Marriage Stability, Taxation and Aggregate Labor Supply in the US vs. Europe*

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Abstract

Aggregate labor supply is higher in America than in Europe, and there is also substantial variation within Europe. Using micro data from the US and eight European countries, we document that the difference between the US and Europe is mainly driven by the labor supply of women. European women work less than American women, whether it is single women, married women, or women with and without children. Using a larger number of countries, we also document that there is a strong correlation between divorce rates and female employment rates across countries and across time. A recent literature, including Prescott (2004), and Rogerson (2005), argues that differences in labor supply between the US and Europe can largely be explained by differences in tax rates. We use tax data from the OECD to develop tax schedules for a sample of 17 countries. The empirical correlation between hours worked and different measures of tax levels and progressivity is negative, however, weak. Motivated by these observations, we develop a life-cycle model with heterogeneous agents, marriage, and divorce and use it to study the impact of two mechanisms: 1) differences in marriage stability and 2) differences in tax systems on labor supply. There are three types of households; single males, single females and married households. Divorces and marriages occur stochastically. The main channel through which individual divorce and singlehood rates impact labor supply is by reducing the implicit insurance of marriage, and thereby providing incentives for individuals to invest in experience. We calibrate our model to US data and study how labor supply in the US changes as we introduce European tax systems, and as we replace the US divorce and marriage rates with their European equivalents. We find that the divorce and tax mechanisms combined on average explains 28% of the difference between the US and 11 European countries. This finding is sensitive to the use of tax revenues.

1 Introduction

It is a well-known empirical finding that aggregate labor supply is higher in the United States than in Europe and that there is also substantial variation among European countries, see for instance Prescott (2004) and Rogerson (2006). Rogerson (2006) notes that these differences are an order of magnitude larger than the fluctuations at business cycle frequencies in post-WWII US data, and thus deserve serious attention. Are the differences in hours worked due to public policies or are they due to other fundamental differences between societies?

In this paper, we start by using micro level data to document the contribution of various demographic groups to the aggregate differences between the US and 8 European countries. We find that among the demographic groups that we consider, the largest contribution comes from women – in most European countries, women work substantially less than in the United States, while the difference in hours worked between European and American men is smaller, and in some cases practically non-existent. This is especially true for married women, but also holds for single women, and for women with and without children. We also document a negative cross-country correlation between tax level and labor supply, and a positive correlation between divorce rates and labor supply across countries and across time. Divorce rates are, however, in particular correlated with female labor supply. Motivated by these observations, we consider the following two potential driving forces for cross-country differences in labor supply: 1) cross-country differences in taxation; 2) cross-country differences in marriage stability.

To quantitatively assess the impact of taxes and marriage stability on labor supply we develop a life-cycle, overlapping-generations model with heterogeneous agents, marriage, and divorce. There are three types of households; single males, single females and married households. Divorces and marriages occur stochastically. The main channel through which individual divorce and singlehood rates impact labor supply is by reducing the implicit insurance of marriage, and thereby providing incentives for individuals to invest in experience accumulation. We calibrate our model to US data and study how labor supply in the US changes as we introduce divorce and marriage probabilities and tax systems from other countries. We find that the effect of making marriages more stable is a reduction in labor supply. This effect is particularly strong for female labor supply, because the woman is usually the lower earner in a married couple. Changing the US probabilities of marriage and divorce to their European equivalents accounts on average for 22% of the difference in hours worked between the US and 11 European countries. When we introduce European taxes and redistribute the increase in taxes evenly to all households, we can account for 19% of the difference in hours worked between the US and the average of the European countries. If the increased tax revenues from European taxation is not redistributed the average effect is an increase in labor supply. When using both the divorce and marriage probabilities and tax systems from the European countries, the model can on average account for 28% of the difference in hour worked between the US and Europe.

Cross-Country Differences in Labor Supply: Possible Explanations and Previous Literature

The economic literature has proposed several potential explanations for the observed cross-country differences in aggregate labor supply. Taxes have been suggested as a major contributor to the differences in labor supply by Prescott (2004) and Rogerson (2006), who used an infinite horizon, representative agent model to evaluate the impact of differences in average tax rates. We extend this argument, and use a life-cycle model with heterogeneous agents, who accumulate labor market experience, and reside in one- and two person households. This allows us to capture several dimensions of tax systems that cannot be captured in a representative agent model. We fit nonlinear income tax schedules that can capture the impact of both tax levels and tax progressivity on aggregate labor supply, as well as one the labor supply of various demographic groups. We are also able to capture the impact of joint versus separate taxation of married couples. As pointed out by Guner, Kaygusuz, and Ventura (2008), separate taxation of married couples leads to a lower marginal tax rate on the secondary earner in a couple, and therefore encourages female labor supply. In Section 7, we find this to be an important effect in our model.

To the best of our knowledge, the role of differences in marriage stability in accounting for cross-country differences in labor supply has not been analyzed in the literature. Yet, our finding in Section 2 below that the biggest contribution to the cross-cross country differences in average hours worked comes from women, and in particular from prime-aged married women, suggests that one may need to pay attention to the cross-country differences in family dynamics. There is ample anecdotal evidence that compared to the US, marriages are more stable in Europe, especially in "catholic" European countries such as Italy, Spain, Ireland, and Greece where divorces have traditionally carried more social stigma with them. Our hypothesis is that more stable marriages provide implicit income and consumption insurance to the spouse who is not the main income earner in the family (the role that for various reasons is traditionally played by the wife), thus giving her/him less incentive to accumulate market experience.

One may argue that divorce and marriage decisions are also affected by economic conditions and that therefore we should make them endogenous choices. However, then we would need a systematic cross-country pattern in economic conditions that could account for both the pattern in divorce rates and in labor supply at the same time. This type of condition could be for instance cross-country differences in the gender wage gap, in the female return to labor market experience, or in the cost of having children. These explanations have been proposed in the literature trying to explain changes in female labor supply over time, see for instance Olivetti (2006) and Attanasio, Low, and Sanchez-Marcos (2008). However, we have not been able to document a cross-country pattern in the gender wage gap or in the female return to labor market experience that would help us explain the observed patterns in aggregate labor supply and divorce rates. In Section 2, we argue that children are unlikely to be an important explanation, as the cross country differences in labor supply is not more pronounced for women with children. We therefore choose to study the economic implications of exogenous differences in marriage and divorce rates caused by "cultural" and/or legal factors. Crouch and Beaulieu (2006) documents a correlation between different types of divorce laws and divorce rates in the US and 22 European countries. Generally divorce laws are stricter in Europe. For instance, they require a longer waiting period before a divorce can be obtained. Johnson and Skinner (1986) provides empirical support to our theory about the impact of exogenous changes in the probability of divorces on female labor supply. They estimate a simultaneous model of future divorce probability and current labor supply using US data, and conclude that their results support the hypothesis that higher divorce probabilities increase labor supply, while the reverse effect appears insignificant. Stevenson (2008) documents that the US states who adopted unilateral divorce in the 1970s experienced a spike in female labor supply compared to states who did not.

One pronounced difference between the US labor market and those in many European countries is the more rigid regulations and laws in Europe, often referred to in the literature as labor market frictions. These are possible contributors to the higher observed unemployment rates and lower labor force participation rates in Europe. Unions are also much more common in Europe. Alesina, Glaeser, and Sacerdote (2005) argues that regulations and unionization are more like explanations than taxes. We believe that they could also be contributing factors and that we should not hope for taxes and divorce rates to explain all of the cross country variation in labor supply. Out of all the above proposed explanations, however, differences in divorce rates stand out as a promising candidate for explaining why cross country differences is mainly driven by female labor supply.

The remainder of the paper is organized as follows: In Section 2, we study the contributions of different demographic groups to aggregate differences in labor supply between the US and 8 European countries. In section 3, we document a correlation between aggregate labor supply and taxation across countries and a correlation between aggregate labor supply and divorce rates across time and place. Section IV studies the impact of divorce rates on labor supply in a simple model. Section 5 develops the quantitative model. Section 6 discusses data and calibration. In Section 7, we study the quantitative implications from changing the US divorce and marriage probabilities to their European counterparts and from introducing European tax schemes in the US. Section 8 concludes.

2 Which Demographics Groups Contribute to Differences in Aggregate Labor Supply: US vs. Europe

In this section, we use data from the Luxembourg Income Study (LIS) and the OECD Employment Database to analyze the contribution of various demographic groups to cross-country differences in aggregate labor supply. We find that women is the biggest contributor to the cross-country differences in labor supply. American women work more than European women, whether it is single women, married women, women with and without children. The contribution of women is the largest in Spain, Italy, Greece and Ireland – the countries where, as we document in the next section, marriages tend to be more stable.

Next, we analyze the importance of the intensive and extensive margins in accounting for the cross-country differences in labor supply, and find that they are both important. However, the extensive margin is particularly important for Spain, Italy, Greece and Ireland (coincidentally, these are the countries where the contribution of women is also particularly large), while the intensive margin is particularly important in Germany and Netherlands.

Data Description

The LIS database that we use contains micro-level data from the United States and a large number of European countries. The advantage of using this database is that the LIS team harmonizes and standardizes the micro data from the different countries' surveys in order to facilitate comparative research.

The LIS database provides information about individual hours worked per week and weeks worked per year[1]. We construct annual hours worked as the product of these two variables. To make our data comparable to the OECD aggregate-level estimates used by Rogerson (2006) and Prescott (2004), we include in our sample all individuals between 15 and 64 years of age. We make two adjustments to the LIS data. First, for several European countries the LIS database does not provide information about the labor market outcomes for 15 and/or 16 year-olds[2]. In these instances, we replace the missing values with the appropriate group averages from the US sample.

Table 1 reports the average annual hours worked by individuals who are from 15 to 64 years old in the US and a number of European countries, computed using OECD data for year 2000. For several European countries the average annual hours worked computed from the LIS data differ substantially from those reported by the OECD. Further research is needed to fully understand what causes this discrepancy.

[1] Variables *phoursu* and *pweektl*.

[2] For instance, German data does not have labor market information for both 15 and 16 year-olds, while for Spain and Ireland, this information is missing only for 15 year-olds

Table 1: Annual Hours Worked, all Persons 15-64 Years of Age, OECD 2000

Country	Annual Hours	% of the US
US	1360.69	100.0
Germany	965.91	70.99
Italy	1002.85	73.70
Spain	993.40	73.01
Ireland	1117.82	82.15
Austria	1132.39	83.22
Belgium	941.14	69.17
Netherlands	1117.82	72.76
Greece	1184.56	87.06

One likely explanation is that the LIS data does not capture the differences between the countries in the number of holidays and paid vacations[3].

Since most of the previous research on cross-country differences in labor supply has relied on OECD data, we use data from the OECD to determine the average country-level annual hours worked, and use the LIS data mainly to compute the contributions of various demographic groups to the cross-country differences. To account for the discrepancy between the OECD and LIS data, we uniformly scale all individual observations in each country in the LIS data so that the aggregate country-level averages that we obtain from the LIS data are equal to those reported by the OECD. Such adjustment makes the contributions of various demographic groups to the cross-country differences in aggregate-level average hours worked more uniform (in other words, we obtain a conservative estimate of the contribution of women to the cross-country differences, since this adjustment makes the contribution of separate demographic groups less pronounced)[4].

Table 2 shows the average annual hours worked for men and women separately,

[3] A vast majority of individuals in all countries in the LIS data report either 0 or 52 weeks worked per year. At the same time, Jorgensen (2002) documents that individuals in most European countries on average enjoy several more weeks of holidays compared to Americans.

[4] Our current adjustment is appropriate, for example, if the duration of vocations and holidays for each individual is a certain percent of his/her workdays. If, on the other hand, one assumes that the duration of vocations is the same for each individual, the differences in the contribution of various demographic groups would become more emphasized.

Table 2: Annual Hours Worked, Men and Women, 15-64 yrs. old, LIS 2000

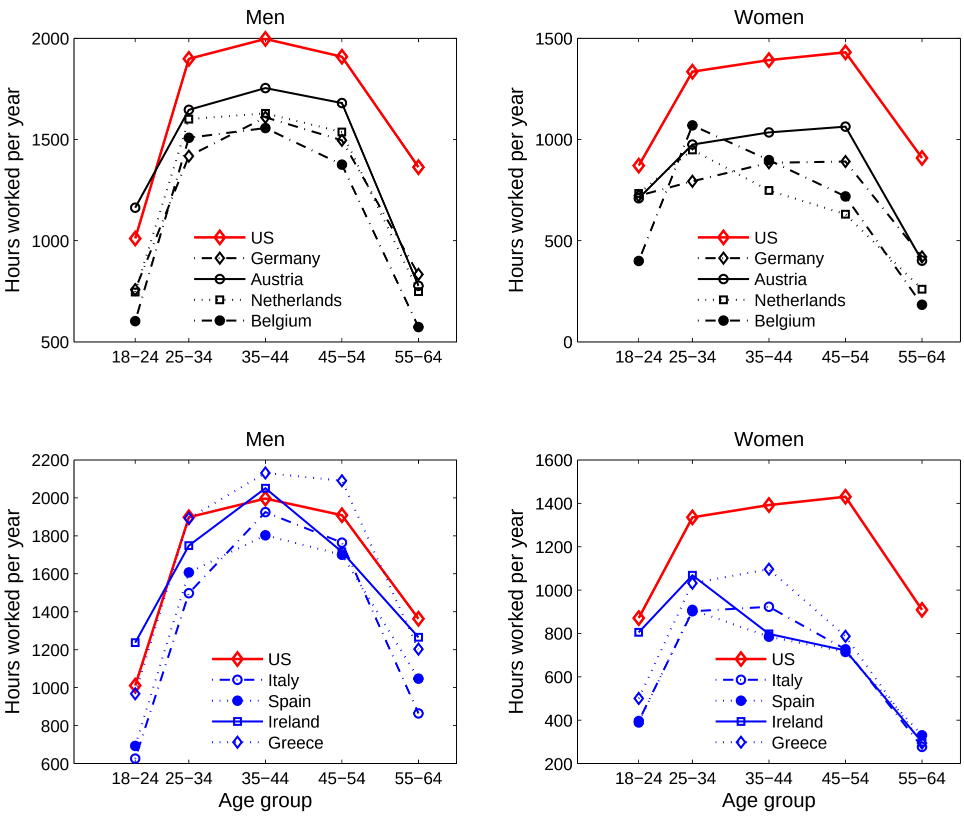
Country	Men		Women	
	Annual Hours	% of US	Annual Hours	% of US
US	1596.82	100.0	1164.64	100.0
Germany	1225.33	76.7	716.87	61.6
Italy	1351.31	84.6	658.78	56.6
Spain	1355.47	84.9	633.17	54.4
Ireland	1517.71	95.0	718.02	61.7
Austria	1425.27	89.3	844.41	72.5
Belgium	1192.77	74.7	711.24	61.1
Netherlands	1319.30	82.6	675.91	58.0
Greece	1671.21	104.7	738.49	63.4

computed using the LIS 2000 data (adjusted as explained above). The table shows that the difference between the hours worked by European women and American women is larger than the corresponding difference for men, both in percentage and in absolute terms. This difference between genders is more pronounced in Italy, Spain, Ireland and Greece, and less pronounced in Germany, Belgium and Austria.

Table 14 in the appendix shows the average annual hours worked of individuals in 3 different age groups: 1) "young" (15-20 year-olds), 2) "prime-aged" (21-55 year-olds) and 3) "old" (56-64 year-olds). There is substantial heterogeneity in hours worked by the "young" across the countries in our data (part of this could reflect poorer quality of the data for this age group). The hours worked by the "prime-aged" and "old" individuals in Europe are uniformly lower compared to the US.

