

Trends in Male and Female Market and Home Hours: A Cross-Country Study

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Abstract

It has become widely recognized that trends in market hours worked vary across countries. Much work has been done trying to understand the forces that influence market hours. More traditional models, like the one used by Prescott (2004) focus on forces that influence the trade-off between market work and leisure. Other models, like Rogerson (2007), Ragan (2005) and, McDaniel (2009) include home production. Each find that home production is a key channel influencing the forces that shape market hours. Aguiar and Hurst (2006) Ramey and Francis (2006) have documented trends in market hours, home production and leisure in the United States. In this paper, we document time trends in market work and home production making use of data available from the Multi-National Time Use Study to document time allocation trends for a set of industrialized countries for men, women both sexes. We observe that labor force participation and market hours worked per female have increased and home production time by men has increased in all countries. We find much of the aggregate differences in market hours to be driven by differences in female labor supply. We construct and calibrate a model of household division of labor that we use to generate changes in female labor force participation and male and female market hours and home production. We take cross country gender productivity differences, income tax rates and distribution of single and married households as given and find that the model generates series for female labor participation, home and market hours that are very sensitive to differences in income tax rates and productivity.

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1 Introduction

Much work has been done in an effort to explain the cross country differences in trends in market hours. Market hours per adult have declined significantly since the 1960s in some European countries while hours have increased slightly in the United States. This paper has two objectives. First we document time allocation across countries and establish a set of facts. We then construct and calibrate a model of household division of labor of the type introduced in Guner et al. (2008). The model is calibrated to match home and market hours and participation rates in United States in 2000. The calibrated model does a very good job of replicating what is observed in the United States in 1965. However, when the calibrated model is used to generate the distribution of hours and labor force participation rates in other countries, the model generates market hours for males and females much lower than observed in the data and home hours slightly greater.

Research like Rogerson (2007), Ragan (2005) and, McDaniel (2009) has argued that home production is an important channel to explain the trend movement in market workers across the continental European countries and the US. The change of market hours in such models relies on the response of home hours to various forces. A successful model should not only generate the change in market hours comparable with the data but also generate the change in home hours comparable with the data in each country. This requires us to have evidence about home hours across country over time. One of the objective of this paper is to document the time allocation between market hours, home hours, and leisure across countries.

1.1 Related Literature

more to come

1.2 Facts

We examine time use and census data, described in detail in the next section, and establish the following set of facts.¹ Figure 1 shows cross country differences in market hours worked per person aged 20-59 in a set of Western countries. For more insight on cross country differences in market hours, we look at labor force participation rates and hours per employed person for both men and women. Figure 2 and 3 show that trends for participation rates are similar for males and females (more so for males) across countries. Figures 4 and 5 show similarity in trends of market hours per employed male across countries and greater differences in hours worked per employed females. Notice that cross country differences in levels or trends in both labor force participation and hours per employee is greater for females than for males.

Data presented in figures 2 - 5 imply that the gap between male and market hours per person has declined in all countries and figure 6 confirms this. Men still work more in the market in all countries by at least 10 hours per week, but the narrowing of the gap in market hours has been dramatic. This raises the question of what has been happening to home production time. Figure 7 shows that the difference between male and female home production time per person has also been declining with women still working more in the home sector, but the difference is shrinking with females working only 10 hours per week more in the home sector than men in both countries.

If females are working more in the market and less at home relative to males, there must be an incentive for them to do so. Figure 8 shows female wages relative to male wages for a small set of countries and years. While data are only available for Canada and the United States in early years, the gender gap in wages is decreasing in these countries and relative wages in France, Germany and Spain in later years are greater than earlier years for Canada and the United States.

¹Population apply to population aged 20-59.

Based on the data presented in figures 1 8 we establish a set of facts.

1. Market hours per adult declined in some countries and increased modestly in others
2. Home hours per adult declined in all countries
3. Men have decreased market hours on both extensive (barely) and intensive margins in all countries and increased home hours in all countries except France
4. Women have decreased home hours in all countries and increased market hours in all countries except Germany. In addition, the labor force participation rates for women have increased in all countries and the market hours per employed female varies across countries.
5. The gap between male and female market and home hours has narrowed in all countries.
6. The gender gap in wages has narrowed over time.

