The Impact of Post-Marital Maintenance on Dynamic Choices and Welfare of Couples

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Abstract

In many countries divorce law mandates post-marital maintenance payments (child support and alimony) to insure the lower earner in married couples against financial losses upon divorce. This paper studies how maintenance payments affect couples' intertemporal decisions and welfare. I develop a dynamic model of family labor supply, housework, savings and divorce and estimate it using Danish register data. The model captures the policy trade off between providing insurance to the lower earner, enabling couples to specialize efficiently, on the one hand, and maintaining labor supply incentives for divorcees, on the other. I use the estimated model to analyze counterfactual policy scenarios in which child support and alimony payments are changed. The welfare maximizing maintenance policy is to increase (triple) child support payments and reduce alimony (by 12.5%) relative to the Danish status quo. Switching to the welfare maximizing policy makes men worse off, but comparisons to a hypothetical first best scenario reveal that there is scope for pareto improvements, pointing towards a role for more innovative maintenance policies.

Keywords: marriage and divorce, child support, alimony, household behavior, labor supply, limited commitment

JEL classification: D10, D91, J18, J12, J22, K36

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1 Introduction

Marital breakdown often has severe financial consequences for the lower earning spouse in divorcing couples. In the U.S. the poverty rate among women who got divorced in 2009 was 21.5%, compared to 10.5% for divorced men and 9.6% for married people (Elliott and Simmons, 2011). Divorce law in many countries therefore mandates post-marital maintenance payments, such as alimony and child support, to insure the lower earner in married couples against losing access to their partner's income upon divorce. In this paper I look at the impact of post-marital maintenance on dynamic decisions and welfare of couples.

In the past decade there have been active political debates about reducing post-marital maintenance payments in several countries, including the U.S., Germany, the U.K. and France. The political discussion was typically dominated by two economic arguments: Those opposed to high maintenance payments emphasize that a divorcee who receives high maintenance payments has little incentive to work and become economically self-sufficient after divorce. Those in favor of high maintenance payments argue that people who invest little in their careers after getting married, e.g. because they spend a lot of time on child-care or housework, should be insured against the potential drop in financial resources upon divorce. How quantitatively relevant is each of these arguments? And how should post-marital maintenance policies be designed if both arguments play a role? I adresses these questions by studying post-marital maintenance payments using a formal economic model.

In particular to study the welfare implications of post-marital maintenance payments I build a dynamic structural model of life-cycle labor supply, consumption, savings and (endogenous) marital status and estimate the model using Danish register data, that include information on post-marital maintenance payments. I then use the estimated model to simulate counterfactual policy scenarios and to assess the impact of policy changes on couples' dynamic decisions and welfare. The main channels through which maintenance policies impact welfare in my model are: 1. Provision of insurance against financial losses upon divorce. 2. Facilitating efficient intra-household specialization and 3. Distortion of labor supply incentives of divorced couples. While aspect 1. and 2. speak in favor of high post-marital maintenance payments, aspect 3. pushes towards low maintenance payments.

In modelling decision-making in marriage I build on the limited commitment framework (see Kocherlakota, 1996, Ligon et al., 2002 and Marcet and Marimon, 2017) that has previously been used to model intertemporal household decision making e.g. by Mazzocco (2007), Voena (2015) and Fernández and Wong (2016) .[1] In limited commitment models of the household a change in one spouse's value of divorce may lead to a shift in intra-household bargaining power from the spouse who wants to stay married to the spouse who wants to divorce. Changes in maintenance payments impact each spouses' value of divorce and thus may trigger shifts in bargaining power within couples or lead to divorce. Decision-making of divorced couples is modeled as a non-cooperative (dynamic) game. Each divorced spouse decides strategically about work hours and savings, taking into account how own choices impact her/his ex-spouses optimal choices and how the stream of post-marital maintenance payments is affected. My model includes savings in a risk-free asset and "learning by doing" human capital accumulation, i.e. by working during marriage model agents can increase their future expected wages and thus self-insure against losing resources upon divorce.[2] By this mechanism lower mandated maintenance payments strengthen the individual incentives to supply labor and thus reduce the possibilities for intra-household specialization according to comparative advantage. Maintenance payments thus facilitate efficient household specialization, while lowering maintenance payments promotes two-earner households.

I estimate the model using longitudinal data from Danish administrative records. Besides marital status, labor supply and wages, the data include information on post-marital maintenance payments between ex-spouses, the number of children a couple has together, the age of these children and who the children stay with, if a couple divorces.

To asses how maintenance policies affect couples' decisions and welfare, I use the estimated model as a policy lab to conduct counterfactual experiments. Based on such experiments I show that the (ex-ante) welfare maximizing policy is characterized by increased (tripled) child support payments and slightly lower alimony payments (12.5% lower), relative to the Danish status quo policy. Increasing child support induces married couples to specialize more, leads to smoother consumption paths around divorce and to a moderate reduction in labor supply among divorced women. Increasing alimony payments in contrast fails to provide insurance: Alimony payments lead to a strong reduction in labor supply among divorced men and women. Because of the strong labor supply reduction, increasing alimony payments leads to larger consumption drops upon divorce (i.e., consumption around divorce becomes less smooth).

To study how close maintenance policies can bring couples to efficiency, I compare the welfare maximizing policy to a first best scenario, in which frictions (limited commitment and non-cooperation in divorce) are removed from the model. The first best-scenario is characterized by

[1]See Chiappori and Mazzocco (2014) for a detailed description of limited commitment framework applied to household decision-making.

[2]See Doepke and Tertilt (2016) for an analysis of the impact of divorce risk on savings.

full consumption insurance and a higher degree of specialization among married couples, relative to the welfare maximizing policy. In terms of women's and men's ex-ante wellbeing, the first best scenario is a pareto improvement over the welfare maximizing maintenance policy and the status quo policy, indicating that there is scope for improvement in couples well-being beyond what is attained by the welfare maximizing maintenance policy.

In this paper I analyze how post-marital maintenance payments should be designed and study the underlying policy trade off. I incorporate post-marital maintenance payments into a dynamic model of household decision-making, taking into account the strategic interaction that arises between ex-spouses, if maintenance payments are computed based on both ex-spouses incomes. I thereby contribute to the literature that estimates economic models to study the impact of divorce law changes on household decisions and welfare. A large part of this literature is focussed on studying switches from mutual-consent to unilateral divorce and the division of household assets upon divorce (e.g. Chiappori et al., 2002; Voena, 2015; Bayot and Voena, 2015; Fernández and Wong, 2016 and Reynoso, 2018).[3] Less attention has been paid to policies like child support or alimony payments, that make spouses financially interdependent beyond divorce. Notable exceptions are Del Boca and Flinn (1995), who rationalize observed child support payments in a static model, and Brown et al. (2015), who study the impact of child support on child investments and fertility.

My paper is the first study of how maintenance payments should optimally be designed. In particular I am the first to study the policy trade off between providing consumption insurance to the lower earner in couples, and enabling couples to specialize efficiently, on the one hand, and maintaining labor supply incentives for divorcees, on the other. By studying maintenance policies in a framework that incorporates this trade off and fully accounts for the strategic interaction between divorced spouses who are linked by maintenance payments, I fill an important gap in the literature.

Supporting evidence for the key mechanisms of my model is provided by the quasi-experimental literature that estimates the impact of divorce law changes on household decisions. A large part of this literature considers the effect of introducing unilateral divorce on divorce rates (e.g. Friedberg, 1998 and Wolfers, 2006) and on labor supply of married and divorced couples (e.g. Gray, 1998; Stevenson, 2007 and Stevenson, 2008). This literature finds that household labor supply and divorce rates do respond to divorce regime changes and that the magnitude of the effects depend on the asset division regime.[4] Fewer studies consider post-marital maintenance policies:

[3]See Abraham and Laczo (2015) for a theoretical analysis of optimal asset division upon divorce.