Figure 1 plots the age profiles, using more detailed data (5-year age groups), separately for men and women for the US and European countries. This figure illustrates that there is a larger difference in hours worked between the US and Europe for women than for men. It also suggests that while the age profiles for men appear to have similar shapre in the US and Europe (with hours worked peaking in the middle age group, 35-44 year-olds), in most European countries (with the exception of Germany and Austria) the age profiles for women look markedly different, with hours worked peaking earlier than in the US.

Figure 1: Average Hours Worked by Gender and Age Group



Averages are adjusted so that the total average across all subgroups is equal to the one reported by the OECD.

Table 3 compares the average annual hours worked by marital status and gender. It shows that in percentage terms married women in Europe display a bigger difference (work less) relative to their American counterparts than do single women. For men, the pattern is much less clear.

Given that we find that the difference in hours worked between the US and Europe is larger for women than for men, it is natural to ask whether this is related to women reducing their labor supply as a result of having children. Figure 13 in the appendix shows that in most of the countries where women worked the least compared to the US (Italy, Spain and Greece, but not in Ireland), women in fact tended to have fewer children than in the US.

Table 16 shows the hours worked by men and women split into three groups: 1) "child 3", which includes the individuals who have a child under 3 years of age, 2) "child 6", which includes the individuals who have a child under 6 years of age, 3) "no child", which includes individuals with no small children. According to the table, it is only in Germany and Austria that mothers with small children reduce their labor supply further compared to the US. In the countries where women worked the least (Italy, Spain, Greece and Ireland), the percentage difference with the US in hours worked for mothers with small children is smaller than for women without small children.

These two observations: 1) that fertility in the US is relatively high; 2) women with small children in Europe do not reduce their labor supply relative to their American counterparts, suggest that having small children is not a major reason for the difference in women's labor supply between the US and Europe.

Group Contribution Decomposition

To analyze the contribution of various demographic groups to the difference between aggregate labor supply in the US and the European countries in our sample, we perform the following decomposition. Suppose we divide each country's sample into

Table 3: Annual Hours Worked, by Gender and Marital Status, LIS 2000

Country	Men				Women			
	Married		Single		Married		Single	
	Annual Hours	% of US	Annual Hours	% of US	Annual Hours	% of US	Annual Hours	% of US
US	1965.87	100.0	1183.67	100.0	1207.27	100.0	1114.78	100.0
Germany	1398.72	71.2	1022.14	86.4	631.36	52.3	826.44	74.1
Italy	1620.99	82.5	982.29	83.0	651.98	54.0	669.62	60.1
Spain	1675.59	85.2	945.39	79.9	616.55	51.1	656.87	58.9
Ireland	1916.06	97.5	1107.74	93.6	692.64	57.4	747.04	67.0
Austria	1508.93	76.8	1324.17	111.9	807.33	66.9	891.72	80.0
Belgium	1328.43	67.6	971.42	82.1	713.24	59.1	708.17	63.5
Netherlands	1461.07	74.3	1134.34	95.8	553.21	45.8	856.81	76.9
Greece	1896.69	96.5	1276.75	107.9	748.15	62.0	719.60	64.6

n different groups. Then the difference between the aggregate average annual hours worked in the US, H^{us}, and in country j, H^j, can be written as:

$$\begin{aligned} H^{us} - H^j &= \sum_{i=1}^{n} \omega_i^{us} h_i^{us} - \sum_{i=1}^{n} \omega_i^j h_i^j \\ &= \underbrace{\sum_{i=1}^{n} (h_i^{us} - h_i^j)\omega_i^{us}}_{\text{behavioral effect}} + \underbrace{\sum_{i=1}^{n} (\omega_i^{us} - \omega_i^j) h_i^j}_{\text{composition effect}} \end{aligned} \tag{1}$$

where ω_i^j is the share of observations that come from group i in country j's sample, while h_i^j is the average annual hours worked by individuals in this group.

We divide the data into 12 demographic groups, according to gender, marital status and age (using 3 age groups). We are interested in analyzing the first summand in the expression above, which we call the behavioral effect, after removing the sample composition effect (which amounts to looking at a hypothetical case where the composition of the samples in different countries would be identical). Tables 20 and 21 in the appendix show the sample compositions in all our countries. It is worth noting that the total contribution of the compositional effects is quite small – in most cases, it is smaller than 5% of the total difference in average hours, except for Belgium (-8.717%), Greece (-7.176%) and Netherlands (-6.174%). Tables 17 and 18 show the contribution of different demographic groups to the aggregate difference in hours worked, weighted by the size of the appropriate group in the US sample,

$\frac{h_i^{us}-h_i^j}{H^{us}-H^j}\omega_i^{us}$.

These tables show that women in general contribute more to the differences in labor supply than men. We find that in all countries, the contribution of women is larger than 50%. This difference between the contribution of the two genders is especially large in the four "catholic" countries – Spain, Italy, Ireland and Greece, where it ranges from 66% in Italy to 101% in Greece. In all countries except Belgium, married prime-aged women are the biggest contributing group. In Spain, Italy, Ireland and Greece single prime-aged women are the second-largest contributing group.

Intensive vs. Extensive Margin

Table 2 shows the contribution of intensive and extensive margins to the overall cross-country differences in labor supply, using the following decomposition formula:

$$\begin{aligned} H^{US} - H^i &= H^{US}_{\text{empl}} \cdot \text{Share}^{US}_{\text{empl}} - H^i_{\text{empl}} \cdot \text{Share}^i_{\text{empl}} \\ &= \underbrace{\left(H^{US}_{\text{empl}} - H^i_{\text{empl}}\right) \text{Share}^{US}_{\text{empl}}}_{\text{Intensive Margin}} + \underbrace{\left(\text{Share}^{US}_{\text{empl}} - \text{Share}^i_{\text{empl}}\right) H^i_{\text{empl}}}_{\text{Extensive Margin}} \end{aligned} \quad (2)$$

From the OECD data, one can compute the total average hours worked in country i, H^i, as the product of the hours worked by employed persons, H^i_{empl}, and the share of the population which is employed, $\text{Share}^i_{\text{empl}}$. Table 2 reports the contributions of intensive and extensive margins as a percentage of the total difference in hours worked between the US and country i, $H^{US} - H^i$. As can be seen from the table, both margins appear to be important. The contribution of the extensive margin is particularly large in Greece, Italy, Spain and Ireland. The intensive margin is more important in the Netherlands and Germany.

Table 4: Contribution of Intensive and Extensive Margins to Cross-Country Differences in Labor Supply

Country	Intensive Margin, %	Extensive Margin, %
Germany	68.21	31.79
Italy	-5.16	105.16
Spain	21.34	78.66
Ireland	35.82	64.18
Austria	57.87	42.13
Belgium	51.46	48.54
Netherlands	92.44	7.56
Greece	-119.62	219.62

3 Possible Determinants of Labor Supply: Taxes and Marriage Stability

In this section, we analyze the empirical relationship between hours worked in the US and Europe, and the following two candidate explanations for cross-country differences in labor supply: 1) differences in taxes; 2) differences in marriage stability. Taxes have been suggested as a major contributor to cross country differences in labor supply in the literature (see Prescott (2004) and Rogerson (2006)). Marriage stability is a new explanation in this context, motivated by our finding in section 2 that women are the biggest contributor to the cross-country differences in labor supply. Our hypothesis is that more stable marriages provide consumption insurance, thereby reducing the incentives to accumulate labor market experience, in particularly for women (who usually are secondary earners). Conversely, a higher probability of divorce can increase the value of market experience for the woman who has a higher probability of ending up as a single earner.

We first compare and discuss some features of the tax systems in the US and Europe with particular focus on the 9 countries in Table 1: the US, Germany, Italy, Spain, Ireland, Austria, Belgium, the Netherlands, and Greece. We then study the correlation between labor supply and various measures of tax levels, tax progressivity, and marriage stability in a larger sample of countries. We find that there is positive correlation between taxes and aggregate labor supply, and negative correlation between marriage stability and aggregate labor supply, but in both cases, the correlation is not very strong. In addition, when we regress average annual hours worked in each country on different measures of taxation and marriage stability separately, the regression coefficients have the expected sign, but are only marginally statistically significant (at 10% significance level), and the R^2 of the regressions are very low.

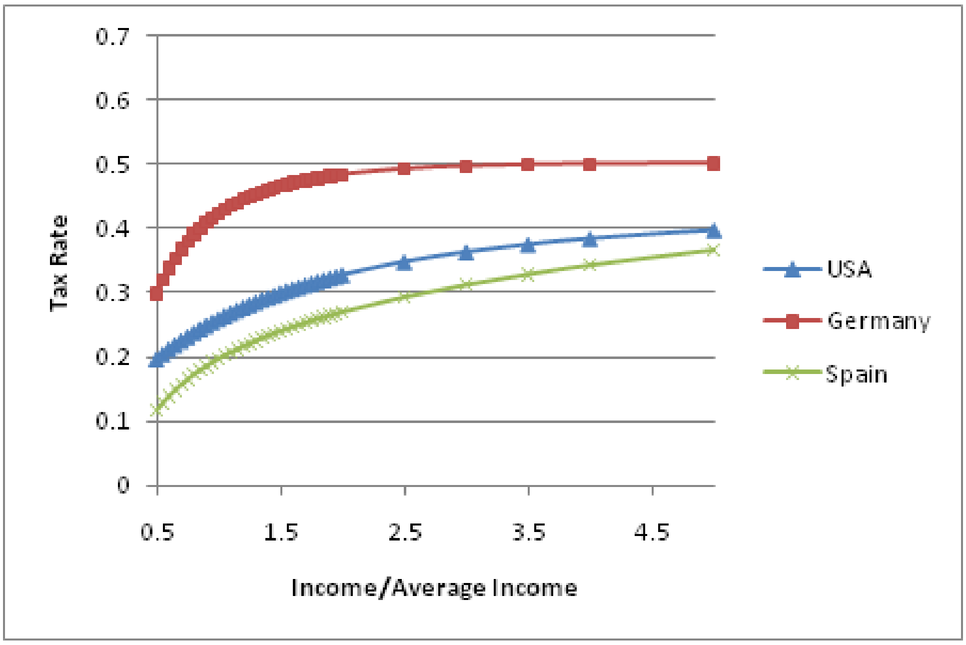
However, when we combine a measure of tax levels and divorce rates in the same regression, both regression coefficients become highly statistically significant, and the adjusted R^2 increases considerably (to 49.4%). We conjecture that the importance of these two mechanisms is different for different groups of countries within Europe. Finally, we document strong correlation between female employment rates and divorce rates[5]. These observations motivate us to more carefully study the impact of taxes and marriage stability on labor supply in a structural model.

Labor Income Taxes in the US and Europe

There are many issues to consider when comparing labor income taxes across countries. (i) Firstly, both the levels and progressivity of taxes may be of interest, when studying the impact of taxation on labor supply. (ii) Secondly, taxes differ with respect to marital status. In the US, Germany, Spain, and Ireland married couples are taxed jointly, while in Italy, Austria, Belgium, the Netherlands, and Greece they are taxed separately. In the whole OECD there are 19 countries practicing separate taxation of married couples and 11 countries practicing joint taxation. There may also be slightly different schemes for married households with 1 and 2 earners. (iii) Finally, taxes vary with the number of children in the household. In this section, we

[5]Unfortunately, we are restricted to using the employment rates when we look at the labor supply by gender, since the OECD does not provide information for hours worked separately for men and women.

Figure 2: Country Labor Income Tax Functions (singles)



will focus on the taxes paid by single households without children[6].

For each country in Table 19, we fit a polynomial tax function, based on tax data from the OECD[7]: Among our countries, labor income taxes are the lowest in Spain and Greece, moderate to low in the US, and highest in Germany and Belgium. In figure 2 we plot fitted labor income tax schedules for single individuals in Spain, the US, and Germany.

Columns 1 and 2 of Table 19 display the top marginal tax rates and the income level where they become effective for single households in the US and many Western European countries. There are not always large differences in the maximum tax rates but the income level where they become effective also vary greatly. In Germany, for instance, the top tax rate becomes effective already at 1.5 times average earnings, while in the US the top marginal rate first becomes effective at 9 times average

[6]Essentially, we abstract in this section from points (ii) and (iii) above. We do it here because taxes paid by an average single household without children is the measure that is most easily comparable between the countries. In sections 5-7, we differentiate between the taxes paid by single and married households within the structural model of labor supply.

[7]See Appendix

earnings. Column 4 of Table 1 displays the labor income tax paid by singles with average earnings across countries.

A person making labor supply decisions will care about his marginal tax rate in addition to his tax level. It is possible that tax progressivity, and not only the level of taxes are important for the cross country pattern in labor supply. A commonly used measure for tax progressivity is so-called progressivity wedges, see for instance Guvenen, Kuruscu, and Ozkan (2009):

$$PW(y_1, y_2) = 1 - \frac{1 - \tau(y_2)}{1 - \tau(y_1)} \quad (3)$$

This measure says something about how fast the tax rate increases as earnings increase from y1 to y2. If there is a flat tax, then the progressivity wedge would be zero for all levels of y_1 and y_2. Figure 3 plots progressivity wedges for $y_1 = 0.5AE$ for the US, Germany, Spain, Denmark, and Switzerland. Among the 17 countries in Table 19, Denmark has the most progressive taxes and Switzerland the least progressive. The US is among the countries with the least progressive taxes, while Germany are among the countries with the most progressive taxes.

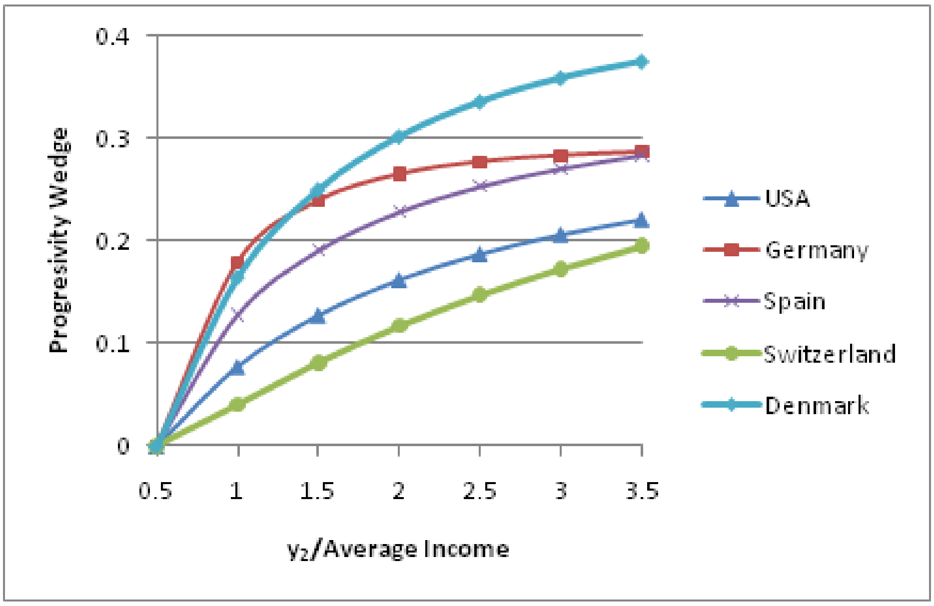
Consumption Taxes

Consumption taxes also have an impact on labor supply decisions. The second column of Table 2 reports these flat taxes in (2001). The consumption tax varies from 7.6% in Switzerland on the low end to 25% in Denmark and Sweden on the high end. Among our 9 countries, the US stands out with low consumption taxes.

