

Till mess do us part: Married women's market hours, home production, and divorce

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Abstract

Part time employment facilitates the reconciliation of work and family life for married women. However, in case of divorce, part time employment implies significant reductions in income, and transitions to full time employment are not automatic. Given non-trivial divorce risks, why do married women work so little? Findings in sociology on marital strain and divorce point to a positive relationship between divorce risk and wives' hours worked. We explore the empirical evidence for a trade-off between higher future wages and higher probability of divorce for married women using micro data for Germany, finding that wives' market hours (hours dedicated to housework and child care) are positively (negatively) related to divorce. We also find size-able wage penalties for working part time and for years taken off from work for women. We then propose a dynamic life-cycle model of female labor force participation, home production, child care, and endogenous divorce risk. We calibrate our model to German data to quantitatively assess how different forces such as child care costs, tax incentives, child benefits/alimony, and the substitutability of housework ("gender norms" or the price for market substitutes) can account for married women's market hours over the life cycle when divorce is endogenous.

JEL classification: J12, J13, J22, H42

Keywords: female labor force participation, home production, divorce

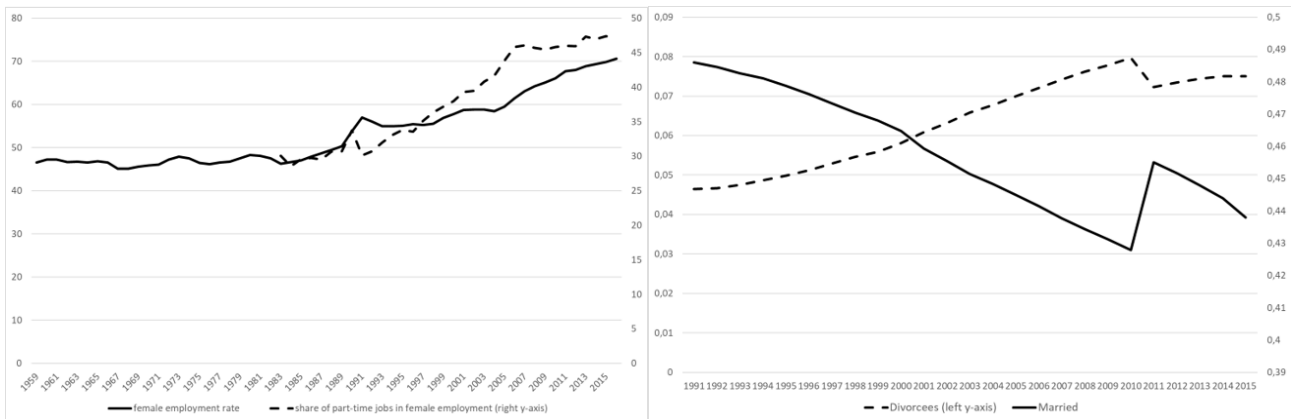
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1 Introduction

Female labor force participation has increased tremendously over the past decades. In Germany, as in many other developed countries, much of this increase can be attributed to the rise in part-time jobs, see left-hand graph of Figure 1. While part-time jobs facilitate mothers' labor market attachment because they ease the reconciliation of work and family life, they provide only limited income. This becomes particular pertinent in case of divorce, a situation that has come to affect more and more individuals over the past decades, see right-hand graph of Figure 1.

Figure 1: Female employment, part-time work, married and divorced individuals in Germany



Data: Statistisches Bundesamt for demographics and female employment; OECD for share of part-time.

Upon divorce, women working part time suffer important losses in income, and in Germany employees who reduce their working hours have no right to return to full time employment.¹ Furthermore, years of part time employment imply lower returns to experience and provide for lower pensions. Old single households are at a higher risk of poverty than two-person households – 15% versus 4.7% – and in particular, women receive systematically lower pensions and are at a higher risk than men of being poor in old age, see Figures A-1 and A-2 in the Appendix. The current paper addresses the following question: In the face of non-trivial divorce risks, why do married women work so little?

A fairly sizable literature in economics has analyzed the relationship between divorce risk and female labor force participation. Most studies attempt to quantify how much of the increase in labor force participation by married women over the past decades can be accounted for by a higher divorce risk associated with unilateral divorce laws and cultural changes. Different from this literature we do not attempt to explain the rise in married women's labor force participation but rather the fact that despite non-trivial divorce risks most married women only work part time. A possible explanation comes from empirical studies in sociology which show how wives' employment and housework (double burden) impose marital strain which leads to a higher risk of divorce. Being better prepared for the event of a divorce by working full time could hence at

¹An attempt to change the German labor law accordingly failed in March 2017 - see <http://www.faz.net/aktuell/wirtschaft/gesetz-von-nahles-rueckkehrrecht-aus-teilzeit-in-vollzeit-gescheitert-15029585.html>

the same time lead to an increased likelihood of divorce.

However, for such a mechanism to be relevant low substitutability between couples' time dedicated to child care and housework and purchased child care time and market goods and services for home production is key. For instance, the quality, price and availability of cleaning services, restaurant meals and child care determine if and how binding couples' time constraints are. Furthermore, cultural norm related to "gender roles" could also imply low substitutability of wives' time dedicated to housework. Another important factor that could explain why married women prefer to work part time is the generosity of child support and alimony payments upon divorce. Empirical findings on this matter are inconclusive. Chiappori et al [2017] find Canadian women in couples to reduce their labor supply upon an unexpected increase in the generosity of alimony payments but find no effect for newly formed couples. Rangel [2006] estimates positive effects on women's labor supply following a similar policy in Brazil, while Bredtmann and Vonnahme [2017] find no labor supply effects for married women in Germany upon an important reduction in alimony rights in 2008. Finally, the tax treatment of married couples could also matter. In Germany, the current joint fiscal treatment of married couples' incomes implies that average tax rates for secondary earners are higher than for primary earners. Hence, for secondary earners, typically wives, the incentives to work additional hours are low. Bick and Fuchs-Schündeln [2017] find that much of the cross-country differences in married women's hours worked can be explained by differences in non-linear labor income taxes and consumption taxes across countries, and Alesina, Ichino, and Karabarbounis [2011] propose gender based taxation that on the contrary would lower taxes on the more elastic labor supply of women, increasing it on men's.

Our paper can be divided into two parts. Looking at micro-data from the German Socio-Economic Panel (SOEP) we first analyze the empirical relationships between wives' hours worked and divorce, and hours dedicated to household activities and divorce. Estimating a probit model for divorce risk, we find that controlling for her employment as well as marriage-specific variables including her share in household income and home ownership, more working hours of wives are associated with a higher risk of separation two years later. On the other hand, couples where wives spend more time on housework and child care have a lower probability of separation in the future. Our results are robust to using random effects cloglog regressions that allow for heterogeneity in couples' frailty. This suggest that above and beyond men's and women's contribution to household income, marriage stability is closely related to how husband and wives allocate their time. Using a subsample for most recent years of the same data, we also establish that there are size-able wage penalties for working part time and for years taken off from work for women. While reverse causality and unobservables which might be driving divorce and work decisions imply that our empirical findings suffer from endogeneity issues, they provide the motivation for our model.

In the second part of the paper we propose a dynamic life-cycle model of female labor force participation, home production, child care, and divorce. Married mothers in our model decide each period whether to stay married and how much time to allocate to market work, housework, child care, and leisure. Given that an important part of family life centers around home production (cooking, cleaning) and taking care of children, a couple has to devote time to these

non-market activities. If women face lower market wages, couples might optimally decide that she works only part time and dedicates some time to housework and child care. Hence, the existence of part time jobs that facilitate the return to employment after maternity leaves eases the reconciliation of work and family life. But working part-time entails much lower returns to experience and hence turns into a costly strategy in the event of a divorce. On the other hand, and depending on the weight of consumption goods, children’s quality, and home-produced goods in individuals’ utility, if wives dedicate more time to market work (and less time to housework and child care) the value of marriage might be lower, increasing the probability of divorce. We calibrate our model to German data to be able to quantitatively assess how different forces such as child care costs, tax incentives, child benefits/alimony, and the substitutability of housework (“gender norms”, price for market substitutes) can account for married women’s market hours over the life cycle when divorce is endogenous.