2 Data

Data on time allocations are obtained from the Multinational Time Use Study (MTUS). The goal of the MTUS is to the creation of a cross-nationally harmonized time use data with identical variables. This data set is continuously updated with new surveys and upgrades of older ones. The data are collected from daily time use diaries. Each diarists are differentiated by (among other things) age, sex, employment status and marital status. There are several different releases, 5.0, 5.52, 5.53, and 5.8. Release 5.0 includes only individuals aged 20-59. Since early surveys for France, Germany and Italy and available only as the 5.0 release, the age group is restricted to 20-59. Table 1 displays countries and years available.

Table 1: Countries and Years

Country	Years
Canada	1971,1981,1986,1992,1998
Denmark	1964,1987
France	1961*,1974*,1998
Germany	1965*,1991,2001
Italy	1979*,1989,2002
The Netherlands	1975,1980,1985,1990,1995,2000
Norway	1971,1981,1990,2000
The United Kingdom	1974,1983,1987,1995,2000
The United States	1965,1975,1985,1992,1998,2003

*5.0 release

2.1 Definition of activities

The Multinational Time Use surveys classify activities into 41 categories, from these categories, we construct broader uses of time. We classify time as either market work, home production, childcare, or leisure. Market work includes paid time and travel to and from work. We consider leisure to be any activity not market work, home production or childcare.

Each entry in the MTUS database represents a diary day with the day of the week the diary was completed included in the entry. Along with minutes per day spent by the diarist in each activity, entries include demographic characteristics of the diarist. Diarists are separated into demographic group by age-group (20-29,30-39,40-49,50-59), sex and employment status for a total of sixteen demographic groups. For each of the 16 demographic groups, we calculate average hours per week spent in each broad activity category. The observations for each activity are weighted such that weekend and weekday observations contribute 2/7 and 5/7 respectively to the group average. This is to avoid any problem resulting from unequal distribution of diary days. Averages for each demographic group are then weighted to reflect distribution of the population using data from *The International Labour Organization* (ILO) annual statistics on economically active population by sex and age group.²

²This is the source suggested by authors of the “Multi-National Time Use Study User’s Guide and Documentation” reference. Labor force participation rates calculation from ILO are consistent with those

Table 2: MTUS Activities

Activity Code	Activity	Activity Code	Activity
AV 1	Paid work	AV 21	Walking
AV 2	Paid work at home	AV 22	Religious activities
AV 3	Paid work, second job	AV 23	Civic activities
AV 4	School, classes	AV 24	Cinema or theatre
AV 5	Travel to/from work	AV 25	Dances or parties
AV 6	Cook, wash up	AV 26	Social clubs
AV 7	Housework	AV 27	Pubs
AV 8	Odd jobs	AV 28	Restaurants
AV 9	Gardening	AV 29	Visit friends at their homes
AV 10	Shopping	AV 30	Listen to radio
AV 11	Childcare	AV 31	Watch television or video
AV 12	Domestic travel	AV 32	Listen to records, tapes, cds
AV 13	Dress/personal care	AV 33	Study, homework
AV 14	Consume personal services	AV 34	Read books
AV 15	Meals and snacks	AV 35	Read papers, magazines
AV 16	Sleep	AV 36	Relax
AV 17	Free time travel	AV 37	Conversation
AV 18	Excursions	AV 38	Entertain friends at home
AV 19	Active sports participation	AV 39	Knit, sew
AV 20	Passive sports participation	AV 40	Other leisure
AV 41	Unclassified time		

Table 3: Activities
Activity **MTUS code**

Market work	AV1-AV3 AV5
Home work	AV6-AV10
Childcare	AV11
Personal Care	AV 13 AV14, AV 16
Leisure	All other activities

2.2 Census Data

Data for figure 8 are constructed using census data from Integrated Public Use Microdata Series (IPUMS) and MTUS. IPUMS provides access to census data for numerous countries and time periods. The data available in each census differs across countries and time periods, so it is not possible to calculate average wages for males and females in all countries in the sample. The IPUMS provides access to data collected by Bureau of the Census for the United States and Statistics Canada for Canada. Average wages in the United States are calculated by dividing annual income from wages and salaries by usual weekly hours worked times the number of months worked. If ranges are given for hours or income, the mid-point is used. Data for hours in Canada 1971 are full or part-time only. We assume that full time workers work an average of 40 hours per week and part-time workers 20. If income variables are present in the census data provided by IPUMS, these variables are used to calculate average wages. In some cases, the data are not available from IPUMS, but are available in the surveys provided by MTUS. Wages for France, Germany and Spain are calculated in a similar fashion using MTUS data.