[4]In particular, the cited literature finds that unilateral divorce led to an increase in married and unmarried

Rangel (2006) and Chiappori et al. (2016) provide quasi-experimental evidence that the introduction of alimony payments leads to a reduction in female labor supply and housework hours and an increase in male labor supply in existing couples.[5] Rossin-Slater and Wüst (2016) study the impact of child support payments on labor supply decisions of divorced couples, finding that higher child support payments lead to a reduction in the labor supply of fathers, who have to make these payments. While the quasi-experimental studies by Rangel (2006), Chiappori et al. (2016) and Rossin-Slater and Wüst (2016) provide valuable evidence on the impact of changes in post-marital maintenance payments on household decisions, a structural framework is needed to analyze how the documented changes in couples' behavior translate into changes in couples' welfare. Developing and estimating a structural model that incorporates the causal mechanisms that have been shown to be active by the quasi-experimental literature, allows me to draw conclusions about how maintenance policies should be designed be designed to balance the underlying policy trade off, i.e., to be welfare maximizing.

2 Institutional Background

In most OECD countries divorce law formulates rules by which it is determined what amount of maintenance payments needs to be payed within divorced couples. These rules typically formulate how maintenance payments are to be computed based on both ex-spouse's labor incomes, the ex-couple's number of children and the childrens' age.[6] The precise rules differ across countries and countries also differ in whether the rules are applied rigidly or serve as broad guidelines. For some countries, like, e.g., the U.S., is known that compliance with maintenance rules is low.[7] I use Denmark as an example to study the impact of maintenance payments for three interrelated reasons: 1. In Denmark rigid rules are applied to determine the amount of maintenance that is to be payed, 2. maintenance payments are strongly enforced by the Danish government,[8] 3. Danish administrative records that contain information on maintenance payments allow me to study to what extent the institutional rules are reflected in actual payments. In the following I describe the rules that are used to determine the size and duration of child support and alimony payments

female labor supply Stevenson (2008), a decrease in household specialization Stevenson (2007) a (short-run) increase in divorce rates Wolfers (2006).

[5] Rangel (2006) and Chiappori et al. (2016) both exploit the introduction of alimony payments for cohabiting couples (albeit in different countries). In particular Rangel (2006) finds a significant reduction in female labor supply and housework hours, but no significant effect for males. Chiappori et al. (2016) find a significant reduction in female labor supply and a siginificant increase in male labor supply.

[6] See Vaus et al. (2017) and C. Skinner et al. (2007) for comparisons of maintenance payments in the OECD.

[7] Low compliance rates were found e.g. for the US (see Weiss and Willis, 1985, Del Boca and Flinn, 1995 and Case et al., 2000).

[8] See C. Skinner et al. (2007) for an overview of which countries apply rigid rules versus broad guidelines.

Figure 1: Child support rules

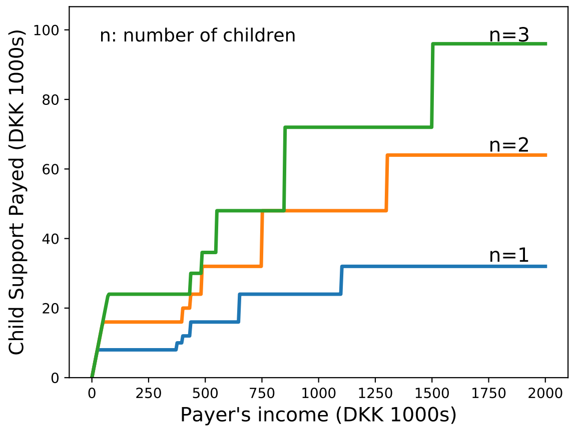
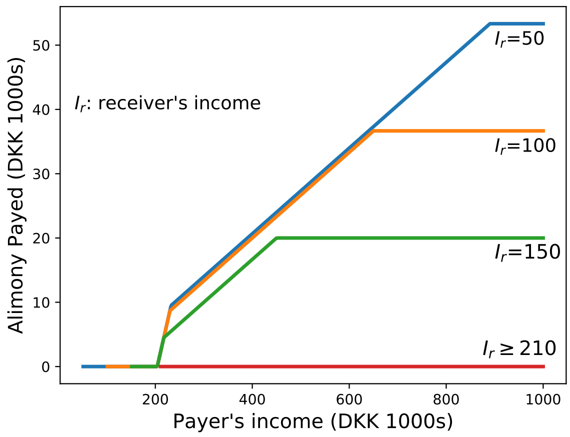


Figure 2: Alimony rules



Notes: Each figure is plotted for the 2004 value of the respective policy parameter (i.e. for $B = 9420$ and $\tau = 0.2$).

in Denmark.[9]

2.1 Child Support

Child support is to be payed from the non-custodial to the custodial parent for each child under the age of 18 a divorced couple has together. The payments are computed based on the child support payer's labor income and the number of children. Consider divorced ex-spouses f and m. Suppose $s \in \{f, m\}$ holds custody of n_s children and the other ex-spouse $\tilde{s} \in \{f, m\} \setminus s$ has monthly labor earnings $I_{\tilde{s}}$. Then the non-custodial parent $\tilde{s}$ is mandated to make monthly child support payments

$$cs(n_s, I_{\tilde{s}}, B) = B \cdot a(n_s, I_{\tilde{s}})$$

to the custodial parent s, where B is a basic money amount and $a(n_s, I_{\tilde{s}}) \geq 1$ is a factor that is increasing in the child support payer's labor earnings $I_{\tilde{s}}$ and the number of children n_s. The functional form of $a(n_s, I_{\tilde{s}})$ and values for B for 1999-2010 are provided in appendix A. Figure 1 provides a graphical illustration of the dependence of child support payments on n_s and $I_{\tilde{s}}$. Child support payments for a given child need to made as long as the child is under the age of 18.

2.2 Alimony

Alimony payments are to be payed from the higher earning to the lower earning ex-spouse within a divorced couple. These payments are mandated independently of whether the divorced couple

[9] Qualitatively the following decriptions apply to a wide range of countries. All functional forms and quantities inserted for policy parameters are specific to Denmark.

has children. Suppose $s \in \{f, m\}$ is the higher-earning and $\tilde{s} \in \{f, m\} \setminus s$ is the lower-earning ex-spouse in terms of monthly labor earnings, i.e. $I_s > I_{\tilde{s}}$. As a simple rule of thumb alimony payments equal a fraction τ of the monthly labor income difference, i.e.

$$\tau \cdot (I_s - I_{\tilde{s}}).$$

There are several exceptions to the rule of thumb taking the form of caps on alimony payments. These caps ensure that:

1. If the receiver's labor income is below C_1, alimony payments equal $\tau \cdot (I_s - C_1)$.
2. The maintenance payer's labor earnings net of maintenance payments are not less than C_2.
3. The maintenance receiver's labor earnings plus maintenance payments do not exceed C_3.

For the formal functional form of alimony payments, $alim(I_s, I_{\tilde{s}}, \tau)$, including the three caps see appendix A. Figure 2 gives a graphical example for the functional dependence of alimony on I_s and $I_{\tilde{s}}$. Alimony payments may last for up to ten years, but end if the receiving ex-spouse remarries or cohabits with a new partner.

2.3 Maintenance Payments

Maintenance payments equal the sum of child support and alimony, subject to a cap on the total amount of maintenance payments that ensures that the maintenance payer does not have to pay more than a third of her/his income. Denote by M_f the overall maintenance payments that are made from ex-husband to ex-wife (if $M_f > 0$) or from ex-wife to ex-husband (if $M_f < 0$) by the ex-wife and by M_m the payments made or received by the ex-husband ($M_m = -M_f$ denotes the same payments from the ex-husbands perspective). The overall maintenance payments equal

$$M_f(n_f, n_m, I_f, I_m) = -M_m(n_f, n_m, I_m, I_f) =$$
$$\min\left\{\frac{1}{3}I_m\ ,\ cs(n_f, I_m) + alim(I_m, I_f)\right\} - \min\left\{\frac{1}{3}I_f\ ,\ cs(n_m, I_f) + alim(I_f, I_m)\right\}.$$

In my dynamic model I account for post-marital maintenance payments by adding M_f and M_m to the budget set of the ex-wife and ex-husband respectively.