To the best of our knowledge the current paper is the first that explicitly focuses on the trade-off between divorce risk, female market hours, home production, and child care with a particular emphasis on couples’ time constraints. Our paper hence relates to the important strand of literature - starting with the seminal paper by Becker, Landes and Michael [1977] on mechanisms driving marital instability - that has tried to analyze fertility, labor force participation, marriage and divorce decisions. As mentioned before, most studies try to explain the parallel time trends of increased female labor force participation and divorce. These studies also tend to test for the contribution of other competing driving forces behind female employment such as a narrowing of the gender wage gap, improvements in home production technology, increasing educational attainment of women, change in divorce laws and change in cultural norms, (see Stevenson and Wolfers [2007] for an overview).²

For instance, Eckstein and Lifshitz [2011] estimate a dynamic model of female labor supply to assess the contribution of among other aspects increased divorce risk on female employment. The authors find that divorce risk can only account for a very small increase in female labor force participation. However, as Fernández and Wong [2014] point out, this result might be driven by the authors’ assumption of a linear utility function. Assuming concave utility in a dynamic life-cycle model with savings, employment decisions and exogenous marital status, Fernández and Wong [2014] estimate a much more important role for the increased divorce risk on female employment. However, their result is not driven by women’s desire to accumulate labor market experience but is the outcome of bargaining among competing interests; husbands wanting to increase consumption and wives wishing to increase savings when divorce becomes more likely. Knowles [2013] who models home production such that it requires a minimum amount of either husbands’ or wives’ time, attempts to account for the fact that despite higher wages for women, non-working time of wives relative to that of husbands has remained constant. The author attributes this to an increase in wives’ bargaining power within marriage due to their improved economic position upon divorce. The model proposed by Greenwood et al [2016] relates not only divorce and female labor force participation but links both to rising income inequality. The authors conclude that technological progress in home production can account for the majority

²On the effect of the change in US divorce laws from mutual consent to unilateral divorce on female employment see Stevenson [2008] and Fernández and Wong [2017]. Voena [2015] analyzes the effects of this policy change on female employment and asset accumulation in states with different division rules of asset upon divorce.

of the increase in female labor force participation and that changes in marital structure on the other hand, in particular positive assortative mating, have amplified the effect of increasing skill premia on inequality. Closely related to our paper is Mazzocco, Ruiz and Yamaguchi [2013] who propose a model that is able to capture the timing of changes in labor supply, time dedicated to home production, and savings decisions of to-be-married and to-be-divorced women who increase their labor supply before marriage, decrease it during marriage and increase it again just before divorce.³

In most models however, individuals' time only plays a limited role as either only the intensive margin of labor force participation is considered, home production is not modeled, or it is modeled in such a way that time can be substituted relatively easily by purchased goods and services. Furthermore, while many models implicitly include the trade-off we want to highlight, i.e. between market hours, home production, and divorce, to the best of our knowledge none discusses or analyzes its implications. The only two exceptions are Weiss [1997] and Anderberg, Rainer and Roeder [2016]. The literature review by Weiss [1997] mentions the trade-off and the potential negative effects that individuals' "defensive investments" in terms of increased market hours when faced with higher divorce risks might have on lower supply of child care and subsequently lower "child quality" but the author does not provide further analysis nor does he discuss how lower supply of home production (here lower "child quality") in turn might have a destabilizing effect for marriage, which is exactly what we want to focus on. Anderberg, Rainer and Roeder [2016] suggest a model where hyperbolic discounting of individuals can explain low investment in marriage-specific capital and high divorce rates and where institutions that make divorce costly can help to achieve first-best outcomes.⁴

Our motivation for focusing on the positive (negative) effect of women's market hours (housework hours) on divorce is based on evidence from the sociology literature as well as our own empirical analysis. To the best of our knowledge, we are hence also the first to document this trade-off between divorce risk, time spent on household tasks and female market hours. The existing literature, mostly in sociology, focuses on how "gendered roles" defined by higher income and lower housework shares for husbands compared to wives are related to marital stability. For instance, Cooke [2006] finds for Germany (but not for the US) that couples who deviate from the "traditional gendered" model face higher divorce risks. Bittman et al [2003] show that wives who earn more do less housework up to the point that they earn more than their husbands when they again increase their share in housework. Closely related to our empirical analysis is the paper by Kraft and Neimann [2009] who also consider German data and estimate a higher divorce risk for couples in which the wife is the "breadwinner." In a similar spirit, Bertrand et al [2015] highlight the empirical discontinuity in couples' earnings at exactly the point where wives start earning

³Empirical papers on the topic of divorce and female labor force participation are Bargain et al [2012] who find that the relative late introduction of divorce in Ireland led to an increase in female employment. Bremmer and Kesslering [2004] look at time series data for the US and find that as more married women join the labor market, the divorce rate increases and that an increase in female income makes divorce more likely. Johnson and Skinner [1986] find that increased divorce risk explains one third of the increase in female labor force participation in the US, and Papps [2006] estimates married women to increase their labor supply when facing higher risks of divorce.

⁴Our paper is also related to the broader literature on female labor force participation and fertility. One interesting paper that also focuses on the trade-off between market work and housework but does not consider divorce is Laun and Wallenius [2017].

more than 50% of household income. The authors argue that the discontinuity arises as most couples try to avoid this situation. They also find that couples where wives earn more than their husbands are unhappier and that in these couples wives do more housework to “compensate” for their higher earnings. In contrast, Newman and Olivetti [2015] find that couples where the wife is a “career woman,” – i.e. she has a continuous work history and has worked at least 75% of the time since marriage – are more stable compared to marriages where the wife has taken years off from work. As motivational evidence the authors plot divorce rates and female labor force participation by US states which show a strong negative correlation. We plot an approximation (because we use female employment rates instead of employment of married women) of their graph in Figure A-3 in the Appendix. Next to the same graph we plot similar data for European countries where the relationship is positive instead; i.e. divorce rates are higher in European countries where female labor force participation is higher. Furthermore, when considering part and full time employment separately, the relationship for US states is negative in the first and positive in the latter case, see Figure A-4 in the Appendix. In line with this suggestive evidence, we argue that while working wives might provide for marital stability, the amount of hours worked might increase the risk of divorce.

As mentioned before, low substitutability of time dedicated to housework and child care and goods and housework and child care services purchased in the market is key for our suggested mechanism to matter. Extensive research already shows that the ability to substitute mothers’ time dedicated to child care by external child care services increases labor force participation of mothers, see Del Boca and Vuri [2007] for a review. There is much less evidence on a relationship between availability of external child care services and marriage stability. One of the few examples we are aware of is Cherlin [1977] who points to a stabilizing effect for marriage of the high costs of child care for preschool children, in terms of time, money, and effort. Low availability of child care might hence also explain the preference of married mothers to work less, potentially affecting marriage stability positively. However, it is not clear why divorced mothers with access to the same child care services would work more. According to the OECD, in Germany 59% of women in couples with children below the age of 14 work less than 30 hours per week, compared to only 39% of single mothers. This suggests that additional factors linked to “gendered roles,” and/or related with the organization of a 2-adult household, and/or the joint tax treatment of couples make additional hours in the market less desirable for married women, despite being a costly strategy in the case of divorce. The remainder of this paper is organized as follows: the next section presents our empirical analysis. Section 3 presents the model and Section 5 describes our calibration strategy. In Section 6 we present the results of the model. In Section 7 we perform two counterfactual experiments, and Section 8 concludes.

2 Empirical analysis

For our empirical analysis we consider data from the German Socio-Economic Panel (SOEP). The SOEP, an annual household survey carried out since 1984, provides extensive information on individuals’ labor force participation, marital and family status, wages, education, etc. (for more details see SOEP [2005] or Wagner et al [2007]). The survey also includes individuals’ history of marriage spells as well as variables that are of particular interest for our analysis: Typical

hours worked per week and time spent on activities related to home production. In particular, the survey asks about time spent on housework (washing, cooking, cleaning) and child care.⁵

Sample For our analysis we use all available waves 1984-2015. We restrict our attention to individuals who have been married at least once, and we exclude same-sex couples. Given pronounced differences between East and West Germany regarding mothers' labor force participation, divorce, and child care provision, we focus in our analysis on women and men from West Germany.⁶ We restrict our attention to individuals who were between 18 years or older when they got married, and who are between 20 and 60 during their marriage and when observed in the data. We consider separations or divorces (whichever occurs first) only if they happen before individuals leave the survey. These sample restrictions leave us with 36,392 observations for 6,522 couples; i.e. on average we observe couples for around 5-6 times. We define a dummy variable "separated" which only takes on value one in the year of separation. Couples who do not separate during their time in the survey are always assigned value 0. All time varying variables are observed one or two years before separation. In particular, we observe variables related to employment, hours worked and income, as well as housework related variables two years before separation while all other variables are observed one year before separation. Note that on average divorces occur 2-3 years after separations.

Descriptive Statistics Table 2.1 provides summary statistics for our sample. On average 1% of couples separate each year, leading to an accumulated 9% of divorces among the couples in our sample. The average marriage lasts for 15 years which is in line with data from the Statistisches Bundesamt showing that between 2000 and 2016, average marriages in Germany lasted between 13-15 years. In 13% of couples one spouse has been married before. Average age at marriage is 26 years for her and 28 years for him. More than 80% of spouses were born in Germany and around 75% live in areas classified as urban. Following Blossfeld and Timm [2003] we define three educational categories (below 11 years, 11-17 years, and more than 17 years) which classifies around 36% and 38% and 54% and 48% of wives and husbands as low and medium educated respectively.

Wives' average hours worked per week are 17 (including commuting time and including 0 hours for those who do not work), and husbands work on average 42 hours. Average monthly gross household income is 4,654€ per month.⁷ On average, women's wages contribute 22% to household income. Regarding time use, women and their spouses spend around 7 and 1-2 hours

⁵We focus on time spent on these activities on "a typical work day" because it is only in some waves that the survey also ask about time spent on these same activities on a Sunday. The survey also asks about time spent on errands (shopping, trips to government agencies) and repairs (on and around the house, car repairs, garden work) which we do not use as we cannot clearly separate these activities from shopping and gardening as leisure activities.

⁶In 1990 (1991 for East Germany), there were 542 and 18 slots for every 1000 children under 3 in East and West Germany respectively (see Statistisches Bundesamt [2015]). Labor force participation rates of East German mothers of small children (0-3 years) have traditionally been very high and continue to be around 15 percentage points higher than rates for West German mothers (Bundesministerium für Familie, Senioren, Frauen und Jugend [2005].)

⁷Using the official DM/Euro exchange rate of 1.95583 we convert pre-2002 wage data into euros and we use data from the Statistische Bundesamt on the German consumer price index to adjust for wage inflation.

per day on housework and child care. However, note in the survey these activities are not necessarily understood as exclusive which implies the sum might appear to be larger than feasible. Given the important change in alimony law in Germany in 2008 we also define two dummy variables for marriage after 2008 and couples being observed after 2008 respectively.