IPUMS data is also used to construct the population distributions used in calibration and simulations for the United States in 1965. Distributions are constructed assuming linear trend over the period 1960 and 1970. Census data for France in the IPUMS database comes from National Institute of Statistics and Economic Studies. Census data are available for

from OECD publications.

1999 and the MTUS survey data used to find hours covers the period 1998-99. Canadian census data are not organized into households, so distribution of married households in Canada 1998 is assumed to be the same as in the United States in the year 2000.

3 Model

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This section presents a simple model of time allocation to account for the facts established earlier. The model emphasizes the changes in three factors that lead to the observed differences in time allocation between the U.S. and continental European countries from 1960 to 2000. The three factors are: gender wage gap, productivity (technology), and government tax and transfer program.

The economy is populated by a continuum of males and a continuum of females. The total mass of each gender is normalized to one. Agents are divided into four types: single male, single female, married male, and married female.

Each agent is endowed with one unit of time which has three uses: market work, home work, and leisure. The utility function for a single person is given by

$$u^s(c, 1 - h_M^s - h_N^s) = \log(c) + a \frac{(1 - h_M^s - h_N^s)^{1-\gamma} - 1}{1 - \gamma},$$

where h_M^s is the time spent in market work and h_N^s is the time spent in home work. c is a composite good representing market good and home good. c is defined by

$$c = [b_c(c_M - \bar{c})^\eta + (1 - b_c)c_N^\eta]^\frac{1}{\eta},$$

where c_M is the consumption of market good and c_N is the consumption of home good. A single person produces home good according to the production function $c_N = A_N h_N^s$. Following the literature, we assume that home good and market good are substitutes, i.e., $\eta > 0$. \bar{c} represents a subsistence level of the market good. As in Rogerson (2008) and McDaniel (2010), the subsistence level will generate the increase in leisure from 1960 to 2000.

Married couples make consumption and labor supply decision jointly. As in Cho and Rogerson (1998), among other papers, we assume that the household incurs a utility loss q if the married female works in the market. The utility of a married household is given by

$$u^m(c, l) = \log(c - \bar{c}) + a \frac{l^{1-\gamma} - 1}{1 - \gamma} - q\lambda,$$

where the composite good c has the same form as before. λ is a indicator function with the interpretation that $\lambda = 1$ if the female member works in the market and $\lambda = 0$ if the female member does not work in the market. l is the leisure enjoyed by the household which is defined as

$$l = [b_l(1 - h_M^{mm} - h_N^{mm})^\epsilon + (1 - b_l)(1 - h_M^{mf} - h_N^{mf})^\epsilon]^{\frac{1}{\epsilon}},$$

where h_M^{mm} and h_N^{mm} are the time spent in market work and home work by the male member and h_M^{mf} and h_N^{mf} are the time spent in market work and home work by the female member. We assume $\epsilon < 0$. This implies that female leisure and male leisure are complements and household members prefer to have similar amount of leisure time. The interpretation is that they like to enjoy leisure together. Technically, this assumption enables us to capture the fact in the data that married male and married female enjoy similar amount of leisure time, see Burda et al. (2008).

The married household combines both family member's time to produce home good via the production function

$$c_N = A_N [b_N (h_N^{mm})^\alpha + (1 - b_N) (h_N^{mf})^\alpha]^{\frac{1}{\alpha}},$$

where h_N^{mm} and h_N^{mf} are the male and female home hour respectively. Female and male home time are substitutes, hence $\alpha > 0$.

Market consumption good is produced through a linear technology: $y = A_M e$, where e

is the total efficient units supplied to the market. Normalizing the wage rate of per efficient unit to be 1, the linearity of technology implies that the price of the market good p is simply given by $\frac{1}{A_m}$.

Each agent in this economy is born with a particular labor productivity and the efficient unit an agent supplies is the product of his/her productivity and time spent in market work. Let z^m denote a male agent's labor productivity and let z^f denote a female agent's labor productivity. We define $F^{sm}(z^m)$ as the fraction of single males with productivity z^m in the male population, define $F^{sf}(z^f)$ as the fraction of single females with productivity z^f in female population, and define $G(z^m, z^f)$ as the fraction of married couple with male member productivity z^m and female member productivity z^f in the married couple population.

