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# Will You "Quasi-marry" Me? The Rise of Cohabitation and Decline of Marriages[1]

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***Abstract.***

In Western Europe and the US, the last couple of decades have witnessed a large increase in the new forms of marriages, usually called quasi-marriages, like cohabitation. Today in many European countries more than 15% of all couples are cohabiting. Furthermore, cohabiting couples differ from married ones. They tend to share household tasks and market works more equally than married couples. The aim of this paper is to account for the rise in cohabitation as well as the cross-sectional differences between cohabiting and married couples. To this end, we build a two-period model of marriage and cohabitation with home production. Using this framework, we analyze, both theoretically and empirically, the effects of the narrowing of the gender wage gap and the improvement in household production technology on the agents' marital decisions.

***JEL classifications****:* D10, J12, J16

***Keywords:*** marriage, cohabitation, marital institutions, household production technology, gender wage gap

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# 1 Introduction

Family and household structure changed drastically in the last couple of decades. The marriage rate has declined sharply resulting in a shift in the composition of population by marital status towards never married. In the US divorce rates rose, doubling between the mid-60s and mid-70s. The divorce rate has also increased more recently in many European countries like Italy, France, Germany, and Spain.

At the same period, the basic institution of marriage also underwent a big change. People have turned to more flexible forms of union. The decision to form a household with another person has been decoupled from the decision to marry, and *quasi marriages* have emerged as a new institution. In some countries cohabiting couples have the possibility to enter formal registration that will provide them with a virtually equivalent legal status to that of married couples (with some possible exceptions). Some examples of more formal types of quasi marriage are registered partnership in Belgium and pacte civile de solidarité in France. In most countries though, informal cohabitation is the only available form of quasi marriage. Both formal and informal cohabitation can be dissolved easily with minor costs and their dissolution rate is higher than the divorce rate (see Pison, 2008 for pacte civile de solidarité in France and Bumpass and Lu, 1989 and 2000 for informal cohabitation in the US).

But what factors are behind the shift towards quasi marriages? One possible factor is the dramatic increase in female labor force participation over the past decades. The increase started earlier in some countries (e.g. the US and the Scandinavian countries) but spread to the most of the OECD countries. In 2001 the participation rates of prime-age women range from less than 50% in many Southern European countries to well above 70% in Scandinavian, Central European countries, and the US (Jaumotte, 2003).

There is a large literature that studies the changes in female labor supply. Among possible factors one can list the diffusion of the contraceptive pill (Goldin and Katz, 2002), the narrowing of the gender wage gap (Jones et al., 2003), the cultural transmission of gender roles from mothers to sons (Fernández et al, 2004), and the improvement in the household production technology (Greenwood et al., 2005). More recently, Kaygusuz (forthcoming) has emphasized the role of tax reforms, while Albanesi and Olivetti (2009b) have proposed medical progress as a potential factor. In this paper we focus on the narrowing of the gender wage gap and the improvement in the household production technology. These two factors may also affect agents' incentives to get married. The narrowing of the gender wage gap increases women's bargaining power and reduces the value to specialization within marriage. Improvements in household technology lead to a further decrease in the returns to specialization, and in the opportunity cost of not getting married (Greenwood and Guner, 2009).

The question we try to investigate is the effect of the narrowing of the gender wage gap and the improvement in household production technology on the rise of

cohabitation. The basic idea is as follows: In the past most women did not work, or earned less than men. Hence, marriage, which was more difficult to break than cohabitation due to the legal costs involved, was an attractive option for women (Becker, 1993). Men on the other hand were depending on women because of house work. Household production technology was not very progressed and it required a lot of time. Hence, a man would get married to a woman so as to use her time in house work and devote his own time to market work (specialization). Nowadays the conditions have changed. The gender wage gap has narrowed and household production technology has improved, weakening the incentives to enter a "secure" union for both men and women.

The idea that the agents' marital decisions are affected by economic reasons goes back to Becker (1993). According to Becker the major cause of the changes of the family was the growth in the earning power of women as the American economy developed. Cohabitation is also a part of the change. Oppenheimer (1994) instead, argues that it is the deterioration of young men's earnings that caused the increase in cohabitation.

The recent economic literature has proposed other possible causes of cohabitation. Stevenson and Wolfers (2007) report as possible driving forces the diminishing social stigma, and the lower value of formal marriage (through the unilateral divorce laws and marriage tax penalty on secondary earners). Social stigma though, can be endogenous. In this case, technological changes may as well affect its evolution in time. Taxes could play a role with the tax penalty acting as an enhancing factor for cohabitation. Chade and Ventura (2005) develop a search model with differential tax treatment of married and single people in the US. They also extend their model to include cohabitation. In their study cohabitors are taxed individually, as if they were single. However, it is worth noticing that in Nordic countries and the US the tax penalty on secondary earners has decreased during the last decades (Jaumotte, 2003). In the same period in the US the rate of cohabitation has doubled. In Italy and Spain, where the tax penalty has increased substantially, cohabiting couples are still a small minority (less than 5%). Lastly, there are countries like France and the Netherlands where cohabiting couples have the possibility of registering and therefore facing the same tax penalty as married couples.

The existing literature takes different paths to model the differences between marriage and cohabitation. Drewianka (2004 and 2006) attributes the difference in the level of commitment, while Cigno (2007), Wydick (2007), and Matoushek and Rasul (2008) adopt a game-theoretical framework where cohabitation arises as a non cooperative equilibrium and marriage as a cooperative one. In Cigno's (2007) framework, the equilibrium in the cooperative game is reached by Nash-bargaining while equilibrium in the non-cooperative game is Cournot-Nash and each party takes the other party's actions as given. Matoushek and Rasul (2008) show that marriage serves as a commitment device that fosters cooperation in an infinitely repeated prisoner's dilemma. In our setting cohabitation differs from

marriage with respect to the probability and the cost of dissolution.

The transition from cohabitation to marriage has also been a matter of interest. Brien et al (2006) study cohabitation, marriage and divorce in the US using a model of learning of match quality. They perform quantitative analysis and show that cohabiting unions have higher dissolution probability than marriages and marriages that are proceeded by cohabitation are less likely to last (selection effect). We treat cohabitation as a substitute and not as a precursor to marriage, i.e. we abstract from transitions into marriage. Moreover, the need to learn the match quality is unlikely to explain why cohabitation has become common nowadays although it was rare in the past. Gemici and Laufer (2010) study the inefficiencies that might arise in cohabitation due to the lack of commitment. Using a model with household production technology they perform policy experiments, and assess the welfare implications of different institutional arrangements regarding divorce regulations.

There is also an empirical literature examining the factors that caused the increase in cohabitation. Kalmjin (2007) uses cross-sectional data for 27 countries in the mid 1990's and finds that female labor force participation as well as the percentage of the population with tertiary education affects positively cohabitation. The unemployment rate decreases cohabitation, while church membership does not have any statistically significant effect. Wydick (2007) also finds that female labor force participation increased cohabitation using data for the 50 states of the US in 1990 and 2000. In some specifications religion also seemed to play a significant negative role. The divorce rate, the mandated health insurance coverage of the contraception pill, as well as per capita abortions do not have any significant effect.

Our variables of interest, i.e. the gender wage gap and the improvement of household production technology are two of the factors that have been identified behind the increase in female employment. Greenwood et al (2005) study the effect of the new household production technology (through the declining prices and wider availability of home appliances) on female labor force participation. This effect is assessed empirically by Cavalcanti and Tavares (2008) using data for 17 OECD countries between the years 1975-1999. Their findings suggest that a decrease in the relative price of home appliances leads to a substantial and statistically significant increase in female labor force participation. Jones et al. (2003) find instead that it is the gender wage gap what drives the increase in female employment. The primer goal of these studies is to examine the factors behind female employment and they therefore treat marital decisions as exogenous without making any distinction between marriage and cohabitation. We endogenize the marital decision and we include cohabitation as an extra marital institution.

# 2 Motivation

## 2.1 Cohabitation, Marriage Rate and Marital Status of the Population

Cohabitation has risen sharply during the last decade. Cohabitants as a percentage of all couples have doubled in the US during the last 20 years (Current Population Survey). The rate of cohabitation is nowadays around 20% or above in many European countries like Denmark, Finland, France, the Netherlands, Norway, and Sweden (Table 1).

Cohabitation serves either as a precursor or as a substitute for marriage. In the US, although most cohabitations do not end in marriage, most marriages are preceded by cohabitation (National Survey of Family Growth, 2002). Furthermore, one fifth of the cohabitations in the US in 2002 last more than 5 years, indicating that cohabitation can be permanent, and thus a substitute for marriage (Stevenson and Wolfers, 2007a).

Table 1

**Cohabiting couples as percentage of all couples**

| | 1990's | | 2000's | | % change |
|---|---|---|---|---|---|
| Austria | 1997 | 9.11 | 2007 | 15.35 | 68.50 |
| Belgium | | | 2007 | 11.10 | NA |
| Denmark | 1996 | 24.81 | 2006 | 24.37 | -1.77 |
| Finland | 1995 | 18.49 | 2007 | 24.19 | 30.83 |
| France | 1995 | 14.58 | 2004 | 19.61 | 34.50 |
| Germany | 1996 | 8.52 | 2005 | 11.71 | 37.44 |
| Ireland | 1995 | 4.67 | 2006 | 14.14 | 202.78 |
| Italy | 1995 | 3.08 | 2006 | 4.47 | 45.13 |
| Netherlands | 1996 | 13.88 | 2008 | 19.25 | 38.69 |
| Norway | | | 2008 | 22.44 | NA |
| Spain | | | 2005 | 4.26 | NA |
| Sweden | 1995 | 23.35 | 2005 | 26.82 | 14.86 |
| UK | 1996 | 10.00 | 2006 | 15.99 | 59.90 |
| US | 1996 | 5.07 | 2008 | 10.43 | 105.72 |

Source: See Appendix

At the same time, the marriage rate has decreased substantially in many countries (Table 2). The crude marriage rate, i.e., the ratio of the number of marriages during the year to the average population in that year, has fallen more than 17% in Austria, France, Italy, the Netherlands, UK, and the US. Tables 1 and 2 indicate that more couples decide to cohabit instead of getting married.

Table 2

**Crude marriage rate (per 1000 inhabitants)**

| | 1990's | | 2000's | | % change |
|---|---|---|---|---|---|
| Austria | 1995 | 5.40 | 2007 | 4.33 | -19.81 |
| Belgium | 1995 | 5.07 | 2007 | 4.29 | -15.38 |
| Denmark | 1995 | 6.64 | 2007 | 6.70 | 0.90 |
| Finland | 1995 | 4.65 | 2007 | 5.58 | 20.00 |
| France | 1995 | 9.10 | 2007 | 4.30 | -52.75 |
| Germany | 1995 | 5.27 | 2007 | 4.48 | -14.99 |
| Ireland | 1995 | 4.32 | 2007 | 5.17 | 19.68 |
| Italy | 1995 | 5.10 | 2007 | 4.21 | -17.45 |
| Netherlands | 1995 | 5.27 | 2007 | 4.34 | -17.65 |
| Norway | 1995 | 4.97 | 2007 | 4.98 | 0.20 |
| Spain | 1995 | 5.10 | 2007 | 4.47 | -12.35 |
| Sweden | 1995 | 3.81 | 2007 | 5.24 | 37.53 |
| UK | 1995 | 5.55 | 2007 | 4.43 | -20.18 |
| US | 1995 | 8.90 | 2007 | 7.30 | -17.98 |

Sources: National Vital Statistics (US) and Eurostat

The changes in the cohabitation and marriage rate are reflected in the composition of the population by marital status (Tables 3 and 4). The married male and female population have decreased in all countries, while the divorced and never married population have risen. Sweden and France have experienced the biggest drop in the percentage of married population, and nowadays more than half of the population is not married. In the US 10% of the population is divorced. In Italy, on the other hand, although divorced people are still a minority, they have doubled during the last decade.