Table 2.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
separate in t	0.01	0.10	0	1
separated	0.09	0.29	0	1
duration marriage	15.91	8.80	2	40
not first marriage one spouse	0.13	0.336	0	1
her age at marriage	25.58	5.626	18	56
his age at marriage	28.03	5.917	18	58
born in Germany, he	0.84	0.369	0	1
born in Germany, she	0.84	0.37	0	1
in urban area ($t - 1$)	0.75	0.431	0	1
low education, she ($t - 1$)	0.36	0.481	0	1
low education, he ($t - 1$)	0.38	0.485	0	1
medium education, she ($t - 1$)	0.54	0.498	0	1
medium education, he ($t - 1$)	0.48	0.5	0	1
nr. children 0-1 ($t - 1$)	0.10	0.305	0	3
nr. children 2-7 ($t - 1$)	0.42	0.697	0	5
nr. children 8-15 ($t - 1$)	0.53	0.805	0	5
her weekly hours $t - 2$	17.50	16.776	0	99
his weekly hours $t - 2$	42.46	12.841	0	99.9
employed, she $t - 2$	0.63	0.484	0	1
employed, he $t - 2$	0.96	0.204	0	1
in education, she $t - 2$	0.03	0.155	0	1
in education, he $t - 2$	0.03	0.162	0	1
household income $t - 2$	4654	3122	0.61	116,252
her share hh income $t - 2$	0.22	0.26	0	1
home owners $t - 1$	0.40	0.49	0	1
her daily housework and child care, $t - 2$	7.23	6.10	0	40
his daily housework and child care, $t - 2$	1.54	2.00	0	30
married after 2008	0.03	0.17	0	1
after 2008	0.37	0.48	0	1

36,948 observations for 6,522 couples

2.1 Market Hours, Home Production, Child Care and Divorce

To explore the relationship between the time women dedicate to market work, home production and the probability of a marriage ending in divorce, we run the following probit regression

$$Pr(sep_t = 1|X) = \Phi(X^T\beta),$$

where $X^T = \begin{bmatrix} Z_{t-1} \\ X_{t-2} \\ D_t \end{bmatrix}$ where Z_{t-1} are individual controls measured one year before and X_{t-2}

are labor market variables, including hours worked, and time use variables measured two years before separation, and D_t are marriage-duration controls. In particular we use a six-degree polynomial for marriage duration. Individual controls are those typically included in regressions of divorce probability such her and his age at marriage, spouses' educational attainment, residence in urban areas, his and her country of birth, the marriage not being the first for one of the

spouses, the presence of children of different ages. We also include a dummy variable for home ownership. To test for the relationship between wives' market hours and divorce probability, in X_{t-2} we include working hours of husband and wife, employment status of each spouse, household income, her share in household income. In our second set of regressions X_{t-2} also includes hours spent on housework and child care by each spouse. Our hypothesis is that market work is costly because time spent on home production and child care has to be reduced, potentially lowering the value of marriage. If this is true, we should observe a positive relationship between women's market hours and divorce and a negative relationship between her time dedicated to home production and child care and divorce. Tables 2.2 displays the results of our first set of regressions.

Regarding our variable of interest, her working hours are related to a higher probability of divorce, while husbands' hours at work have no significant effect and neither does household income nor her share in household income. Other coefficients show the expected sign. Marriages where one of the spouses has been married before are more likely to fail, as are those where she marries at a younger age. The number of children, and if they are of younger age, has a stabilizing effect on marriage.

Table 2.2: Probability of divorce and women's market hours

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
her weekly hours $t - 2$	0.006 (0.001)***	0.007 (0.002)***	0.007 (0.002)***	0.006 (0.002)***	0.006 (0.002)***	0.005 (0.003)**	0.005 (0.003)**
his weekly hours $t - 2$	0.0004 (0.002)	0.001 (0.002)	0.0008 (0.002)	0.001 (0.002)	0.001 (0.002)	0.002 (0.002)	0.002 (0.002)
employed, she $t - 2$		-0.053 (0.071)	-0.071 (0.072)	-0.096 (0.074)	-0.100 (0.074)	-0.110 (0.076)	-0.102 (0.076)
employed, he $t - 2$		-0.026 (0.138)	-0.019 (0.139)	-0.044 (0.14)	-0.044 (0.14)	0.013 (0.163)	0.012 (0.163)
not first marriage one spouse			0.43 (0.056)***	0.396 (0.057)***	0.386 (0.058)***	0.387 (0.058)***	0.384 (0.058)***
her age at marriage			-0.016 (0.005)***	-0.018 (0.005)***	-0.017 (0.005)***	-0.017 (0.005)***	-0.016 (0.005)***
his age at marriage			-0.007 (0.005)	-0.007 (0.004)	-0.007 (0.005)	-0.007 (0.005)	-0.006 (0.005)
nr. children 0-1 ($t - 1$)				-0.345 (0.086)***	-0.342 (0.087)***	-0.342 (0.087)***	-0.340 (0.087)***
nr. children 2-7 ($t - 1$)				-0.084 (0.036)**	-0.082 (0.037)**	-0.081 (0.037)**	-0.071 (0.037)*
nr. children 8-15 ($t - 1$)				-0.059 (0.033)*	-0.057 (0.033)*	-0.057 (0.033)*	-0.054 (0.033)*
household income $t - 2$						-3.03e-06 (9.36e-06)	-3.76e-06 (9.45e-06)
her share hh income $t - 2$						0.118 (0.179)	0.108 (0.179)
home owners $t - 1$						-0.010 (0.043)	-0.005 (0.043)
married after 2008							-0.508 (0.2)**
after 2008							0.003 (0.05)
Obs.	36,948	36,948	36,948	36,948	36,948	36,948	36,948

Source: SOEP: 1984-2015, The dependent variable is "separated in t ". The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All columns include a sixth-degree polynomial for duration of marriage and are estimated by probit regressions. From column 2 onwards we control for husband and wife being in education, from column 3 onwards we also control for residence in urban area and country of birth of each spouse and from column 5 onwards for husbands' and wives' education.

Table 2.3 displays the results for our second set of regressions. Wives' time dedicated to housework and child care has a negative and significant relationship with the probability of divorce. Once we control for household income and her share in household income as well as number of children of different ages the coefficient is robust to the inclusion of additional controls. Spouses' time dedicated to the same activities is only sometimes significantly related with the probability of divorce, and in that case positively.

Table 2.3: Probability of divorce and women's housework and child care hours

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
her housework and child care, $t - 2$	-0.020 (0.004)***	-0.018 (0.005)***	-0.010 (0.005)*	-0.011 (0.005)**	-0.010 (0.005)*	-0.010 (0.005)*	-0.010 (0.005)*
his housework and child care, $t - 2$	0.015 (0.009)	0.011 (0.01)	0.018 (0.01)*	0.018 (0.01)*	0.02 (0.01)*	0.02 (0.01)*	0.022 (0.01)**
household income $t - 2$		-6.13e-06 (7.73e-06)	-4.48e-06 (7.64e-06)	2.78e-06 (7.51e-06)	-2.34e-06 (9.20e-06)	-3.20e-06 (9.41e-06)	-3.92e-06 (9.49e-06)
her share hh income $t - 2$		0.096 (0.09)	0.074 (0.091)	0.087 (0.093)	0.084 (0.181)	0.083 (0.181)	0.073 (0.181)
nr. children 0-1 ($t - 1$)			-0.366 (0.086)***	-0.346 (0.087)***	-0.340 (0.087)***	-0.340 (0.087)***	-0.339 (0.087)***
nr. children 2-7 ($t - 1$)			-0.095 (0.041)**	-0.069 (0.042)*	-0.065 (0.042)	-0.064 (0.042)	-0.055 (0.043)
nr. children 8-15 ($t - 1$)			-0.069 (0.034)**	-0.060 (0.034)*	-0.052 (0.034)	-0.051 (0.035)	-0.050 (0.035)
not first marriage one spouse				0.384 (0.058)***	0.387 (0.058)***	0.386 (0.058)***	0.383 (0.058)***
her age at marriage				-0.018 (0.005)***	-0.017 (0.005)***	-0.017 (0.005)***	-0.016 (0.005)***
his age at marriage				-0.008 (0.004)*	-0.007 (0.005)	-0.007 (0.005)	-0.006 (0.005)
her weekly hours $t - 2$					0.005 (0.003)*	0.005 (0.003)*	0.005 (0.003)*
his weekly hours $t - 2$					0.002 (0.002)	0.002 (0.002)	0.002 (0.002)
employed, she $t - 2$					-0.123 (0.076)	-0.122 (0.076)	-0.113 (0.077)
employed, he $t - 2$					0.029 (0.163)	0.025 (0.163)	0.027 (0.164)
home owners $t - 1$						-0.010 (0.043)	-0.004 (0.043)
married after 2008							-0.520 (0.201)***
after 2008							-0.001 (0.05)
Obs.	36,948	36,948	36,948	36,948	36,948	36,948	36,948

Source: SOEP: 1984-2015, The dependent variable is "separated in t ". The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All columns include a sixth-degree polynomial for duration of marriage and are estimated by probit regressions. From column 4 onwards we control husbands' and wives' education and country of birth of each spouse. From column 6 onwards we also include a control for residing in urban area.