The government in this economy imposes a proportional labor income tax τ^h and consumption tax τ^c and the proceeds are rebated back in a lump-sum fashion. We can now define the budget constraint facing by the single household and married household. In particular, the single household faces the following budget constraint:

$$p(1 + \tau^t)c_M = z^j h_M^s (1 - \tau^h) + T, \quad j = m, f \quad (1)$$

and the married household faces the following budget constraint:

$$pc_M(1 + \tau^c) = (z^m h_M^{mm} + z^f h_M^{mf})(1 - \tau^l) + 2T \quad (2)$$

3.1 Equilibrium

The equilibrium time allocation can be easily obtained by maximizing each type the household's utility subject to the relevant budget constraint.

4 Calibration

In this section, we describe the calibration of the model. The model is calibrated to match the levels of time allocation for the U.S. economy in 1965 and 2003 taking the productivity distribution and the demographics as given. We choose four levels of productivity for both male and female. Each productivity level corresponds to an educational attainment: less than high school, high school, some college, college and post-college education. We use data from the IPUMS to construct the productivity for different education group. The productivity is simply calculated as the mean hourly wage of each group normalized by the average wage of that year. Table 4 reports the productivity for each education group by gender in 1965 and 2003, where wage is normalized by the overall mean wage at a given year. Several facts are worth noting in the table. First, the gender gap is roughly constant across educational categories in 2003, but is decreasing with education level in 1965. Second, the gender gap has decreased for less than college education but remained constant for college and post-college education.

We use data from IPUMS to construct the demographic distribution of individuals. The IPUMS data comes from the U.S. Census. Since census data only available every 10 years, we use 2000 Census to construct statistics for 2003 and use the average of 1960 and 1970 Census to construct statistics for 1965. The implied distribution for $F^{sm}(z^m)$, $F^{sf}(z^f)$, and $G(z^m, z^f)$ are reported in table 5, 6 and 7.

We set γ to be one which leads us to log-log preferences. There are several estimates of the elasticity of substitution between home good and market good we can use to pin down η . In particular, Using microeconomic data, Rupert, Rogerson and Wright (1995) estimate η to be between 0.4 and 0.45 depending on the demographic group. Also using micro data, Aguiar and Hurst (2007a) finds η to be in the range of 0.5-0.6. Using macro data, Chang and Schorfheide (2003) finds a value of η to be between 0.55 to 0.6, and McGrattan, Rogerson and

Wright (1997) estimate it to be 0.4-0.45. We set η to be the middle value of the estimates, 0.5. We normalize A_M and A_N to be one in 2003. Following McDaniel (2010), we set the annual growth rate of A_M to be 0.018. This implies that the market productivity in 1965 is 0.51.

This leaves us with eight parameters: a , b_c , b_N , α , b_l , ϵ , \bar{c} , q and A_N^{1965} . We calibrate these eight parameters jointly to match the following targets: aggregate market and home hours in 1965, aggregate market and home hours, female and male market and home hours, and female labor force participation rate in 2003. The labor force participation rate is taken from OECD, other targets come from MTUS. In the data, not all working age male supply positive hours to the market (though nearly 90%). However in the model there is no utility loss for male to work in the market. As a result, it is optimal for all males to supply positive hours to the market. Hence, we target at the relative labor force participation rate of female to male instead of the actual female employment rate in the data. To be consistent with the hours allocation from the MTUS, all data is for ages 20 to 59. For this age group, there is little difference in male participation rates between European countries and the U.S. (see figure 2).

With the tax rate series from McDaniel (2007), the tax rate for the U.S. is set to 0.17 in 1965 and 0.26 in 2003. This includes labor income tax, social social security tax, and consumption tax. The calibrated parameter values are shown in table 8. The targets and the corresponding statistics generated by the model are listed in table 9. The model does a good job in matching the targets. Moreover, the female employment rate and the female and male home and market hours in 1965 generated by the model matches the data well although they are not targeted in the calibration.

5 Simulations

This section uses the calibrated model to explain the difference in time allocation in different countries by feeding the country specific tax rate and productivity and demographic distributions.

5.1 Canada

The tax income tax rate used for Canada is 0.37 from McDaniel (2007). The resulting hours distribution for Canada in 1998 is shown in table 10.

5.2 France

The income tax rate used for France is 0.55 also from McDaniel. The resulting hours distribution for France in 1998 is shown in table 11.