Table 3

**Marital Status of Male Population, 15 Years Old and Over in Percentages**

| Country | Marital Status | 1993 | 2003 | % Change |
|---|---|---|---|---|
| US | % married | 60,0 | 57,2 | -4,7 |
| | % never married | 30,3 | 32,1 | 5,9 |
| | % divorced | 7,1 | 8,2 | 15,5 |
| Germany | % married | 60,7 | 55,3 | -8,9 |
| | % never married | 31,3 | 34,6 | 10,5 |
| | % divorced | 5,0 | 6,9 | 38,0 |
| France | % married | 56,2 | 50,9 | -9,4 |
| | % never married | 34,5 | 37,8 | 9,6 |
| | % divorced | 4,3 | 6,0 | 39,5 |
| Italy | % married | 62,0 | 61,6 | -0,6 |
| | % never married | 34,0 | 34,3 | 0,9 |
| | % divorced | 0,7 | 1,2 | 71,4 |
| Netherlands | % married | 57,9 | 54,5 | -5,9 |
| | % never married | 34,7 | 36,6 | 5,5 |
| | % divorced | 4,8 | 6,3 | 31,3 |
| Sweden | % married | 48,5 | 43,1 | -11,1 |
| | % never married | 40,1 | 44,0 | 9,7 |
| | % divorced | 8,1 | 10,0 | 23,5 |

Sources:

Germany, France, Italy, Netherlands, and Sweden: generated from Eurostat

United States: U.S. Census Bureau

Table 4

**Marital Status of Female Population, 15 Years Old and Over in Percentages**

| Country | Marital Status | 1993 | 2003 | % Change |
|---|---|---|---|---|
| US | % married | 56,4 | 54,0 | -4,3 |
| | % never married | 22,9 | 25,3 | 10,5 |
| | % divorced | 9,6 | 10,9 | 13,5 |
| Germany | % married | 55,4 | 52,0 | -6,1 |
| | % never married | 22,7 | 26,0 | 14,5 |
| | % divorced | 6,1 | 7,9 | 29,5 |
| France | % married | 51,3 | 46,5 | -9,4 |
| | % never married | 27,5 | 30,8 | 12,0 |
| | % divorced | 5,6 | 7,5 | 33,9 |
| Italy | % married | 57,7 | 57,2 | -0,9 |
| | % never married | 26,4 | 26,2 | -0,8 |
| | % divorced | 1,0 | 1,7 | 70,0 |
| Netherlands | % married | 55,6 | 52,5 | -5,6 |
| | % never married | 27,1 | 28,9 | 6,6 |
| | % divorced | 6,0 | 7,9 | 31,7 |
| Sweden | % married | 46,7 | 41,7 | -10,7 |
| | % never married | 30,9 | 34,8 | 12,6 |
| | % divorced | 9,8 | 12,2 | 24,5 |

Sources:

Germany, France, Italy, Netherlands, and Sweden: generated from Eurostat

United States: U.S. Census Bureau

## 2.2 Cross-country evidence

There are scarce data on cohabitation. In the case of the US an appropriate estimate of cohabitation is available only after 1996. Before 1996 the estimates

of unmarried couples also included households that had two unmarried adults of the opposite sex without identifying themselves as unmarried partners (Casper et al, 1999). United Nations Economic Commission for Europe (UNECE) provides some data on cohabitation but only for a few countries and years. We gathered our sample from the National Statistical Services of each country as well as from UNECE. We constructed the rate of cohabitation as the number of cohabiting couples divided by the number of all couples.

Surprisingly, data on the gender wage gap is also difficult to find. Most data on wages are collected from firm surveys without making any distinction with respect to the gender of the employees. We constructed the gender wage gap as the difference of average male and female earnings divided by average male earnings using data from Eurostat, OECD and UNECE.

The relative price of home appliances is the price of home appliances as a ratio of CPI. Data are available from Eurostat for all years after 1995. This variable has been used in other studies (Cavalcanti and Tavares, 2008) as an indicator of household production technology. Our complete dataset is an unbalanced panel for 15 OECD countries in the period 1990-2008.

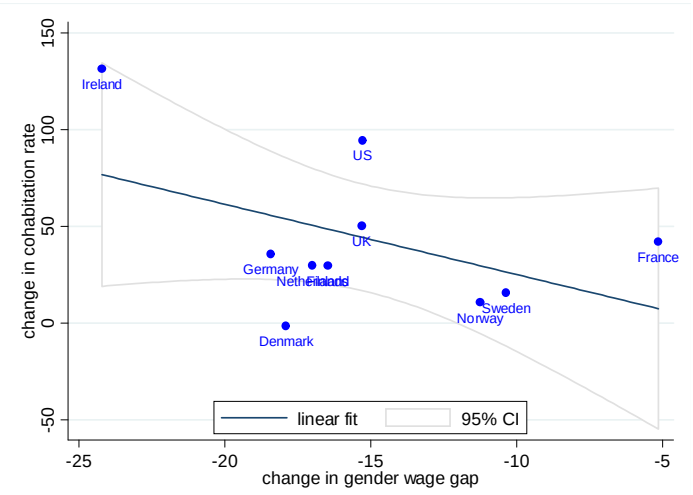


Figure 1

In Figure 1 we plot the change in the gender wage gap and the change in the rate of cohabitation during the last decade for a group of countries in our sample.[3] All data sources are explained in Appendix 5.1. The gender wage gap is the difference between average earnings of male employees and of female employees as a percentage of average earnings of male employees. The rate of

[3]For the figures we consider only the countries for which there are available data for both variables for a sufficiently long period. In particular, the periods covered are: Denmark: 1996-2005, Finland: 1995-2006, France: 1995-2005, Germany: 1996-2005, Ireland: 1995-2005, the Netherlands: 1996-2005, Norway: 2001-2008, Sweden: 1995-2004, UK: 1997-2006, and the US: 1996-2007.

cohabitation refers to cohabiting couples as a percentage of all couples. Figure 1 indicates the existence of a negative relationship between the two variables that is further explored below.

Next we focus on the possible relationship between the relative price of home appliances and cohabitation. In Figure 2 we plot the change in the relative price of home appliances and the change in the cohabitation rate during the last decade for various countries.[4]The relative price of home appliances is measured as the ratio of the price of home appliances over the consumer price index. We use 1996 as base year. There is evidence of a negative relationship between the two variables, which is examined below.

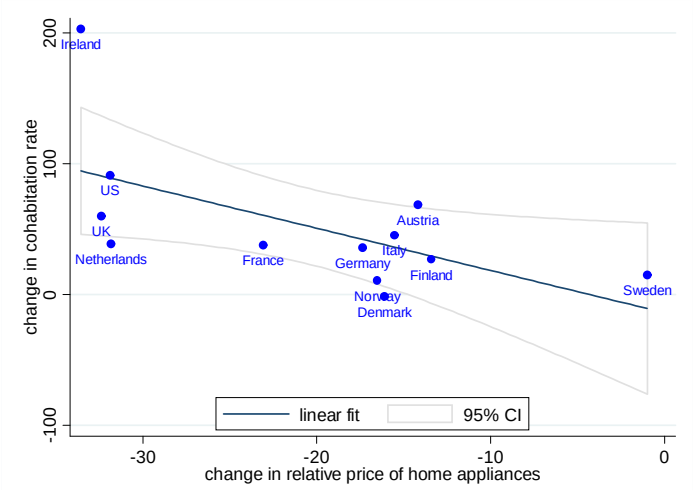


Figure 2

Figures 1 and 2 indicate the existence of a negative relationship between the rate of cohabitation and the gender wage gap as well as between the rate of cohabitation and the relative price of home appliance. We investigate the relation between the cohabitation rate on the one hand, and the gender wage gap and the relative price of home appliances on the other hand, using panel data regressions below. Our specification is

$$\begin{aligned}(\text{cohabitation rate})_{it} &= \alpha + \beta_0(\text{gender wage gap})_{it} \\ &\quad +\beta_1(\text{relative price of home appliances})_{it} \\ &\quad +\beta_2(\text{other controls})_{it} \end{aligned} \tag{1}$$

[4]The countries and periods of reference are: Austria: 1997-2007, Denmark: 1996-2006, Finland: 1996-2007, France: 1996-2005, Germany: 1996-2005, Ireland: 1995-2006, Italy: 1995-2006, the Netherlands: 1996-2008, Norway: 2001-2008, Sweden: 1995-2005, UK: 1996-2007, and the US: 1998-2008.

The vector of additional controls includes the annual percentage rate of GDP growth and the percentage of urban population. GDP growth reflects the degree of development of each country and it is expected to affect positively cohabitation. People who live in urban areas have usually less traditional stereotypes about marriage and are more open to changes than people in rural areas. This is why we expect it to have a positive effect on the rate of cohabitation. Summary statistics of the main variables of interest are shown in Table 5.

Table 5. Summary Statistics

| | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Cohabitation | 139 | 14.267 | 6.792 | 1.98 | 27.49 |
| Gender wage gap | 117 | 21.999 | 3.781 | 12.31 | 30.6 |
| Relative price of home appliances | 152 | 1.093 | 0.121 | 0.89 | 1.46 |

We first check the correlations between the three variables of interest (Table 6). There is a statistically significant negative correlation between the rate of cohabitation and the gender wage gap as well as between the rate of cohabitation and the price of home appliances.

Table 6. Correlations

| | Cohabitation | Gender wage gap |
|---|---|---|
| Gender wage gap | -0.340*** | |
| Relative price of home appliances | -0.286*** | 0.429*** |

We then estimate the model by OLS without including additional controls, using standard errors robust to heteroskedasticity. The results are presented in Table 7. In all specifications both the relative price of home appliances and the gender wage gap have a negative and statistically significant effect as expected. Even when the two variables are introduced in isolation (specification 1) they explain a good share in total variability in the rate of cohabitation. Their effect is robust to the inclusion of year dummies or time trend (specifications 2 and 3). We then include country dummies so as to capture country-specific differences in the rate of cohabitation. The coefficients remain negative and significant although they decrease in absolute value (specifications 4 and 5).[5] This is in accordance with Figures 1 and 2 where we verified that countries with the biggest change in the gender wage gap and the relative price of home appliances experienced the biggest change in the rate of cohabitation.

[5]The results when the country dummies are included should be interpreted with caution due to the high value of $R^2$.

Table 7. Determinants of Cohabitation

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Gender wage gap | -0.291** | -0.316** | -0.307** | -0.176** | -0.144** |
| | (0.141) | (0.124) | (0.142) | (0.078) | (0.072) |
| Relative price of home appliances | -18.49*** | -60.81*** | -62.84*** | -9.00*** | -5.34** |
| | (4.947) | (6.424) | (6.492) | (1.443) | (2.403) |
| Year dummies | No | No | Yes | No | Yes |
| Trend | No | Yes | No | No | No |
| Country dummies | No | No | No | Yes | Yes |
| N. of Observations | 95 | 95 | 95 | 95 | 95 |
| $R^2$ | 0.17 | 0.40 | 0.42 | 0.99 | 0.99 |

All specifications include a constant not reported. ** indicates significant at the 95% confidence level and *** at the 99%.

In the last specification the estimated elasticity for the average value of cohabitation and the gender wage gap is -0.198, i.e. on average, if the gender wage gap narrows by 15% this will lead to an increase in cohabitation by 2.97%. The estimated elasticity for the average value of cohabitation and the price of home appliances is almost double; -0.37. This means that a 15% decrease in the relative price of home appliances leads to an increase in cohabitation by 5.55%. Note that the countries we study have experienced a decrease around 15% both in the gender wage gap and in the relative price of home appliances during the last decade. Germany, for instance, has experienced a 18.42% decrease in the gender wage gap and a 17.36% decrease in the relative price of home appliances. According to our estimates, such changes would imply an increase in the rate of cohabitation of about 3.64% and 6.42% respectively. Given that the rate of cohabitation in Germany increased by 35.56% from 1996 to 2005, the narrowing of the gender wage gap accounts for about 10% of the increase, and the decline in the relative price of home appliances for almost 20%.