Marginal effects evaluated at means displayed in Table 2.4 indicate that one additional hour per week worked in the market increases the probability of divorce by 1% (relative to a baseline probability of 1%) while one additional hour of housework or child care per day decreases divorce by 2%. Tables A1 and A2 in the Appendix display the same regressions using random effects cloglog regressions that account for differences in couples' frailty. Our results are robust to this alternative estimation method. We find evidence that couples where wives do more housework (washing, cooking and cleaning) and child care are less likely to divorce, while more market hours are related to a higher probability of divorce. The fact that hence working many hours and doing less home production and child care could lead to divorce, might be a factor accounting for why

Table 2.4: Marginal effects evaluated at means

All couples (evaluated at means)	(1)	(2)
Her hours $t - 2$	0.0001 (0.00005)**	0.00009 (0.00005)*
Her housework & child care $t - 2$	-	-0.0002 (0.0001)*

married women only work part time, even though it is costly in terms of future earnings and particularly harmful in case of divorce.

2.2 Limited labor market participation and women’s wages

To highlight the cost of working few hours, we then use a more recent sample of women from the SOEP to analyze the effect of not working or working part-time on women’s wages. We focus on women from West Germany between 20 and 60, and we pool the data from waves 2009-2015. Table A3 in the Appendix displays the descriptive statistics for this sample. We then run a Mincer wage regression on the log of real hourly wages as follow:

$$\log w_{i,t} = \beta_0 + \beta_1 X_{i,t} + \beta_2 J_{i,t} + \beta_3 F_{i,t} + \beta_4 e\tilde{x}p_{i,t} + \beta_5 D_t + \beta_6 D_s + \epsilon_{t,s,i}, \quad (2.1)$$

where $X_{i,t}$ denotes individual controls, D_t and D_s are time and state fixed effects, $J_{i,t}$ are job characteristics, $F_{i,t}$ are family characteristics and $e\tilde{x}p_{i,t}$ are variables related to individuals’ job market experience. As individual controls we include education, a dummy variable if the individual resides in an urban area, nationality and country of birth, marital status, and spouse’s income (set to 0 for those who are not married). We also control for characteristics of the individual’s current job, in particular, years with the current firm and if the current job is a full time job. Family characteristics included in our regression are a dummy for having children, the number of children and a dummy variable for small children between the ages of 0 and 3. Finally our coefficient of interest β_4 refers to individual’s job market experience where we include years not worked, years of full time work experience, years of part time work experience and the last two terms squared. Note that these controls make it impossible for us to control for age of the individual separately. Table 2.5 shows the regression results.

Regarding our variables of interest, we find that each year women spent not working is associated to 0.5% lower hourly wages.⁸ This is considerable given an average gap of more than 7 years for women in our sample. Returns to experience for part time are around one third compared to those for full time work experience. Other coefficients are as expected. Women with university education, those residing in urban areas, those born in Germany and of German nationality have higher hourly wages. Spouse income and having children and in particular young children is also associated with higher hourly wages, most likely due to assortative mating and selection into

⁸Blebo and Wolf [2000] also estimate wage reductions for German women who take years off. The authors find that wage penalties are very dependent on the timing of those breaks.

Table 2.5: Extend of women's labor market participation and wages

	(1)	(2)	(3)	(4)	(5)
university education	0.438 (0.006)***	0.391 (0.006)***	0.382 (0.006)***	0.376 (0.006)***	0.381 (0.006)***
in urban area	0.124 (0.008)***	0.107 (0.006)***	0.116 (0.007)***	0.115 (0.007)***	0.11 (0.007)***
born in Germany	0.144 (0.009)***	0.113 (0.008)***	0.112 (0.008)***	0.104 (0.008)***	0.096 (0.008)***
nationality other than German	-0.143 (0.012)***	-0.102 (0.011)***	-0.104 (0.01)***	-0.100 (0.01)***	-0.086 (0.01)***
married		0.055 (0.007)***	0.028 (0.007)***	0.04 (0.007)***	0.006 (0.007)
log(income spouse)		0.008 (0.0008)***	0.006 (0.0008)***	0.006 (0.0008)***	0.006 (0.0008)***
firm tenure		0.019 (0.0003)***	0.02 (0.0003)***	0.019 (0.0003)***	0.016 (0.0004)***
fulltime		0.224 (0.006)***	0.252 (0.006)***	0.241 (0.006)***	0.222 (0.007)***
number of children under 16			0.051 (0.003)***	0.054 (0.003)***	0.058 (0.003)***
children: 0-3			0.069 (0.01)***	0.051 (0.01)***	0.084 (0.01)***
years not working				-0.006 (0.0005)***	-0.005 (0.0005)***
full time experience (years)					0.027 (0.0009)***
parttime experience (years)					0.012 (0.001)***
years full time squared					-0.007 (0.00003)***
years part time squared					-0.003 (0.00004)***
Obs.	32065	32065	32065	32065	32065
R^2	0.171	0.301	0.318	0.321	0.346
F statistic	265.215	986.766	481.664	472.212	470.883

Source: SOEP: 2009-2015, The dependent variable is log hourly wages. The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All columns are estimated by OLS regressions and include as additional controls year and federal state fixed effects.

employment respectively. As expected, full time jobs pay higher hourly wages, and wages also increase with years worked within one firm.

Given strong interdependencies of decisions regarding female labor force participation, market hours, home production, child care and divorce, our empirical analysis faces problems of endogeneity issues. Although we observe individuals two years before separation and thus four of five years before divorce, we cannot rule out that other unobservables determine decisions on hours worked, home production, child care and divorce. Nevertheless, from the observed relationships between market hours, time dedicated to home production and child care and divorce and the negative wage effects for working less than full time a set of interesting questions arise: Why in the face of non-trivial divorce risks do married women continue to work so little? How do decisions on market hours and divorce change as better substitutes for home production (e.g. high quality child care or quality meals on demand, flexible cleaning services, etc.) become more affordable? What role do tax treatments of couples play for married women's decisions to work fewer hours? How important are alimony payments? In order to answer these and other questions and to disentangle women's decisions on market hours, home production, child care and divorce, we build a model economy.

3 Model

Our model economy is populated by men and women who live for 20 periods, 8 periods as children, and 12 as adults. As children individuals make no decisions. Each period is equivalent to 3 years. At the beginning of adulthood women and men live in couples, and they have one child. Hence, there are only 2-adult and 1-child households. Households receive utility from consumption of a market good, their child's "quality" and a home produced good. Home production is time consuming and costly. A substitute for the home good can be purchased in the market at cost p_n . Similarly, producing children's "quality" is time consuming and costly and as a substitute child care can be purchased in the market at cost $p_{m,a}$, depending on the child's age a . However, different from the price of home produced goods, child care may be subsidized by the government. Adult men spend a fixed fraction of their time at work, and the rest is spent in home production and child care. Women on the other hand have to decide how to split their time between work, child care, home production, and leisure every period. Women's wage rate will depend on their initial human capital (education level) and their labor market experience.

Marriage Market At the beginning of adulthood all men and women are matched in couples according to the distribution $\Pi(x, z)$. At the end of every period each couple receives a match quality shock - γ - from the distribution $\Gamma(\gamma'|\gamma)$. Upon observing this shock, individuals decide whether to remain married or whether to divorce. Divorce is unilateral, and hence both husband and wife must want to remain married for there not to be divorce. If couples divorce, they enter the next period as divorcées, and they can re-marry. With some probability - π_r - individuals are then matched with another individual and re-marry, else they will remain divorced until the next period.

Utility Individuals receive utility from consumption of a market good, c , from the "quality" of their child H_c , from consuming a home produced good H_h , from leisure t_l , and from the quality of their match (γ).

$$U(c, H_c, H_h, t_l, \gamma) = \log(c) + \frac{1}{1-\sigma} H_c^{1-\sigma} + \frac{1}{1-\sigma} H_h^{1-\sigma} + \frac{1}{1-\sigma} t_l^{1-\sigma} + \gamma. \quad (3.1)$$

Children's quality Children's quality depends on the mothers' child care time (t_c) and market purchased child care m . The weight of mother's time changes with the child's age, d_a .

$$H_c = (d_a m^\rho + (1 - d_a) t_c^\rho)^{1/\rho}. \quad (3.2)$$

We assume that purchased child care time has to equal mothers' time at work $t_c = t_w$.

Home produced goods Housework production depends on the wife's time and a market purchased input, n

$$H_h = (bn^\eta + (1 - b)t_h^\eta)^{1/\eta}. \quad (3.3)$$

Household thus decide how many housework services n to buy.

Labor market participation decision Each couple has to decide how much the woman works in the market. She can work full-time (l^f), part-time (l^p) or not work at all (l^n). The rest of her disposable time is spent on child care time and housework and leisure. In particular, women who work full time, part time or not at all and choose time spent on child care, depending on their child's age.

Wage dynamics Hourly wage rates grow according to the following process

$$w_t = (1 + g(l_{t-1}))w_{t-1}, \quad (3.4)$$

where g - the growth rate - is a function of past labor market participation,

$$g(l_{t-1}) = [g^f g^p g^n]. \quad (3.5)$$

Men are assumed to work full-time, thus their wages grow at rate g_m^f .