Correlation Between Labor Supply and Taxes and Labor Supply and Divorce Rates

In Figure 4, we plot the correlation between labor supply and four tax-related measures. They are: the average labor income tax rate at average earnings, the average effective tax rate on labor income at average earnings, the top marginal tax rate, and the tax progressivity wedge at $y_1 = 0.5AE$, $y_2 = 2AE$. The effective tax rate on

Figure 3: Country Tax Functions (Singles)



labor income, τ, as defined in Prescott (2004) is:

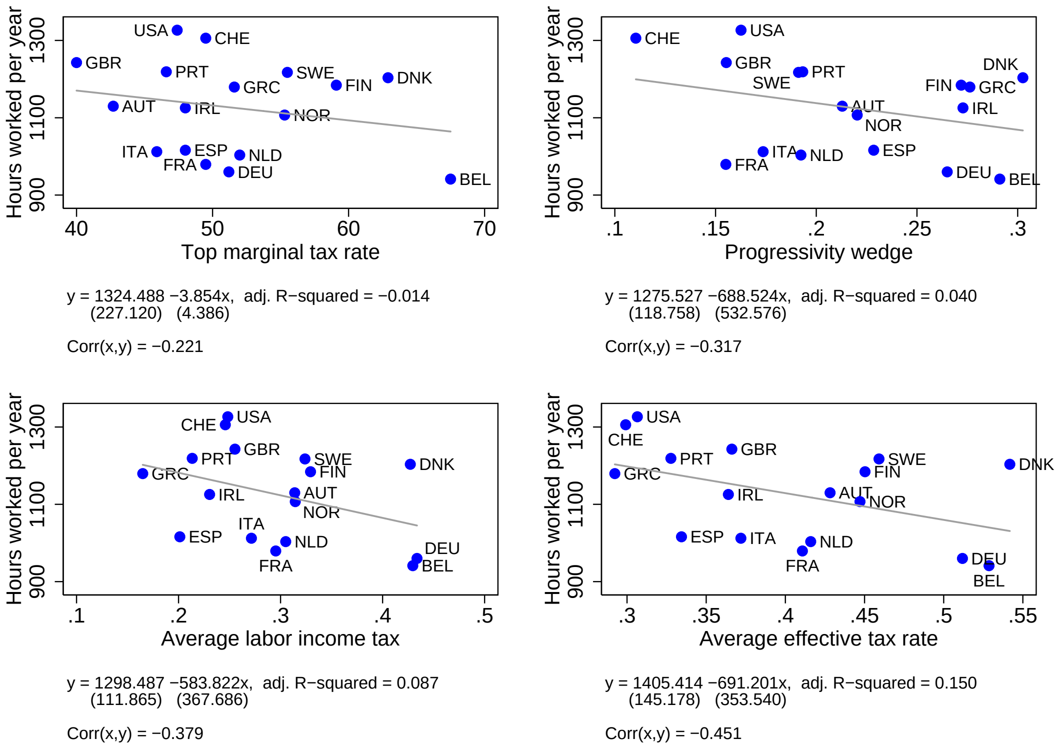
$$\tau = 1 - \frac{1 - \tau_l}{1 + \tau_c} \tag{4}$$

It is the fraction of labor income that is taken in the form of taxes, holding investment fixed. In other words a measure that combines labor income tax and consumption tax into a single tax rate.

As can be seen from Figure 4, there is generally a negative but weak correlation between different measures of taxes and aggregate hours worked. The strongest correlation, -0.45, is with the effective tax rate at average earnings. There is a negative relationship between labor supply and all our tax measures, but only the regression coefficient for the effective tax rate at average earnings is marginally statistically significant at the 10% level. In addition, the largest adjusted R^2 in the regressions is 15%, so taxes alone do not explain much of the cross- country variation in labor supply.

In figure 5, we plot the correlation between divorce rates and aggregate labor

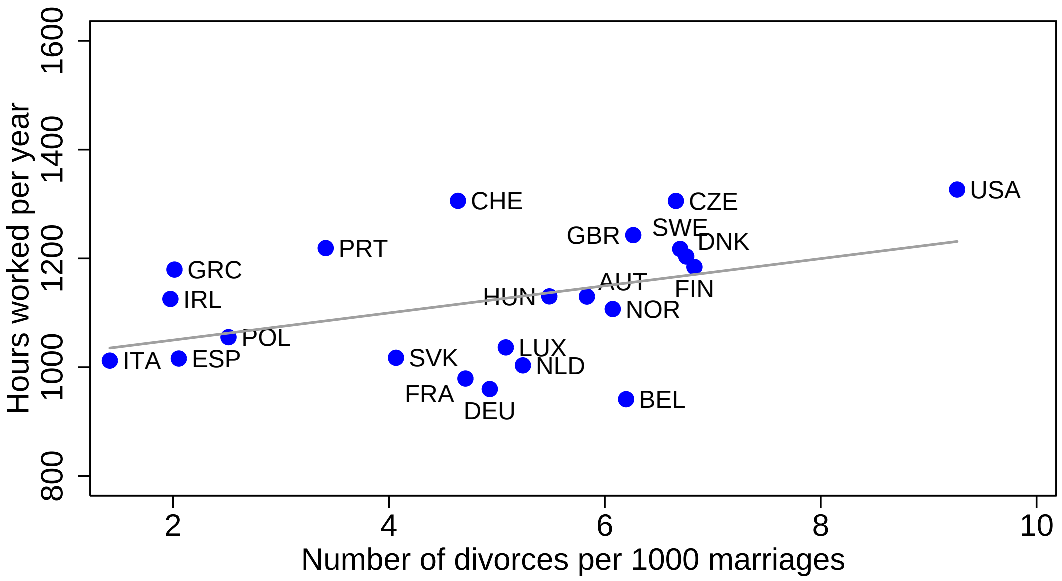
Figure 4: Relationship Between Annual Hours and Tax Measures by Country



supply. The data for divorce rates in European countries is constructed using Eurostat data, while for the US we use the National Vital Statistics data provided by the Centers for Decease Control and Prevention, and the US Census data. As can be seen from Figure 5, there is a positive relationship between average annual hours worked and divorce rates. The regression coefficient is almost statistically significant at the 5% level, and the adjusted R^2 is only 13.7%.

In Table 5 we present the results from a regression of labor supply on divorce rate and each of the different tax measures. In two cases (when using the average labor income tax and average effective tax rate), the coefficients for both the divorce rates and the tax measure that we use are statistically significant at any conventional significance level, and the adjusted R^2 improves substantially to 49.4%. Using both taxes and divorce rates together explains a significant share of the cross- country variation in labor supply.

Figure 5: Relationship Between Annual Hours and Divorce Rates by Country



y = 1000.018 + 24.950x, adj. R−squared = 0.137
(63.454) (11.991)

Corr(x,y) = 0.422

Guner, Kaygusuz, and Ventura (2008) argue that one of the features of the tax system that can be particularly important for the labor supply of the married couples is whether the labor income of the couple is taxed jointly or separately. Table 25 in the appendix reports the regression results when we add a dummy variable equal to 1 for countries in our sample that practice separate taxation. Table 25 shows that the coefficient for separate taxation in 3 out of 4 regressions reported in the table has the expected positive sign, but is not statistically significant.

Unfortunately, the OECD dataset does not provide data for hours worked separately for men and women, but it does provide data on employment rates by gender. Figure 6 shows the relationship between the divorce rates and employment ratios by country for men and women separately. It shows that for both men and women, this relationship is positive, but the magnitude of the coefficient is about three times as large for women as it is for men. In addition, the coefficient is statistically significant

Table 5: Regressing Average Hours Worked on Divorce rate and Tax Measures

	(I)	(II)	(III)	(IV)
Const	1321.283***	1166.408***	1258.655***	1383.385***
	(207.819)	(137.197)	(83.996)	(112.1656)
Divorce rate	27.101*	19.428	42.036***	36.733***
	(13.694)	(13.418)	(11.627)	(10.968)
Top marginal tax rate	−6.409	–	–	–
	(4.215)			
Progressivity wedge	–	−629.513	–	–
		(515.734)		
Average labor income tax	–	–	−1156.867***	–
			(316.286)	
Average effective tax rate	–	–	–	−1088.327***
				(297.347)
adjusted R^2	0.151	0.106	0.494	0.494

Standard errors are in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

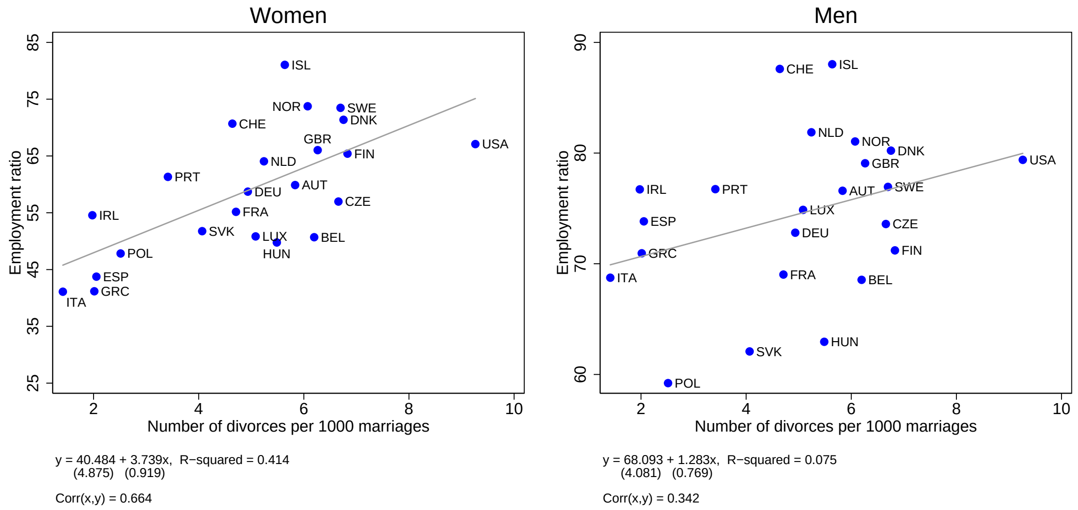
for women and not statistically significant for men.

Figures 14 and 15 in the appendix show the relationship between our tax measures and employment ratios for women and men respectively. None of the tax measures is statistically significant for either of the sexes, and in many cases the relationship appears to be negative. We conclude that our macro level data suggest that while both tax measures and divorce rates appear to be related to annual hours worked, taxes appear to impact mostly the intensive margin (hours worked for those who are employed), while divorce rates appear to be related to the extensive margin – the employment ratios (see figure 16), and this relationship appears much stronger for women.

Finally, Table 6 shows the panel regression results, when regressing employment ratios on divorce rates for men and women separately, using the data from 1990 to 2009 (one obtains a qualitatively similar results when starting at an earlier date)[8].

[8]Since the Eurostat data on the number of divorces that we use to construct the divorce rate measure spans different time periods for different countries, we have an unbalanced panel. The US data start in 2000. Also, the data here lacks observations for some European countries, such as Spain and Greece, altogether. In our previous cross-sectional plots for 2001, we used the Eurostat Census 2001 data on the number of married people for these countries, but this data is available only for one year, 2001.

Figure 6: Relationship Between Divorce Rates and Employment Ratios for Men and Women by Country



The panel regression results provide further support to our finding that divorce rates appear to affect mostly the labor supply of women.

Table 6: Relationship Between Employment Ratios and Divorce Rates, Panel Regression Results

Employment rate	Women	Men
Constant	51.809***	72.681***
	(2.795)	(2.076)
Divorce rates	1.685***	0.323
	(0.398)	(0.283)
Standard errors are in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$		

In this section, we have documented an empirical relationship between aggregate labor supply and taxes and aggregate labor supply and divorce rates. This motivates our study in the next three sections of the impact of taxes, divorce- and marriage probabilities on labor supply in a structural model.

4 Gaining Intuition: Labor Supply and Divorce in a Simple Two-Period Model

In this section, we outline the intuition for the effect of divorce rates on women's labor supply using a simplified two-period version of our model[9]. We describe our full model in the next section.

Consider a family that consists of a husband (a "man") and a wife (a "woman") who live for 2 periods. Suppose that both members of the family have 1 unit of time at their disposal in each period. For simplicity, assume here that the husband always works full-time, while the wife has to decide how much time to spend working in period 1 and in period 2. Assume that the husband's wage in period 1 is $w_{1,m}$, while the wife's wage in the first period is $w_{1,f}$. Suppose that their wages in the second period increase linearly with the amount of time they spend working in period 1, with parameters k_m and k_f controlling the "returns to experience" for the husband and the wife. Thus, the husband's wage in period 2 is $w_{1,m} + k_m$ (since the husband always works full-time), while the wife's wage in period 2 is $w_{1,f} + k_f h_{1,f}$. Assume that with probability π_d, the couple divorces before the second period starts. Suppose that they cannot save or borrow in period 1.

[9] The intuition concerning the effect of taxation is described very well in Rogerson (2007), Guner, Kaygusuz, and Ventura (2008) etc.

At the start of period 1, the couple jointly solves:

$$
\begin{aligned}
\max_{\substack{c_1,c_2,c^s_{2,m},c^s_{2,f},\\ h_{1,f},h_{2,f},h^s_{2,f}}} \quad & \alpha \log(c_1/e) + (1-\alpha)\log(1-h_{1,f}) \\
+ \quad & (1-\pi_d)\left(\alpha\log(c_2/e) + (1-\alpha)\log(1-h_{2,f})\right) \\
+ \quad & \pi_d\left(\alpha\log(c^s_{2,m}) + \alpha\log(c^s_{2,f}) + (1-\alpha)\log(1-h^s_{2,f})\right) \\
s.t.: \quad c_1 \; = \; & w_{1,m} + w_{1,f}h_{1,f} \\
c_2 \; = \; & w_{1,m} + k_m + (w_{1,f} + k_f h_{1,f})h_{2,f} \\
c^s_{2,m} \; = \; & w_{1,m} + k_m \\
c^s_{2,f} \; = \; & (w_{1,f} + k_f h_{1,f})h^s_{2,f}
\end{aligned} \tag{5}
$$

where $h_{2,f}$ is the woman's choice of work in period 2 in case she stays married, $h^s_{2,f}$ is her choice of work if she gets divorced, and e is the adult equivalence scale.

The solution is characterized by the following 3 first-order conditions:

$$\frac{1-\alpha}{1-h_{2,f}} = \frac{\alpha}{c_2}(w_{1,f} + k_f h_{1,f}) \tag{6}$$

$$\frac{1-\alpha}{1-h^s_{2,f}} = \frac{\alpha}{c^s_{2,f}}(w_{1,f} + k_f h_{1,f}) \tag{7}$$

$$\frac{1-\alpha}{1-h_{1,f}} = \frac{\alpha}{c^s_{1,f}}w_{1,f} + (1-\pi_d)\frac{\alpha}{c_2}k_f h_{2,f} + \pi_d\frac{\alpha}{c^s_{2,f}}k_f h^s_{2,f} \tag{8}$$

First, let us consider how a change in the probability of divorce, π_d, affects the woman's choice of labor supply in period 1, $h_{1,f}$. An increase in π_d will affect $h_{1,f}$ both directly through equation 8, and also indirectly through the effect of the change in $h_{1,f}$ on $h_{2,f}$ and $h^s_{2,f}$ in equations 6 and 7, which feeds back into c_2 and $c^s_{2,f}$ in equation 8. For simplicity, let us disregard the indirect effect, and concentrate on the direct effect in equation 8. On the right hand side of that equation, we have the marginal benefit of an increase in the wife's work in period 1, which includes both an immediate increase in consumption in period 1, and the increase in consumption in period 2 because of the accumulation of the woman's experience (and increased period 2 wages). An increase in π_d effectively decreases the weight put on the second period's marginal utility of consumption in case the couple stays married, and increases the weight on the second period's marginal utility of consumption of the divorced woman. Intuitively, because the income of the married couple also includes the income of the husband (which typically is larger than the income of the wife), we get $c_2 > c^s_{2,f}$. From equations 6 and 7, it also follows that $h^s_{2,f} > h_{2,f}$, so that $\frac{\alpha}{c^s_{2,f}} h^s_{2,f} > \frac{\alpha}{c_{2,f}} h_{2,f}$, and such re-weighting increases the marginal benefit from the woman's work in period 1. This increases the woman's incentive to work in period 1.