We then included GDP growth and the percentage of urban population in all specifications but their coefficients were not statistically significant from zero. The results with respect to the variables of interest were not affected by the inclusion of any extra regressor.

Interestingly, religiosity does not seem to play any role either. The World Values Survey contains information on religiosity for various countries in 1990 and in 1999. We use two alternative measures of religiosity; the percentage of people who attend religious services more than once a week and the percentage of people who practically never attend religious services.

In Figures 3 and 4 we plot the percentage change in religiosity and the percentage change in cohabitation rate. There is no strong evidence of a relationship between the two variables.

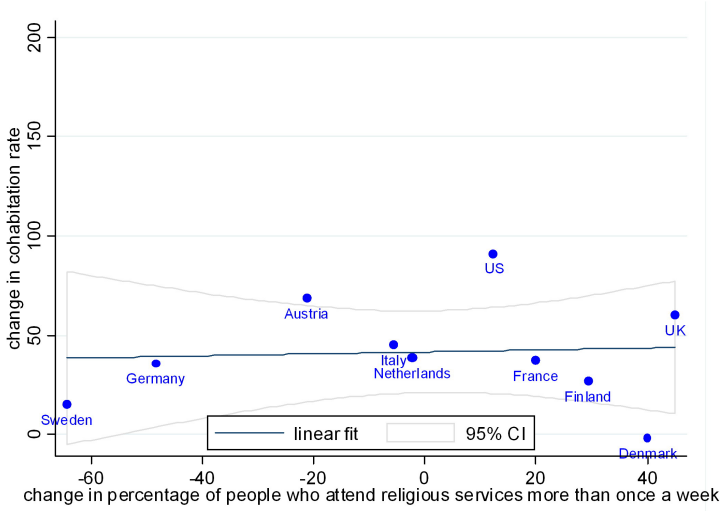


Figure 3

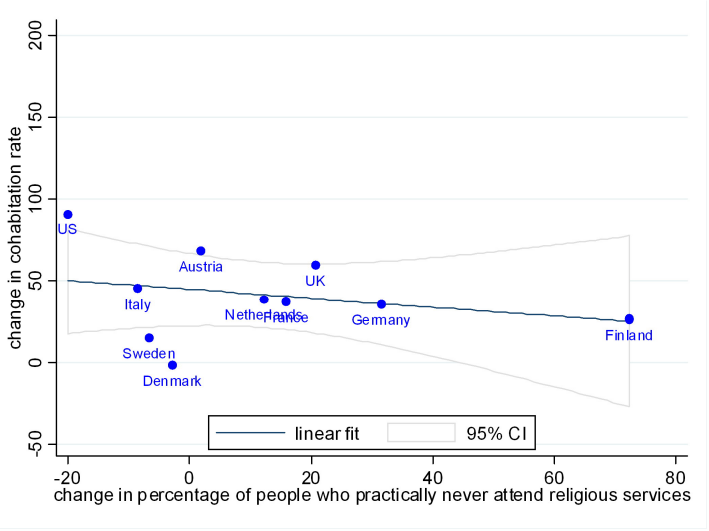


Figure 4

Finally, if we measure cohabitation as a ratio of all households (instead of all couples) the gender wage gap loses its statistical significance. This indicates that the gender wage gap has an indirect effect on cohabitation through a decrease in the number of marriages. Before moving to the theoretical model though, it is important to see whether cohabitation is more common among specific groups of the population with respect to some characteristics (education, wealth, and employment status).

## 2.3 Cross-sectional facts

Cohabiting and married couples differ along many dimensions. Cohabitation in the US is more common among poor and less educated partners (Bumpass and

Sweet, 1989). This pattern is still observed in more recent data according to the report of Vital and Health Statistics (2010). Similar patterns are observed also in UK (Goodman and Greaves, 2010). Table 8 shows the percent distribution of women aged 15-44 in the US according to education and poverty characteristics. Married women seem to be more educated and richer than the cohabiting ones. There is a similar pattern also for men.

Furthermore married couples in the US are less alike with respect to hours and earnings when compared to cohabiting ones (Brines and Joyner, 1999 and Jepsen and Jepsen, 2002). Table 9 shows the percentage of cohabiting and married women, who report being a housewife as their main occupation. We use data from the 2002 International Social Survey Program (ISSP) on Family and Changing Gender Roles as it contains information on the relationship and occupational status of the respondents and of their partners.

Table 8

**Percent distribution of women aged 15-44 by current marital or cohabiting status**

| Characteristic | Married | Cohabiting |
|---|---|---|
| | Percent distribution | |
| Total | 46.0 | 9.1 |
| Education* | | |
| No high school diploma or GED | 49.1 | 17.2 |
| High school diploma or GED | 56.7 | 11.3 |
| Some college, no bachelor's degree | 57.4 | 7.6 |
| Bachelor's degree or higher | 62.9 | 5.4 |
| Percent of poverty level* | | |
| 0-149% | 40.9 | 13.0 |
| 0-99% | 39.1 | 13.1 |
| 150-299% | 60.4 | 9.9 |
| 300% or higher | 66.5 | 6.4 |

Source: Vital and Health Statistics, Series 23, No. 28, February 2010 based on NSFG 2002 data
The percent of poverty level is based on the 2001 poverty levels defined by the U.S. Census Bureau
*Limited to women aged 22-44

Table 9

**Percentage of housewives**

| | Cohabiting women | Married women |
|---|---|---|
| Austria | 11.89 | 26.36 |
| Denmark | 2.76 | 2.73 |
| Finland | 4.24 | 4.46 |
| France | 4.92 | 16.38 |
| Germany | 2.77 | 17.40 |
| Ireland | 9.52 | 39.07 |
| Netherlands | 10.53 | 32.19 |
| Norway | 6.62 | 7.37 |
| Spain | 15.71 | 49.60 |
| Sweden | 0.00 | 1.13 |
| UK | 14.79 | 16.90 |
| US | 15.56 | 26.25 |

Source: ISSP 2002 (own calculations)
Age group: all ages

In all countries except for Denmark the percentage of housewives is higher among married than among cohabiting women.[6] The traditional "woman at home-man in the market" pattern is more common among married couples. Cohabitation seems to be more symmetric, in the sense that both spouses work.

In order to highlight the way gender wage gap and price of home appliances affect cohabitation, in the next section we build a model that can account for the changes in cohabitation and deliver the cross sectional facts that we have just discussed. This model will allow us to examine the effects of the gender wage gap and the price of home appliances on agents's decision to get married, cohabit or stay single. These two factors will act through the female labor supply channel. Female labor supply will also be the key determinant of the cross sectional differences among married and cohabiting couples.

# 3 A Two-period Model

Consider the following model of marriage, cohabitation and divorce. Agents live for two periods. They are heterogeneous with respect to wages. Both men and women can work in the labor market but women face a gender wage gap. They derive utility from a market good and a good produced at home using durables and house work as inputs. In the 1st period they meet in pairs in the marriage market and the man may propose marriage or cohabitation to the woman through a take-it or leave-it offer. In the 2nd period couples face a probability of divorce. Cohabitation differs from marriage in terms of probability and cost of dissolution.

There is a continuum of males ($m$) and females ($f$), each of measure one. Agents discount time in rate $0 < \beta < 1$. Each agent has 1 unit of time and derives no utility from leisure. The utility function is additively separable of the form

$$U(c,h) = \mu \ln(c) + (1-\mu)\ln(h),$$

where $c$ is a market good and $h$ a good produced at home.

There is a labor market where both men and women can work. There is heterogeneity in wages among men and among women. Men's wages $w_m$ are drawn from a distribution $F_{w_m}$ with support $[\underline{w}, \overline{w}]$. Women's wages are drawn from a distribution $F_{w_f}$ with support $[\tau\underline{w}, \tau\overline{w}]$ and $\tau \in (0,1)$ i.e. there is a

[6] The ISSP contains information on the occupation of both the respondent and the spouse/partner but information on age is limited to the respondent. This prohibits us from controlling for age since half of the observations are refered to the spouse/partner. Hence, a part of the difference in percentage of housewifes among cohabitors and married can be attributed to the older age of married women.

gender wage gap. This difference in wages is exogenous[7]. There is a household production technology that transforms work at home into home produced goods $h$ according to

$$h = A\left[\theta d^{\rho} + (1-\theta)(1-l)^{\rho}\right]^{1/\rho},\ 0 < \rho < 1,$$

where $d$ is the stock of household durables which are purchased in price $q$, $l$ is labor supplied to the market (hence, $1-l$ is the time devoted to household production), $A$ is technological progress and $\rho$ determines the elasticity of substitution between durables and house work ($\frac{1}{1-\rho}$). We assume that durables purchased in the 1st period depreciate fully by the beginning of the 2nd period. Married/cohabiting men devote all of their available time to market work, while married/cohabiting women distribute their time between market work $l_f$ and house work $(1-l_f)$.[8]

There is also a marriage market where single people meet randomly potential partners of the opposite sex (who are also single). In the 1st period people meet in pairs. Upon meeting, the man makes take-it or leave-it offers to the woman.[9] Each offer consists of a sextuple $\left(c^i_{1f}, l^i_{1f}, d^i_1, c^i_{2f}, l^i_{2f}, d^i_2\right)$ where $i$ is the type of marital institution, i.e. marriage or cohabitation. Note that the offer will be a function of $(w_m, w_f)$. Cohabitation differs from marriage with respect to the divorce cost. The divorce cost entailed with marriage ($\phi > 0$) is higher than the one entailed with cohabitation due to the law. We normalize the separation cost of cohabitors to zero. The woman can either accept the offer and enter into a union with the man, or reject the offer and remain single. The reason why agents would prefer entering a marital institution to singlehood is specialization. The woman will work at home in order to produce the household good and the man in the market where he earns more than the woman.

We assume that the good produced at home is a shared good for the couple with sharing parameter $\gamma \in \left[\frac{1}{2}, 1\right]$. Hence, if the amount of the household good produced is $h$, each partner will consume $\gamma h$. Note that as $\gamma \to 1$ there are economies of scale in the consumption of the household good. This is because the needs of a household grow with each additional member but not in a proportional way. Needs for housing space, electricity, etc will not be twice as high for a household with two members than for a single person.

In the 2nd period the agents who matched in the 1st period and have entered a union (marriage or cohabitation) face an exogenous probability of divorce $\pi^m$

[7] A possible extention is to endogenize the gender wage gap through the work experience channel (a form of human capital accumulation). See among others Albanesi and Olivetti (2009a), and Erosa et al. (2010).

[8] We relax this assumption by assuming that the man supplies a fixed amount of time to household production. For a reasonable amount (less than 20%) we get a very similar pattern of marital outcomes (See Appendix 5.3).

[9] This assumption is not critical. In Appendix 5.3 we analyze the case that the woman makes the take-it or leave-it offer to the man and the results are unaffected.

or separation $\pi^c$ respectively, with $0 \leq \pi^m \leq 1$, $0 \leq \pi^c \leq 1$, and $\pi^m < \pi^c$.[10] We assume that divorced/separated agents do not rematch in the 2nd period. Agents who are single in the beginning of the 2nd period did not match in the 1st period waiting for a different match (in terms of wages). In the 2nd period single agents meet again in the marriage market. Upon meeting single men/women make/receive take-it or leave-it offers just like in the 1st period.[11]

## 3.1 Single agent's problem

Below we define and characterize the utility maximization problem of single and divorced agents and the optimal marriage/cohabitation proposal.[12] In the analysis that follows we set $\rho$ equal to 0, i.e. we use a Cobb-Douglas production function in order to get analytical results. The problem of a single agent in the current period (1st or 2nd) is

$$U(c_g^s(w_g), h_g^s(w_g)) = \max_{c_g^s>0, h_g^s>0, 0<l_g^s\leq 1, d_g^s>0} \mu \ln(c_g^s) + (1-\mu)\ln(h_g^s)$$

subject to

$$c_g^s = w_g l_g^s - q d_g^s,$$

and

$$h_g^s = A(d_g^s)^\theta (1-l_g^s),^{1-\theta}$$

where $g = m, f$ stands for male and female.

