy	0.1019	0.0000	0.0000	0.8322	0.9937
Netherlands	-0.2968	-21.1289	21.6571	0.0232	0.9826
	-0.2194	-22.6890	22.6433	0.0005	0.9530
Norway	0.0000	0.0780	0.0000	0.0000	0.9999
United Kingdom	-0.0402	0.0027	0.1904	1.7313	0.9951
United States	0.0332	0.1027	-0.0054	1.2323	0.9912

In order to match the Social Security in Netherland two social security functions are estimated. The first one for income less than 44506 euros, and the second one for income greater than 44506 euros.

5 The Benchmark Economy

The model is calibrated to match the United States time allocation patterns in 2003. Given the American demographic and wage distribution, five parameters $\sigma, \zeta, \psi, \theta$ and α are calibrated to match average market work hours and home production hours for males and females. Last the fraction of married agents, in which both spouses are in the labor force is also target. Table 8 summarizes all parameters targeted in the model.

The parameter σ is equal 0.63, which generates a frish elasticity for males equal to 0.46 in the range of recent estimation of Domeij and Floden (2006). The elasticity of substitution between the leisure of husband and the leisure of wife ζ is equal to -0.41 , which indicates that they are complements. This result is consistent with the evidence from ?), which shows that married households over time and across countries tend to spend the same amount of time on all-work hours (sum of market hours and home production hours). The parameter θ is equal to 0.50 and indicates that women and men have the same productivity at home. Last the parameter χ is equal to 0.40, which indicates that husband and wife time at home are substitutes.

Table 8: Parameter Values

Category	Parameter Values	Source
Preferences	$\alpha = 0.41, \zeta = -0.14$	Calibrated
	$\sigma = 0.63$	Calibrated
Home Production	$\eta = 0.45$	Prior Information
	$\psi = 0.37, \chi = 0.40$	Calibrated

In this section I analyzed the performance of the calibrated model. Table 9 summarizes the performance of the model and the statistics targeted. The objective of the exercise is to quantify how much of differences in income taxation and social security contribution can explain differences in hours worked between the United States and the selected European Countries. In order to be able to quantify the impact of taxes on not only, male labor supply, but also on female labor supply, both hours worked of males and females are targeted; the model performs quite well in these dimensions. Also to have a more precise response of the impact of taxes on female labor supply, hours spend on home production are targeted for both males and females. The model also perform quite well in this dimension, only overestimating the amount of hours spend on home production by men.

Table 9: Benchmark Calibration Results

	Data	Model
Average Hours Worked Females	24.20	25.35
Average Hours Worked Males	36.03	36.45
Average Home Production Females	27.30	26.51
Average Home Production Males	16.58	18.10
Proportion of Two-Earner Married Agents	0.62	0.63

The last moment which is the fraction of two-earner households is also important, because as mentioned before countries not only differ in the level of progressivity, but on the unit of taxation. Consequently a change in the unit of taxation from the family to the individual results in one-earner families no longer receiving tax benefits and two-earner families no longer paying a tax penalties. By targeting the fraction of two-earner households, the model correctly predicted the impact of changes in income taxation in these two types of families.

6 Cross Country Comparison

In this section, I perform the main exercise of the paper, I replace the income tax and the social security contribution of the United States for the income tax and social security contribution of each selected European country; and then I quantify how much differences in income tax and social security contribution can explain differences in hours worked and home production between these European countries and the United States.

6.1 Females

The success of differences in income tax and social security contribution in explaining differences in hours worked varies across countries. Differences in labor income tax explains almost all the difference in females hours worked in Germany, but they don't explain any of the difference in female hours worked in the United Kingdom. This last result is not so surprising, since both the United States and the United Kingdom have the least progressive tax schedule; In addition, the unit the taxation in the United Kingdom is the individual, differently from the United States, which is the family. When the unit of taxation is the individual, secondary-earners face on average a lower marginal income tax, which explains why females work more when they face the British labor income tax. Table 10 summarizes the main finding for females hours worked.

Table 10: Females Hours Worked Data and Model

Country	Data	Model	Percentage Explained
France	18.28	19.01	0.92
Germany	16.25	16.30	0.99
Italy	15.40	17.13	0.85
Netherland	17.40	13.40	0.62
Norway	20.04	24.10	0.35
United Kingdom	19.08	27.16	-0.15

France, Germany and the United States have a progressive income tax and the family as the unit of taxation. A tax system with these two characteristics is not *marriage neutral*, meaning that changes in marital status affect individuals federal income tax obligation. In particular, primary earners face a lower marginal income tax rate after marriage, while secondary earners face a higher marginal income tax. Since both Germany and France have a more progressive tax schedule than the United States, the increase in the marginal income tax is even higher in these two countries. Consequently,

females work fewer hours in Germany and France. In addition, since the German income tax schedule is more progressive than the French, female hours worked are even lower in Germany. For France, differences in labor income tax explain 96 percent of the difference in females hours worked, while for Germany they explain 99 percent. In both cases differences in labor income tax explain almost all the difference in hours worked between females.