3 Data and Descriptive Statistics

I use Danish register data covering 33 years from 1980 to 2013. The data include all Danish individuals who have been married at some point during the covered period. For each year

I observe each individual's annual labor income, labor force status and hours worked. Hours worked are employer-recorded in five bins of weekly hours (<10, 10-19, 20-29, 30-37 and ≥ 38).[10] Moreover I observe each individual's marital history (starting from 1980) and number of children as recorded in the Danish birth register.[11] For divorced individuals I additionally observe the amount of maintenance payments they make to or receive from their ex-spouse and with which parent divorced couples' children continue to live after divorce.[12] I restrict the sample to couples where both spouses are in their first marriage, aged between 25 and 58 and where at least one spouse is working in at least one sampled year. Furthermore I exclude couples where one spouse has a child from a previous relationship.[13] The final sample includes 279,197 couples (558,394 individuals) and 4,912,474 couple-year observations. Table D.1 presents summary statistics for the final sample.

[10]See Lund and Vejlin (2015) for a detailed description of the measurement of hours worked in Danish register data.

[11]By using information from the Danish birth register I can distinguish the biological children that a couple has *together* from children living with the couple that are not biological children of the couple (e.g. children that one of the spouses has with someone else).

[12]Maintenance payments are recorded by tax authorities. The data source is the maintenance payer's tax declaration.

[13]This case would be complicated to study as there would be child support payments to be made or received for the children from previous relationships as well.

Table 1: Summary statistics, Danish register data

Variable	Mean	Std. Dev.
Age	38.70	7.68
Employed female	0.88	0.32
Employed male	0.93	0.26
Weekly hours worked female (cond. on working)	33.80	7.67
Weekly hours worked male (cond. on working)	34.36	8.22
Annual earnings female (DKK 1000s)	219	147
Annual earnings male (DKK 1000s)	299	241
No. of children (married)	1.40	0.98
% divorced after 5 years	6.91	25.38
% divorced after 10 years	15.28	35.98
% divorced after 15 years	21.57	41.13
% divorced after 20 years	25.26	43.44
% divorced after 25 years	28.29	45.04

Notes: Summary statistics from Danish register data. Pooled sample of 4,912,474 couple-year observations.

For the estimation of the structural model I further make use of information on housework hours. These data are obtained from the *Danish Time Use Survey*, which was conducted in 2001 among a 2,105 households representative sample of the Danish population.[14] Table 2 presents summary statistics computed by reweighting the data to match the age distribution of my main sample. A limitation of the *Danish Time Use Survey* is that married couples cannot be distinguished from cohabiting ones and divorced individuals cannot be distinguished from singles. I therefore pool these groups when making use of the time use data.

[14]For a detailed description of the data see Browning and Gørtz (2012).

Table 2: Summary statistics (age-reweighted), Danish time use survey

Variable	Mean	St. dev.	Obs.
Housework hours female (married/cohabiting)	18.82	9.93	1271
Housework hours female (divorced/single)	19.92	8.94	156
Housework hours male (married/cohabiting)	10.83	8.08	1227
Housework hours male (divorced/single)	12.48	7.62	169

Notes: Summary statistics from the Danish Time Use survey 2001. Cross-section of 2,105 households. The data are reweighted to match the age distribution in the Danish register data. Housework hours are total weekly hours spent on household chores and child care.

3.1 Maintenance payments: data vs. imputations

Previous work based on U.S. data generally found low compliance with maintenance policies data and was therefore mainly focussed on understanding how compliance behavior may respond to policy changes (Weiss and Willis, 1985; Weiss and Willis, 1993; Del Boca and Flinn, 1995; Flinn, 2000).[15] In Denmark in contrast maintenance policies are strongly enforced by the government, which allows me to take compliance as given, when studying the impact of policy changes.[16]

To confirm in the data to what extent actually implemented maintenance payments correspond to the institutional rules I compute annual imputed maintenance payments for each divorced couple in my sample based on the Danish institutional rules described in section 2 and check to what extent the imputations conform with maintenance payments recorded in the administrative data.

[15] For a survey of these studies see Del Boca (2003).

[16] In Denmark, if the ex-spouse mandated to pay maintenance refuses to make the payments a public agency helps to collect the outstanding payments. In case of non-compliance this agency can withhold tax refunds (see Rossin-Slater and Wüst, 2016.)

Figure 3: Maintenance payments, data and imputations

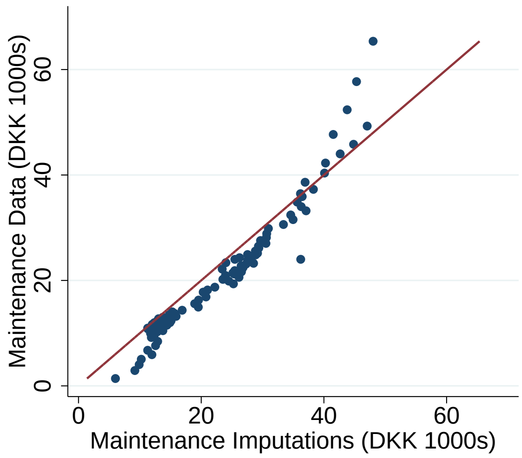


Figure 4: Maintenance payments by payer's labor income, data and imputations

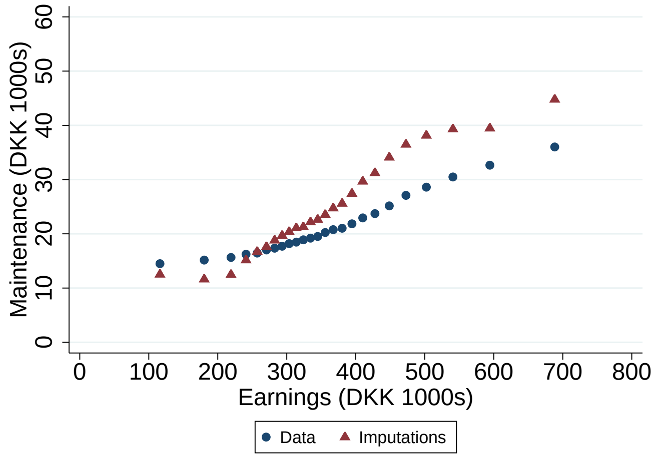
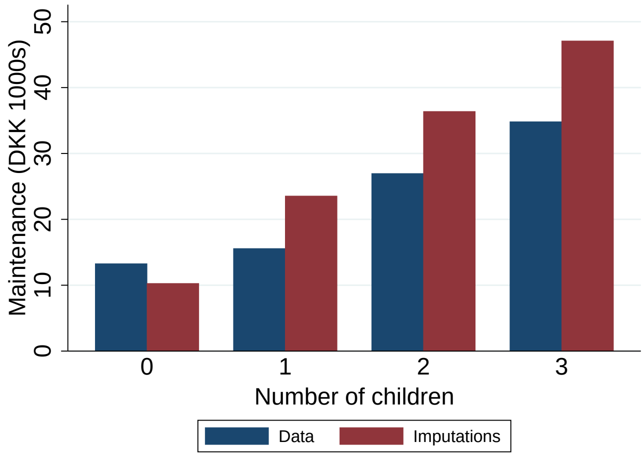


Figure 5: Maintenance payments by no. children, data and imputations



Notes: The figures are based on observations, covering all divorced couples in my sample. Figure 3 and 4 display binned scatterplots, where each dot corresponds to a percentile of the underlying distribution.

Figures 3 - 5 show how well the imputations match the observed data regarding several aspects. Figure 3 plots average imputed maintenance payments against observed maintenance payments in a binned scatter plot. The plot exhibits some small deviations, but by and large is clustered around the 45 degree line, confirming that on average the imputations of maintenance payments are close to the payments observed in the data. Figure 4 shows how maintenance payments evolve with the maintenance payer's labor income in the observed data and for my imputations of maintenance payments respectively. Both the maintenance imputations and the maintenance data exhibit a positive gradient in the payer's labor income that is steepest between

300,000 and 500,000 DKK and somewhat flatter outside this income range. This gradient however is somewhat steeper in the imputations than in the data. Figure 5 shows imputed and actual annual maintenance payments by number of children. My imputations capture that maintenance payments are increasing in the number of children divorced couples have and the magnitude of the increase is similar in my imputations and in the data. The level of maintenance payments however is higher in the imputations than in the data for couples with 1,2 and 3 children, while being somewhat lower for couples with 0 children. Overall, the displayed relationships show that the instutional rules about maintenance payments are reflected in the actual payments, although the precise amounts may deviate to some extent.