Combining the first order conditions, and the constraints we get

$$d_g^s = \theta(1-\mu)\frac{w_g}{q}, \tag{2}$$

$$l_g^s = \mu + \theta(1-\mu), \tag{3}$$

$$h_g^s = A(\theta(1-\mu)\frac{w_g}{q})^\theta((1-\theta)(1-\mu)),^{1-\theta} \tag{4}$$

and

$$c_g^s = \mu w_g. \tag{5}$$

Note that working hours are constant. Thus, improvements in household technology do not alter the amount of labour supplied by single agents. This is simply due to the Cobb-Douglas assumption, and with $\rho \neq 0$, improvements in

[10] There is empirical evidence that cohabitations are more unstable than marriage (Bumpass and Sweet, 1989, and Bumpass and Lu, 2000). Alternatively we could endogenize the divorce decision by assuming that agents derive utility from a match quality that evolves over time. Note that also in this case cohabitation will be more unstable than marriage, since the couples that decide to cohabit will be the ones with low match quality (See Brien at el, 2006).

[11] Since there are only 2 periods the offer in the 2nd (last) period will be a triple $(c_f^i, l_f^i, d_f^i)$.

[12] See appendix 7.2 for all the derivations.

household technology do affect working hours. The woman's reservation utility in the second period is then

$$U_f^s(w_f) = \mu \ln(\mu w_f) + (1-\mu)\ln(A(\theta(1-\mu)\frac{w_f}{q})^\theta((1-\theta)(1-\mu))^{1-\theta}). \quad (6)$$

Note that the woman's reservation utility increases as her wage goes up or as the price of durables goes down. This is because the higher wage allows the single woman to buy more durables (remember that the labor supply is constant) and therefore to produce more household good. Lowering the price of durables has the same effect.

## 3.2 Divorced agent's problem

The problem that a divorced agent faces in the 2nd period depends on the divorce cost $\phi$ and is given by

$$U_g^d(w_g) = \max_{c_g^d>0, h_g^d>0, 0<l_g^d\leq 1, d_g^d>0} \mu \ln(c_g^d) + (1-\mu)\ln(h_g^d) \quad (7)$$

subject to

$$c_g^d = w_g l_g^d - q d_g^d - \phi,$$

and

$$h_g^d = A(d_g^d)^\theta (1-l_g^d)^{1-\theta},$$

where $g = m, f$ stands for male and female.

The first order conditions are

$$d_g^d = \theta(1-\mu)\frac{(w_g-\phi)}{q}, \quad (8)$$

$$l_g^d = \mu + \theta(1-\mu) + \frac{(1-\theta)(1-\mu)\phi}{w_g}, \quad (9)$$

$$h_g^d = A(\theta(1-\mu)\frac{(w_g-\phi)}{q})^\theta((1-\theta)(1-\mu)(1-\frac{\phi}{w_g})),^{1-\theta} \quad (10)$$

and

$$c_g^d = \mu(w_g - \phi). \quad (11)$$

The first order conditions are similar to the ones of the problem of a single man. The difference lies on the budget constraint, and in particular on the cost of divorce. The divorce cost decreases the quantity of the durable good and the quantity of the consumption good. Also note that the labor supply is not constant as in the case of singles, but it depends negatively on the wage due to

the fixed cost of divorce. More specifically, if the wage goes down the divorced agent will have to work more hours in order to cover the divorce cost.

Hence, the utility of a divorced agent is

$$U_g^d(w_g) = \mu \ln(\mu(w_g - \phi)) + (1-\mu)\ln(A(\theta(1-\mu)\frac{(w_g-\phi)}{q})^\theta((1-\theta)(1-\mu)(1-\frac{\phi}{w_g}))^{1-\theta}), \tag{12}$$

where $g = m, f$ stands for male and female.

There are also women who chose to remain single in the 1st period, waiting for a better match in the 2nd period. Let us define the expected utility that a woman will derive in the 2nd period, who was single in the 1st period by $V_f^2(w_f)$. She can either remain single in the 2nd period or enter a union (cohabitation or marriage). Her decision depends on the probability of meeting a man willing and able to make an acceptable proposal. Let $r^c = \int_{w_m \in W^c} dF(w_m)$ be the fraction of men who can propose cohabitation and $r^m = \int_{w_m \in W^m} dF(w_m)$ be the fraction of men who can propose marriage. Then,

$$\begin{aligned} V_f^2(w_f) &= (1-r^c-r^m)U_f^s(w_f) + \int_{w_m \in W^c} (\mu \ln(c_f^c) + (1-\mu)\ln(\gamma h^c))dF(w_m) \\ &+ \int_{w_m \in W^m} (\mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m))dF(w_m) \\ &= (1-r^c-r^m)U_f^s(w_f) + E_{r^c}(\mu \ln(c_f^c) + (1-\mu)\ln(\gamma h^c)) \\ &+ E_{r^m}(\mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m)) \\ &= (1-r^c-r^m)U_f^s(w_f) + r^c V_f^{2,c}(w_f) + r^m V_f^{2,m}(w_f), \ \forall \ w_m, \end{aligned} \tag{13}$$

where the last equality follows from the fact that no man can influence $r^c$, $E_{r^c}$, $r^m$, $E_{r^m}$, $U_f^s(w_f)$ and hence each woman of type $w_f$ has a fixed reservation value for accepting a take-it or leave-it offer independently from the man's type $w_m$. The functions $V_f^{2,c}(w_f)$ and $V_f^{2,m}(w_f)$ are the utility that a woman, who was single in the 1st period, will derive in the 2nd period from cohabitation and marriage, respectively.

Note that since there is no possibility of divorce after the 2nd period the utility derived from marriage or cohabitation is the same for all men and for all women. Hence, $V_f^{2,m}(w_f) = V_f^{2,c}(w_f)$, i.e. women are indifferent between cohabitation and marriage. The only thing that matters for a woman is whether she receives a proposal or not. Let $r = r^m + r^c$. Then (13) becomes

$$\begin{aligned} V_f^2(w_f) &= (1-r)U_f^s(w_f) + rV_f^{2,m}(w_f) \\ &= (1-r)U_f^s(w_f) + r(\ln(c_f^m(w_f)) + (1-\mu)\ln(\gamma h^m(w_f))), \forall w_m. \end{aligned} \tag{13a}$$

## 3.3 Optimal marriage proposal in the 2nd period

Now let us define the problem of a man who wants to propose marriage/ cohabitation to a woman in the 2nd period given that the woman will accept the proposal (participation constraint). The problem consists of finding the triple $\left(c_f^m, l_f^m, d^m\right)$ that maximizes his utility given the budget constraint (BC), the household production technology (HPT), the woman's participation constraint (WPC), and the utility of the woman when single. It is given by

$$\max_{c_f^m>0, 0<l_f^m\leq 1, d^m>0} \mu \ln(c_m^m) + (1-\mu)\ln(\gamma h^m) \tag{14}$$

subject to

$$\begin{aligned} c_m^m + c_f^m &= w_m + w_f l_f^m - q d^m, && \text{(BC)} \\ h^m &= A(d^m)^\theta (1-l_f^m)^{1-\theta}, && \text{(HPT)} \end{aligned}$$

and

$$U_f^s(w_f) \leq \mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m), \tag{WPC}$$

where $U_f^s(w_f)$ is given by (6).

Combining the first order conditions and the constraints,[13] we get

$$d^m = \frac{(1-\mu)\theta(w_f + w_m)}{q}, \tag{15}$$

$$l_f^m = (\mu + (1-\mu)\theta) - (1-\mu)(1-\theta)\frac{w_m}{w_f}, \tag{16}$$

and

$$h^m = A(\frac{(1-\mu)\theta(w_f + w_m)}{q})^\theta((1-\mu)(1-\theta)(1+\frac{w_m}{w_f})).^{1-\theta} \tag{17}$$

Given the Cobb-Douglas assumption, the labor supply of a married/cohabiting woman does not depend on $A$ and $q$. Hence, improvements in the household production technology only increase the quantity of purchased durables and therefore the quantity of the home good produced. However, in contrast to the case of singles, the labor supply of the married/cohabiting woman depends on both her own wage (positively) and on the wage of her spouse (negatively). Hence, changes in the gender wage gap will have an impact on female labor supply.

Note that the WPC will always bind, since the man has all the bargaining power. Hence, even if the woman accepts the proposal in the 2nd period her utility will not alter (it will exactly match her reservation utility $U_f^s(w_f)$ in singlehood). The man, however, can be better off if the woman accepts the proposal, thanks to specialization. Therefore,

$$U_f^s(w_f) = \mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m).$$

[13] See appendix 7.2 for the corner solutions.

Then,

$$c_f^m = \exp\left(\frac{1}{\mu}U_f^s(w_f) - \frac{(1-\mu)}{\mu}\ln(\gamma h^m)\right), \tag{18}$$

where $U_f^s(w_f)$ and $h^m$ are given by (6) and (17) respectively. Then (13a) becomes

$$\begin{aligned} V_f^2(w_f) &= (1-r)U_f^s(w_f) + rV_f^{2,m}(w_f) \\ &= (1-r)U_f^s(w_f) + rU_f^s(w_f) = U_f^s(w_f) \qquad (19) \\ &= \mu\ln(\mu w_f) + (1-\mu)\ln(\gamma A(\theta(1-\mu)\frac{w_f}{q})^\theta((1-\theta)(1-\mu))^{1-\theta}). \end{aligned}$$

Note that although the utility that the woman will derive in a union will be the same as the utility that she derives in singlehood, the allocation will differ, i.e. $c_f^s \neq c_f^m$ and $h_f^s \neq h^m$. In particular, using (4), (5), (17) and (18), we get

$$\mu\ln c_f^m - \mu\ln c_f^s = (1-\mu)\left[\ln w_f - \ln(w_f + w_m) - \ln\gamma\right] < 0 \tag{20}$$

and

$$(1-\mu)\ln\gamma h_f^m - (1-\mu)\ln h_f^s = (1-\mu)\left[\ln(w_f + w_m) - \ln w_f + \ln\gamma\right] > 0, \tag{21}$$

$\forall\gamma \in \left[\frac{w_f}{w_f+w_m}, 1\right]$, i.e. a woman who decides to get married or cohabit in the 2nd period will consume less consumption good but more household good than if she had stayed single. Note that the increase in the household good exactly compensates for the decrease in the consumption good.