Given the utility function that we have assumed in this section, one can in fact show that an increase in divorce probability leads to an increase in the woman's labor supply:

Proposition 4.1.

$$\frac{\partial h_{1,f}}{\partial \pi_d} > 0, \quad \frac{\partial h_{2,f}}{\partial \pi_d} > 0, \quad \frac{\partial h^s_{2,f}}{\partial \pi_d} = 0 \tag{9}$$

Proof: See Appendix 9.3

It is clear from equation 8 that for the change in divorce probability to have an impact on the woman's labor supply, we need $k_f > 0$ (returns to experience must be positive). One can expect this impact to be larger, the bigger is the gender wage gap ($\frac{w_m}{w_f}$). One could also be tempted to conclude from equation 8 that the effect of the change in divorce probability is stronger, the bigger is the returns to experience. However, even though this is true for fixed c_2 and $c^s_{2,f}$, and we found it to be true for a variety of reasonable choices of parameters in this simple two-period model, this could be at least partially offset by the income effect of the increase in k_f, which could be larger for the single woman.

To see that the increased probability of divorce can also increase labor supply of single women, imagine that there are 3 periods of active life, all women are single in period 0, but they are certain to get married in period 1 (and periods 1 and 2 are the same as the above), and that the the wages the woman receives in period 2 increase both in experience accumulated in period 0 and 1.

5 Quantitative Model

The stationary economy is populated by three types of households: single males, single females, and married couples. Individuals start their life at age 20. They live for at least 65 years, and at most 95 years, but enter retirement at age 65. A model period is 1 year, so there are a total of 45 model periods of active work life. Single households face an age-dependent probability of becoming married, while married couples face an age dependent probability of divorce. One is more likely to be married to someone with the same level of education. We assume that marriage will always happen to a partner of the same age, and that married couples die together. Households decide whether to participate in the labor market, how much to consume, and how much to save, and they accumulate labor market experience.

Labor Income

The wage, w, of an individual depends on his level of education, $j \in \{\mathrm{hs}, \mathrm{c}\}$ (where "hs" stands for high school and "c" stands for college), gender, $g \in \{\mathrm{m}, \mathrm{f}\}$, and years of labor market experience, x:

$$w(j, g, x) = e^{\gamma_{0jg} + \gamma_{1jg} x + \gamma_{2jg} x^2 + \gamma_{3jg} x^3} \tag{10}$$

Given this wage function, the beginning wage levels as well as the returns to experience are allowed to differ by level of education and gender.

Preferences

The momentary utility function of single individuals, U^S, depends on labor market participation, $n \in 0, 1$, consumption, c, and on gender:

$$U^S(g, c, n) = \frac{c^{1-\sigma}}{1-\sigma} - F_g n \tag{11}$$

F_g is here a fixed, gender specific, disutility from working. Married couples have a joint utility function, U^M, with shared consumption, measured in adult equivalents:

$$U^M(c, n_m, n_f) = \frac{\left(\frac{c}{e}\right)^{1-\sigma}}{1-\sigma} - F_m n_m - F_f n_f \tag{12}$$

Household's Problem

Written recursively, a single household's problem can be formalized as follows:

$$\begin{aligned} V^S(g, j, k, x, t) &= \max_{c,n,k'} U^S(g, c, n) + \beta\Big((1 - \bar{\omega}(t))V^S(g, j, k', x', t+1) \\ &\quad + \bar{\omega}(t) E_{j_p, k'_p, x'_p}\left[V^M(j, j_p, k' + k'_p, x', x'_p, t+1)\right]\Big) \\ \text{s.t.:} \quad c(1+\tau_c) + k' &= k(1+r) + nw(j, g, x)(1 - \tau_S(w(j, g, x)n)) + (1-n)T \\ x' &= x + n, \quad n \in \{0, 1\}, \quad k' \geq 0, \quad c > 0 \end{aligned} \tag{13}$$

k here is the level of asset holdings, r is the risk-free interest rate, and β the time discount factor. τ_c is a constant consumption tax, while τ_n is a nonlinear labor income tax. In the US and some European countries, the tax schedule is dependent on whether a person is single or married. T is an individual's income if he chooses not to participate in the labor market. The sources of such income would be unemployment benefits, social aid, transfers from relatives and charities and so on. $\bar{\omega}(t)$ is a time-dependent probability of becoming married in the next period. The subscript, p, stands for partner. In the case that an individual becomes married in the next period, the expectation of next period's utility must be taken with respect to the distribution over potential partners' education, experience, and asset holdings, $Q^{jgt}(j_p, x'_p, k'_p)$. An individual is more likely to find a partner of his own education group, and the distribution of partners naturally varies by gender and age. The distribution over x'_p and k'_p is derived from the individuals' optimal desicions.

Married couples maximize their joint utility and face a time-dependent probability, $\pi(t)$, of becoming divorced. When couples divorce, they split their assets evenly. Their problem can be written as:

$$\begin{aligned}
V^M(j_m, j_f, k, x_m, x_f, t) &= \max_{c,k',n_m,n_f} U^M(c, n_m, n_f) \\
&\quad + \beta(1-\pi(t))V^M(j_m, j_f, k', x'_m, x'_f, t+1) \\
&\quad + \beta\pi(t)V^S(m, j_m, k'/2, x'_m, t+1) \\
&\quad + \beta\pi(t)V^S(f, j_f, k'/2, x'_f, t+1) \\
\text{s.t:} \quad c(1+\tau_c) + k' &= k(1+r) + (n_m w_m + n_f w_f)(1 - \tau_{n,M}(n_m w_m + n_f w_f)) \\
&\quad +(2-(n_m+n_f))T \\
x'_m = x_m + n_m, \;\; x'_f &= x_f + n_f, \;\; n_f, n_m \in \{0,1\}, \;\; k' \geq 0, \;\; c > 0 \qquad (14)
\end{aligned}$$

Retired households make no labor supply decisions but receive an amount of social security, $\Phi(g)$, depending on their gender. We assume that retired households do not marry or get divorced, and that husband and wife die at the same time. Their problem, if single, is simply:

$$\begin{aligned}
V^S(g, k, t) &= \max_{c>0,k'\geq 0} U^S(g, c) + \Omega(t)\beta V^S(g, k', t+1) \\
\text{s.t.:} \quad c(1+\tau_c) &= k(1+r) + \Phi(g), \qquad (15)
\end{aligned}$$

where $\Omega(t)$ is the probability of survival until the next period. Married retirees solve:

$$\begin{aligned}
V^M(k, t) &= \max_{c>0,k'\geq 0} U^M(c) + \Omega(t)\beta V^M(g, k', t+1), \\
\text{s.t.:} \quad c(1+\tau_c) &= k(1+r) + \Phi(m) + \Phi(f), \qquad (16)
\end{aligned}$$

6 Calibration

This section describes the calibration of the model parameters. We calibrate our model to match the appropriate moments from the US data. We use data from different sources. We try to use data from 2000 or the year closest to 2000 that we can obtain. Many parameters can be calibrated to direct empirical counterparts without solving the model. They are listed in Table7. The 7 parameters in Table 2 below are, however, calibrated using an exactly identified simulated method of moments approach. We use the data from the European countries in our sample only to obtain the estimates of tax polynomials and age-specific marriage and divorce probabilities, which we use in section 7 in our counterfactual experiments.

Preferences

The momentary utility function is a standard CRRA utility function in equations 11 and , with consumption measured in adult equivalents, $\frac{c}{e}$. We use the OECD adult equivalence scale and set $e = 1.7$ for married couples, and $e = 1.0$ for singles. Consistent with a survey of the empirical literature in Browning et. al. (1999), we set the coefficient of relative risk aversion, σ, equal to 2. The discount factor, β, and fixed costs of working, F_m and F_f, are among the estimated parameters. The corresponding data moments are the mean asset holdings of households with head aged $20 - 64$, taken from the PSID (99-05), and the male- and female employment rates, taken from OECD 2000.

Risk Free Interest Rate

Given the partial equilibrium nature of the model, we take the risk free rate as fixed and calibrate it using the data. We set the risk free rate equal to the average of 3-month t-bill rates minus inflation over the period from 1947-2008 based on data from the Federal Reserve Bank of St. Louis[10].

[10]Series TB3MS and GDPDEF.

Wages

We calibrate the experience profile of wages exogenously, using the PSID from 1968-1997. After 1997 it is not possible to get years of actual labor market experience from the PSID. We regress earnings on a 3rd order polynomial in years of labor market experience and control for the year of birth. We estimate different returns to experience for each gender/education group. To get levels of earnings that are in line with the asset holdings, we include a parameter controlling the average earnings of each gender/education group in the structural estimation. The corresponding data moments are the average wage of each group in the PSID 99-05.

Taxes

The labor income tax schedule is a polynomial function of an individual's earnings relative to the average earnings, AE, equation 20 in the appendix. As described in more detail in the appendix, we fit this polynomial to labor income tax data from the OECD tax database (2001). This data is constructed by the OECD based on tax laws from different countries. It is well suited for cross country comparisons, see also see Guvenen, Kuruscu, and Ozkan (2009). For those countries who practice joint taxation of married couples, we fit a different tax schedule for married and single individuals. Coming up with an accurate estimate of consumption taxes in the US is complicated by the fact that there are local county-level taxes in addition to state taxes. Vertex Inc. (a consulting company) estimated that the average consumption tax in the US was 8.4% in 2002. We use that number. For simplicity, we abstract from capital taxes. we do this because different types of capital is taxed differently, and this also differs across countries. Households do for instance have about half of their wealth in their homes which may or may not be taxed. In the US, interest income is taxed as labor income, while dividends and capital gains are subject to capital gains tax. The return on capital is, however, set very conservatively in our calibration. It is set equal to the returns on risk free bonds, which was 1.1% over

Table 7: Parameters Calibrated Outside of the Model

Parameter	Value	Description	Target
r	0.011	Risk free interest rate (annual)	3-mnth T-bill minus inflation (1947-2008)
σ	2	$u(c,n) = \frac{(c/e)^{(1-\sigma)}}{(1-\sigma)}$	Browning et. al. (1999)
e	1.0 or 1.7		OECD equivalence scale.
$\gamma_{1hsm}, \gamma_{2hsm}, \gamma_{3hsm}$	0.066, -20(-4), 17(-6)	$w_{hsm} = e^{(\gamma_{0hsm}+\gamma_{1hsm}x+\gamma_{2hsm}x^2+\gamma_{3hsm}x^3)}$	PSID (1968-1997)
$\gamma_{1cm}, \gamma_{2cm}, \gamma_{3cm}$	0.109, -32(-4), 26(-6)	$w_{cm} = e^{(\gamma_{0cm}+\gamma_{1cm}x+\gamma_{2cm}x^2+\gamma_{3cm}x^3)}$	
$\gamma_{1hsf}, \gamma_{2hsf}, \gamma_{3hsf}$	0.069, -16(-4), 12(-6)	$w_{hsf} = e^{(\gamma_{0hsf}+\gamma_{1hsf}x+\gamma_{2hsf}x^2+\gamma_{3hsf}x^3)}$	
$\gamma_{1cf}, \gamma_{2cf}, \gamma_{3cf}$	0.064, -12(-4), 6(-6)	$w_{cf} = e^{(\gamma_{0cf}+\gamma_{1cf}x+\gamma_{2cf}x^2+\gamma_{3cf}x^3)}$	
τ_{s0}, τ_{s1}	1.727, -6.450	$\tau(y) = \tau_{s0} + \tau_{s1}(y/AE)^{0.2}$	OECD tax data (01)
τ_{s2}, τ_{s3}	8.995, -5.000	$+\tau_{s2}(y/AE)^{0.4} + \tau_{s3}(y/AE)^{0.6}$	
τ_{s4}	0.988	$+\tau_{s4}(y/AE)^{0.8}$	
τ_{m0}, τ_{m1}	2.162, -7.302	$\tau(y) = \tau_{m0} + \tau_{m1}(y/AE)^{0.2}$	OECD tax data (01)
τ_{m2}, τ_{m3}	9.222, -4.736	$+\tau_{m2}(y/AE)^{0.4} + \tau_{m3}(y/AE)^{0.6}$	
τ_{m4}	0.872	$+\tau_{m4}(y/AE)^{0.8}$	
τ_c	0.084	Consumption tax	Vertex Inc. (2002)
T	$8440	income if not working	CEX 2000-2001
$\Phi(m), \Phi(f)$	$12600, $9680	Social security	S.S. Admin. (2000)
$\bar{\omega}(t)$	Varies	Prob. of marriage	CPS (1999-2001)
$\pi(t)$	Varies	Prob of divorce	CPS (1999-2001)
$\Gamma(t)$	Varies	Death probabilities	NCHS (1991-2001)
Fraction w. some college.	0.533		CPS (1999-2001)
Prob. intra ed. marriage	0.737		CPS (1999-2001)
k_0	8260	Savings at age 20	NLSY97
M_0	0.126	Share of married 20 year-olds	CPS (1999-2001)

Table 8: Parameters Calibrated Endogenously

Parameter	Description	Data Moment	Value
γ_{0hsm}	$w_{hsm} = e^{(\gamma_{0hsm}+\gamma_{1hsm}x+\gamma_{2hsm}x^2+\gamma_{3hsm}x^3)}$	Mean male hs-wages	-1.438
γ_{0cm}	$w_{cm} = e^{(\gamma_{0cm}+\gamma_{1cm}x+\gamma_{2cm}x^2+\gamma_{3cm}x^3)}$	Mean male c-wages	-1.464
γ_{0hsf}	$w_{hsf} = e^{(\gamma_{0hsf}+\gamma_{1hsf}x+\gamma_{2hsf}x^2+\gamma_{3hsf}x^3)}$	Mean female hs-wages	-2.081
γ_{0cf}	$w_{cf} = e^{(\gamma_{0cf}+\gamma_{1cf}x+\gamma_{2cf}x^2+\gamma_{3cf}x^3)}$	Mean female c-wages	-1.692
β	Discount factor	Mean assets	1.001
F_m	Fixed cost of working	Male employment rate	2.092
F_f	Fixed cost of working	Female employment rate	2.265

the past 60 years.

Death Probabilities and Social Security

The probability that a retiree will survive to the next period, we obtain from the National Center for Health Statistics (1991-2001). We assume that all retirees receive the same constant Social Security benefit, only dependent on gender. We obtain the average benefit for males and females from the Annual Statistical Supplement to the Social Security Bulletin (2000).

Marriage and Divorce Probabilities

To compute the age-specific probabilities for marriage and divorce for the US, we use the data from the CPS March supplement from 1999-2001. For most European countries, we use the data from Eurostat on-line database[11]. For some European countries, we supplement it with the data from the IPUMS International.