3.2 Evidence from event studies: work hours around divorce

To understand the relevance of post-marital maintenance payments it is important to know to what extent (and in what direction) divorcing spouses adjust their labor supply upon divorce. This subsection presents empirical evidence on the order of magnitude by which women and men adjust their labor supply before and after getting divorced. I conduct event study regressions that exploit variation in the timing of divorce to seperate labor supply changes that are associated with divorce from general marriage duration and time trends.[17]

As outcome variable I consider work hours, as recorded in the Danish register data. This measure of work hours corresponds to weekly work hours and distinguishes between 5 work hours bins (<10, 10-19, 20-29, 30-37 and $\geq$ 38). I code work hours to be equal to 0 in case of non-participation, 38 in case of full-time and equal to the mid-point of the respective bin, if work hours fall into one of the bins. Following the specification used in Kleven et al. (2016) I include calendar year fixed effects as well as fixed effects that control for the time that elapsed since a couple got married for the first time. Denote by h_{ict} the weekly work hours of individual i in calendar year $c \in \{1980, 1981, ..., 2013\}$ in t year after first getting married. I run the following regression seperately for women and men

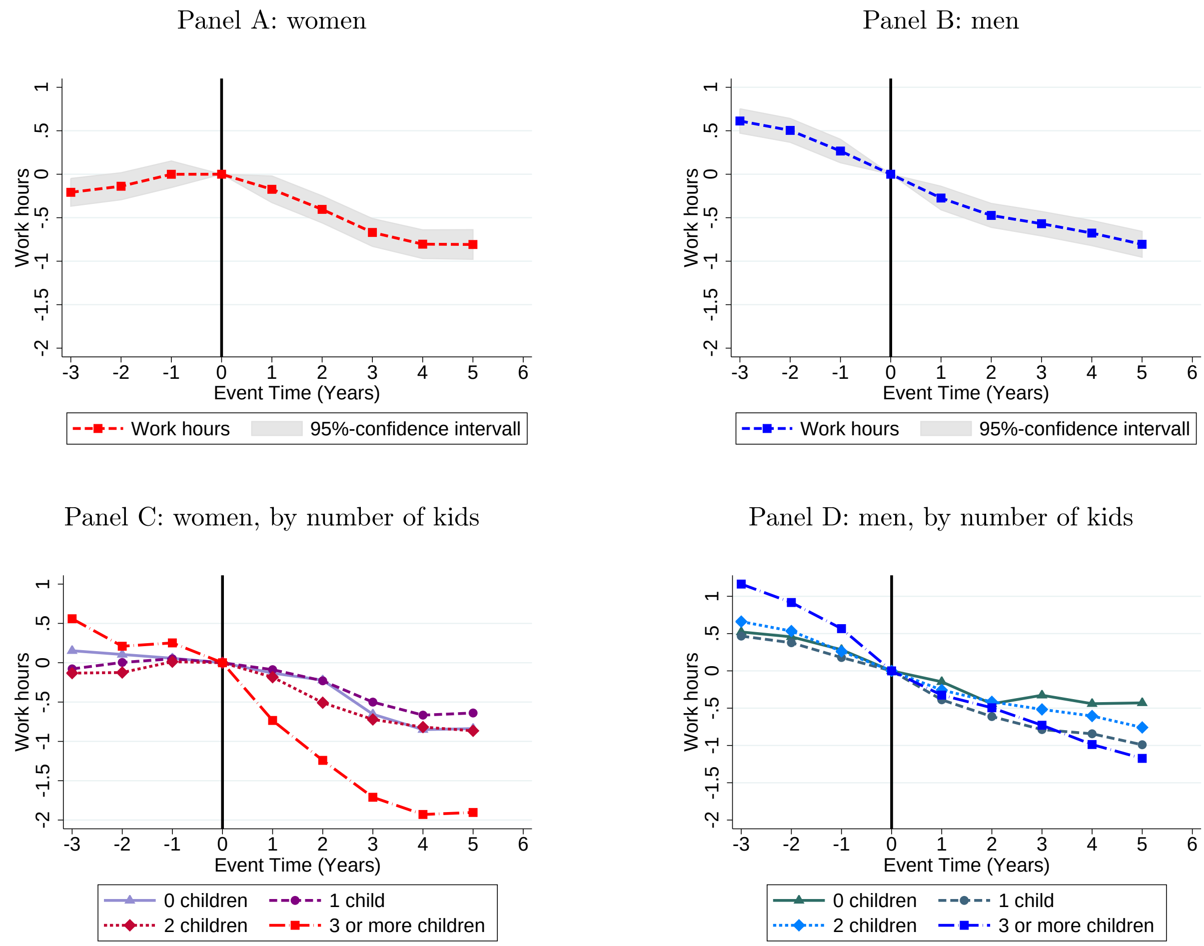
$$h_{it} = a_{c(i,t)} + b_t + \sum_{r=-3}^{6} \kappa_r \cdot D_{it+r} + \nu_{it}, \tag{1}$$

where D_{it} is a dummy indicating whether individual i gets divorced after having been married for t years. b_t are fixed effects that control for t, the time that elapsed since i got married for the

[17] In similar analyses Fisher and Low (2015) and Fisher and Low (2016) consider the evolution of divorcing spouses' labor income (as well as other sources of income) after divorce.

first time. $a_{c(i,t)}$ are calendar time fixed effects, where $c(i,t)$ denotes the calendar year in which t years have elapsed since i got married for the first time. I consider an event time window of 3 years before and 6 years after divorce. Panel A and B in figure 6 plot the coefficient estimates seperately for women and men. Panel C and D in figure 6 show coefficient estimates from seperate regressions by number of children (and for women/men).[18]

FIGURE 6: Weekly work hours around divorce



Notes: Each figure contains coefficient estimates of 1, for women (panel A), men (panel B) and seperately by number of children (panel C and D). Included are all individuals in my sample, that are observed for at least 3 periods prior and 6 periods after getting divorced.

The graphs show that both men and women reduce their labor supply upon divorce. Following divorce both men an women reduce their weekly work hours by 0.75 hours. For men this is complemented by a 0.5 work hours reduction in the three years preceeding divorce.[19] These findings

[18]For better overview panel B and C in figure 6 do not include confidence intervals. The respective graphs along with 95% confidence intervals are displayed in seperate figures, F.1 and F.2.

[19]In a similare analyses for the U.S. Johnson and J. Skinner (1986) and Mazzocco et al. (2014) find that women

have interesting implications, in the context of maintenance payments. First, if divorcing spouses reduce their work hours (and thus their earnings) the mandated amount of maintenance payments is affected. In particular for the person paying child support and/or alimony, a reduction in own earnings reduces the amount of mandated payments. For the person receiving alimony, in contrast, a reduction in own earnings increases the received alimony payments. At the same time maintenance payments directly improve the financial situation of the maintenance receiver, i.e., the consumption effect of a reduction in the receiver's earnings is mitigated by maintenance payments.

4 Model

This section describes a dynamic structural model of labor supply, home production, savings and divorce that incorporates the following main features of married and divorced couples' decision-making: 1. divorced ex-spouses are linked by maintenance payments and interact non-cooperatively, 2. married couples make decisions cooperatively subject to limited commitment, i.e. bargaining power and divorce rates respond to changes in married spouses' outside options, 3. agents are forward looking and working improves their future wages, i.e. working during marriage mitigates financial losses upon divorce.

In the model a female individual f and a male individual m interact in each time period either as married couple or as divorced ex-spouses. The model is set in discrete time, m and f are married in period 1 and decide in each time period $t \in \{1, 2, ..., T\}$ about work hours h_f, h_m, housework hours q_f, q_m, (private) consumption c_f, c_m, savings in a joint asset A_t and (if married) whether to stay married or get divorced. Work hours are discrete, i.e. each spouses working hours are chosen from finite sets $\mathcal{H}_f$ and $\mathcal{H}_m$. In period T spouses retire and live as retirees until period $T + R$.