## 3.4 Optimal marital status in the 2nd period

Is it possible that marriage/cohabitation will not be feasible in the 2nd period? It may be the case that a man is better off single, so he will not be willing to propose to the woman. It may also be the case that the man is not able to propose because his budget is not enough so as to satisfy the woman's participation constraint, and make her accept his proposal. Both cases depend on the combination of $w_f$ and $w_m$. Formally, marriage/cohabitation in the 2nd period is not feasible if the man is better off single, i.e.

$$U_m^s(w_m) > \mu\ln(c_m^m) + (1-\mu)\ln(\gamma h^m),$$

or if he cannot satisfy the WPC, i.e. both

$$U_f^s(w_f) = \mu\ln(c_f^m) + (1-\mu)\ln(\gamma h^m),$$

and

$$c_m^m + c_f^m \leq w_m + w_f l_f^m - qd^m$$

cannot hold simultaneously with

$$c_m^m > 0, c_f^m > 0, 0 \leq l_f^m < 1, d^m > 0, h^m > 0.$$

## 3.5 Optimal marriage proposal in the 1st period

Now let us focus on the optimal marriage proposal in the 1st period. A man who wants to propose marriage to a woman in the 1st period has also to consider the probability and the cost of divorce. Note that his offer is renegotiation-proof; even if we allow for renegotiation, the man will have no incentive to change his offer in the 2nd period because the woman's participation constraint will always bind. The problem consists of finding the vector $\left(c_f^{1,m}, l_f^{1,m}, d^{1,m}, c_f^{2,m}, l_f^{2,m}, d^{2,m}\right)$ that maximizes his utility given the budget constraint in each period (BC1) and (BC2), the household production technology in each period (HPT1) and (HPT2), the woman's participation constraint in each period (WPC1) and (WPC2), as well as his utility if divorced, the utility of the woman when single, and the utility of the woman if divorced

$$\max_{c_f^{1,m}>0,0<l_f^{1,m}<1,d^{1,m}>0,c_f^{2,m}>0,0<l_f^{2,m}<1,d^{2,m}>0,} \mu \ln(c_m^{1,m}) + (1-\mu)\ln(\gamma h^{1,m}) + \beta\left[(1-\pi^m)\left(\mu\ln(c_m^{2,m}) + (1-\mu)\ln(\gamma h^{2,m})\right) + \pi^m U_m^d(w_m)\right]$$

subject to

$$\begin{aligned} c_m^{1,m} + c_f^{1,m} &= w_m + w_f l_f^{1,m} - q d^{1,m}, && \text{(BC1)} \\ c_m^{2,m} + c_f^{2,m} &= w_m + w_f l_f^{2,m} - q d^{2,m}, && \text{(BC2)} \\ h^{1,m} &= A(d^{1,m})^\theta (1-l_f^{1,m})^{1-\theta}, && \text{(HPT1)} \\ h^{2,m} &= A(d^{2,m})^\theta (1-l_f^{2,m})^{1-\theta}, && \text{(HPT2)} \end{aligned}$$

$$\begin{aligned} (1+\beta)U_f^s(w_f) \leq\ & \mu\ln(c_f^{1,m}) + (1-\mu)\ln(\gamma h^{1,m}) \\ & + \beta[(1-\pi^m)\left(\mu\ln(c_f^{2,m}) + (1-\mu)\ln(\gamma h^{2,m})\right) + \pi^m U_f^d(w_f)], \end{aligned} \quad \text{(WPC1)}$$

and

$$U_f^s(w_f) \leq \mu\ln(c_f^{2,m}) + (1-\mu)\ln(\gamma h^{2,m}), \quad \text{(WPC2)}$$

where $U_f^s(w_f)$ is given by (6), and $U_m^d(w_m)$ and $U_f^d(w_f)$ are given by (12).

Combining the first order conditions and the constraints we find that

$$d^{1,m} = d^{2,m},$$

and

$$l_f^{1,m} = l_f^{2,m},$$

and therefore

$$h^{1,m} = h^{2,m}.$$

Thus, the man's take-it or leave-it offer to the woman will entail the same amount of durables, hours of market work, and therefore hours of housework and household good as the ones we found when we characterized the 2nd period (15)-(17). Moreover, the consumption good he offers to the woman in the 2nd period ($c_f^{2,m}$) will again be given by (18) since the woman's participation constraint in the 2nd period (WPC2) is the same.

The difference lies on the amount of consumption good offered in the 1st period ($c_f^{1,m}$). The man will have to offer as much $c_f^{1,m}$ as it is necessary so as to satisfy the woman's participation constraint in the 1st period (WPC1). However, the woman's participation constraint in the 1st period differs from the one in the 2nd period because of the dissolution probability and its resulting cost. Again, the man will exactly match the woman's reservation utility because he has all the bargaining power

$$\begin{aligned}(1+\beta)U_f^s(w_f) = \mu \ln(c_f^{1,m}) + (1-\mu)\ln(\gamma h^{1,m}) \\ + \beta[(1-\pi^m)\left(\mu \ln(c_f^{2,m}) + (1-\mu)\ln(\gamma h^{2,m})\right) + \pi^m U_f^d(w_f)].\end{aligned}$$

Taking into account that the woman's participation constraint will bind also in the 2nd period we get

$$(1+\beta)U_f^s(w_f) = \mu \ln(c_f^{1,m}) + (1-\mu)\ln(\gamma h^{1m}) + \beta[(1-\pi^m)\, U_f^s(w_f) + \pi^m U_f^d(w_f)],$$

and therefore

$$c_f^{1,m} = \exp\left[\frac{1}{\mu}\left(U_f^s(w_f) - (1-\mu)\ln(\gamma h_1^m) + \beta\pi^m(U_f^s(w_f) - U_f^d(w_f))\right)\right]. \quad (22)$$

Equation (22) completes the characterization of the optimal marriage proposal. The next step is to characterize the optimal cohabitation proposal. Only then the man will be able to determine his optimal marital status.

## 3.6 Optimal cohabitation proposal

The problem of the optimal cohabitation proposal in the 1st period is the same as the one of the optimal marriage proposal, but without any divorce cost ($\phi = 0$) and with higher dissolution probability $\pi_c > \pi_m$.

Hence, in both periods, the man will offer to the woman the same amount of durables ($d^c$), hours of market work ($l_f^c$), and therefore hours of housework

$(1 - l_f^c)$ and household good $(h^c)$ as the ones of the marriage proposal (15)-(17). The amount of consumption good offered in the 2nd period $(c_f^{2,c})$ will be given by (18).

What about the amount of consumption good in the 1st period $(c_f^{1,c})$? The man will have to offer as much $c_f^{1,c}$ as it is necessary so as to exactly match the woman's reservation utility. However, the woman's participation constraint differs from the one in marriage in terms of dissolution probability and cost.

$$(1+\beta)U_f^s(w_f) = \mu \ln(c_f^{1,c}) + (1-\mu)\ln(\gamma h^{1,c}) \\ + \beta[(1-\pi^c)\left(\mu \ln(c_f^{2,c}) + (1-\mu)\ln(\gamma h^{2,c})\right) + \pi^c U_f^s(w_f)],$$

which can be written as

$$(1+\beta)U_f^s(w_f) = \mu \ln(c_f^{1,c}) + (1-\mu)\ln(\gamma h^{1c}) + \beta[(1-\pi^c)\, U_f^s(w_f) + \pi^c U_f^s(w_f)].$$

This simplifies into

$$U_f^s(w_f) = \mu \ln(c_f^{1,c}) + (1-\mu)\ln(\gamma h^{1,c}),$$

from which we get

$$c_f^{1,c} = \exp\left(\frac{1}{\mu}(U_f^s(w_f) - (1-\mu)\ln(\gamma h^{1,m}))\right) = c_f^{2,c}. \tag{23}$$

Hence, if the man wants to propose cohabitation to the woman in the 1st period he has to make the same offer as in the 2nd period. Contrary to the marriage offer, the man will offer the same amount of consumption good to the woman in both periods. This is because in the case of cohabitation there is no dissolution cost. If there was no divorce cost in the case of marriage, equations (22) and (23) would be equal, and as a result, the proposal of marriage would be identical to the proposal of cohabitation. With positive divorce cost though, $U_f^s(w_f) > U_f^d(w_f)$ in (22) which yields $c_f^{1,m} > c_f^{1,c}$, i.e. the man has to offer more consumption good to the woman in marriage than in cohabitation (in this way the man compensates the woman for possible divorce costs).

## 3.7 Optimal marital status in the 1st period

In order to determine the optimal marital status the man has to compare his utility in singlehood to his utility in cohabitation and to his utility in marriage. In the two latter cases he should be able to satisfy the woman's participation constraint or else singlehood is the only possible option. Singlehood is optimal if the man is better off single, i.e.

$$\begin{aligned}(1+\beta)U_m^s(w_m) &> \mu\ln(c_m^{1,m}) + (1-\mu)\ln(\gamma h^{1,m}) \\ &\quad +\beta[(1-\pi^m)\left(\mu\ln(c_m^{2,m}) + (1-\mu)\ln(\gamma h^{2,m})\right) + \pi^m U_m^d(w_m)],\end{aligned}$$

and

$$\begin{aligned}(1+\beta)U_m^s(w_m) &> \mu\ln(c_m^{1,c}) + (1-\mu)\ln(\gamma h^{1,c}) \\ &\quad +\beta[(1-\pi^c)\left(\mu\ln(c_m^{2,c}) + (1-\mu)\ln(\gamma h^{2,c})\right) + \pi^c U_m^c(w_m)],\end{aligned}$$

or if he cannot satisfy the WPC in marriage and cohabitation in any of the two periods, i.e.

$$c_m^{t,m} + c_f^{t,m} \leq w_m + w_f l_f^{t,m} - qd^{t,m}$$

cannot hold simultaneously with

$$c_m^{t,m} > 0, c_f^{t,m} > 0, 0 \leq l_f^{t,m} < 1, d^{t,m} > 0, h^{t,m} > 0$$

for some $t = 1, 2$ and

$$c_m^{t,c} + c_f^{t,c} \leq w_m + w_f l_f^{t,c} - qd^{t,c}$$

cannot hold simultaneously with

$$c_m^{t,c} > 0, c_f^{t,c} > 0, 0 \leq l_f^{t,c} < 1, d^{t,c} > 0, h^{t,c} > 0$$

for some $t = 1, 2$.

Marriage is optimal if the man is better off married, i.e. his discounted utility in marriage for both periods is higher than his discounted utility in singlehood and his discounted utility in cohabitation. Similarly for cohabitation.

Up to now we have set up and solved a model of marriage and cohabitation, whose main ingredients are the gender wage gap and the household production. We showed that the man will propose marriage or cohabitation to a woman in order to maximize his utility. In the case that the woman's reservation utility is too high, matching may not be feasible. The outcome will depend on the combination of wages of each prospective couple $(w_m, w_f)$. In the following subsection we examine marital outcomes for different combinations of male and female wages.

## 3.8 Numerical Example

As it became clear from the theoretical model, the optimal marital status of the agents depends on the combination of wages of the prospective couple. In other words, when a man meets a woman, he will either propose marriage or cohabitation to her, or he will prefer to stay single, or he will not even be able to propose. The outcome will depend on the combination of their wages. In order

to get a better understanding of the mechanics of the model we solve a numerical example using the parameter values in Table 10.

We have not picked these values so as to match any data, i.e. we do not calibrate the model since it is too simplistic. Still, we have chosen them in a way that generates "reasonable" results (e.g. non negative consumption) and gives predictions close to the data estimates. Our benchmark is the US economy in 2008. The value of the discount rate $\beta = 0.96$ is standard in the literature. We assume that the agents value the consumption good as much as the household good and we set their weights equal, i.e. $\mu = 0.5$. We set $\gamma = 1.7$ following the equivalence scale proposed by OECD (1 for the first member of the household, 0.7 for the second). The probability of dissolution in cohabitation is set almost double than the probability of divorce in marriage. In particular, we set the probability of divorce for married couples $\pi_m = 0.30$ following Stevenson and Wolfers (2007b). For cohabiting couples we set the probability of dissolution $\pi_c = 0.50$; according to the report of Vital and Health Statistics (2010) about half of cohabiting unions do not survive after 1 year of cohabitation. Setting $A = 20$ in the household production function and $q = 2$ for the price of durables gives an average share of expenditure on durables over labor income equal to 21% which is in accordance with recent estimates (Baxter and Rotz, 2009). The divorce cost $\phi$ is set equal to 3.5 in order the percentage of married population to be 55%, i.e. close to its value in 2008 (Source: http://www.census.gov/population/socdemo/hh-fam/cps2008/tabA1-all.xls). We start with a gender wage gap $\tau$ =78% and we then examine the effect of decreasing it to 70% of men's wage, i.e. its value in the beginning of the 1990's (Source: http://www.iwpr.org/pdf/C350.pdf).[14] The lowest wage is normalized to 10, and it is assumed that wages are uniformly distributed between 10 and 100 with increments of 10.