We assume the stationary environment, where the probabilities of getting married and divorced don't change over time (we allow them to depend on the age of the person, but not on his/her cohort)[12]. We also assume that the probability of getting married is the same for those who get married for the first time, and those who were previously divorced. This allows us to compute the probabilities using the

[11] Available at `http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database`.

[12] Figure 17 in appendix shows the number of divorces per 1000 marriages for 3 countries – US, Italy and Netherlands over a span of 10 (in case of US) to 20 (in case of Netherlands and Italy) years. It shows that even though the number of divorces have been increasing in Italy and decreasing in the US, these changes over time were rather slow and small compared to the differences in levels.

following approach. Let M_t and D_t be the share of the married and divorced persons respectively at age t[13]. Then the probability of getting married at age t, π_t^m, and the probability of getting divorced at age t, π_t^d, is pinned down by:

$$M_{t+1} = (1 - M_t)\pi_t^m + M_t(1 - \pi_t^d) \quad (17)$$

$$D_{t+1} = D_t(1 - \pi_t^m) + M_t\pi_t^d \quad (18)$$

We smooth the resulting age-profiles for π_t^m and π_t^d by fitting a polynomial. Figure 7 shows the resulting probability profiles for the US, Germany and Italy[14].

Figure 7: Age-dependent probabilities of marriage and divorce

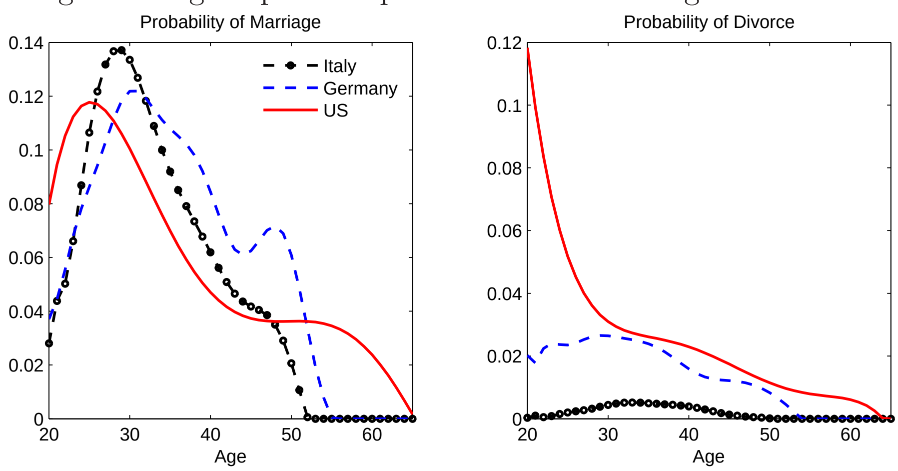


Figure 7 shows that the probability of getting divorced is noticeably higher in the US than Italy, and somewhat higher than in Germany. At the same time, the probability of getting married reaches its peak in the US somewhat earlier compared to the two European countries[15].

[13]Figure 18 in appendix shows the share of married women in the countries in our sample.

[14]Countries like Spain, Ireland, Greece and Portugal have marriage and divorce probabilities similar to Italy, and countries like Netherlands and Belgium are similar in this respect to Germany.

[15]The computed probabilities use the data for women. We get a qualitatively similar picture when using the data for both men and women (with the exception that men in all countries tend to get married somewhat later than women).

Table 9: Calibration Fit

Moment	Data	Model
Mean wage of high school educated males	0.396	0.396
Mean wage of college educated males	0.594	0.594
Mean wage of high school educated females	0.255	0.255
Mean wage of college educated females	0.372	0.372
Mean assets	1.200	1.198
Male employment rate	0.841	0.841
Female employment rate	0.699	0.700

Fixed Cost of Working and Income if Not Working

The data moments for the fixed cost of working for men and women are the male and female employment rates in 2000, taken from the OECD. As an approximation for income when not working, we take the value of non-housing consumption of households with income less than \$5000 per year from the 2000-2001 Consumer Expenditure Survey. The sources of such income would be unemployment benefits, social aid, gifts from relatives and charities etc.

Estimation Method

7 model parameters are calibrated using an exactly identified simulated method of moments approach. We minimize the squared percentage deviation of simulated model statistics from the 7 data moments in Table 3. Let $\Theta = \{\gamma_{0hsm}, \gamma_{0cm}, \gamma_{0hsf}, \gamma_{0cf}, \beta, F_m, F_f\}$ and let $V(\Theta) = (V_1(\Theta), \ldots, V_7(\Theta))'$ denote the vector where $V_i(\Theta) = (\bar{m} - \hat{m}(\Theta))/m$ is the percentage difference between empirical moments and simulated moments. Then:

$$\hat{V} = \min_{\Theta} V(\Theta)' V(\Theta) \tag{19}$$

Table8 summarizes the estimated parameter values. As can be seen from Table 9, we get close to match all the moments exactly.

7 Counterfactual Experiments

In Section 3, we have documented a correlation between labor supply and tax levels and labor supply and divorce rates across countries and across time. This motivates the study, in this section, of the quantitative impact of cross country differences in tax schemes and divorce rates on labor supply. When we perform the policy experiments, we keep taxes, old age social security, and income when not working as functions of average earnings in the economy. In this way if the society becomes richer or poorer because of a counterfactual experiment, taxes and social security payments will adjust accordingly. Since there is no public good in the model, we do not keep a balanced government budget and excess tax revenues are assumed to finance bureaucracy.

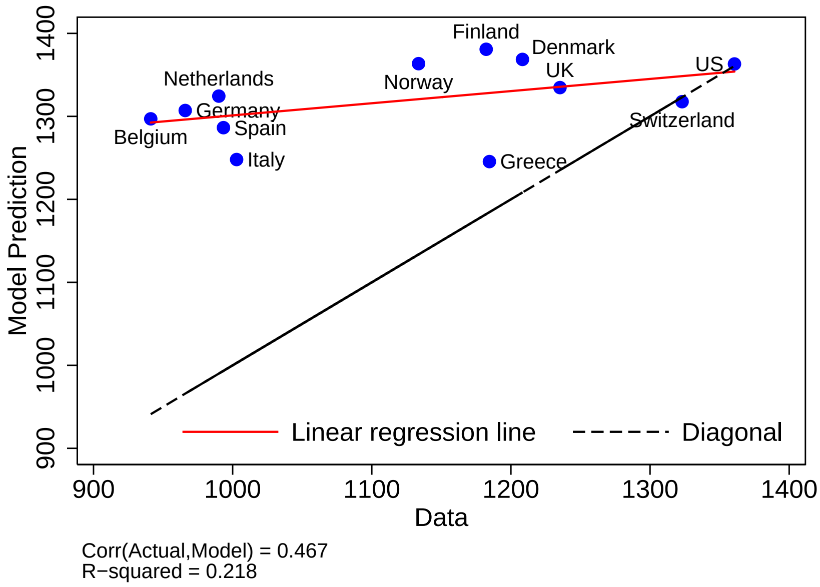
The Effect of Marriage and Divorce Probabilities on Labor Supply

In this subsection, we use our model that we described in Section 5, and calibrated to match the US economy in Section 6, to study the impact of marriage and divorce probabilities on labor supply. We do this by imposing the marriage and divorce probabilities that we computed for each of the European countries in our sample on the model. Figure 8 shows how it affects hours worked[16]. We obtain a positive correlation between the model's predictions and the data (equal to 0.467). As we expect, higher marriage stability reduces labor supply both in the model and in the data.

Ideally, if the model matched the data perfectly, all observations would be located somewhere on the diagonal line. The distance from the diagonal shows the discrepancy between the data and the model prediction.Table 10 and figures 9 and 10 illustrate the impact on the employment rates for men and women. Unfortunately, we cannot perform the comparison by gender in terms of the hours worked because

[16]Since we do not have the intensive margin in our model, we compute the predicted annual hours worked for all European countries in our sample as a product of employment rates predicted by our model and hours worked by employment persons in the data in the US.

Figure 8: The Impact of Marriage and Divorce Probabilities on Hours Worked, Both Genders



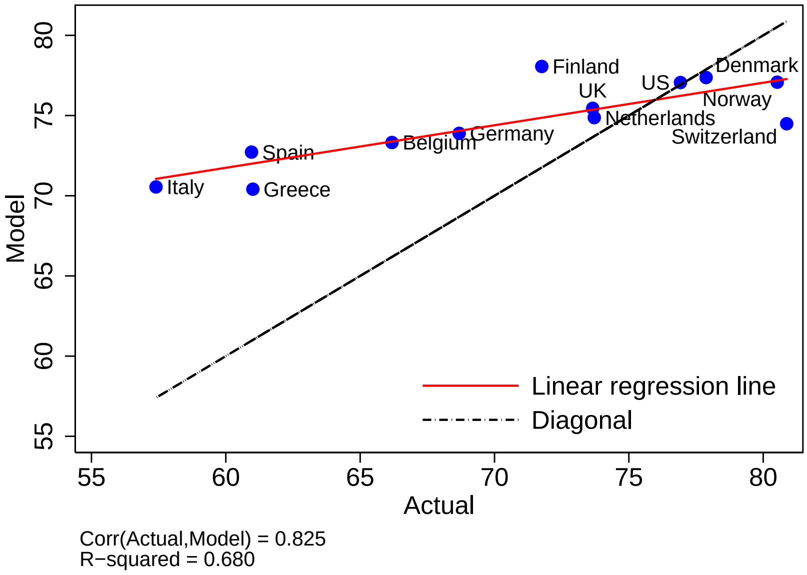
of the lack of the data. However, as we show in Section 3, marriage stability appears to affect mostly the extensive margin.

Table 10: The Impact of Marriage and Divorce Probabilities on Employment Rates

Country	Aggregate Employment Rates		Female Employment Rates		Male Employment Rates	
	Actual	Model	Actual	Model	Actual	Model
US	0.770	0.770	0.699	0.699	0.841	0.841
Greece	0.610	0.704	0.450	0.608	0.781	0.800
Italy	0.574	0.706	0.421	0.616	0.728	0.795
Spain	0.610	0.727	0.445	0.646	0.774	0.809
Belgium	0.662	0.733	0.564	0.649	0.759	0.817
Switzerland	0.809	0.745	0.715	0.669	0.903	0.821
Germany	0.687	0.739	0.610	0.659	0.762	0.819
Netherlands	0.737	0.749	0.637	0.668	0.835	0.829
UK	0.737	0.755	0.665	0.685	0.810	0.825
Norway	0.805	0.771	0.763	0.702	0.847	0.840
Denmark	0.779	0.774	0.733	0.703	0.823	0.844
Finland	0.718	0.781	0.684	0.720	0.751	0.841

Figure 9 shows a rather high correlation (equal to 0.825) between our model's predictions and data for the individuals of both genders – higher marriage stability appears to reduce labor supply both in the model and in the data. Figure 10 shows that the correlation between the model predictions and the data is even higher for women (equal to 0.889). Figure 19 in appendix shows that the correlation between the model's predictions and the data is substantially worse for men (equal to 0.474). This is not surprising, as we expect the marriage stability mechanism to be able to better account for the behavior of women. We conclude that the marriage stability

Figure 9: The Impact of Marriage and Divorce Probabilities on Employment Rates, Both Genders

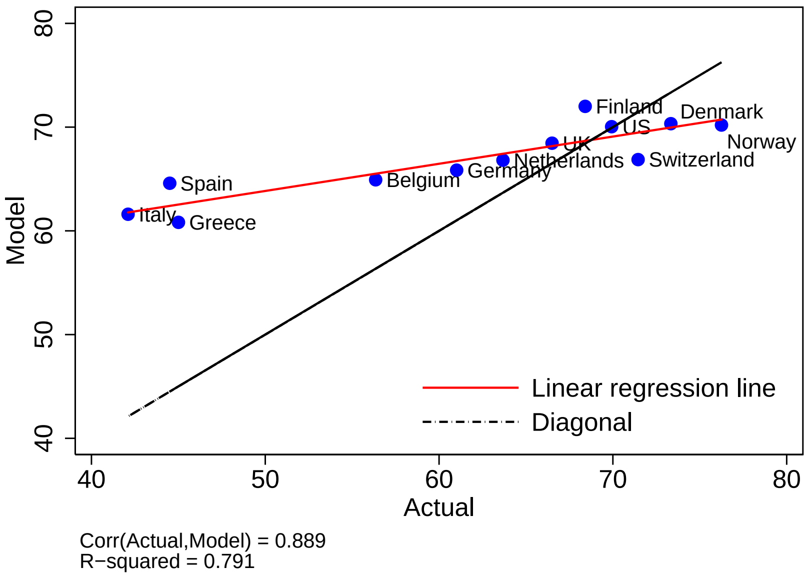


mechanism works in the right direction in our model by reducing the labor supply in the countries with more stable marriages. As one would expect, this mechanism appears to be able to account better for the labor supply of women.

The Impact of Differences in Taxation on Labor Supply

Figure 20 compares the predictions of our model to the data when we assume that the divorce and marriage probabilities in all countries are the same as in the US, but replace the tax system in the model by the one computed for each country using the OECD data (as described in section 6), and furthermore assume that all the difference in tax revenues that result from the change of the tax system go to waistful government spending. The figure shows that there is little impact on hours worked in our model in this case. We in fact obtain a negative correlation between our model's predictions and the data. Table 24 shows that one feature of the tax system that

Figure 10: The Impact of Marriage and Divorce Probabilities on Employment Rates, Women



appears to be particularly important in our model is whether the married couples are taxed jointly or separately. In table 24, we see that our model predicts that labor supply is noticeably higher in the countries that practice separate taxation. Table 23 shows that this is primarily driven in the model by higher employment ratios of women.Figure 21 shows that the predictions of our model improve when we assume that the additional tax revenues are redistributed to all the agents in the economy as a lump sum. This illustrates that the use of the tax revenues is crucial in our model for taxes to have a negative effect on labor supply. *The Combined Impact of*

Divorces and Taxation on Labor Supply

Figure 11 shows the impact of both the divorce and tax mechanisms combined in our model. When we include both mechanisms in the model, the correlation between the model's predictions and the data increase to 0.637, and we are able to explain 41% of the variation in hours worked in the data (as shown by the R^2).