At the outset of the model, in period $t = 1$, couples are heterogenous in their initial number of children, n_1 and initial assets A_1. During marriage a new child is born in each time period $t < T$ with probability $p(t, n_t)$, which is a function of t and n_t, the number of children already present in the household.[20]

increase and men decrease work hours around divorce. Johnson and J. Skinner (1986) find effects in the years preceeding divorce for women. Effects preceeding divorce could be due to anticipation of divorce or because of events that cause persistent changes in labor supply as well as persistent changes in the divorce probability.

[20]Not modelling an endogenous fertility process is in line with the previous literature that evaluates divorce law changes using formal economic models (e.g. Fernández and Wong (2016), Voena (2015), Bayot and Voena (2015), Reynoso (2018)). See Adda et al. (2011) for dynamic structural model of career choices and fertility and Doepke

As I model couples who are just married at the outset of the model, household formation is taken as given. The model hence is useful for studying the impact of policy changes on the population of already married couples, but does not address how household formation is affected by post-marital maintenance payments.

Preferences.

Model agents $s \in \{f, m\}$ derive utility from private consumption c_s, from a household good Q and from leisure time ℓ_s. The household good represents a couple's children well-being as well as goods and services produced within the household, like home made meals and cleaning up. Q is produced from time inputs q_f, q_m and is a public good within married couples, but becomes private when a couple divorces.

Intraperiod utility is additively separable in consumption, leisure, the household good and a taste shock that affects an individual's utility of being married relative to being divorced. The intraperiod utility function of married spouses $s \in \{f, m\}$ is given by[21]

$$u_s^{mar}(c_s, \ell_s, Q, \xi_s) = \frac{c_s^{1+\eta_s}}{1+\eta_s} + \psi_s \frac{\ell_s^{1+\gamma_s}}{1+\gamma_s} + \lambda(n) \frac{Q^{1+\kappa}}{1+\kappa} + \xi_s \ ,$$

where n denotes the couple's number of children and $\lambda(n) = B \cdot (1 + b \cdot n)$, i.e. the relevance of the household good depends on the number of children present in the household. In order to account for persistence in the taste for marriage ξ_s is assumed to follow a random walk with shocks correlated across s. Specifying ξ_s to be individual specific rather than specific to the couple, allows for greater flexibility in marital status dynamics.[22]

The intraperiod utility function of divorced ex-spouses is given by

$$u_s^{div}(c_s, h_s, Q_s) = \frac{c_s^{1+\eta_s}}{1+\eta_s} + \psi_s \frac{\ell_s^{1+\gamma_s}}{1+\gamma_s} + \lambda(n_s) \frac{Q_s^{1+\kappa}}{1+\kappa} \ ,$$

where the s subscript on Q_s accounts for the fact that the household good Q is not public within divorced couples and n_s denotes the number of children living with spouse s after divorce.

and Kindermann (2016) for a household bargaining model with endogenous fertility.

[21] Time subscripts are ommitted for convenience. Q is a public good within married households and hence has no s subscript.

[22] Imposing marriage specific quality shocks, i.e. $\xi_f = \xi_m$ within each married couple, rules out situations where the spouse who benefits most in economic terms from the marriage wants to divorce while the spouse who benefits least in economic terms wants to maintain the marriage.

Home Production.

Each spouse $s \in \{f, m\}$ has a time budget H_s, which is allocated between work, home production and leisure time, i.e. $H_s = h_s + q_s + \ell_s$. The technology by which the household good Q is produced takes female and male home production time q_f, q_m as inputs and has a constant elasticity of substitution form

$$Q = F_Q(q_f, q_m) = \left(aq_f^\sigma + (1-a)q_m^\sigma\right)^{\frac{1}{\sigma}},$$

where σ controls the degree of substitutability between q_f and q_m and the factor $a \in [0, 1]$ captures productivity differences between the male and the female time input. The parameters σ and a jointly determine to what extent male and female non-work time are substitutes or complements in the process of producing the household good. Importantly married couples produce the household good jointly, while in divorced ex-couples each ex-spouse produces a seperate household good, i.e. during marriage $Q = F_Q(q_f, q_m)$ and in divorce $Q_f = F_Q(q_f, 0)$ and $Q_m = F_Q(q_m, 0)$.

Economies of Scale and Expenditures for Children.

I account for economies of scale in married couples' consumption and expenditures for children by specifying the household expenditure function (cf. Voena, 2015)

$$F_x(c_f, c_m, n) = e(n)(c_f^\rho + c_m^\rho)^{\frac{1}{\rho}}.$$

For $\rho \geq 1$ and given expenditures $x_t = F_x(c_f, c_m, n)$ this functional form allows married couples to enjoy economies of scale from joint consumption, while there are no economies of scale if only one spouse consumes. $e(n) \geq 1$ is an equivalence scale that accounts for expenditures for children, where $e(0) = 1$ and $e(n)$ is strictly increasing in n. A married couple with n children and private consumption levels c_f, c_m hence has expenditures $x_t^{mar} = F_x(c_f, c_m, n)$. The individual expenditures of divorcees f, m with consumption levels c_f, c_m are $x_{ft}^{div} = F_x(c_f, 0, n_f)$ and $x_{mt}^{div} = F_x(0, c_m, n_m)$, meaning there are no economies of scale from joint consumption and each divorcee has expenditures only for children that continue to live with her/him.

Wages.

For each spouse $s \in \{f, m\}$ the wage process depends on human capital K_{ft}, K_{mt} and an i.i.d. random component ϵ_{st}

$$
\begin{aligned}
ln(w_{st}) &= \phi_{0s} + \phi_{1s} K_{st} + \epsilon_{st}, \\
\epsilon_{st} &\overset{iid}{\sim} \mathcal{N}(0, \sigma_{s\epsilon}).
\end{aligned}
$$

Human capital K_{st} is discrete with values $\{0, 1, 2, ..., K_{\max}\}$ and is accumulated through learning by doing.[23] In particular from period t to $t+1$, the stock of human capital K_{st} increases by one unit with probability $p_K(h_{st})$, which is strictly increasing in period t working hours (). At the same time K_{st} constantly depreciates with (exogenous) probability p_δ. This leads to the following law of motion for human capital:

$$
K_{st} = \begin{cases} \min\{K_{st-1} + 1, K_{\max}\} & \text{with prob. } p_K(h_{t-1})(1 - p_\delta) \\ K_{st-1} & \text{with prob. } p_K(h_{t-1}) p_\delta + (1 - p_K(h_{t-1}))(1 - p_\delta) \\ \max\{K_{st-1} - 1, 0\} & \text{with prob. } (1 - p_K(h_{t-1})) p_\delta. \end{cases}
$$

Allowing for learning by doing adds an important dynamic component to the model. By working during marriage model agents can increase their individual expected future wages and thereby can self-insure against losing access to their spouses income upon divorce.

Problem of Divorced Couples.

Divorced couples are linked by maintenance payments and interact non-cooperatively.[24] Each ex-spouse makes choices to maximize her/his own discounted lifetime utility, taking into account how decisions affect the stream of maintenance payments that flows from one ex-spouse to the other. As both ex-spouses' decisions jointly impact the amount of maintenance payments, the interaction of divorced couples becomes strategic.

In each time period each ex-spouse chooses her/his time allocation between work hours, home production hours and leisure time as well as consumption and savings in a risk free asset A_{st+1},

[23] By making these assumptions I can include human capital for both spouses, while keeping the dimension of the state space manageable. In my estimations I impose $K_{\max} = 4$.

[24] Flinn (2000) analyzes a framework in which the interaction mode between divorcees is endogenous.

subject to the budget constraint

$$x_{st}^{div} = w_{st}h_{st} + \Xi_t M_{st} + (1+r)A_{st} - A_{st+1}, \tag{2}$$

where r denotes the risk free interest rate and maintenance payments are denoted by $M_{ft} = -M_{mt} = M_f(n_{ft}, n_{mt}, w_{ft}h_{ft}, w_{mt}h_{mt})$. Note that f's work hours decision hence impacts m's decision problem through the maintenance payments M_m in m's budget constraint (vice versa m's work hours decision also affect f's budget constraint). Period t maintenance payments depend on the each ex-spouse's period t labor income and the number of children living with each ex-spouse. The functional form of M_f is as described in section 2, i.e. corresponds exactly to the Danish institutional setting. To account for the duration for which maintenance payments are made I introduce an indicator variable Ξ_t that equals 1 as long as maintenance payments are ongoing. In each period maintenance payments are discontinued ($\Xi_t = 0$) with probability $1 - p_M$, implying an average duration of maintenance payments of $\frac{1}{1-p_M}$ time periods. Once discontinued maintenance payments remain at zero (i.e. if $\Xi_t = 0$ then $\Xi_{t+1} = 0$).