Table 10

| | Parameters | Values |
|---|---|---|
| Preferences | $\mu$ | 0.5 |
| | $\beta$ | 0.96 |
| Public good parameter | $\gamma$ | 1/1.7 |
| Household production technology | $A$ | 20 |
| | $\rho$ | 0.19 |
| | $\theta$ | 0.2 |
| | $q$ | $2 \rightarrow 5$ |
| Wages | $w$ | $[10, 20, ..., 100]$ |
| | $\tau$ | $0.78 \rightarrow 0.70$ |
| Dissolution | $\pi^m$ | 0.30 |
| | $\pi^c$ | 0.50 |
| | $\phi$ | 3.5 |

[14] In the model the gender wage gap is captured by the parameter $\tau$, which expresses women's wage as percentage of men's wage. Hence, the lower $\tau$, the wider the gender wage gap.

In the literature improvements of household production technology have been modeled as a reduction in the price of home appliances (e.g. Greenwood et al., 2005). We set $\rho = 0.19$ and $\theta = 0.2$, values estimated by McGrattan, Rogerson and Wright (1997). Regarding the change of the price of home appliances, the available data for the US cover only the period between 1998-2008, during which the decline was 32% (US Bureau of Labor Statistics). We assume a moderate decline of similar magnitude for the years between 1990-1998 and we set the price in 1990 equal to 5, i.e. a 60% increase with respect to the price in 2008, which was 2.

### 3.8.1 The effect of the gender wage gap

First we examine the effects of the narrowing of the gender wage gap on women's market labor supply and on all agents' marital decisions. Recall that the agents live only for 2 periods. Therefore, in the last (2nd) period there is no difference between marriage and cohabitation as dissolution is not possible any more. This is why we will focus only on the 1st period.

The effect of the gender wage gap on agent's marital status is shown in Figure 4. When gender gap in pay is narrow, more agents choose to stay single or cohabit. As a result, the number of cohabiting agents as a percentage of all matched agents goes up, reducing the percentage of married population.

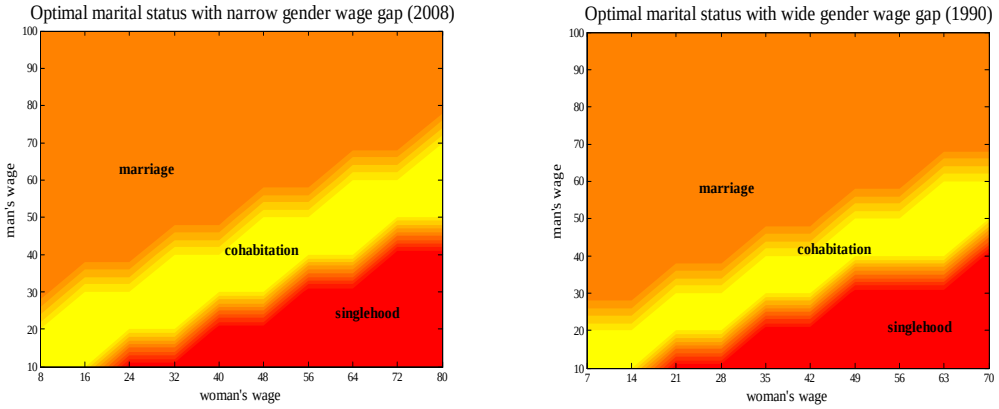


Figure 4

This effect is driven by changes in the market labor supply of the females. The narrowing of the gender wage gap makes women work more in the market, improving their outside option (singlehood). It is then more costly for a man to satisfy the woman's participation constraint and convince her to match with him. Moreover, the returns to specialization decrease, weakening the incentives to get married. Marriage implies higher cost and lower probability of dissolution than cohabitation. In the absence of substantial returns to specialization, cohabitation is favored against marriage.

Table 7

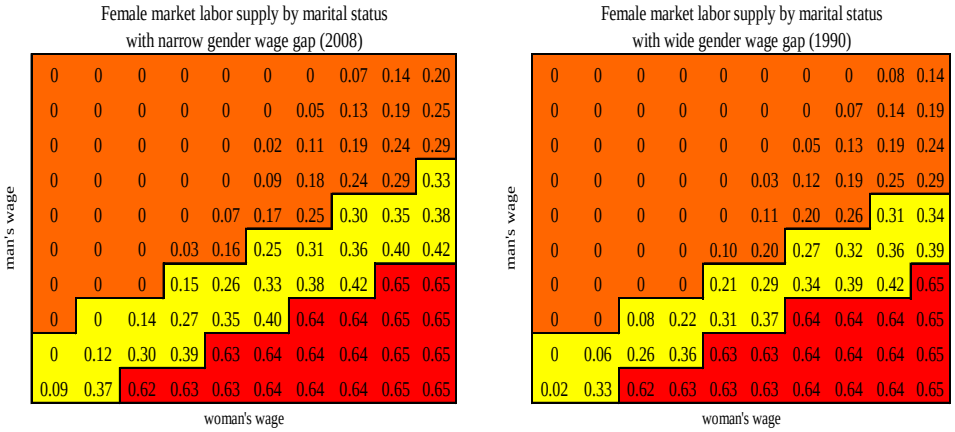


Table 7 depicts the effect of the gender wage gap on female market labor supply. In the benchmark economy (left panel) the model predicts that 64% of women will participate in the market. This value is in accordance with recent statistics (US Bureau of Labor Statistics). First note that the labor supply of single women remains fairly constant,[15] i.e. it is almost unaffected by the narrowing of the gender wage gap.[16] By contrast, the labor supply of all married and cohabiting women increases substantially after the narrowing of the gender wage gap. In the intensive margin, single women work more than both married and cohabiting women. Furthermore, a cohabiting woman will work more hours in the market than a married woman at the same wage rate.

A more interesting implication of the model has to do with the extensive margin of female labor force participation. There are many married women who are fully specialized in home production, while almost all cohabiting women do work in the market. Moreover, cohabiting couples are composed by partners with similar wages. This is in accordance with the study of Brines and Joyner (1999) who show that economic equality is a key element of a long term cohabiting relationship and specialization for marriage.

### 3.8.2 The effect of the price of home appliances

We examine the effect of improvements in the household production technology through a decrease in the price of home appliances. The results are shown in Figure 5. When home appliances are cheaper all men and women are better off because they can substitute house work with durables. However, some couples who would get married when home appliances were expensive, prefer to cohabit after the decline in prices. For these couples the benefits of marriage (specialization and returns to scale) are not enough so as to compensate the man for

[15] The model predicts that single women devote around 65% of their time to market labor. This number is reasonable, given the model's assumption that there is no leisure.

[16] This is in accordance with the data, see Jones et al (2003)

the cost of a possible divorce. On the one hand cohabitation can be dissolved without any cost. On the other hand cohabitation has a higher probability of dissolution. However, a possible dissolution can be accommodated more easily after the decrease in price of home appliances. Hence, these couples decide to cohabit instead of getting married.

There are also singles who decide to cohabit after the decline in price of home appliances in order to benefit from the increasing returns to scale in the household good. All in all, the rate of cohabitation increases and the percentage of unmarried population (cohabiting and singles) goes up.

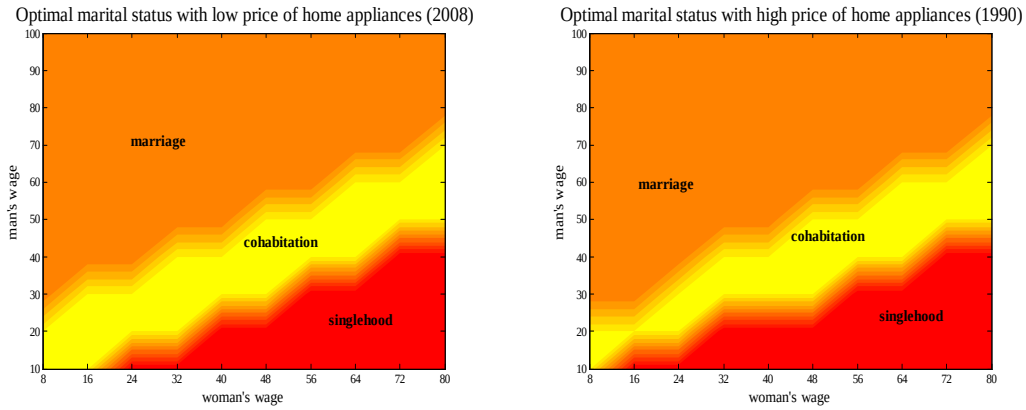


Figure 5

Similarly to the narrowing of the gender wage gap, the decrease in the price of home appliances also leads to an increase in female market labor supply (Table 8).

Table 8

Female market labor supply by marital status with low price of home appliances (2008)

| man's wage \ woman's wage | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0.07 | 0.14 | 0.20 | |
| 90 | 0 | 0 | 0 | 0 | 0 | 0 | 0.05 | 0.13 | 0.19 | 0.25 |
| 80 | 0 | 0 | 0 | 0 | 0 | 0.02 | 0.11 | 0.19 | 0.24 | 0.29 |
| 70 | 0 | 0 | 0 | 0 | 0 | 0.09 | 0.18 | 0.24 | 0.29 | 0.33 |
| 60 | 0 | 0 | 0 | 0 | 0.07 | 0.17 | 0.25 | 0.30 | 0.35 | 0.38 |
| 50 | 0 | 0 | 0 | 0.03 | 0.16 | 0.25 | 0.31 | 0.36 | 0.40 | 0.42 |
| 40 | 0 | 0 | 0 | 0.15 | 0.26 | 0.33 | 0.38 | 0.42 | 0.65 | 0.65 |
| 30 | 0 | 0 | 0.14 | 0.27 | 0.35 | 0.40 | 0.64 | 0.64 | 0.65 | 0.65 |
| 20 | 0 | 0.12 | 0.30 | 0.39 | 0.63 | 0.64 | 0.64 | 0.64 | 0.65 | 0.65 |
| 10 | 0.09 | 0.37 | 0.62 | 0.63 | 0.63 | 0.64 | 0.64 | 0.64 | 0.65 | 0.65 |

Female market labor supply by marital status with high price of home appliances (1990)

| man's wage \ woman's wage | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.02 | 0.09 | 0.15 |
| 90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.08 | 0.15 | 0.20 |
| 80 | 0 | 0 | 0 | 0 | 0 | 0 | 0.06 | 0.14 | 0.20 | 0.25 |
| 70 | 0 | 0 | 0 | 0 | 0 | 0.04 | 0.13 | 0.20 | 0.25 | 0.29 |
| 60 | 0 | 0 | 0 | 0 | 0.02 | 0.13 | 0.20 | 0.26 | 0.31 | 0.34 |
| 50 | 0 | 0 | 0 | 0 | 0.12 | 0.21 | 0.27 | 0.32 | 0.36 | 0.39 |
| 40 | 0 | 0 | 0 | 0.11 | 0.22 | 0.29 | 0.34 | 0.38 | 0.63 | 0.63 |
| 30 | 0 | 0 | 0.09 | 0.23 | 0.32 | 0.37 | 0.62 | 0.62 | 0.63 | 0.63 |
| 20 | 0 | 0.08 | 0.26 | 0.61 | 0.61 | 0.62 | 0.62 | 0.62 | 0.63 | 0.63 |
| 10 | 0.05 | 0.60 | 0.60 | 0.61 | 0.61 | 0.62 | 0.62 | 0.62 | 0.63 | 0.63 |

# 4 Conclusions

This paper examines the rising forms of quasi marriages from an economic perspective. It presents some cross-country evidence on the evolvement of cohab-

itation and it is an attempt of getting a more general understanding of marital behavior in the last decade.

Our conjecture is that more flexible types of family are associated with the improvement in the household production technology and the narrowing of the gender wage gap. These changes enabled women to work more in the market and be financially less dependent from their partners. Likewise, these changes reduced men's need to have a housewife for the household chores. In the data the price of home appliances as a proxy of household production technology has a strong effect on cohabitation confirming the general view that household production technology is a determinant of marital behavior. The gender wage gap also plays a role.

An interesting implication of the model is that women in cohabiting units do not specialize fully at home in contrast to the married ones. This is a result of the relative instability of cohabitation as a marital institution through its ease of dissolution. Moreover, a married woman, who does work in the market, works less hours than a cohabiting woman at the same wage rate.