On average, the experiment with changing only the divorce rates can account for 22% of the difference between the US and European countries in our sample, the

Figure 11: The Impact of Marriage and Divorce Probabilities on Hours Worked, Both Genders

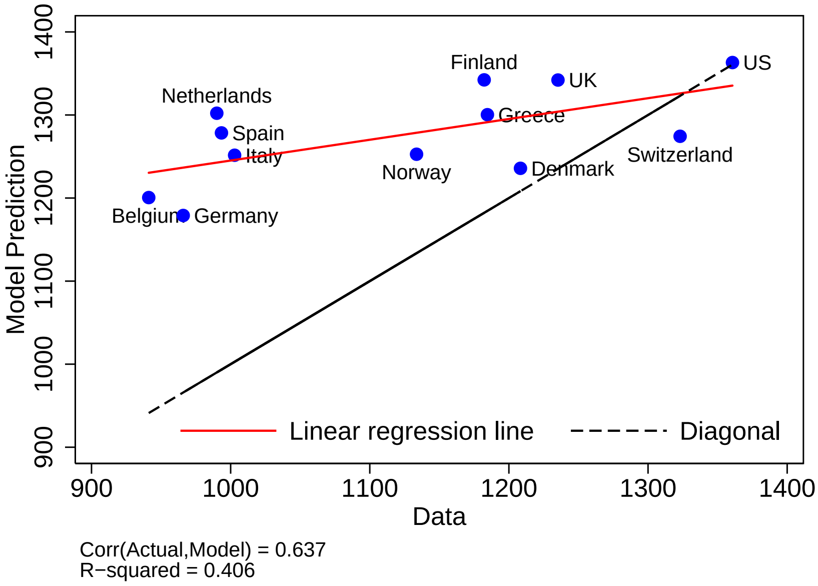


Table 11: Labor Supply, Taxation and Marriage and Divorce Rates

Country	Divorces	Taxation	Divorces and Taxation	Data
US	100.000	100.000	100.000	100.000
Greece	91.536	104.381	95.566	87.056
Italy	91.718	99.362	91.978	73.701
Spain	94.539	100.871	93.954	73.007
Belgium	95.319	91.562	88.234	69.167
Switzerland	96.840	99.869	93.655	97.234
Germany	96.060	88.782	86.648	70.987
Netherlands	97.334	97.685	95.696	72.762
UK	98.088	99.765	98.634	90.783
Norway	100.208	92.056	92.069	83.313
Denmark	100.585	89.287	90.821	88.802
Finland	101.482	97.282	98.647	86.886

The table shows hours worked (model predictions and data) as a percent of hours worked in the US.

experiment with changing only the tax system (and assuming redistribution of the additional tax revenues) can account for 19% of the difference, and in the experiment with both mechanisms included we account for 28% of the difference.

As can be seen from table 11, for Italy, Spain and Greece marriage stability appears to be a more important mechanism, while taxes is a relatively good predictor of labor supply in Germany, Belgium and Scandinavia. One interesting observation is that by a more careful modeling of the tax systems and introduction of the divorce mechanism we are able to resolve what Rogerson (2007) calls a puzzle, the fact that Scandinavian countries have among the highest taxes but still greater labor supply than a country like Germany. An important feature of the tax system in all Scandinavian countries (except Norway) is separate taxation of married couples. As was pointed out by Guner, Kaygusuz, and Ventura (2008), this can help explain higher labor supply in these countries. For Denmark and Finland, the average tax level mechanism cannot account for the higher labor supply in these countries compared with Germany, as average tax level is higher in Denmark and about the same in Finland. However, both of these countries have separate taxation of married couples.

We conclude that our counterfactual experiments suggest that both the divorce and the tax mechanisms are important for accounting for the differences in labor supply between the US and Europe. The significance of these two mechanisms appear to vary for different European countries. When combined, they on average allow us to account for 28% of the difference.

8 Conclusion

In this paper we show that prime aged women is the largest contributor to differences in aggregate labor supply between the US and Europe. We document a negative cross-country correlation between tax levels and labor supply and a positive correlation between divorce rates and labor supply across time and place. The latter correlation is, however, driven by a strong correlation between female labor supply and divorce rates.

To quantify the impact of differences in tax schemes and divorce/marriage rates on labor supply, we develop a life-cycle, overlapping-generations model with heterogeneous agents, marriage, and divorce. We calibrate our model to US data and study how labor supply in the US change as we introduce European tax systems, and as we replace the US divorce and marriage rates with their European equivalents. Changing the US probabilities of marriage and divorce to their European counterparts on average accounts for 22% of the difference in hours worked between the US and the 11 European countries. When we also introduce European taxes and redistribute the increase in taxes evenly to all households, we can account for 28% of the difference in hours worked between the US and Europe.

9 Appendix

9.1 Fitting Tax Functions Based on Data from the OECD

For every country in Figure 3, we fit the below polynomial where an individuals average tax rate is a function of his earnings relative to the average earnings in the economy:

$$\tau(y) = \tau_0 + \tau_1 \left(\frac{y}{AE}\right)^{0.2} + \tau_2 \left(\frac{y}{AE}\right)^{0.4} + \tau_3 \left(\frac{y}{AE}\right)^{0.6} + \tau_4 \left(\frac{y}{AE}\right)^{0.8} \tag{20}$$

We use this functional form because it generally gives us a very good fit, R2, and because we get functions that are strictly increasing and well behaved on a relatively wide range of labor income. We use labor income tax data from the OECD Tax-Benefit Calculator[17] and the OECD Tax Database[18]. This data is constructed by the OECD based on tax laws from different countries. The OECD Tax-Benefit Calculator gives the gross- and net-, after taxes and benefits, labor income, by family type in 2001. For single individuals we can get tese data for every percentile of average labor income for a range between 50% and 200% of average labor income. For married couples, one spouse's earnings have to be fixed at either 0%, 67%, 100% or 167% of average labor income, while the other spouse's earnings can take any whole percent value between 50% and 200% of average labor income. For countries that practice joint taxation of married couples, we fit different polynomials for married and single. We use the data for single and married individuals without children. For married individuals, we let the couples be as symmetric as possible. In the US this is inconsequential, since the tax system is completely symmetric, i.e. it does not matter who makes the income. The OECD Tax Database provides the top marginal tax rate in each country and the starting point for this tax rate for single individuals. To get

[17]Available at: `www.oecd.org/document/18/0,3343,en_2649_34637_39717906_1_1_1_1,00.html`.

[18]Available at: `www.oecd.org/document/60/0,3343,en_2649_34533_1942460_1_1_1_1,00&&en-USS_01DBC.html`.

the tax at earnings above 200% of average labor income, we use this information. For many countries the top marginal tax rate kicks in before 200% of average labor income but in the US, for instance, the top marginal tax rate starts at about 9 times average earnings. We then assume that the marginal tax rate increases linearly between 2 times average earnings and the point where the top marginal tax rate becomes effective. For countries that practice joint taxation of married couples, we assume that the top marginal tax rate for married starts at twice the level for singles.

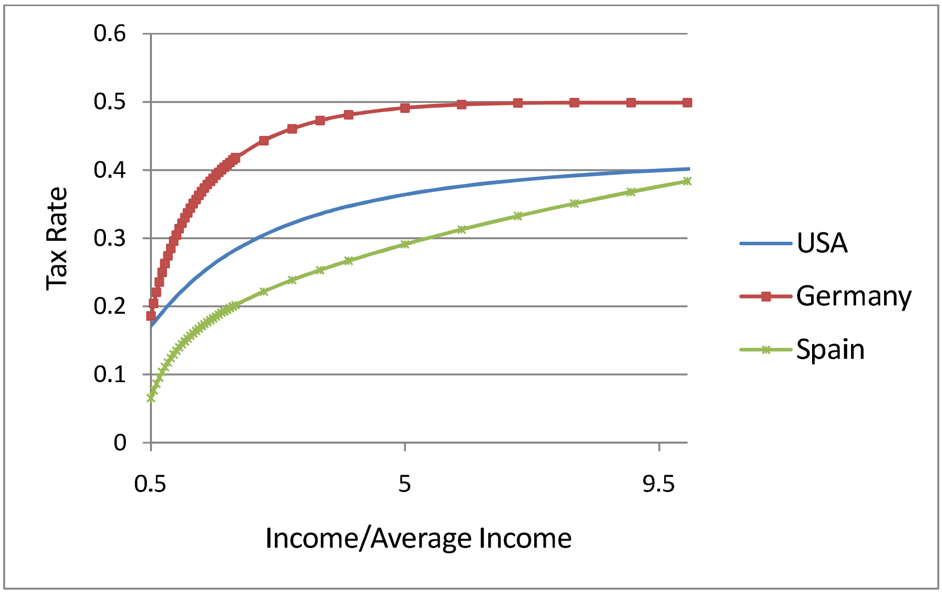
Table 12: Country Tax Functions for Married Couples

Country	τ_0	τ_1	τ_2	τ_3	τ_4	R^2
France	-0.4677592	2.062677	-2.743411	1.820481	-0.4305004	0.9989
Germany	-0.5409343	-0.9886915	4.474231	-3.421762	0.7909097	0.9962
Ireland	1.612143	-6.871639	9.391285	-4.898055	0.8901651	0.9940
Norway	-5.335858	14.96881	-15.43612	7.362051	-1.335945	0.9981
Portugal	3.907341	-12.23614	13.88106	-6.514196	1.101643	0.9995
Spain	-2.811092	8.034616	-8.401096	4.023208	-0.7058137	0.9959
Switzerland	-16.09581	48.2164	-53.35435	26.20165	-4.78368	0.9950
USA	2.16239	-7.301506	9.221961	-4.736035	0.8718943	0.9949

Table 13: Country Tax Functions for Singles

Country	τ_0	τ_1	τ_2	τ_3	τ_4	R^2
Austria	-5.626168	16.19854	-16.39948	7.397988	-1.250442	0.9937
Belgium	-4.587984	13.62661	-14.19084	6.823648	-1.24974	0.9959
Denmark	0.1422833	-2.357568	5.737164	-3.968169	0.8855884	0.9940
Finland	-1.387284	2.706099	-0.9767094	-0.0860593	0.0717587	0.9987
France	0.7157418	-2.514716	3.64648	-1.88936	0.3320441	0.9980
Germany	-6.582745	19.08046	-19.22463	8.580912	-1.430125	0.9964
Greece	-5.55185	14.76655	-14.7313	6.887032	-1.237959	0.9909
Ireland	-1.75284	2.625375	0.1463597	-1.13193	0.3456357	0.9983
Italy	-1.555522	2.965259	-0.9916236	-0.3076185	0.1599916	0.9992
Netherlands	1.126893	-4.322011	6.331867	-3.487033	0 .6651015	0.9899
Norway	2.335783	-8.6315	11.83152	-6.471281	1.25354	0.9988
Portugal	2.604929	-9.655736	12.78917	-6.821912	1.293703	0.9994
Spain	-2.640157	7.853874	-8.641411	4.527437	-0.9025463	0.9979
Sweden	5.645098	-18.75109	23.36599	-12.24517	2.322895	0.9968
Switzerland	-1.4185	5.181097	-6.488006	3.771889	-0.8035895	0.9985
UK	-0.3775787	0.2900424	1.07663	-0.9579886	0.2236049	0.9953
USA	1.727408	-6.44973	8.994808	-4.999817	0.9875019	0.9969

Figure 12: Country Tax Functions (Married)



9.2 Computational Details

Computation of Optimal Policies

We put boundaries on the capital space and pick a 16 point grid in $K = [k^{min}, k^m ax]$. Capital is the only continuous state variable. Let $J = \{hs, c\}$ be the state space for whether an individual is high school or college educated, $X = \{0, ..., 44\}$ be the state space for the number of years of labor market experience, and $T = \{20, ..., 95\}$ be the state space for age. The state space for working age married individuals is then: $T \times J \times J \times X \times X \times K$, for working age single individuals it is: $T \times J \times X \times K$, and for retired individuals, both married and single it is: $T \times K$. We compute the household's optimal policies for each state by iterating backwards. We start from age 95, the last period of life. In that period, the next period's value function is 0, and the optimal policy is to consume as much as possible. Knowing the value function at age 95, we can compute optimal policies and value functions for age 94, and so on. The labor supply decisions are discrete, and so we compare the different options. For each choice of labor, we must solve for the optimal level of next period's capital. We find the optimal choice of capital by "golden search". To interpolate next period's value function outside of the grid, we use cubic splines.

Simulation

We simulate an over lapping generations economy with 100 000 men and 100 000 women in each identical generation. Knowing today's state, the policy functions, and next period's marital status, we can find the next period's state. To determine next period's marital status, we draw a random number, $\nu \in (0, 1)$, for every single individual and every married couple in each time period. We use the age dependent probabilities for divorce and marriage to determine whether a single individual is going to marry or a couple is going to split. We only let the random number drawn by the single men determine if they are going to get married. Then to find them a partner, we sort single men- and women by their random number and find a partner for each man that is going to change status. We also make sure that the right number of men marries someone with the same level of education.

Partial Equilibrium

When we calibrate the model we must have equilibrium in the marriage market, in the sense that single individuals must have rational expectations about their potential partners in the next period. This expectation must be taken with respect to education, experience, and asset holdings, $Q^{jgt}(j_p, x_p^{'}, k_p^{'})$. Given his own education, an individual knows the likelihood of marrying someone whit high school and college education in the next period. We keep track of the distribution of single individuals in each education group with respect to capital and experience at every age. We start out with an educated guess and then solve the model iteratively until we reach a fixed point.

When we perform the policy experiments we must also solve for a fixed point in terms of the average earnings in the economy because the tax functions, the social security payments, and the value of not working are kept as functions of average earnings. Finally when redistributing the increase in tax revenues, we must solve for a fixed point in terms of the lump sum redistribution.

9.3 Proof of Proposition 4.1

Given the choice of the utility function, one can solve for $h_{2,f}$ and $h^s_{2,f}$ in terms of $h_{1,f}$ from equations 6 and 7, and after plugging these solutions into 8, obtain that the dependence of $h_{1,f}$ on π_d is implicitly defined by:

$$\begin{aligned} & G(h_{1,f},\pi_d) \\ = \; & \frac{\alpha w_{1,f}}{w_{1,m}+w_{1,f}h_{1,f}} - \frac{1-\alpha}{1-h_{1,f}} + \pi_d\left(\frac{\alpha k_f}{w_{1,f}+k_f h_{1,f}}\right) \\ & +(1-\pi_d)\left(\frac{k_f}{w_{1,f}+k_f h_{1,f}+w_{1,m}+k_m}\left(\alpha+(\alpha-1)\left(\frac{w_{1,m}+k_m}{w_{1,f}+k_f h_{1,f}}\right)\right)\right) \\ = \; & 0 \end{aligned} \tag{21}$$

Using the implicit function theorem, one can show that:

$$\begin{aligned} \operatorname{sign}\left(\frac{\partial h_{1,f}}{\partial \pi_d}\right) &= \operatorname{sign}\left(\frac{\partial G}{\partial \pi_d}\right) \\ &= \operatorname{sign}\left(\frac{\alpha}{w_{1,f}+k_f h_{1,f}} - \frac{1}{w_{1,f}+k_f h_{1,f}+w_{1,m}+k_m}\left(\alpha+(\alpha-1)\left(\frac{w_{1,m}+k_m}{w_{1,f}+k_f h_{1,f}}\right)\right)\right) \end{aligned} \tag{22}$$

Since $\frac{w_{1,f}+k_f h_{1,f}+w_{1,m}+k_m}{w_{1,f}+k_f h_{1,f}} > 1 > 1+\frac{\alpha-1}{\alpha}\left(\frac{w_{1,m}+k_m}{w_{1,f}+k_f h_{1,f}}\right)$, we get $\frac{\partial h_{1,f}}{\partial \pi_d} > 0$.