In order to determine allocations in this setting I restrict my attention to Markov-Perfect equilibria. To rule out multiplicity of equilibria which often occurs in simultaneous-move games I impose sequential (stackelberg type) decision-making within time periods. In particular I assume that within each time period m chooses first and f responds optimally to m's choices.[25,26]

Denote the period t decisions of spouse s by $\iota_s = (c_{st}, h_{st}, q_{st}, \ell_{st}, A_{st+1})$. In the second stage of time period t, f solves the following decision problem. Given m's first stage choices ι_{mt} and given the vector of period t state variables $\Omega_t^{div} = (A_{ft}, A_{mt}, n_{ft}, n_{mt}, K_{ft}, K_{mt}, \epsilon_{ft}, \epsilon_{mt}, \Xi_t)$, f solves[27]

$$\begin{aligned} \tilde{\iota}_{ft} &= \arg\max_{\iota_{ft}} \; u_f^{div}(c_{ft}, \ell_{ft}, Q_{ft}) + \beta \mathbb{E}_t[V_{ft+1}^{div}(\Omega_{t+1}^{div})] \qquad (3) \\ \text{s.t.} \quad x_{ft}^{div} &= w_{ft}h_{ft} + \Xi_t M_f(n_{ft}, n_{mt}, w_{ft}h_{ft}, w_{mt}h_{mt}) + (1+r)A_{ft} - A_{ft+1} \\ Q_{ft} &= F_Q(q_{ft}, 0) \\ H_f &= h_{ft} + q_{ft} + \ell_{ft}\,. \end{aligned}$$

[25](Weiss and Willis, 1993) model decision-making of divorced couples as (static) stackelberg game. Kaplan (2012) imposes sequential decision-making to ensure uniqueness of a Markov-Perfect equilibrium in a similar dynamic two-player setting, where youths interact with their parents. His paper provides a discussion of multiplicity of Markov-Perfect equilibria in dynamic two-player settings.

[26]Changing the timing of the game such that f moves first tends to produce unrealistically low levels of male labor supply.

[27]f's optimal choices depend functionally on m's first stage choices (e.g. for labor supply $\tilde{h}_{ft} = \tilde{h}_{ft}(\iota_{mt})$). For convenience I supress the functional dependence in my notation.

In the first stage, m makes his decision taking into account how it influences his female ex-spouse's second stage response $\tilde{\iota}_{ft}$, i.e. m solves

$$\begin{aligned}
\iota^*_{mt} &= \underset{\iota_{mt}}{\arg\max} \;\; u^{div}_m(c_{mt}, \ell_{mt}, Q_{mt}) + \beta \mathbb{E}_t[V^{div}_{mt+1}(\tilde{\Omega}^{div}_{t+1})] \qquad (4)\\
\text{s.t.} \;\; x^{div}_{mt} &= w_{mt}h_{mt} + \Xi_t M_m(n_{ft}, n_{mt}, w_{ft}\tilde{h}_{ft}, w_{mt}h_{mt}) + (1+r)A_{mt} - A_{mt+1}\\
Q_{mt} &= F_Q(0, q_{mt})\\
H_m &= h_{mt} + q_{mt} + \ell_{mt}\,,
\end{aligned}$$

where $\tilde{h}_{ft}$ denotes f's optimal work hours response and $\tilde{\Omega}^{div}_{t+1}$ is the vector of state variables given f's optimal second stage response. Given m's optimal choices ι^*_{mt} and f's optimal responses

$$\iota^*_{ft} = \tilde{\iota}_{ft}(\iota^*_{mt}),$$

the value of divorce for ex-spouse $s \in \{f, m\}$ is given by

$$V^{div}_{st}(\Omega^{div}_t) = u^{div}_s(c^*_{st}, \ell^*_{st}, Q^*_{st}) + \beta \mathbb{E}_t[V^{div}_{st+1}(\Omega^{*div}_{t+1})]$$

where $c^*_{st}, h^*_{st}, Q^*_{st}$ denote the respective components of ι^*_{st} and Ω^{*div}_{t+1} is the vector of state variables given optimal period t choices of f and m. Given the period T value of divorce V^{div}_{sT} (the value of entering retirement as divorcee) for $s \in \{f, m\}$ the decision problems (3) and (4) and equation (5) recursively define the value of divorce V^{div}_{st} for every period $t \in \{1, ..., T-1\}$ for $s \in \{f, m\}$.

Division of Assets upon Divorce and Child Custody.

If a couple divorces in period t savings in the joint asset A_t are divided among the divorcing spouses. I assume that property is divided equally, such that each spouse receives $\frac{A_t}{2}$. Equal property division is a close approximation to the property division regime that is in place in Denmark, where assets accumulated during marriage are divided equally, but assets held prior to marriage are exempt from property division.

Upon divorce it is furthermore decided which spouse receives physical custody of the divorcing couples children. I assume all children either stay with their mother, $n_{ft} = n_t$, with exogenous probability p_{cust_f}, or with their father, $n_{mt} = n_t$, with probability $1 - p_{cust_f}$. In case of multiple children I do not account for cases where some children stay with their mother, while others stay with their father, as this would increase the dimensionality of the state space and increase the computational complexity of the model solution drastically. In my sample I observe that in 93% of all divorcing couples all children stay with one parent, while in 7% of all cases some children stay with each parent.

Problem of Married Couples.

Married couples make decisions cooperatively subject to limited commitment. In limited commitment models of the family the outside options of both spouses impact the distribution of bargaining power between husband and wife and the propensity of the couple to divorce. As policy changes to post-marital maintenance payments affect each spouse's outside option, the limited commitment framework allows maintenance payments to impact the intra-household distribution of bargaining power and divorce rates.

In each time period married couples choose work hours, home production hours, (private) consumption for each spouse and savings in the joint asset A_{t+1}. Define the vector of period t state variables of a married couple by $\Omega_t^{mar} = (\mu_{ft}, A_t, n_t, K_{ft}, K_{mt}, \epsilon_{ft}, \epsilon_{mt}, \xi_{ft}, \xi_{mt})$ and denote a married couple's choice variables by $\iota_t = (c_{ft}, c_{mt}, h_{ft}, h_{mt}, q_{ft}, q_{mt}, \ell_{ft}, \ell_{mt}, A_{t+1}, D_t)$, where $D_t = 1$ indicates the couple's decision to get divorced in t. Conditional on the decision to stay married ($D_t = 0$) and for given female bargaining power μ_{ft} the couple solves the constrained maximization problem

$$
\begin{aligned}
\iota_t^* &= \arg\max_{\iota_t} \ \mu_{ft}\big(u_f^{mar}(c_{ft}, \ell_{ft}, Q_t, \xi_{ft}) + \beta\mathbb{E}_t[V_{ft+1}]\big) \\
&\quad +(1-\mu_{ft})\big(u_m^{mar}(c_{mt}, \ell_{mt}, Q_t, \xi_{mt}) + \beta\mathbb{E}_t[V_{mt+1}]\big) \\
\text{s.t.} \quad x_t^{mar} &= w_{ft}h_{ft} + w_{mt}h_{mt} + (1+r)A_t - A_{t+1} \\
Q_t &= F_Q(q_{ft}, q_{mt}) \\
H_f &= h_{ft} + q_{ft} + \ell_{ft} \\
H_m &= h_{mt} + q_{mt} + \ell_{mt}
\end{aligned}
\tag{5}
$$

and the value of marriage for spouse s is

$$
V_{st}^{mar}(\Omega_t^{mar}) = u_s(c_{st}^*, \ell_{st}^*, Q_t^*, \xi_{st}) + \beta\mathbb{E}_t[V_{gt+1}], \tag{6}
$$

where $c_{st}^*, q_{st}^*, \ell_{st}^*$ are the respective components of ι^* and Q_t^* is the quantity of the home good that is produced at q_{ft}^*, q_{mt}^*.