4 Value Functions

4.1 Marriage

The value of marriage at child's age a for a couple is the weighted sum of individuals' expected values of marriage.

$$\max_{l_a} (\mu V_{m,a}^w(x, z, \gamma) + (1 - \mu) V_{m,a}^h(x, z, \gamma))$$

s.t.

$$c = \Phi(2, 1)(T(zl^f + xl_a) - (1 - \omega)p_{m,a}m_a - p_n n),$$

$$H_c = (d_a m^\rho + (1 - d_a)t_c^\rho)^{1/\rho}$$

$$H_h = (bn^\eta + (1 - b)t_h^\eta)^{1/\eta}$$

$$m_a = l_a,$$

$$n < 1$$

$$1 = t_{h,a} + t_{c,a} + t_{l,a} + l_a,$$

where $\Phi(2, 1) = \frac{1}{(2+1\epsilon_1)\epsilon_2}$ and $T = \theta_0(zl^f + xl_a)^{1-\theta_1}$. The couple enjoys economies of scale in consumption - $\Phi(2, 1)$ -, they have to pay taxes according to the tax schedule T and their child care costs are subsidized at rate ω .

The individual value of marriage for a woman with a child of age a is

$$V_{m,a}^w(x, z, \gamma) = \log(c) + \frac{1}{1-\sigma} H_c^{1-\sigma} + \frac{1}{1-\sigma} H_h^{1-\sigma} + \frac{1}{1-\sigma} t_l^{1-\sigma} + \gamma + \beta EV_{m,a+1}^w(x, z, l_a, \gamma)$$

and her expected continuation value is

$$EV_{m,a+1}^w(x, z, l_a) = E_\gamma(V_{m,a+1}^w(x, z, l_a)IJ + EV_{s,a+1}^w(x, l_a)(1 - IJ)),$$

where I and J are indicator functions equal to 1 if the value of marriage is larger than the value of divorce for the woman and the man respectively. The first term corresponds to the expected value of marriage in the following period, while $V_{s,a+1}^w(\cdot)$ is the value of divorce in the following period.

4.2 Divorced women

Divorced women receive utility from consumption of the market good and the home produced good, similar to couples. In addition they also incur a disutility from working (I_w) that depends on their child's age, $\delta_{l,a}$. This parameter may be interpreted as a minimum level of home production and child care that cannot be bought in the market, or as maternal leaves or the cost of joining the labor force after a break.

$$V_{s,a}^w(x, l_a) = \max_{l_a, n} (U(c, H_s, H_l, t_l) - \delta_{l,a} I_w + \beta V_{s,a+1}^w(x, l_a))$$

s.t.

$$\begin{aligned} c &= \Phi(1, 1)((1 - \tau)(xl_a) - (1 - \omega)p_{m,a}m_a - T + s_a) \\ m_a &= l_a, \\ 1 &= t_{h,a} + t_{c,a} + t_{l,a} + l_a \\ H_c &= (d_a m^\rho + (1 - d_a)t_c^\rho)^{1/\rho} \\ H_h &= (bn^\eta + (1 - b)t_h^\eta)^{1/\eta} \\ n &< 1 \end{aligned}$$

where $\Phi(1, 1) = \frac{1}{(1+1\epsilon_1)e^2}$ and $T = \theta_0(xl_a)^{1-\theta_1}$.

Divorced women with children will receive child alimony from their ex-husbands dependent in the child's age equal to s_a . Divorced individuals remarry with probability π_r . Thus,

$$EV_{s,a+1}^w(x, l_a) = (1 - \pi_r)V_{s,a+1}^w(x, l_a) + \pi_r V_{m,a+1}^w(x, z, l_a, \gamma).$$

The divorced man's value function is very similar to that of the woman's, except that he pays alimony instead of receiving it and does not incur a disutility from working.

Children leave the household after 8 periods. At the end of period 8, married couples receive their last match quality shock which determines whether they will remain married or divorced for the rest of their lives. Hence, given that there are no shocks afterwards, decisions regarding the woman's labor force participation will remain the same until retirement when individuals receive a pension income dependent on their employment history- $R(l(a - 1))$.

5 Calibration

In order to quantitatively assess how married women's market hours over the life cycle react to changes to different forces when divorce is endogenous we calibrate our model. A model period corresponds to three years, and hence the discount factor β is set to 0.88 to match a yearly

interest rate of 4%. Policy parameters are taken directly from German data. Unless otherwise stated, the statistics used for calibration come from a 2005-20015 sample of West German mothers age 20 to 65 without children or with a youngest child below the age of 32. In particular, we consider weighted statistics and we group mothers by the age of their children, a . We define three periods. During periods 1 and 2 when children are 0-3 and 4-7 mothers are defined as young, during periods 3 and 4 when children are 8-15 and 16-19 mothers are middle aged and finally when children are older in periods 5 and 6 mothers are defined as old. We first describe in detail how we construct our matching matrix that assigns spouses to women, and how both are assigned wages. Finally, we discuss how we calibrate the parameters of the model, and how we set policy parameters to represent German family policies.

We define women of type i and spouses of type j according to their education or schooling levels s such that $i, j \in s$. Following the International Standard Classification of Education (ISCED 1997) the SOEP defines the following ISCED levels: (1) primary schooling, (2) lower secondary, (3) upper secondary or vocational, (4) upper secondary and vocational, (5) higher vocational, and (6) university. To pair up women and men we use a matching matrix obtained from our sample $\Phi(s, s)$, with $\Phi(i, j)$ being a particular element of this matrix, and where $i \in s$ and $j \in s$ denote women's and men's education levels respectively - see Table A4 of the Appendix. Following Guner et al [2012], we use men's average hourly wages by education from our sample to assign wage rates to spouses. Women's wages are then set to be 22% lower than men's wages according to the gender wage gap in Germany for 2015 - Eurostat [2015].⁹

The amount of time a woman spends working in the market, at home, caring for her children and on leisure depends on her choice of market hours. Table 5.1 displays the share in time allocation of women according to their labor force participation status. We calculate these shares using SOEP data. The growth rates of women's wages according to experience come from the estimates of the Mincer wage regression in the empirical section (see Section 2.2). We set the wage growth rate of working full time to be equal to the estimated coefficient of years working full time $-g^f = 0.03$. We do the same for returns to part time experience: $g^p = 0.01$ -, and we estimate that no participation in the labor market leads to a depreciation of wages, so that $g^n = -0.005$. The parameters ϵ_1 and ϵ_2 correspond to economies of scale in consumption, and ϵ_1 takes on value 0.4 and ϵ_2 takes on value 0.5. These numbers are within the range of values provided by Cutler and Katz [1992]. The price of child care for 0-3 and 4-7 year old children is taken from the literature. Wrohlich [2006] reports an expected monthly cost of full-time day care of €664 per month for children below the age of 3 and €354 per month for older children. This implies that the price for each unit of time in child care for a 0-3 year old child is equal to 1.9, and for children above 3 it is equal to 1.1. For the parameters of the home production function, we take from Ragan [2013] the value for the parameter determining the elasticity of substitution between time and market purchased inputs in child care and housework, so that ρ and η equal 0.85 and 0.6 respectively. We assume public pensions to be proportional to average labor income and set the replacement rate equal to 0.7 - see Bürsch-Supan and Wilke [2003].

Regarding calibrated parameters, the weight of purchased time in the home production function b is set to match the share of mothers age 25-34 who work full time. While the weight

⁹See Table A5 in the Appendix for average hourly wages by education for men in the data.

Table 5.1: Time allocation

	Full time	Part time	No work
Work, l	52	35	0
Child care, t_s	28	40	60
Housework, t_f	10	15	20

of mothers' time in child care is set to 0.59 to match the share of mothers of age 35-44 who work full time. The disutility of work of divorced women depends on the extent of their labor force participation, and these parameters are chosen such as to match the share of divorced women working full and part time respectively. The following three parameters play a key role in matching marriage statistics in our model. Match quality is distributed according to the uniform distribution $\Gamma(\gamma)$ where the upper limit is $\gamma_h = 5$ and the lower limit is $\gamma_l = -1.35$, and the probability of receiving the same match quality the following period, $p(\gamma_c)$ is equal to 0.8. Receiving a low match quality is decisive for matching the percentage of individuals who divorce. The share of divorced individuals during the three first periods of life is affected by the lower limit of match quality shocks. At the same time, we want this share to be larger during individuals' middle age - 35-44. The upper limit of the match quality affects this share. The persistence of the match quality shock is set to match the average duration of marriage in 2000. We obtain this number from Engstler and Menning [2004] who report that 35 percent of all marriages are expected to end in divorce during the first 25 years. We also assume that there is no remarriage so that π_r equals zero. We set the price of child care when children are 8 years and older to 0.72 in order to match labor force participation rates of mothers of these children. The price of housework is set to 6.8 to match the fraction of full time working mothers who hire cleaning help.

Finally, the model's policy parameters are parameters for the tax function, child care subsidies - ω and child alimony - s_a . We follow Holter, Krueger, Stepanchuk [2015] and set τ_0 and τ_1 to 0.95 and 0.23. In Germany, public child care slots are highly subsidized - OECD [2008]. However, availability of these slots for small children (0-3) is very restricted, especially in West Germany. The large majority of mothers thus does not have access to highly subsidized child care for their small children. Hence, effective child care costs are high. We set child care subsidies, ω equal to zero in our benchmark economy, and we use this parameter as a policy instrument to lower average child care costs in one of our counterfactual experiments. A subsidy that leads to a reduction in effective child care costs can then also be interpreted as an increase in the provision of public child care slots. We use the 2017 Düsseldorf Tables to assign the value of the child alimony in case of divorce. We assume that the child remains with the mother after divorce such that she is the recipient of any alimony. The Düsseldorf Tables report for Germany the minimum alimony awarded after a divorce according to children's ages and fathers' income. For now, we assume that all divorced fathers pay the same amount of alimony - 396€(which according to the Düsseldorf Tables is paid to children in the 0-3 age group by fathers whose income is below €1500). In our model this number is equivalent to 26% of income of fathers in the lowest income bracket. We hence set $s_a = 3.20$ for the first 8 periods when children are in the divorced mother's household. All parameters are displayed in Table 5.2.