An increase in woman's labor supply in period 1 leads to accumulation of experience, and thus higher wages in period 2. On one hand, this gives both the married and the single woman an incentive to increase labor supply in period 2 through the substitution effect. However, there is also potentially an offsetting income effect. Intuitively, the income effect will be stronger for the divorced woman who does not have access to her spouse's income (and thus, its is more likely that the married woman will increase her labor supply in period 2). Given the utility function we have assumed in this section, we get $h^s_{2,f} = \alpha$ and $h_{2,f} = \frac{\alpha(w_{1,f}+k_f h_{1,f}+w_{1,m}+k_m)-(w_{1,m}+k_m)}{w_{1,f}+k_f h_{1,f}}$, so that $\frac{\partial h^s_{2,f}}{\partial \pi_d} = 0$ and $\frac{\partial h_{2,f}}{\partial \pi_d} = \frac{\partial h_{2,f}}{\partial h_{1,f}}\frac{\partial h_{1,f}}{\partial \pi_d} = \frac{k_f(w_{1,m}+k_m)(1-\alpha)}{(w_{1,f}+k_f h_{1,f})^2}\frac{\partial h_{1,f}}{\partial \pi_d} > 0$

■

9.4 Figures and Tables

Figure 13: Share of Persons with Children Younger than 3 Years Old, by Age Group

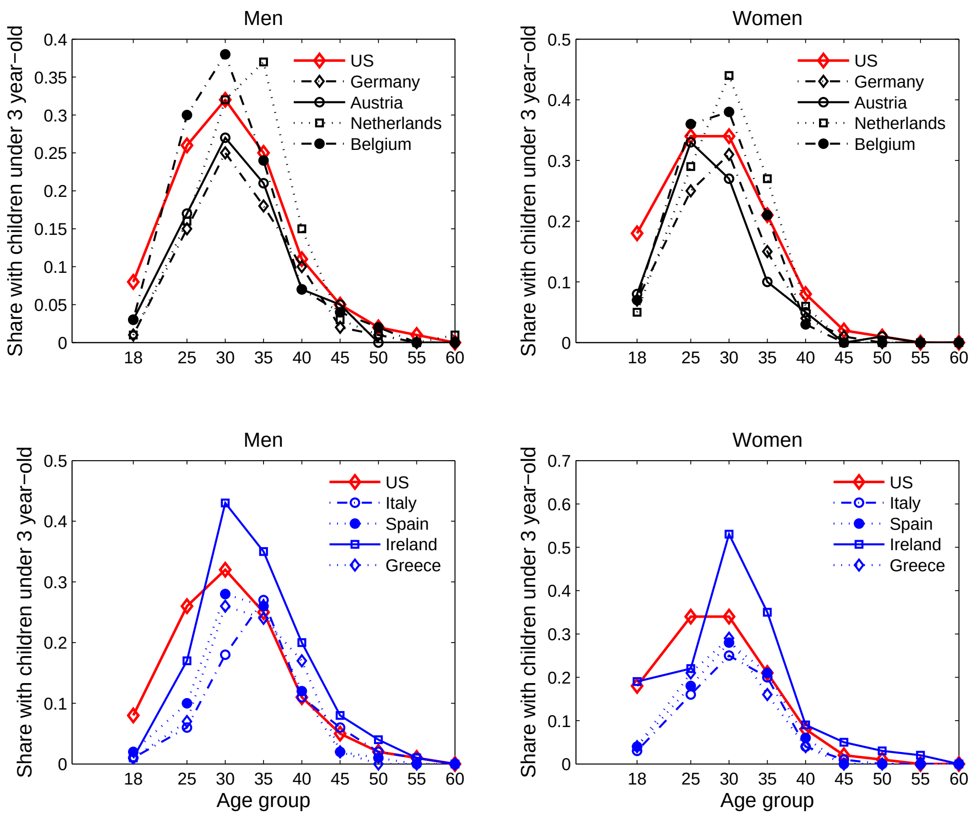


Figure 14: Relationship Between Tax Measures and Employment Ratios for Women

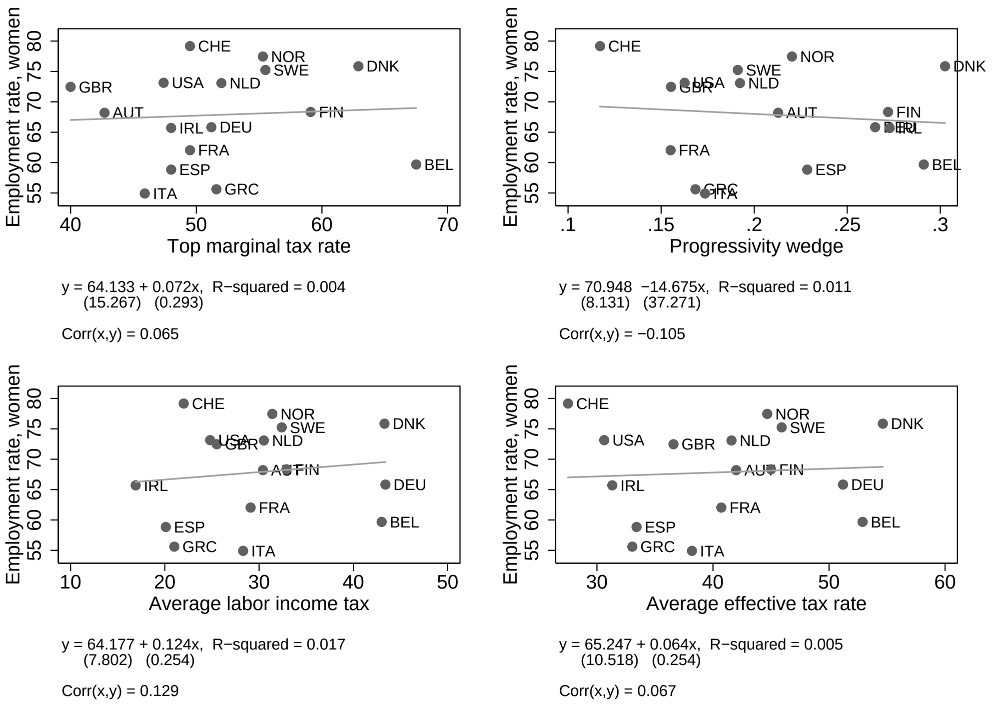


Figure 15: Relationship Between Tax Measures and Employment Ratios for Men

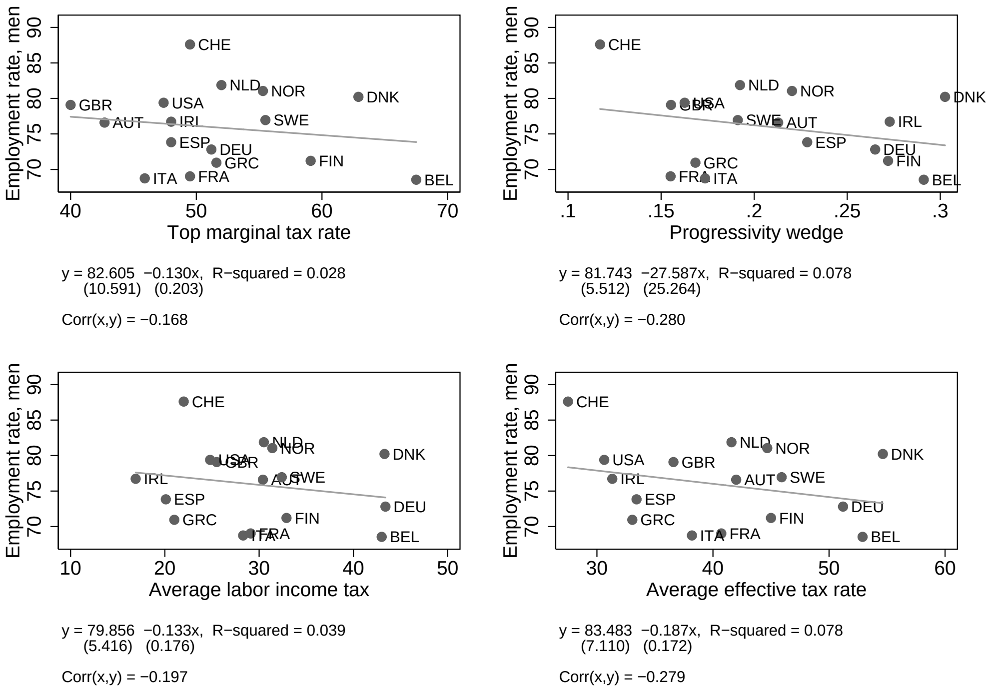


Figure 16: Relationship Between Divorce Rates and Employment Ratios for Both Genders

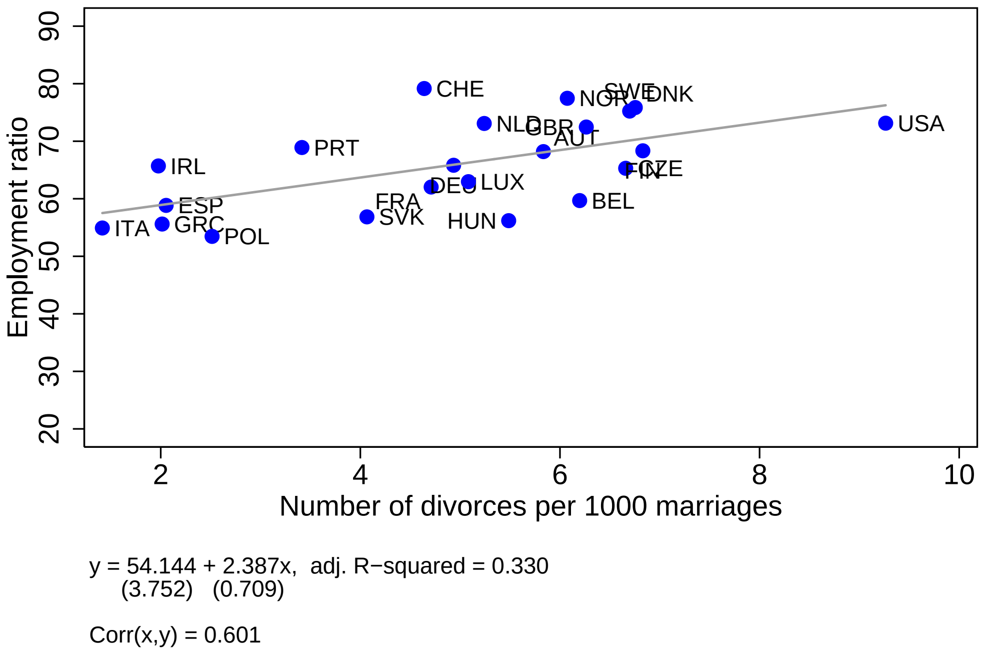


Figure 17: Trends in the Number of Divorces Over Time

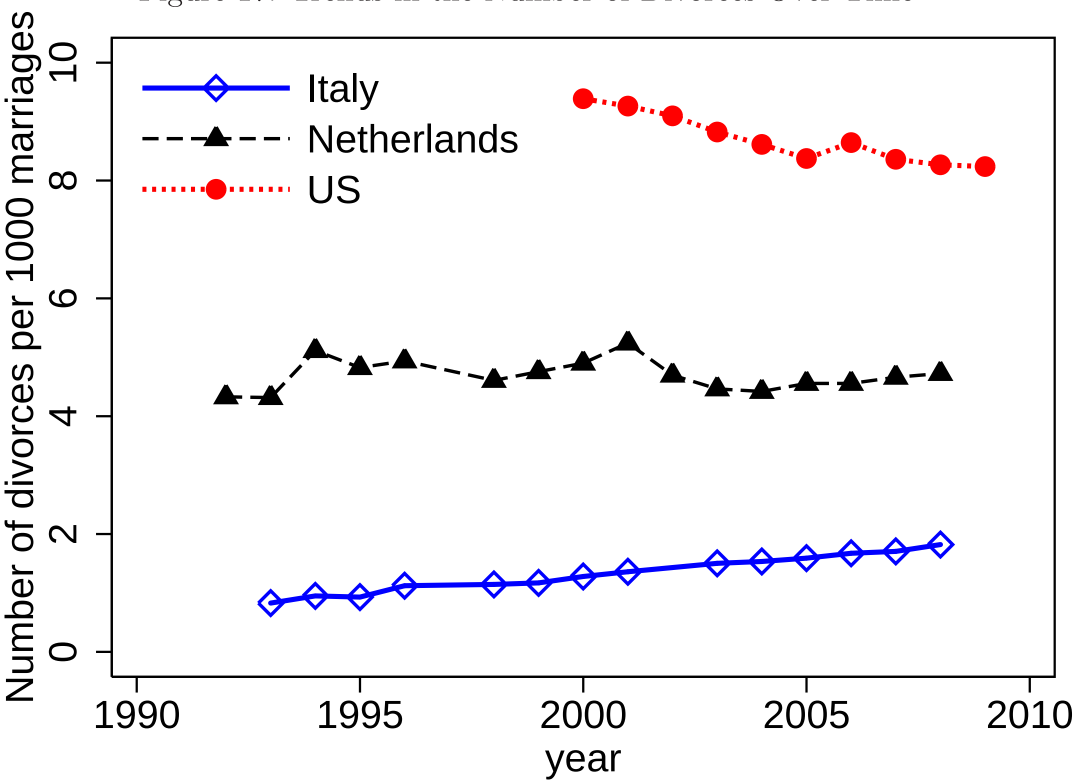


Table 14: Annual Hours Worked, by Age Group, LIS 2000

Country	15-20 yr	% of US	21-55 yr	% of US	56-64 yr	% of US
US	363.70	100.0	1600.89	100.0	1077.54	100.0
Germany	310.46	85.4	1154.65	72.1	582.38	54.0
Italy	102.50	28.2	1232.94	77.0	505.38	46.9
Spain	167.36	46.0	1177.30	73.5	644.34	59.8
Ireland	336.59	92.5	1309.16	81.8	782.43	72.6
Austria	571.16	157.0	1325.48	82.8	507.15	47.1
Belgium	90.54	24.9	1132.67	70.8	320.16	29.7
Netherlands	352.51	96.9	1152.01	72.0	446.21	41.4
Greece	173.91	47.8	1422.52	88.9	698.62	64.8

Figure 18: Share of Married and Divorced Women at Different Ages

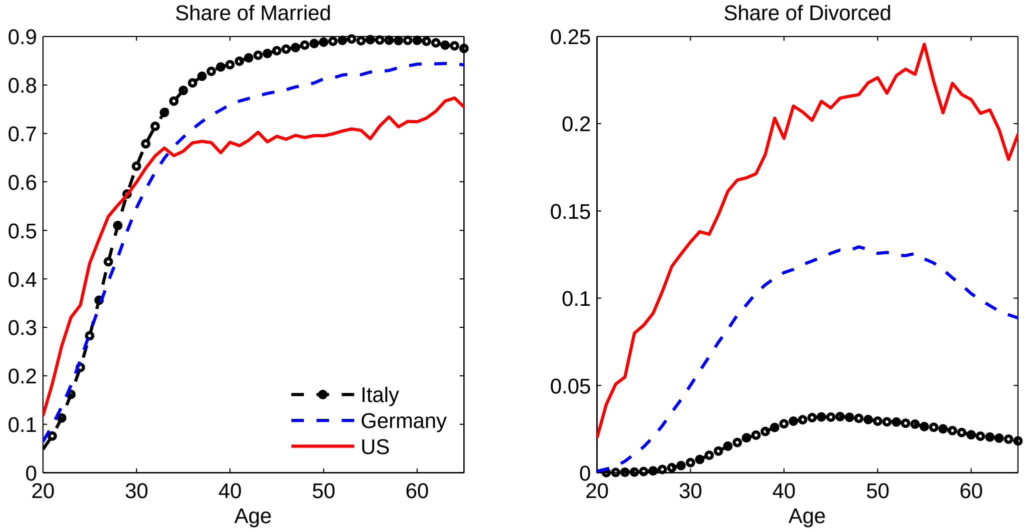


Table 15: Annual Hours Worked, by Age Group and Sex, LIS 2000

Country	Men						Women					
	15-20 yr	% of US	21-55 yr	% of US	56-64 yr	% of US	15-20 yr	% of US	21-55 yr	% of US	56-64 yr	% of US
US	380.80	100.0	1865.56	100.0	1309.24	100.0	345.88	100.0	1349.64	100.0	874.74	100.0
Germany	333.71	87.6	1464.09	78.5	779.80	59.6	287.22	83.0	857.98	63.6	395.93	45.3
Italy	130.80	34.3	1645.44	88.2	782.11	59.7	72.63	21.0	827.07	61.3	239.35	27.4
Spain	243.36	63.9	1587.55	85.1	992.96	75.8	85.96	24.9	768.40	56.9	321.42	36.7
Ireland	432.49	113.6	1761.80	94.4	1274.16	97.3	230.79	66.7	865.56	64.1	283.31	32.4
Austria	696.83	183.0	1649.07	88.4	725.37	55.4	452.59	130.9	1004.45	74.4	296.82	33.9
Belgium	155.56	40.9	1426.76	76.5	498.50	38.1	19.62	5.7	868.73	64.4	156.29	17.9
Netherlands	337.53	88.6	1530.10	82.0	679.06	51.9	366.06	105.8	788.86	58.4	225.45	25.8
Greece	261.82	68.8	1948.03	104.4	1169.27	89.3	101.26	29.3	931.88	69.0	277.77	31.8