The $t+1$ continuation value V_{st+1} depends on whether the couple stays married $D_{t+1} = 0$ or gets divorced $D_{t+1} = 1$ in $t + 1$ and is given by

$$V_{st+1} = D_{t+1} V_{st+1}^{div}(\Omega_{t+1}^{div}) + (1 - D_{t+1}) V_{st+1}^{mar}(\Omega_{t+1}^{mar}).$$

In the limited commitment framework intra-household bargaining power may shift if one spouses participation constraint is violated. If at given female bargaining power μ_{ft} both spouses participation constraints are satisfied, i.e.

$$V_{st}^{mar}(\Omega_t^{mar}) \geq V_{st}^{div}(\Omega_t^{div}) \quad \text{for } s \in \{f, m\}, \tag{7}$$

then it is individually rational for both spouses to stay married. In this case the couple stays married and makes decisions according to (5). If however the participation constraint (7) is violated for one spouse but not the other, bargaining power is increased (if f's participation constraint is violated) or decreased (if m's participation constraint is violated) until the spouse whose participation constraint is binding is just indifferent between staying married and getting divorced. Divorce occurs if no value of μ_{ft} exists such that both spouses' participation constraints are satisfied simultaneously.

Policy changes to post-marital maintenance payments typically increase the value of one spouse's outside option while decreasing the value of the other spouse's outside option. Under limited commitment this may trigger changes in intrahousehold bargaining power. Furthermore divorce rates may respond to such policy changes, if divorce becomes too attractive relative to staying married for (at least) one spouse and if reallocating bargaining power cannot restore the incentives to stay married for both spouses.

5 Estimation

To obtain estimated values for the structural parameters of my model I proceed in three steps. First, a small subset of the model parameters is set externally to match values from the previous literature. Next, several model parameters are estimated directly from the data without making use of the structural model. The remaining parameters are estimated by the method of simulated moments (MSM), (see Pakes and Pollard, 1989; McFadden, 1989), i.e., I use numerical optimization techniques to find model parameters such that a set of simulated model moments match the corresponding moments from the data as close as possible. The next subsections describe each of the three steps of obtaining estimates of my model parameters in more detail.

5.1 Pre-set parameters.

I pre-set several model parameters to match values from the literature. These parameters and the values that I fix them at are summarized in table 3. I set the relative risk-aversion η to 1.5 and the annual discount factor to 0.98 in line with Attanasio et al. (2008). As annual interest rate I take the average yearly deposit rate across my sample period, which is published by the danish central bank. Following Voena (2015) I fix the economies of scale parameter ρ at 1.4023, which is the value implied by the McClements scale.

I set a time period to correspond to three years to keep the computational complexity managable and in line with previous sutdies (see Voena, 2015; Reynoso, 2018). I solve the model for $T = 10$ and $TR = 4$, i.e., for individuals whose working life lasts for 30 years after getting married and who spent live for 12 years as retirees after their working life has ended. For both spouses, f and m the domain of weekly working hours is restricted to four values: non-participation (0 hours) two levels of part-time work (20 and 30 hours) and full time work (38 hours). To arrive at annual work hours I impose that one year consists of 49 working weeks. I fix the overall weekly time budget at 50 hours ($H_f = H_m = 50$), such that if a person works full time there is a residual of 12 hours to be allocated between weekly housework and leisure.

Table 3: Pre-set parameters

Parameter	Value	Source
Implied annual discount factor:	0.98	Attanasio et al. (2008)
Risk aversion (η):	1.5	Attanasio et al. (2008)
Implied annual interest rate:	0.046	Abildgren (2005) & Danmarks Nationalbank
Economies of scale (ρ):	1.4023	implied by McClements scale (see Voena, 2015)
Number of time periods (T):	10	-
Duration of retirement (TR):	4 time periods	-
Implied weekly work hours domain:	$\{0, 20, 30, 38\}$	-

Notes: For ease of interpretation the table presents the implied annual discount factor and interest rate and the implied weekly work hours domain, rather than the corresponding numbers for a model time period (which corresponds to three years).

5.2 Directly estimated parameters.

A subgroup of parameters are estimated directly from the data. These parameters are 1. the parameters governing the fertility process 2. the parameters governing compliance with maintenance policies and the duration of maintenance payments and 3. parameters related to child custody.

Fertility process The parameters of the fertility process are the initial (period 1) distribution of children

$$p_{n_1}(n) = P(n_1 = n) \quad \text{for} \quad n \in \{0, 1, 2, 3\}$$

and the probabilities of giving birth to an additional child as a function of the model time period t and the number of children already present in the household[28]

$$p_n(t, n_t) = P(\text{birth}|t, n_t) \quad \text{for} \quad n_t \in \{0, 1, 2\},\ 1 \leq t < T.$$

I estimate $p_{n_1}(n)$ and $p_n(t, n_t)$ by computing the corresponding sample means and Markov transition probabilities from the Danish birth register data. The estimates for p_{n_1} are reported in table 4. The matrix of estimated Markov transition probabilities is presented in table E.2. Note that for $t \geq 4$ (i.e., after 12 years of marriage) birth probabilities generally are practically equal to 0.

TABLE 4: Initial number of children distribution, p_{n_1}

n	0	1	2	3
$p_{n_1}(n)$	0.34	0.37	0.25	0.04

Notes: Source: Danish birth register.

5.3 Method of simulated moments estimation.

The remaining model parameters that are estimated using the method of simulated moments are (for $s \in \{f, m\}$) the parameters governing preferences for leisure $\gamma_s,\ \psi_s$ and preferences for the home good $B,\ b,\ \kappa$, the parameters governing home production $a,\ \sigma$, the love shock parameters $\mu_\xi,\ \sigma_\xi,\ r_\xi$ and the parameters governing the wage processes $\phi_{0s},\ \phi_{1s},\ \sigma_{\epsilon,s},\ \alpha_s,\ p_{\delta,s}$. I denote the

[28]Note that I allow couples to have at most 3 children, i.e., $p_n(t, 3) = 0$ for all t.

vector of structural model parameters estimated by MSM by θ. For a given θ I solve the structural model by backwards recursion, simulate data for $20,000$ hypothetical couples and compute the vector of simulated moments $m(\theta)$. MSM-estimates $\widehat{\theta}$ are obtained by minimizing the distance between simulated model moments and their empirical counterparts $\widehat{m}$

$$\min_{\theta} \, (m(\theta) - \widehat{m})'\widehat{W}(m(\theta) - \widehat{m}).$$

The empirical moments I target are conditional averages of working hours, housework hours and wages, where I condition on marital status (married/ divorced) and number of children.[29] I also target the fraction of ever divorced couples by time that elapsed since couples got married. Overall I target 53 empirical moments.

As weighting matrix $\widehat{W}$ I use the diagonal matrix with the inversed variances of the empirical moments as diagonal entries.[30] The MSM parameter estimates are presented in table 5 together with asymptotic standard errors (see, e.g., Newey and McFadden, 1994). For an assessment of the model fit figure 7 contrasts average outcomes computed from model simulations with the respective empirical moments computed from my data. In particular Panel A-C of figure 7 show average work hours, housework hours and wages (computed seperately by marital status, but averaged over number of children). Panel D shows the fraction of ever divorced couples by the time that elapsed, since they first got married. Overall the model matches the considered data moments well, even though the model simulations deviate slightly from the data for married men's wages and work hours (my model slightly underpredicts these moments) and divorced women's housework hours (which are slightly overpredicted by my model). To give the full picture of how well my model fits all 53 targeted empirical moments table D.1 contrasts all targeted empirical moments with their counterparts from model simulations at the estimated parameters. Relative to figure 7, table D.1 also shows how well my model captures heterogeneity in the observed outcomes across couples with different numbers of children. Even though the model is a bit sparse on couples with no kids, the model generally captures heterogeneity by number of children well. E.g., for couples with children the model does a good job at capturing the variation work hours and housework hours across number of children.