Table 5.2: Parameters

Parameter	Explanation	Value	Source
<i>Parameters set a priori</i>			
β	discount factor	0.88	-
p_1	cost of child care, period 1	1.9	Bick(2016), Wrohlich(2006)
p_2	cost of child care, period 2	1.1	
ρ	elast. substit., time & market inputs	0.85	Ragan(2013)
η	elast. substit., time & market inputs	0.6	Ragan(2013)
ϵ_1	economies of scale	0.4	Cutler and Katz(1992)
ϵ_2	economies of scale	0.5	
R	replacement rate	0.7	Buersch-Supan and Wilke(2003)
<i>Calibrated Parameters</i>			
d_a	weight of time purchased in child care production	0.41	
b	weight of time purchased in housework production	0.11	
σ	utility weight home production and leisure	0.47	
p_{middle}	cost of child care, period middle	0.72	
p_n	price of housework	6.8	
γ_h	highest value of match quality	5	
γ_l	lowest value of match quality	-1.35	
γ_c	persistence in match quality	0.8	
$\delta_{s,p}$	disutility part time work, divorced	0.46	
$\delta_{s,f}$	disutility full time work, divorced	0.55	
<i>Policy Parameters</i>			
θ_0	tax function	0.95	Holter, Krueger, Stepanchuk (2015)
θ_1	tax function	0.23	Holter, Krueger, Stepanchuk (2015)
ω	child care subsidy	0	
s	child alimony	3.20	Düsseldorf Tables

6 Results - Benchmark Economy

Table 6.1 presents targeted moments from our benchmark model together with the corresponding data moments. Our model matches the data on married mothers' labor force participation and divorce statistics fairly well. As children are older mothers' labor force participation as full and part time employees increases and divorce becomes more likely. Full time employment is much more likely among divorced women compared to married women. However, our model period corresponds to 3 years and given that we have used aggregated moments of 10 years to calibrate the model, we have more un-targeted moments to assess the validity of the model. The following figures show married mothers' labor force participation over the life cycle differentiating by full and part time participation. Figure 2 shows the percentage of married mothers working over the life cycle. The model over-estimates the participation rate of mothers especially when their children are young, but it can reproduce the life cycle properties of the data.

Figure 3 shows the percentage of mothers working full time and part time out of all mothers, respectively. The model cannot replicate the increase in mothers working full time over the life cycle. The increase in labor force participation in the model comes from increasing part time

Table 6.1: Data and model moments: targeted

	Benchmark	Data
% working full time, period young	0.125	0.103
% working part time, period young	0.363	0.349
% working full time, period middle	0.152	0.141
% working part time, period middle	0.490	0.579
% working full time, period old	0.144	0.222
% working part time, period old	0.530	0.510
% divorces, period 2	0.126	0.120
% divorces, period 4	0.188	0.189
% divorces, period 6	0.256	0.233
% divorced working full time, average	0.478	0.44
% divorced working part time, average	0.307	0.33
% married hiring cleaning services, full time	0.273	0.22

participation, which is overestimated. However, it does a good job in matching the pattern of part time participation over the life cycle.

6.1 Divorce probabilities and women's employment decisions

We can use our model to quantitatively assess how married mothers' market hours over the life cycle react to changes to different forces when divorce is endogenous. In the first place we would like to know how changes in divorce probabilities affect women's employment decisions. In the model there are two competing forces. As divorce probabilities increase women would like to work more to be better prepared for the event of a divorce. On the other hand, they would like to increase the value of marriage which might imply dedicating less time to market work and more time to housework and child care. In order to disentangle these effects we run three different economies. In the first economy we eliminate the costs of not working or only working part time on women's human capital accumulation. As a result women with very young children work less and those who work only do so part time. Home production and the quality of children are more important than the additional income full time employment provides. When children are older, more women participate but still part time employment prevails. Divorce increases slightly as divorcees can increase their participation at full human capital capacity. In the second economy we lower the persistence in match quality which can be interpreted as an increase in divorce risk. As a result full time participation decreases slightly and mothers dedicate more time to housework and child care to increase the value of marriage. Effectively as a result, divorces

Figure 2: % of married mothers who work over the life cycle

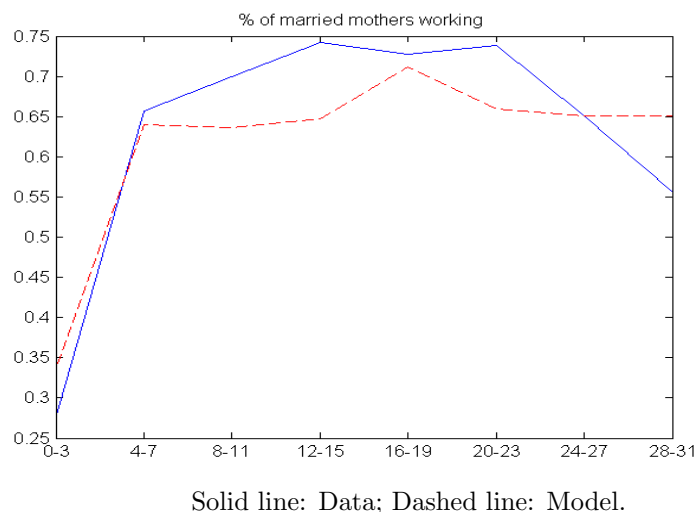
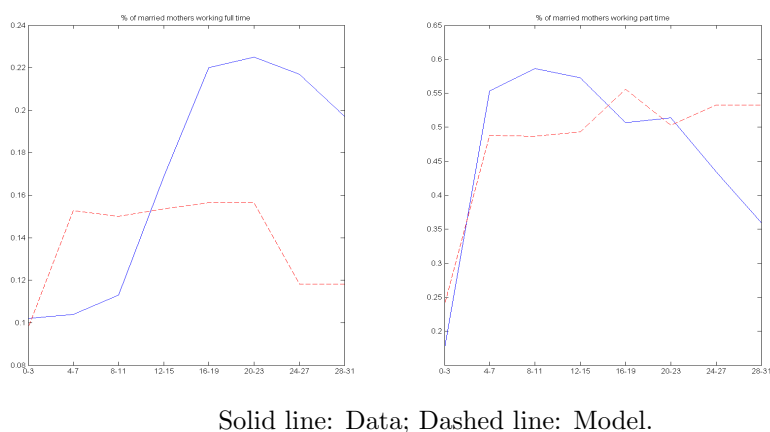


Figure 3: % of married mothers who work over the life cycle, full and part time



decrease. In the last economy we combine both changes and observe the change in labor force participation as in the first economy combined with lower divorce rates from the second economy.

7 Counterfactual Experiments

We propose two counterfactual experiments to evaluate the effects of different policies on women's labor force participation and divorce.

First, we analyze the effects of ruling out part time work on women's labor force participation and on divorce. We argue that part time work decreases the probability of divorce, allowing women to work while spending time on home production. Table 7.1 reports the model's moments when part time is ruled out as well as the moments from our benchmark calibration. We observe

Table 6.2: Changing divorce probabilities and women's employment decisions

	(1) Benchmark	(2) No wage penalty	(3) Less persistence in γ	Both (2)+(3)
% working full time, period young	0.125	0.000	0.122	0.000
% working part time, period young	0.363	0.392	0.364	0.393
% working full time, period middle	0.152	0.000	0.144	0.000
% working part time, period middle	0.490	0.721	0.497	0.715
% working full time, period old	0.144	0.036	0.139	0.035
% working part time, period old	0.530	0.891	0.530	0.894
% divorces, period 2	0.126	0.126	0.084	0.084
% divorces, period 4	0.188	0.199	0.136	0.145
% divorces, period 6	0.256	0.258	0.241	0.244

that more mothers work full time when there is no option of part time. Ruling out the option of working part time also has an effect on divorces. Especially the share of divorced mothers in the age group [31-34] increases by 2.1 percentage points. Thus divorce increases when there is no possibility of working part time. This could be due to women working full time instead of part time which leads to less home production and hence to a lower value of marriage, increasing the risk of divorce.

Table 7.1: Experiment: No part time work and benchmark moment

	Benchmark	No part time option
% working full time, period young	0.125	0.489
% not working, period young	0.512	0.512
% working full time, period middle	0.152	0.662
% not working, period middle	0.358	0.338
% working full time, period old	0.144	0.669
% not working, period old	0.326	0.331
% divorces, period 2	0.126	0.156
% divorces, period 4	0.188	0.209
% divorces, period 6	0.256	0.268

In the second experiment, we propose a subsidy to child care costs for all periods. The subsidy - ω - is such that child care costs in the first period - when children are 0 to 3 years old - are equal to child care costs for older children ($\omega p_1 = p_2$). This implies a subsidy rate equal to 0.53. Table 7.2 reports the model's moments from this experiment next to those from our benchmark economy. The effect of the child care subsidy is most evident in the labor force participation of younger mothers - (25-35] who were facing higher costs previously. The increase in younger

Table 7.2: Experiment: subsidized child care - $\omega = 0.53$ - and benchmark moments

	Benchmark - $\omega = 0$	Subsidized child care - $\omega = 0.53$
% working full time, period young	0.125	0.312
% working part time, period young	0.363	0.584
% working full time, period middle	0.152	0.301
% working part time, period middle	0.490	0.610
% working full time, period old	0.144	0.208
% working part time, period old	0.530	0.660
% divorces, period 2	0.126	0.132
% divorces, period 4	0.188	0.190
% divorces, period 6	0.256	0.258

mothers working full time is notable, from 12.5% in the benchmark economy to 31.2%. However, overall participation rates of young mothers increase even more by almost 22 percentage points. However, most of this increase is driven by higher part time participation, allowing mothers to work in the market engage in home production and spent time on child care. However, divorces increase slightly among women of all ages.