Another important statistics generated by the model is the difference in female labor force participation. Differences in income tax and social security contribution can also explain differences in female labor force participation in these countries. From the OECD data⁴ female labor force participation in France is around 72 percent, and in the model it is around 74 per cent. For Germany female labor force participation is around 70 per cent, and the model predicted a female labor force participation of 68 percent.

Italy, Netherlands, Norway and the United Kingdom have also a progressive income tax system, however the unit of taxation in these countries is the individual, not the family as in the United States, Germany, and France. Consequently, the second-earner marginal income tax does not depend on the first-earner earnings, this has a positive impact on married females hours worked. However, although the unit of taxation is the individual in these countries, in Italy, Netherlands, and United Kingdom generous tax benefits are given to families with one-earner, which reduces married women incentive' to participate in the labor force. As a result from all European countries Netherland, which is the only country that do not offer tax-benefits to one-earner families, has the highest labor force participation.

With respect to hours worked, differences in income tax and social security contribution explain 35 percent of the differences in female labor supply in Norway, 85 percent in Italy, and 62 percent in Netherland. However, for the United Kingdom the model generates female hours worked very similar to Americans, which is not consistent with the data; on average an American women works 6 hours more than a British women per week. The income tax and social contribution in both countries are quite similar, however the main difference is in the unit of taxation, which in the United Kingdom is the individual, and in the United States is the family. Consequently on average a secondary earner face a lower marginal income tax in the United Kingdom than in the United States tax. As a result, in the model British women work more than Americans.

6.2 Males

For males differences in income tax and social security contribution do not explain so well differences in hours worked. For three countries, Italy, Netherlands, and the

⁴OECD sample restricted of females aged 20-65.

United Kingdom, the model predicts hours worked lower than they actually are. This generates a bigger difference in hours worked in the model than in the data. One possible explanation is that the actual hours worked on the data from the MTUS are actually overestimated. It is a well-known fact that for some countries the MTUS data underestimates holidays, sick days, and vacations, which is an important source of the difference in hours worked between United States and Europe. In this case, the actual hours worked for males is lower than the one presented in the table 11, and consequently the model is being consistent with the "actual" data. Table 11 summarizes the main finding for males hours worked.

Table 11: Males

Country	Data	Model	Percentage Explained
France	30.52	31.17	0.75
Germany	29.05	29.10	0.99
Italy	33.55	31.30	1.77
Netherland	33.09	32.14	0.80
Norway	32.58	33.18	0.84
United Kingdom	32.42	36.44	-0.10

As it was mentioned before, France, Germany and the United States have the family as the unit of taxation and a progressive tax system. Like females, because the German income tax is more progressive than the French, on average a German man works less hours than a French man. Differences in income tax and social security contribution explain 75 per cent of differences in hours worked between Americans and French, and it explains 99 percent of the differences between Americans and Germans.

For the group of countries in which the unit of taxation is the individual, so the head of the household does not receive a tax benefit from filling jointly, in one case, Italy the model actually generated less hours worked than the ones observed in the MTUS data, which caused the percentage explained to be greater than one. It also important to observe that these two countries generate a larger difference in hours worked for women between the model and the data. This feature indicates that the model predicted a more "equal" division of market work between spouses than the one observed in the data.

For Norway, differences in income tax and social security contribution explain 84 percent of differences in hours worked between an American man and a Norwegian man. In the case of the United Kingdom, like British women, the model predicts on average more hours worked than the data, moreover, it predicts that on average a British man works more hours than a American man, which is not consistent with the data

7 Conclusion

In this paper, I quantify the impact of differences in income taxation and social security contribution across countries on household labor supply. The main contribution of this paper is to study the impact of labor income taxes on female labor supply, considering not only differences in the progressivity of the tax schedule, but also differences in the treatment of families. More precisely, this paper consider differences in the unit of taxation and how they impact female labor supply. The main finding is that differences in labor income taxation are much more important in explaining differences in hours worked for women than it is for men. Overall labor income tax is able to explain two thirds of differences in female hours worked between the United States and the selected European countries and it is able to explain on quarter of differences in male hours worked.

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