# 5 Appendix

## 5.1 Data sources

Table A1. Data on cohabitation

| Country | Source |
|---|---|
| Austria | Statistik Austria,www.statistik.at |
| Belgium[17] | SPF Economie - Direction generale Statistique et Information economique selon le Registre National, www.statbel.fgov.be |
| Denmark | Statistics Denmark, www.dst.dk |
| Finland | Statistics Finland, www.stat.fi |
| France | INED, www.ined.fr |
| Germany | Statistisches Bundesamt Deutschland, www.destatis.de |
| Hungary | UNECE, www.unece.org |
| Ireland | UNECE, www.unece.org |
| Italy | UNECE, www.unece.org |
| Netherlands | Statistics Netherlands, www.cbs.nl |
| Norway | Statistics Norway, www.ssb.no |
| Spain | UNECE, www.unece.org |
| Sweden | UNECE, www.unece.org |
| UK | own calculations from the General Household Survey, www.esds.ac.uk |
| US | U.S. Census Bureau, www.census.gov |

Table A2. Data on price of home appliances and CPI

| Country | Source |
|---|---|
| US | Bureau of Labor Statistics, www.bls.gov/data |
| Other countries | Eurostat, http//epp.eurostat.ec.europa.eu |

Table A3. Data on price of GDP growth and urban population

| Country | Source |
|---|---|
| All countries | World Bank (WDI), www.worldbank.org |

[17]The data for Belgium do not refer solely to cohabiting couples but also include pairs of cohabiting persons of the same or different sex, eg. two siblings or two friends.

Table A4. Data on gender wage gap

| Country | Source |
|---|---|
| Austria | UNECE, www.unece.org |
| Belgium | Eurostat, http//epp.eurostat.ec.europa.eu |
| Denmark | OECD, www.oecd.org |
| Finland | OECD, www.oecd.org and UNECE, www.unece.org |
| France | Eurostat, http//epp.eurostat.ec.europa.eu and OECD |
| Germany | Eurostat, http//epp.eurostat.ec.europa.eu |
| Hungary | UNECE, www.unece.org |
| Ireland | Eurostat, http//epp.eurostat.ec.europa.eu |
| Italy | - |
| Netherlands | Eurostat, http//epp.eurostat.ec.europa.eu |
| Norway | UNECE, www.unece.org |
| Spain | Eurostat, http//epp.eurostat.ec.europa.eu |
| Sweden | Eurostat, http//epp.eurostat.ec.europa.eu |
| UK | OECD, www.oecd.org |
| US | U.S. Census Bureau, www.census.gov |

## 5.2 First order conditions

### 5.2.1 Single agent's problem

The problem of a single agent $g = m, f$ is

$$\max_{c_g^s>0, h_g^s>0, 0<l_g^s\leq 1, d_g^s>0} \mu \ln(w_g l_g^s - q d_g^s) + (1-\mu)\ln(A(d_g^s)^\theta (1-l_g^s)^{1-\theta}).$$

Below we derive the first order conditions of this problem. The first order condition associated with the labor supply decision is given by

$$\frac{\mu w_g}{w_g l_g^s - q d_g^s} = \frac{(1-\mu)(1-\theta)A(d_g^s)^\theta (1-l_g^s)^{-\theta}}{A(d_g^s)^\theta (1-l_g^s)^{1-\theta}},$$

which reduces to

$$\frac{\mu w_g}{w_g l_g^s - q d_g^s} = \frac{(1-\mu)(1-\theta)}{1-l_g^s}. \tag{S1}$$

The first order condition associated with the amount of durables is given by

$$\frac{\mu q}{w_g l_g^s - q d_g^s} = \frac{(1-\mu)\theta A(d_g^s)^{\theta-1}(1-l_g^s)^{1-\theta}}{A(d_g^s)^\theta (1-l_g^s)^{1-\theta}},$$

which becomes

$$\frac{\mu q}{w_g l_g^s - q d_g^s} = \frac{(1-\mu)\theta}{d_g^s}. \tag{S2}$$

### 5.2.2 2nd period optimal marriage proposal

The optimal marriage proposal problem in the 2nd period is

$$\max_{c_f^m>0, 0\leq l_f^m<1, d^m>0} \mu \ln(w_m + w_f l_f^m - q d^m - c_f^m) + (1-\mu)\ln(\gamma A (d^m)^\theta (1-l_f^m)^{1-\theta})$$

subject to

$$\mu \ln(\mu w_f) + (1-\mu)\ln(A(\theta(1-\mu)\frac{w_f}{q})^\theta((1-\theta)(1-\mu))^{1-\theta}) \leq \mu \ln(c_f^m) + (1-\mu)\ln(\gamma A (d^m)^\theta (1-l_f^m)^{1-\theta}).$$

The first order conditions for interior solutions ($l_f > 0$) are given by (M1)-(M3). Derivating with respect to the woman's consumption good we get

$$\frac{\mu}{w_m + w_f l_f^m - q d^m - c_f^m} = \zeta \frac{\mu}{c_f^m},$$

which becomes

$$\frac{1}{w_m + w_f l_f^m - q d^m - c_f^m} = \zeta \frac{1}{c_f^m}. \tag{M1}$$

Derivating with respect to the woman's labor supply we get

$$\frac{\mu w_f}{w_m + w_f l_f^m - q d^m - c_f^m} - \frac{(1-\mu)(1-\theta)}{(1-l_f^m)} = \zeta \frac{(1-\mu)(1-\theta)}{(1-l_f^m)},$$

which can be written as

$$\frac{\mu w_f (1-l_f^m) - (1-\mu)(1-\theta)(w_m + w_f l_f^m - q d^m - c_f^m)}{(w_m + w_f l_f^m - q d^m - c_f^m)} = \zeta(1-\mu)(1-\theta). \tag{M2}$$

Lastly, derivating with respect to the amount of durables we get

$$\frac{\mu q}{w_m + w_f l_f^m - q d^m - c_f^m} - \frac{(1-\mu)\theta}{d^m} = \zeta \frac{(1-\mu)\theta}{d^m},$$

which can be written as

$$\frac{\mu q d^m - (1-\mu)\theta(w_m + w_f l_f^m - q d^m - c_f^m)}{(w_m + w_f l_f^m - q d^m - c_f^m)} = \zeta(1-\mu)\theta. \tag{M3}$$

### 5.2.3 1st period optimal marriage proposal

The optimal marriage proposal problem in the 1st period is

$$\max_{\substack{c_f^{1,m},l_f^{1,m},d^{1,m},\\ c_f^{2,m},l_f^{2,m},d^{2,m}}} \mu \ln(w_m + w_f l_f^{1,m} - qd^{1,m} - c_f^{1,m}) + (1-\mu)\ln(\gamma A(d^{1,m})^\theta (1-l_f^{1,m})^{1-\theta})$$
$$+ \beta\left[(1-\pi^m)\left(\mu \ln(w_m + w_f l_f^{2,m} - qd^{2,m} - c_f^{2,m})\right.\right.$$
$$\left.\left.+(1-\mu)\ln(\gamma A(d^{2,m})^\theta (1-l_f^{2,m})^{1-\theta})\right) + \pi^m U_m^d(w_m)\right]$$

subject to

$$\begin{aligned}(1+\beta)U_f^s(w_f) \quad \leq \quad & \mu \ln(c_f^{1,m}) + (1-\mu)\ln(\gamma h^{1,m}) \\ & +\beta[(1-\pi^m)\left(\mu \ln(c_f^{2,m}) + (1-\mu)\ln(\gamma h^{2,m})\right) + \pi^m U_f^d(w_f)],\end{aligned} \tag{WPC1}$$

and

$$U_f^s(w_f) \leq \mu \ln(c_f^{2,m}) + (1-\mu)\ln(\gamma h^{2,m}). \tag{WPC2}$$

The first order conditions for interior solutions ($l_f^{1,m} > 0, l_f^{2,m} > 0$) are given by (M11-M23). In particular, derivating with respect to the consumption of the woman in the 1st period we get

$$\frac{\mu}{w_m + w_f l_f^{1,m} - qd^{1,m} - c_f^{1,m}} = \zeta \frac{\mu}{c_f^{1,m}},$$

which simplifies into

$$\frac{1}{w_m + w_f l_f^{1,m} - qd^{1,m} - c_f^{1,m}} = \zeta \frac{1}{c_f^{1,m}}. \tag{M11}$$

The first order condition associated with the woman's labor supply is

$$\frac{\mu w_f}{w_m + w_f l_f^{1,m} - qd^{1,m} - c_f^{1,m}} - \frac{(1-\mu)(1-\theta)}{(1-l_f^{1,m})} = \zeta \frac{(1-\mu)(1-\theta)}{(1-l_f^{1,m})},$$

which is equivalent to

$$\frac{\mu w_f (1-l_f^{1,m}) - (1-\mu)(1-\theta)(w_m + w_f l_f^{1,m} - qd^{1,m} - c_f^{1,m})}{(w_m + w_f l_f^{1,m} - qd^{1,m} - c_f^{1,m})} = \zeta(1-\mu)(1-\theta). \tag{M12}$$

Derivating with respect to the amount of durables in the 1st period gives

$$\frac{\mu q}{w_m + w_f l_f^{1,m} - q d^{1,m} - c_f^{1,m}} - \frac{(1-\mu)\theta}{d^{1,m}} = \zeta \frac{(1-\mu)\theta}{d^{1,m}},$$

which can be written as

$$\frac{\mu q d^{1,m} - (1-\mu)\theta(w_m + w_f l_f^{1,m} - q d^{1,m} - c_f^{1,m})}{(w_m + w_f l_f^{1,m} - q d^{1,m} - c_f^{1,m})} = \zeta(1-\mu)\theta. \tag{M13}$$

Similarly, the first order conditions associated with the decisions of the 2nd period are given by

$$\frac{\beta(1-\pi_m)}{w_m + w_f l_f^{2,m} - q d^{2,m} - c_f^{2,m}} = (\zeta\beta(1-\pi_m) + \xi)\frac{1}{c_f^{2,m}}, \tag{M21}$$

for the consumption good of the woman,

$$\beta(1-\pi_m)\frac{\mu w_f(1-l_f^{2,m}) - (1-\mu)(1-\theta)(w_m + w_f l_f^{2,m} - q d^{2,m} - c_f^{2,m})}{(w_m + w_f l_f^{2,m} - q d^{2,m} - c_f^{2,m})} = (\zeta\beta(1-\pi_m) + \xi)(1-\mu)(1-\theta), \tag{M22}$$

for the labor supply of the woman, and

$$\beta(1-\pi_m)\frac{\mu q d^{2,m} - (1-\mu)\theta(w_m + w_f l_f^{2,m} - q d^{2,m} - c_f^{2,m})}{(w_m + w_f l_f^{2,m} - q d^{2,m} - c_f^{2,m})} = (\zeta\beta(1-\pi_m)+\xi)(1-\mu)\theta, \tag{M23}$$

for the amount of durables.