Table 16: Annual Hours Worked, With and Without Children, LIS 2000

Country	Men						Women					
	child 3	% of US	child 6	% of US	no children	% of US	child 3	% of US	child 6	% of US	no children	% of US
US	2096.01	100.0	2093.84	100.0	1502.11	100.0	946.43	100.0	1021.13	100.0	1197.06	100.0
Germany	1604.33	76.5	1585.37	75.7	1170.99	78.0	196.58	20.8	304.35	29.8	786.22	65.7
Italy	2027.87	96.7	1976.34	94.4	1257.59	83.7	757.66	80.1	744.57	72.9	645.82	54.0
Spain	1883.10	89.8	1871.86	89.4	1273.15	84.8	676.93	71.5	642.64	62.9	631.69	52.8
Ireland	2045.85	97.6	2063.94	98.6	1390.88	92.6	680.39	71.9	639.05	62.6	740.95	61.9
Austria	1725.81	82.3	1751.53	83.7	1370.35	91.2	434.21	45.9	543.47	53.2	895.71	74.8
Belgium	1525.43	72.8	1540.27	73.6	1118.88	74.5	852.11	90.0	856.72	83.9	678.38	56.7
Netherlands	1668.32	79.6	1681.76	80.3	1232.26	82.0	583.29	61.6	568.38	55.7	702.31	58.7
Greece	2195.55	104.7	2218.34	105.9	1582.30	105.3	899.60	95.1	883.38	86.5	716.79	59.9

Table 17: Contribution of Different Demographic Groups to the Difference in Average Hours Worked Between the US and Europe

Germany

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.391	0.507	0.171	0.743
21-55:	25.379	10.538	33.299	14.594
56-64:	6.053	1.074	4.465	2.787
Total:	43.941		56.058	

Austria

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.422	-9.176	-0.720	-2.356
21-55:	27.700	3.199	34.182	20.023
56-64:	12.037	0.308	8.663	5.719
Total:	34.488		65.511	

Belgium

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	-0.103	3.025	0.362	4.172
21-55:	26.239	8.854	22.143	16.891
56-64:	7.473	1.789	5.763	3.393
Total:	47.276		52.723	

Netherlands

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.380	0.434	0.030	-0.379
21-55:	23.357	6.533	36.989	14.941
56-64:	6.649	1.690	6.215	3.160
Total:	39.043		60.956	

Table 18: Contribution of Different Demographic Groups to the Difference in Average Hours Worked Between the US and Europe, continued

Greece

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.760	3.320	0.698	7.129
21-55:	-6.865	-3.162	45.841	29.511
56-64:	4.366	0.271	10.115	8.016
Total:	-1.309		101.309	

Ireland

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.590	-1.744	0.648	2.452
21-55:	4.882	7.890	44.842	26.557
56-64:	-0.173	0.511	8.148	5.397
Total:	11.956		88.043	

Spain

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	-0.036	2.149	0.346	3.894
21-55:	12.859	12.912	33.838	21.756
56-64:	3.853	0.699	5.518	2.211
Total:	32.436		67.563	

Italy

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.407	4.092	0.395	4.285
21-55:	11.360	10.105	32.058	19.440
56-64:	6.371	1.376	5.980	4.132
Total:	33.710		66.289	

Table 19: Tax-Related Measures by Country (2001)

Country	Max marginal rate	Earnings level where the max marginal rate becomes effective	Consumption tax	Average labor income tax rate paid by the average worker
Austria	42.7%	2.2*AE	20.0	32.0%
Belgium	67.5%	1.2*AE	21.0	42.2%
Denmark	62.9%	1.0*AE	25.0	43.9%
Finland	59.1%	2.1*AE	22.0	32.8%
France	49.5%	1.8*AE	19.6	29.0%
Germany	51.2%	1.5*AE	16.0	42.4%
Greece	51.6%	3.8*AE	18.0	16.5%
Ireland	48.0%	1.1*AE	21.0	23.3%
Italy	45.9%	3.7*AE	20.0	27.0%
Netherlands	52.0%	1.4*AE	19.0	31.5%
Norway	55.3%	2.4*AE	24.0	31.8%
Portugal	46.6%	4.9*AE	17.0	21.3%
Spain	48.0%	4.2*AE	16.0	19.7%
Sweden	55.5%	1.5*AE	25.0	33.8%
Switzerland	49.5%	3.9*AE	7.6	23.8%
UK	40.0%	1.3*AE	17.5	25.5%
USA	47.4%	9.0*AE	8.4	26.0%

Table 20: Sample Compositions

United States

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.001	0.067	0.003	0.063
21-55:	0.215	0.151	0.234	0.151
56-64:	0.041	0.012	0.039	0.022

Germany

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.000	0.049	0.000	0.049
21-55:	0.195	0.156	0.219	0.146
56-64:	0.070	0.020	0.067	0.029
Total contribution of compositional effects = 2.798%				

Spain

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.000	0.057	0.001	0.053
21-55:	0.224	0.153	0.239	0.139
56-64:	0.056	0.008	0.055	0.015
Total contribution of compositional effects = -4.692%				

Italy

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.000	0.052	0.001	0.049
21-55:	0.219	0.149	0.248	0.125
56-64:	0.068	0.009	0.061	0.019
Total contribution of compositional effects = -2.597%				

Austria

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.001	0.043	0.001	0.045
21-55:	0.208	0.169	0.231	0.149
56-64:	0.063	0.012	0.050	0.028
Total contribution of compositional effects = -1.030%				

Table 21: Sample Compositions, continued

Belgium

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.000	0.039	0.000	0.036
21-55:	0.242	0.129	0.264	0.150
56-64:	0.054	0.014	0.053	0.020
Total contribution of compositional effects = -8.717%				

Greece

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.000	0.040	0.001	0.048
21-55:	0.227	0.129	0.269	0.112
56-64:	0.078	0.005	0.075	0.017
Total contribution of compositional effects = -7.176%				

Ireland

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.000	0.071	0.000	0.064
21-55:	0.211	0.160	0.223	0.156
56-64:	0.042	0.015	0.043	0.014
Total contribution of compositional effects = -2.310%				

Netherlands

	Men		Women	
Age:	Married	Single	Married	Single
15-20:	0.000	0.038	0.001	0.041
21-55:	0.223	0.160	0.251	0.147
56-64:	0.053	0.014	0.052	0.019
Total contribution of compositional effects = -6.174%				

Figure 19: The Impact of Marriage and Divorce Probabilities on Employment Rates, Men

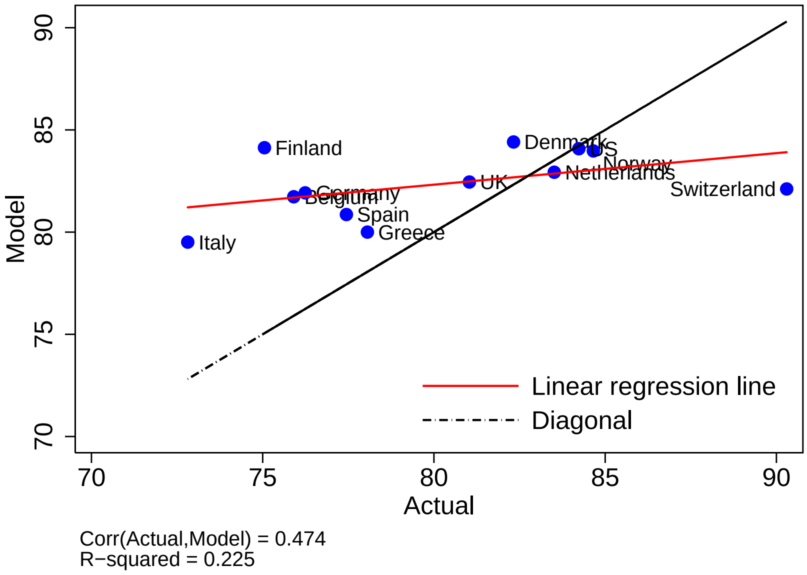


Table 22: The Impact of Taxation (Without Redistributiion) on Hours Worked

Country	Aggregate Employment Rates	
	Actual	Model
Countries with joint taxation of married couples:		
US	100.000	100.000
Germany	70.987	98.400
Norway	83.313	101.351
Spain	73.007	101.625
Switzerland	97.234	100.012
Countries with separate taxation of married couples:		
Greece	87.056	107.839
Italy	73.701	109.412
Belgium	69.167	110.231
Netherlands	72.762	109.555
UK	90.783	108.411
Denmark	88.802	111.193
Finland	86.886	110.959

The table shows hours worked (model predictions and data) as percent of the hours worked in the US

Table 23: The Impact of Taxation (Without Redistribution) on Employment Rates

Country	Aggregate Employment Rates		Female Employment Rates		Male Employment Rates	
	Actual	Model	Actual	Model	Actual	Model
Countries with joint taxation of married couples:						
US	0.771	0.771	0.699	0.700	0.841	0.841
Germany	0.687	0.757	0.610	0.693	0.762	0.821
Norway	0.805	0.780	0.763	0.710	0.847	0.850
Spain	0.610	0.782	0.445	0.716	0.774	0.857
Switzerland	0.809	0.769	0.715	0.699	0.903	0.840
Countries with separate taxation of married couples:						
Greece	0.610	0.830	0.450	0.779	0.781	0.880
Italy	0.574	0.842	0.421	0.800	0.728	0.883
Belgium	0.662	0.848	0.564	0.809	0.759	0.887
Netherlands	0.737	0.843	0.637	0.800	0.835	0.885
UK	0.737	0.834	0.665	0.783	0.810	0.885
Denmark	0.779	0.855	0.733	0.823	0.823	0.888
Finland	0.718	0.854	0.684	0.816	0.751	0.891

Figure 20: The Impact of Taxation Without Redistribution on Employment Rates, Both Genders

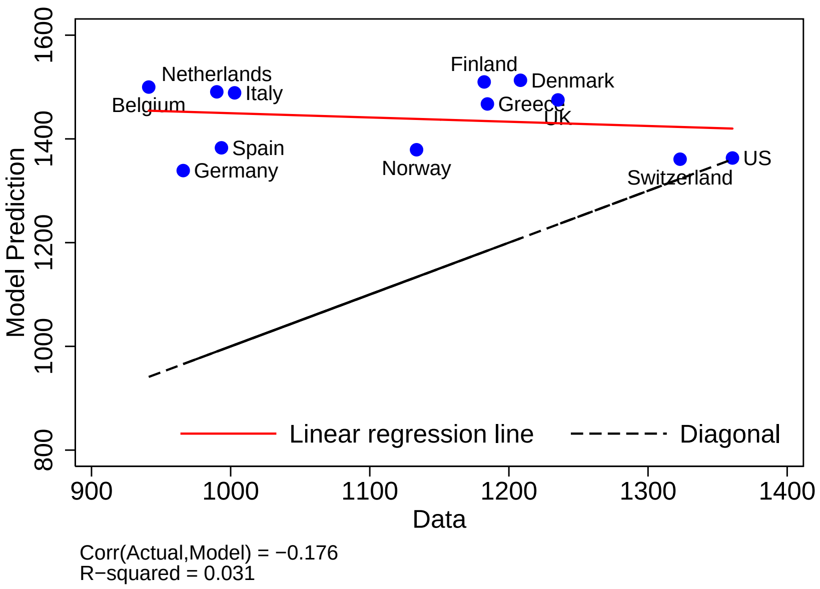


Figure 21: The Impact of Taxation With Redistribution on Hours Worked, Both Genders

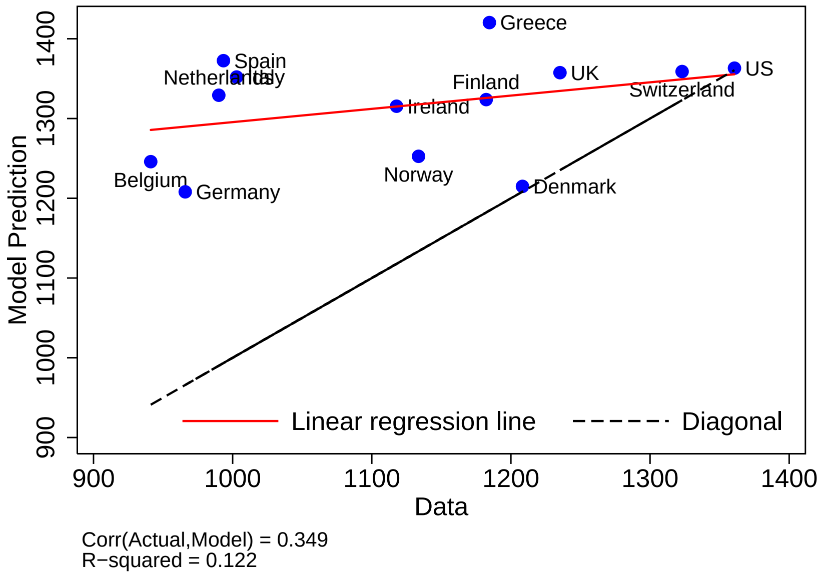


Table 24: The Impact of Taxation (With Redistributiion) on Hours Worked

Country	Aggregate Employment Rates		
	Actual	Model	
Countries with joint taxation of married couples:			
US	100.00	100.00	0.324
Germany	88.782	70.987	0.490
Norway	92.056	83.313	0.446
Spain	100.871	73.007	0.329
Switzerland	99.869	97.234	0.302
Countries with separate taxation of married couples:			
Greece	104.381	87.056	0.287
Italy	99.362	73.701	0.392
Belgium	91.562	69.167	0.551
Netherlands	97.685	72.762	0.445
UK	99.765	90.783	0.380
Denmark	89.287	88.802	0.585
Finland	97.282	86.886	0.476

The table shows hours worked (model predictions and data) as percent of the hours worked in the US

Table 25: Regressing Average Hours Worked on Divorce Rate and Tax Measures (Including Joint vs. Separate Taxation of Married Couples)

	(I)	(II)	(III)	(IV)
Const	1321.374***	1166.408***	1258.269***	1395.375***
	(217.377)	(142.989)	(86.756)	(115.362)
Divorce rate	27.097*	19.428	41.959***	36.638***
	(14.248)	(14.142)	(12.010)	(11.163)
Top marginal tax rate	−6.413	–	–	–
	(4.497)			
Progressivity wedge	–	−629.507	–	–
		(557.163)		
Average labor income tax	–	–	−1183.122***	–
			(334.931)	
Average effective tax rate	–	–	–	−1160.108***
				(318.644)
Separate Taxation	0.197	-0.002	16.046	32.918
	(59.042)	(61.365)	(45.244)	(45.770)
adjusted R^2	0.085	0.037	0.460	0.476

Standard errors are in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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