8 Conclusion

We find empirical evidence for a positive relationship between wives spending more hours on market work (and less hours on home production and child care) and divorce for West German married couples. This suggests that even though working part time implies a cost in terms of lower future wages, affecting in particular divorced women, married women could be optimally choosing to work only part time work to reduce the risk of divorce.

We build a dynamic life cycle model of women's labor force participation, home production, child care, and divorce decisions, that allows us to study this mechanism in detail. We use our model to run two policy experiments. Ruling out the option to work part time we find that more women choose to work full time dedicating less time to home production and child care. As the value of marriage thus decreases, the percentage of divorces increases. We also consider an experiment with high child care subsidies. As child care becomes cheaper we observe that overall more women work but most of them do so only part time. In this case we observe slightly more divorces.

Our findings highlight the importance of considering divorces when analyzing the effect of

different labor market policies on women's labor supply because divorce is closely inter-related with women's labor market decisions.

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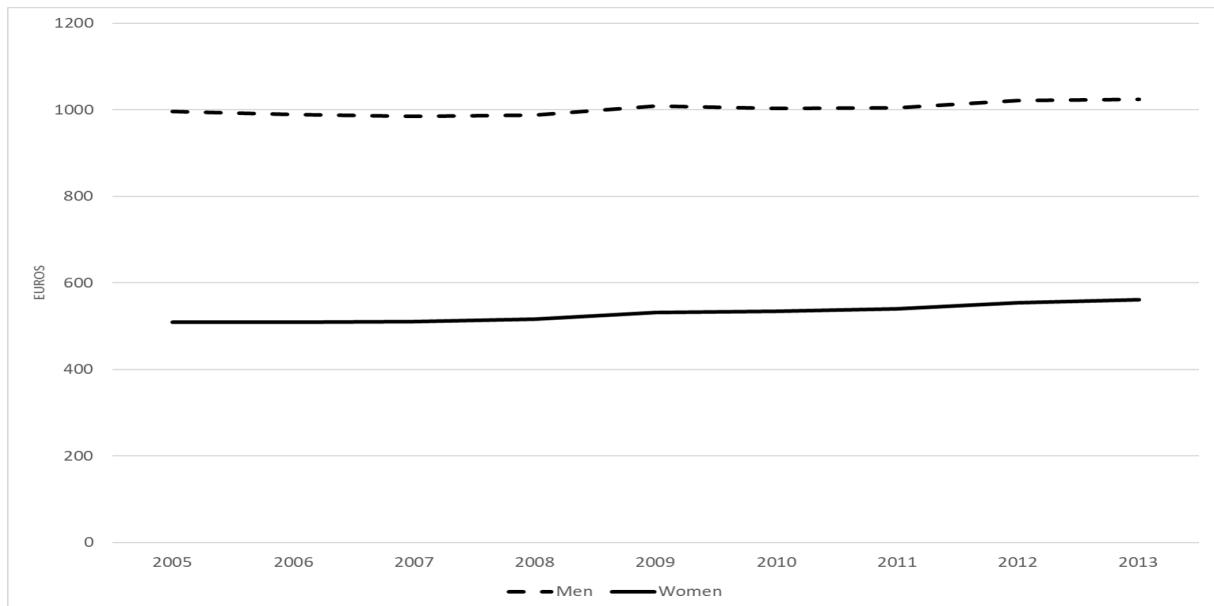
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Figure A-1: Average old age pensions for men and women, Germany



Data: Statistisches Bundesamt (monthly averages correspond July 1st of each year)

Table A1: Probability of divorce and women's market hours - with difference un couples' frailty

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
her weekly hours $t - 2$	0.014 (0.003)***	0.017 (0.005)***	0.018 (0.005)***	0.015 (0.005)***	0.015 (0.005)***	0.013 (0.006)**	0.013 (0.006)**
his weekly hours $t - 2$	0.0007 (0.004)	0.002 (0.006)	0.001 (0.006)	0.002 (0.006)	0.002 (0.006)	0.004 (0.006)	0.004 (0.006)
employed, she $t - 2$		-0.145 (0.189)	-0.203 (0.19)	-0.268 (0.195)	-0.276 (0.196)	-0.305 (0.201)	-0.290 (0.202)
employed, he $t - 2$		-0.073 (0.36)	-0.017 (0.361)	-0.083 (0.361)	-0.087 (0.362)	0.073 (0.418)	0.067 (0.419)
not first marriage one spouse			1.087 (0.14)***	1.005 (0.142)***	0.981 (0.145)***	0.982 (0.145)***	0.97 (0.145)***
her age at marriage			-0.039 (0.012)***	-0.043 (0.012)***	-0.041 (0.012)***	-0.041 (0.012)***	-0.040 (0.012)***
his age at marriage			-0.017 (0.012)	-0.019 (0.011)*	-0.017 (0.011)	-0.017 (0.011)	-0.014 (0.012)
nr. children 0-1 ($t - 1$)				-0.946 (0.241)***	-0.940 (0.242)***	-0.938 (0.242)***	-0.933 (0.242)***
nr. children 2-7 ($t - 1$)				-0.225 (0.095)**	-0.223 (0.096)**	-0.220 (0.096)**	-0.197 (0.097)**
nr. children 8-15 ($t - 1$)				-0.158 (0.088)*	-0.156 (0.088)*	-0.154 (0.088)*	-0.148 (0.089)*
household income $t - 2$						-8.70e-06 (0.00002)	-1.00e-05 (0.00002)
her share hh income $t - 2$						0.326 (0.458)	0.298 (0.457)
home owners ($t - 1$)						-0.007 (0.112)	0.007 (0.112)
married after 2008							-1.407 (0.597)**
after 2008							0.018 (0.133)
Obs.	37,553	37,553	37,553	37,553	37,553	37,553	37,553
e(N-g)	6,566	6,566	6,566	6,566	6,566	6,566	6,566
e(g-min)	1	1	1	1	1	1	1
e(g-max)	29	29	29	29	29	29	29
e(g-avg)	5.719	5.719	5.719	5.719	5.719	5.719	5.719

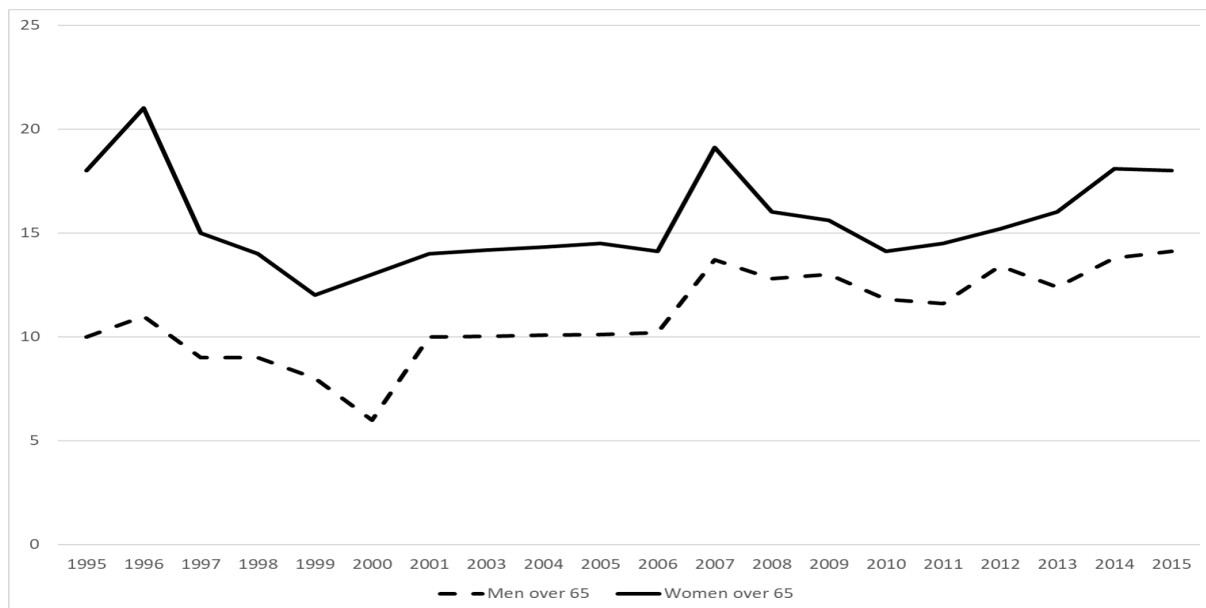
Source: SOEP: 1984-2015, The dependent variable is "separated in t ". The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All columns include a sixth-degree polynomial of for duration of marriage and are estimated by random-effects cloglog model regressions. From column 2 onwards we control for husband and wife being in education, from column 3 onwards we also control for residence in urban area and country of birth of each spouse and from column 5 onwards for husbands' and wives' education..