6 Discussion

The tables show that model generates a lower level of market hours for both men and women in both countries and a higher level of home than observed in the data. ?? shows that the elasticity of substitution between home and market goods is an important determinant of the sensitivity of market hours to tax rate changes. Our choice of $\eta = 0.5$ likely generates the disparity between data and model. Our next task is to incorporate different types of home production with different elasticities of substitution.

6.1 progressive Tax

The earlier analysis has assumed a proportional labor income tax while the tax system in the U.S. and continental European countries are both progressive. This section explores

the implications of the progressive tax on labor allocation. For this purpose, we borrowed the income tax function estimated by Guvenen et al. (2009). We also model the consumption tax separately and set it to be 0.075 following the calculation from McDaniel (2007). The difference in labor allocation between the U.S. and European countries generated by progressive tax is similar to that of the proportional labor tax.

7 Conclusion

More to come

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Figure 1: Total Market Hours

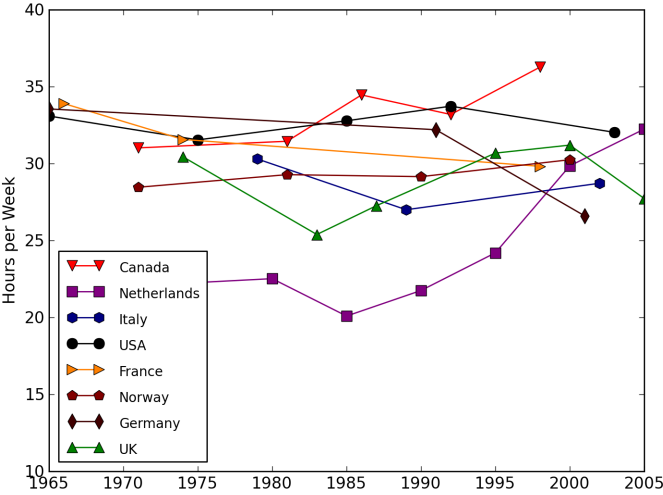