### 5.2.4 Corner solutions

### 5.2.5 2nd period optimal marriage/cohabitation proposal

We have assumed that married/cohabiting men devote all their available time to market work while married/cohabiting women distribute their time between market work and housework. In the case that women specialize completely in housework ($l_f = 0$) the first order condition with respect to the consumption of the female and the durables remain unchanged

$$\frac{1}{w_m - q d^m - c_f^m} = \zeta \frac{1}{c_f^m}, \tag{C1}$$

and

$$\frac{\mu q d^m - (1-\mu)\theta(w_m - q d^m - c_f^m)}{(w_m - q d^m - c_f^m)} = \zeta(1-\mu)\theta, \tag{C2}$$

while the first order condition with respect to female labor is now given by the Kuhn-Tucker condition

$$l_f^m = 0, \quad \frac{\mu w_f - (1-\mu)(1-\theta)(w_m - q d^m - c_f^m)}{(w_m - q d^m - c_f^m)} - \zeta(1-\mu)(1-\theta) > 0. \tag{C3}$$

Combining (C1) to (C3), and the constraints we get

$$\begin{aligned} d^m &= \frac{(1-\mu)\theta w_m}{(\mu + (1-\mu)\theta)q}, \\ l_f^m &= 0, \\ h^m &= A(\frac{(1-\mu)\theta w_m}{(\mu + (1-\mu)\theta)q})^\theta. \end{aligned} \tag{C4}$$

## 5.3 Robustness

### 5.3.1 The married/cohabitating man does not work full time in the market

The model presented in Section 3 is based on the assumption that the man works full time in the market and the woman allocates her time between the house- and market work. We relax this assumption by assuming that the man devotes a fixed amount of time to housework denoted by $\overline{z}$. The optimal marital proposal in the 2nd period becomes

$$\max_{c_f^m > 0, 0 < l_f^m \leq 1, d^m > 0} \mu \ln(c_m^m) + (1-\mu)\ln(\gamma h^m) \tag{24}$$

subject to

$$\begin{aligned} c_m^m + c_f^m &= w_m(1-\overline{z}) + w_f l_f^m - q d^m, && \text{(BC)} \\ h^m &= A(d^m)^\theta (1 - l_f^m + \overline{z})^{1-\theta}, && \text{(HPT)} \end{aligned}$$

and

$$U_f^s(w_f) \leq \mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m). \tag{WPC}$$

The first order condition for the woman's consumption good is

$$\frac{\mu}{w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m} = \zeta \frac{\mu}{c_f^m},$$

which becomes

$$\frac{1}{w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m} = \zeta \frac{1}{c_f^m}. \tag{R1}$$

Derivating with respect to the woman's labor supply we get

$$\frac{\mu w_f}{w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m} - \frac{(1-\mu)(1-\theta)}{(1-l_f^m+\overline{z})} = \zeta \frac{(1-\mu)(1-\theta)}{(1-l_f^m+\overline{z})},$$

which can be written as

$$\frac{\mu w_f(1-l_f^m+\overline{z}) - (1-\mu)(1-\theta)(w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m)}{(w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m)} = \zeta(1-\mu)(1-\theta). \tag{R2}$$

Lastly, derivating with respect to the amount of durables we get

$$\frac{\mu q}{w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m} - \frac{(1-\mu)\theta}{d^m} = \zeta \frac{(1-\mu)\theta}{d^m},$$

which can be written as

$$\frac{\mu q d^m - (1-\mu)\theta(w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m)}{(w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m)} = \zeta(1-\mu)\theta. \tag{R3}$$

The solution is

$$d^m = \frac{(1-\mu)\theta(w_f+w_m)}{q} + \overline{z}\frac{(1-\mu)\theta(w_f-w_m)}{q}, \tag{25}$$

$$l_f^m = (1+\overline{z})(\mu+(1-\mu)\theta) - (1-\overline{z})(1-\mu)(1-\theta)\frac{w_m}{w_f}. \tag{26}$$

We then perform the numerical example of Subsection 3.8 for different values of $\overline{z}$.

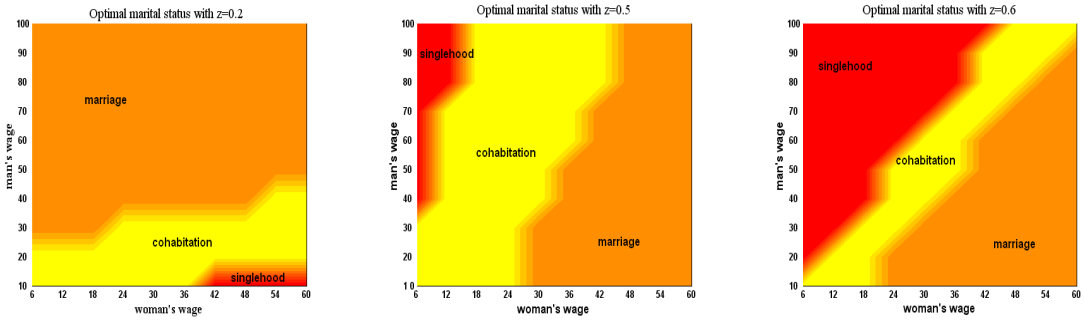


Figure 6

For small values of $\overline{z}$ (left panel of Figure 6) the results are similar to the ones we obtained when the man worked full time in the market. Note that the number of cohabiting households has increased while the number of singles has decreased. This happens because a man with a low salary can now convince a woman with high salary to cohabit with him by offering his housework.

However, the pattern of the optimal marital status changes drastically as $\overline{z}$ takes higher values (central and right panel of Figure 6). Given the existence of the gender wage gap in the labor market forcing the man to devote large amount of his time to housework would give rise to non traditional marriages (high salary woman with low salary man) as well as to rich males who remain single. The interesting feature is that cohabitation entails again symmetric couples (i.e. partners with similar wages).

### 5.3.2 The woman makes the take-it or leave-it offer to the man

In Section 3 we assumed that the man is the one who proposes marriage or cohabitation to the woman upon meeting in the marriage market. We check if our results are driven by this assumption and we examine the case that the woman makes the offer. The problem of the optimal marriage proposal in the 2nd period becomes

$$\max_{c_m^m>0, 0<l_f^m\leq 1, d^m>0} \mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m) \tag{27}$$

subject to

$$\begin{aligned} c_m^m + c_f^m &= w_m + w_f l_f^m - q d^m, && \text{(BC)} \\ h^m &= A(d^m)^\theta (1-l_f^m)^{1-\theta}, && \text{(HPT)} \end{aligned}$$

and

$$U_m^s(w_m) \leq \mu \ln(c_m^m) + (1-\mu)\ln(\gamma h^m). \tag{MPC}$$

Note that the woman is now trying to maximize her utility by choosing the hours she will work in the market and the amount of consumption good and durable good she will offer to the man. We maintain the assumption that the man works full time in the market. The woman has to take into account the man's participation constraint in her decision i.e. she has to be able to convince him to cohabit/get married to her.

The first order conditions with respect to $l_f^m$ and $d^m$ are the same as in the case that the man makes the offer. We obtain $c_m^m$ from the man's participation constraint which will bind (following the same reasoning as in Section 3) and lastly we get $c_f^m$ from the budget constraint. The woman will compare her utility in singlehood, cohabitation, and marriage and decide whether making or not a proposal to the man as well as the kind of the proposal (marriage or cohabitation).

The numerical example yields exactly the same results. The only difference lies on the fact that the utility of the woman is higher in marriage or cohabitation than in singlehood, while the utility of the man is always the same as his participation constraint is binding. This mitigates the optimal marital status that is obtained when the man makes the take-it or leave-it offer.

# References


Albanesi, S., and C. Olivetti (2009a). "Production, Market Production and the Gender Wage Gap: Incentives and Expectations," *Review of Economic Dynamics*, Vol. 12, 80-107.

Albanesi, S., and C. Olivetti (2009b). "Gender Roles and Medical Progress", *CEPR Working Paper*, No. 14873.

Baxter, M., and D., Rotz (2009). "Detecting Household Production", *Mimeo.*

Becker, G. (1993). "*Treatise on the Family*", Harvard University Press.

Brien, M., L. Lillard, and S., Stern (2006). "Cohabitation, Marriage and Divorce in a Model of Match Quality", *International Economic Review*, Vol. 47, 451-494.

Brines, J., and K. Joyner (1999). "The Ties that Bind: Principles of Cohesion in Cohabitation and Marriage", *American Sociological Review,* Vol. 64, 333-355.

Bumpass, L., and H. Lu (2000). "Trends in Cohabitation and Implications for Children's Family Contexts in the US", *Population Studies*, Vol. 54, 29-41.

Bumpass, L., and J. Sweet (1989). "National Estimates of Cohabitation", *Demography,* Vol. 26, 615-625.

Casper, L., P. Cohen, and T. Simmons (1999). "How Does POSSLQ Measure Up? Historical Estimates of Cohabitation", *US Census Bureau Population Division Working Paper*, No. 36.

Cavalcanti, T., and J. Tavares (2008). "Assessing the Engines of Liberation: Home Appliances and Female labor Force Participation", *The Review of Economics and Statistics*, Vol. 90, 81-88.

Chade, H., and G., Ventura (2005). "Income Taxation and Marital Decisions", *Review of Economic Dynamics,* Vol. 8, 565-599.

Cigno, A. (2007). "A Theoretical Analysis of the Effects of Legislation on Marriage, Fertility, Domestic Division of Labour, and the Education of Children", *CESifo Working Paper*, No. 2143.

Drewianka, S. (2006). "A Generalized Model of Commitment", *Mathematical Social Sciences,* Vol. 52, 233-251.

Drewianka, S. (2004). "How Will Reforms of Marital Institutions Influence Marital Commitment? A Theoretical Analysis", *Review of Economics of the Household,* Vol. 2, 303-323.

Erosa, E., L., Fuster, and D. Restuccia (2010). "A Quantitative Theory of the Gender Gap in Wages", *IMDEA Working Paper 2010-04.*

Fernández, R., A. Fogli, and C. Olivetti (2004). "Mothers and Sons: Preference Formation and Female Labor Force Dynamics", *CEPR Discussion Paper*, No. 3592.

Gemici, A. and S. Laufer (2010). "Marriage and Cohabitation", *Mimeo.*

Goldin. C., and L. Katz (2002). "The Power of the PillOral Contraceptives and Women's Career and Marriage Decisions", *Quarterly Journal of Economics*, Vol. 119, 1249-1299.

Goodman, A., and E. Greaves (2010). "Cohabitation, Marriage and Child Outcomes", *IFS Commentary*, C114.

Greenwood, J.,and N. Guner (2009). "Marriage and Divorce since World War II: Analyzing the Role of Technological Progress on the Formation of Households", *NBER Macroeconomics Annual 2008*, Vol. 23, 231-276.

Greenwood, J., A. Seshadri , and M. Yorukoglu (2005). "Engines of Liberation", *Review of Economic Studies*, Vol. 72, 109-133.

Jaumotte, F. (2003). "Female labour force participation past trends and main determinants in OECD countries", *OECD Economics Department Working Papers*, No. 376.

Jepsen, L., and C. Jepsen (2002). "An Empirical Analysis of Same-sex and Opposite-sex Couples: Do 'Likes' Still Like 'Likes' in the '90s", *Demography*, Vol 39, 435-453.

Jones, L., R. Manuelli, and E. McGrattan (2003). "Why Are Married Women Working So Much?", *Federal Reserve Bank of Minneapolis Staff Report*, No 317.

Kalmjin, M. (2007). "Explaining Cross-National Differences in Marriage, Cohabitation, and Divorce in Europe, 1990-2000", *Population Studies*, Vol 61, 243-263.

Kaygusuz, R. (forthcoming). "Taxes and Female Labor Supply", *Review of Economics Dynamics.*

Matoushek N., and I. Rasul (2008). "The Economics of The Marriage Contract: Theories And Evidence", *Journal of Law and Economics*, Vol. 51, 59-110.

McGrattan, E., R. Rogerson, and R. Wright (1997). "An Equilibrium Model of the Business Cycle with Household Production and Fiscal Policy", *International Economic Review,* Vol. 38, 267-290.

Oppenheimer, V. (1994). "Women's Rising Employment and the Future of the Family in Industrial Societies", *Population and Development Review*, Vol. 20, 293-342.

Pison, G. (2008). "The Population of France in 2007", *Population & Societies*, No. 443.

Stevenson, B., and J., Wolfers (2007a). "Marriage and Divorce: Changes and their Driving Forces", *Journal of Economic Perspectives*, Vol. 21, 27-52.

Stevenson, B., and J., Wolfers (2007b). "Trends in Marital Stability", *Mimeo.*

Wydick, B. (2007). "Grandma Was Right: Why Cohabitation Undermines Relational Satisfaction, But Is Increasing Anyway", *KYKLOS*, Vol. 60, 617-645.