Table A2: Probability of divorce and women's housework and child care hours - with difference un couples' frailty

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
her daily housework and child care, $t - 2$	-0.055 (0.011)***	-0.050 (0.012)***	-0.027 (0.014)*	-0.029 (0.014)**	-0.026 (0.014)*	-0.026 (0.014)*	-0.026 (0.014)*
his daily housework and child care, $t - 2$	0.04 (0.024)*	0.029 (0.026)	0.049 (0.025)*	0.046 (0.025)*	0.05 (0.025)**	0.05 (0.025)**	0.054 (0.025)**
household income $t - 2$		-0.00002 (0.00002)	-1.00e-05 (0.00002)	6.44e-06 (0.00002)	-7.04e-06 (0.00002)	-9.38e-06 (0.00002)	-1.00e-05 (0.00003)
her share hh income $t - 2$		0.229 (0.238)	0.174 (0.237)	0.194 (0.242)	0.205 (0.465)	0.204 (0.465)	0.182 (0.464)
nr. children 0-1 ($t - 1$)			-0.987 (0.24)***	-0.943 (0.242)***	-0.955 (0.242)***	-0.953 (0.242)***	-0.949 (0.242)***
nr. children 2-7 ($t - 1$)			-0.256 (0.111)**	-0.198 (0.111)*	-0.193 (0.111)*	-0.190 (0.111)*	-0.171 (0.112)
nr. children 8-15 ($t - 1$)			-0.196 (0.093)**	-0.173 (0.092)*	-0.151 (0.092)	-0.149 (0.092)	-0.146 (0.093)
not first marriage one spouse				0.977 (0.145)***	0.985 (0.145)***	0.983 (0.145)***	0.971 (0.145)***
her age at marriage				-0.044 (0.012)***	-0.044 (0.012)***	-0.045 (0.012)***	-0.043 (0.012)***
his age at marriage				-0.021 (0.011)*	-0.020 (0.011)*	-0.020 (0.011)*	-0.017 (0.012)
her weekly hours $t - 2$					0.011 (0.007)*	0.011 (0.007)*	0.011 (0.007)*
his weekly hours $t - 2$					0.005 (0.006)	0.005 (0.006)	0.005 (0.006)
employed, she $t - 2$					-0.334 (0.202)*	-0.330 (0.202)	-0.313 (0.204)
employed, he $t - 2$					0.091 (0.418)	0.078 (0.419)	0.091 (0.422)
home owners ($t - 1$)						-0.024 (0.112)	-0.009 (0.112)
married after 2008							-1.422 (0.597)**
after 008							0.007 (0.133)
Obs.	36,951	36,951	36,951	36,951	36,951	36,951	36,951
e(N-g)	6,541	6,541	6,541	6,541	6,541	6,541	6,541
e(g-min)	1	1	1	1	1	1	1
e(g-max)	28	28	28	28	28	28	28
e(g-avg)	5.649	5.649	5.649	5.649	5.649	5.649	5.649

Source: SOEP: 1984-2015, The dependent variable is "separated in t ". The coefficients are marked with * if the level of significance is between 5% and 10%, ** if the level of significance is between 1% and 5% and *** if the level of significance is less than 1%. All columns include a sixth-degree polynomial of for duration of marriage and are estimated by random-effects cloglog model regressions. From column 4 onwards we control husbands' and wives' education and country of birth of each spouse. From column 6 onwards we also include a control for residing in urban area.

Figure A-2: At risk-of-poverty-rates for men and women over 65, Germany



Data: Statistisches Bundesamt

Table A3: Summary statistics for wage regression

Variable	Mean	Std. Dev.	N
logh_wage	2.528	0.574	32065
university education	0.301	0.459	32065
in urban area	0.734	0.442	32065
born in Germany	0.810	0.392	32065
married	0.59	0.492	32065
log(income spouse)	4.133	4.053	32065
firm tenure	9.183	9.113	32065
nationality other than German	0.104	0.305	32065
fulltime	0.392	0.488	32065
number of children under 16	0.776	0.999	32065
children: 0-3	0.087	0.282	32065
years not working	7.33	5.758	32065
full time experience (years)	9.753	8.925	32065
parttime experience (years)	6.464	6.886	32065

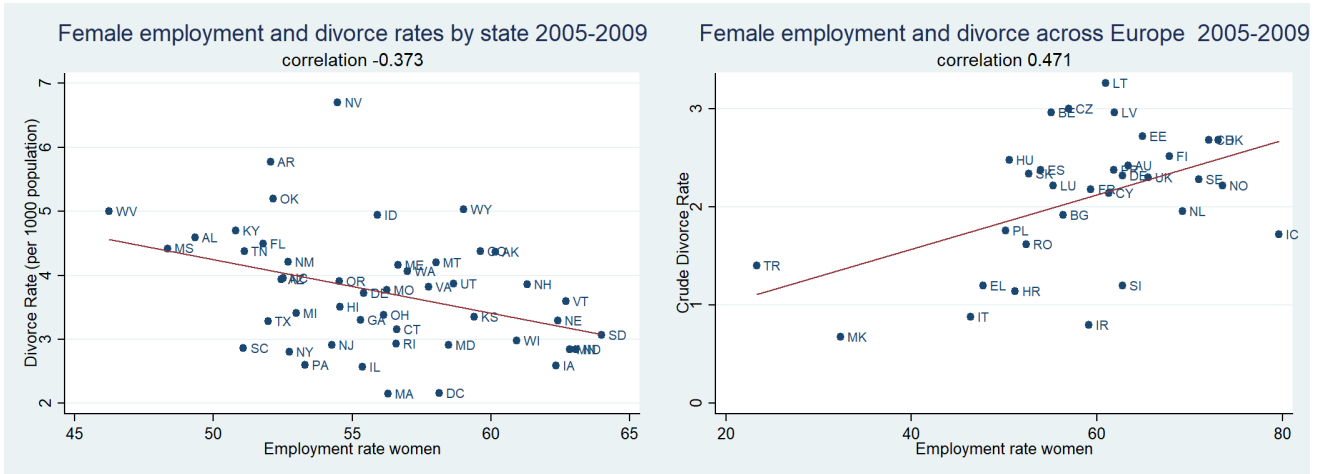
Table A4: Matching matrix

ISCED level	Spouses						Σ	
	1	2	3	4	5	6		
1	24.9	23.2	41.1	7.0	0.3	3.4	100	
W	2	5.5	22.5	54.5	2.2	6.4	8.8	100
o	3	1.2	6.0	60.5	5.4	12.8	14.2	100
m	4	2.4	4.5	38.9	15.0	8.5	30.8	100
e	5	0.3	3.6	36.7	5.7	26.2	27.5	100
n	6	0.5	2.5	21.2	6.3	7.2	62.3	100

Pooled data from SOEP unbalanced panel 2005-2015 for West German

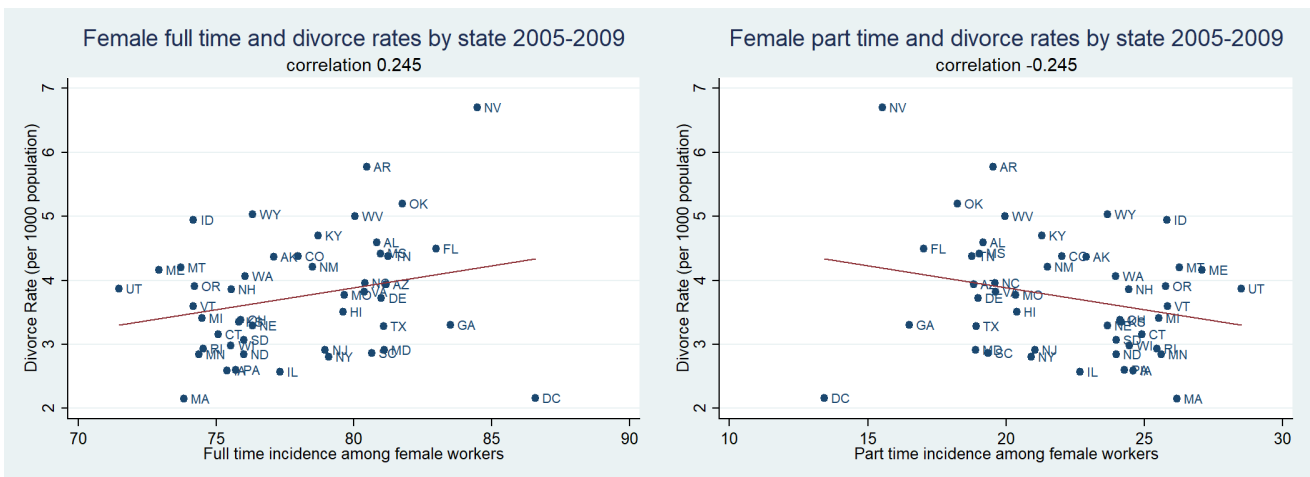
married women age 20-65 without or with youngest child < 32 N = 37444

Figure A-3: Divorce rates and female employment in US and Europe



Divorces: US National Center for Health Statistics-National Vital Statistics Report; population numbers and female employment are from the OECD; Eurostat for Europe

Figure A-4: Divorce rates and female full-and part time employment in US



Divorces: US National Center for Health Statistics-National Vital Statistics Report; population numbers and female full-time employment are from the OECD.

Table A5: Average hourly wages (in 2010 €) by education level for husbands

ISCED level	
1	13.52
2	15.18
3	17.82
4	19.11
5	20.35
6	30.45

Data: Pooled data from SOEP unbalanced panel 2005-2015;
for West German married women age 20-65
without or with youngest child < 32.