Figure 2: Male Labor Force Participation Rate

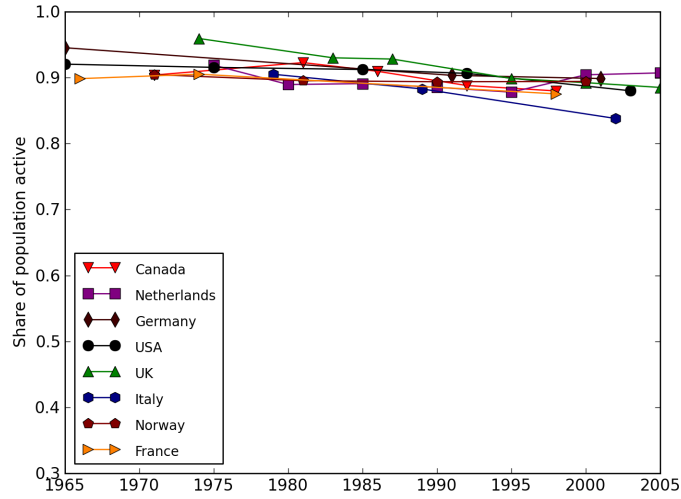


Figure 3: Female Labor Force Participation Rate

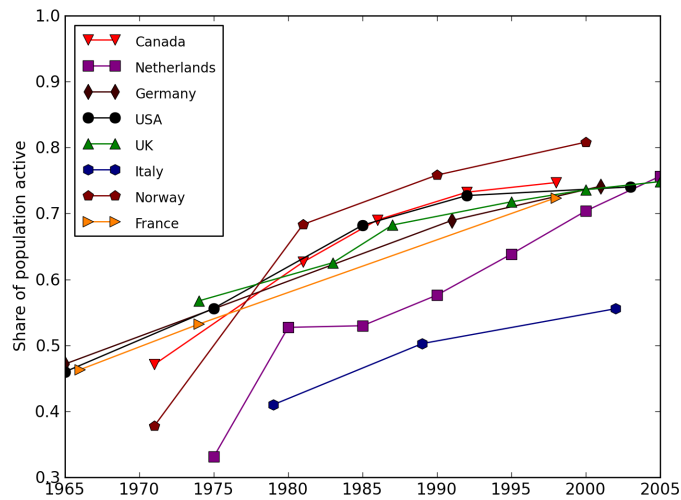


Figure 4: Hours per employed male

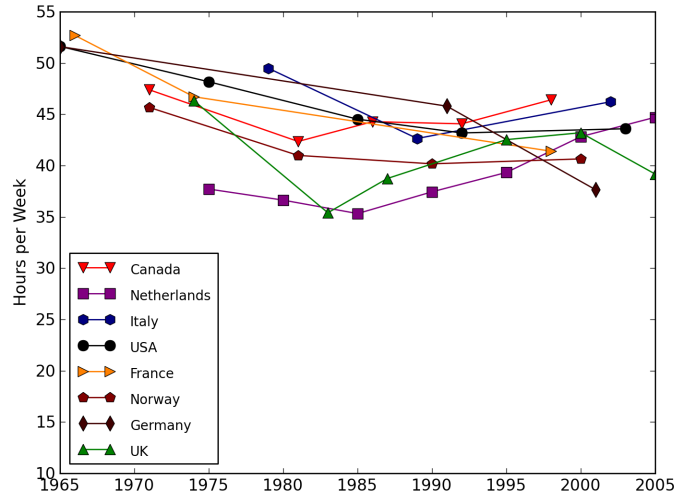


Figure 5: Hours per employed female

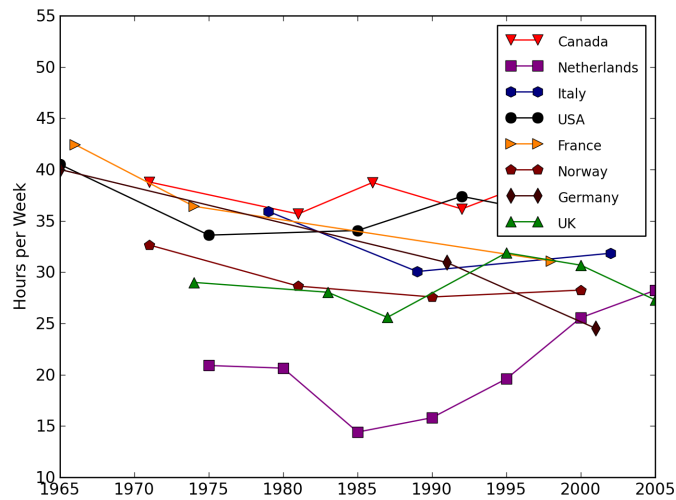


Figure 6: Difference between male and female market hours per person

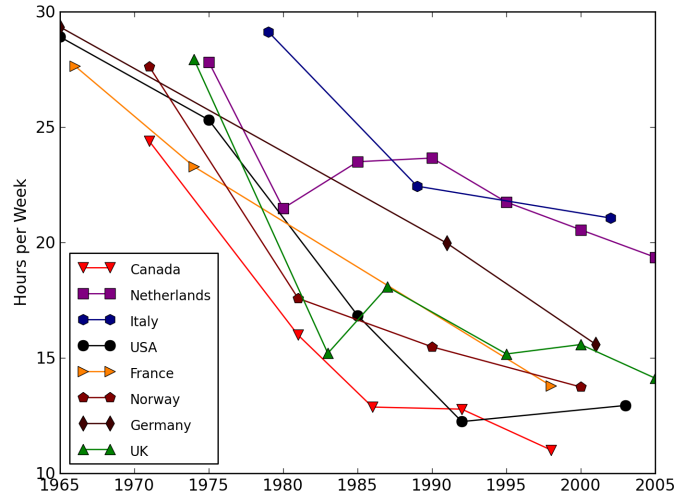


Figure 7: Difference between male and female home hours per person

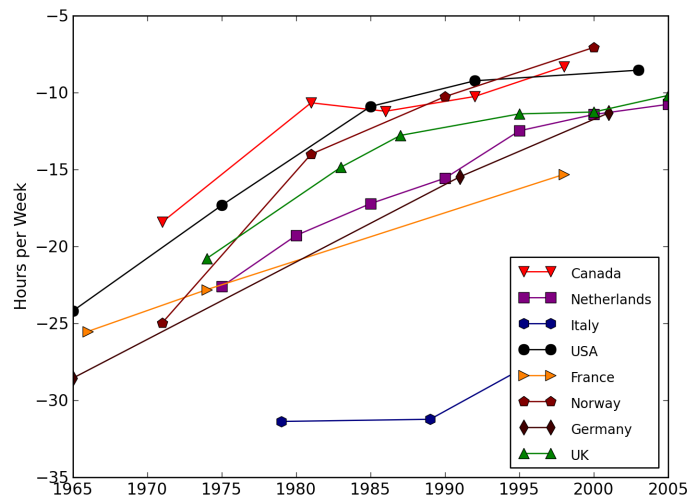


Figure 8: Female wages relative to male wages

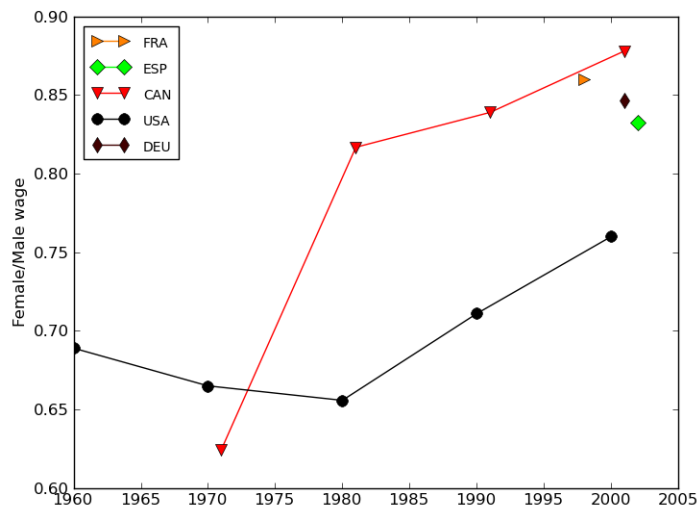


Table 4: Productivity, United States

	1965			2000		
Education	Male (z^m)	Female (z^f)	z^f/z^m	Male (z^m)	Female (z^f)	z^f/z^m
<HS	0.9635	0.6129	0.6361	0.709	0.505	0.712
HS	1.0977	0.7224	0.6579	0.92	0.669	0.727
SC	1.2740	0.8618	0.6765	1.113	0.799	0.718
COL	1.6366	1.2337	0.7543	1.628	1.189	0.73

Table 5: Distribution of Single Household

	1965		2000	
Education	Male	Female	Male	Female
<HS	0.092659195	0.09911414	0.0386	0.0403
HS	0.061761505	0.07119971	0.0703	0.0679
SC	0.04105276	0.035503	0.0773	0.0848
COL	0.023604745	0.02100566	0.0738	0.0670

Table 6: Distribution of Married Household, 1965

	Female			
Male	< HS	HS	SC	COL
<HS	26.90842915	6.647631	1.555029	0.54433175
HS	14.3456357	19.1261455	5.552748	3.07636675
SC	2.44077615	3.7120435	3.3552765	2.98889285
COL	0.95160855	1.6334745	1.63664	5.5249718

Table 7: Distribution of Married Household, 2003

		Female			
Male	< HS	HS	SC	COL	
<HS	6.76	4.24	2.32	0.56	
HS	3.15	13.49	7.29	2.51	
SC	1.75	7.44	13.51	5.88	
COL	0.56	3.26	8.39	18.88	

Table 8: Parameter Values

Parameter	a	b_c	b_N	α	b_l	ϵ	\bar{c}	q	A_N^{1965}
Value	1.94	0.63	0.5	0.37	0.5	-10	0.0065	0.035	0.76

Table 9: Targets

Statistics*	Data	Model
2003		
market hour	31.9	32.1
home hour	16.8	16.3
male market hour	38.6	38.3
male home hour	12.6	12.1
female market hour	25.2	25.9
female home hour	21.3	20.5
female employment rate	0.84	0.87
1965		
market hour	33.6	30.58
home hour	19.7	21.5
male market hour	49.6	42.0
male home hour	7.1	12.9
female market hour	19.2	19.3
female home hour	31.1	30.1
female employment rate	0.52	0.64

*The time endowment is equivalent to 168 hours per week

Table 10: Distribution of Hours in Canada, 1998

	h_M	h_N	h_N^f	h_M^f	h_N^m	h_M^m	Female part./Male part.
model	27.4	18.8	20.7	24.7	17.0	30.2	.96
data	36.3	17.8	22	30.7	13.7	41.8	.85

Table 11: Distribution of Hours in France, 1998

	h_M	h_N	h_N^f	h_M^f	h_N^m	h_M^m	Female part./Male part.
model	18.5	24.9	30.1	11.6	19.7	25.7	.60
data	29.8	18	25.6	20.6	10.3	36.7	.81