[29] As the data from the *Danish Time Use Survey* feature few observations on people with two or more children I compute joint moments for this group, i.e., target average housework hours seperately for three groups: people with no children, people with one child and people with two or more children.

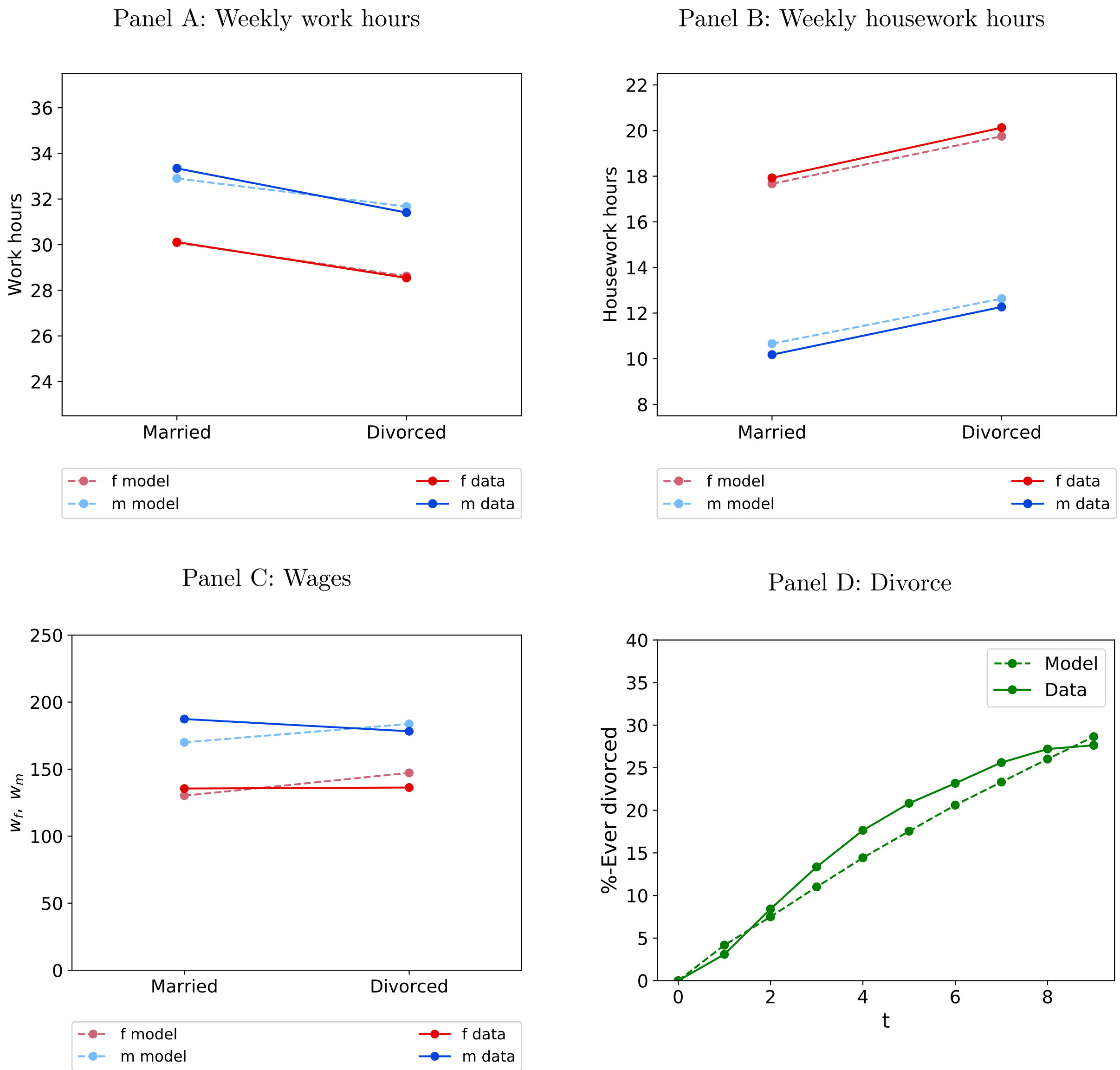
[30] Altonji and Segal (1996) show that using the efficient weighting matrix leads to undesirable finite sample properties.

Table 5: MSM parameter estimates

Parameter	Estimate	Standard error
Leisure preferences		
γ_f	-2.2	0.0112
ψ_f	0.08	0.0032
γ_m	-2.2	0.0140
ψ_m	1.20	0.0027
Home good preferences		
B_f	0.0017	$0.26 \cdot 10^{-3}$
B_m	0.0010	$0.48 \cdot 10^{-3}$
b	0.25	0.0077
κ	-1.19	0.028
Home good production		
a	0.51	0.064
σ	0.15	0.0082
Marriage preferences		
μ_ξ	0.0094	$0.20 \cdot 10^{-3}$
σ_ξ	0.12	0.0093
Wage processes		
ϕ_{0f}	4.05	0.07
ϕ_{1f}	0.4	0.043
α_f	$0.69 \cdot 10^{-4}$	$0.19 \cdot 10^{-4}$
σ_{ϵ_f}	0.22	0.02
δ_f	0.11	0.01
ϕ_{0m}	4.31	$0.08 \cdot 10^{-3}$
ϕ_{1m}	0.42	$0.030 \cdot 10^{-3}$
α_m	$0.72 \cdot 10^{-4}$	$0.16 \cdot 10^{-4}$
σ_{ϵ_m}	0.21	0.06
δ_m	0.14	$0.02 \cdot 10^{-3}$

Notes: Model parameters estimated by MSM and asymptotic standard errors. The estimates are obtained by fitting average work hours, housework hours and wages by marital status and number of children as well as the fraction of ever divorced couples by the time that elapsed since couples got married. For an assessment of the model fit see table D.1.

Figure 7: Model fit, simulated moments and data moments



Notes: The figures display mean data moments (solid lines) and simulated model moments (dotted lines) by marital status and seperately for women/men. Data moments on work hours, housework hours and divorce are computed from Danish register data. Data moments on housework are computed based on the Danish Time Use Survey. Model moments are computed based on simulations for $N = 20,000$ couples. For the fit regarding all 53 data moments see table D.1.

6 Underlying Frictions and First Best Allocation

Before analyzing counterfactual policy scenarios and asking what the welfare maximizing maintenance policy is, it is worthwhile to consider what the frictions in my model are that can potentially be mitigated by maintenance policies. A first friction, which has been studied a lot in the previous literature, is limited commitment (see Mazzocco, 2007; Voena, 2015; Fernández and Wong, 2016;

Lise and Yamada, 2017). Since married spouses cannot commit to staying married, it needs to be ensured that each spouse is better off married than divorced (i.e. participation constraints need to be satisfied) in each time period and in each state. Ensuring that these participation constraints are satisfied is what keeps married spouses from fully insuring each other and introduces scope for re-bargaining, when participation constraints are violated.

The second friction is non-cooperation in divorce. Most studies of divorced couples assume that divorcees make decisions non-cooperatively (see, e.g., Voena, 2015; Fernández and Wong, 2016; Reynoso, 2018), but few have studied the welfare loss that non-cooperation in divorce entails and to what extent this loss can be overcome by policy.[31] Because of non-cooperation in divorce there is no mutual insurance between divorcees, i.e., there is an inefficient lack of insurance against income losses upon divorce. Maintenance payments can help to rectify this lack of insurance. One consequence of lacking insurance against income losses upon divorce are strong incentives for married indidividuals to work and accumulate human capital to self-insure. These individual incentives to supply a lot of labor reduce the possibilities for intra-household specialization, as specialization requires one spouse to work little and mainly engage in home production. By reducing the individual need for self-insurance, maintenance policies may (partially) strengthen the overall incentives for intra-household specialization and thus help married households to realize specialization gains.

6.1 First Best Scenario

This subsection characterizes the first best scenario in which both frictions, limited commitment and non-cooperation in divorce are removed from the model.[32] In this first best version of my model spouses/ex-spouses cooperate under full commitment for the entire time horizon independent of whether they are married or got divorced. Couples thus fully realize gains from mutual insurance and household specialization. The first best scenario is characterized by the following features: 1. within a couple labor income is fully shared between spouses/ex-spouses for the entire time horizon of the model, 2. married as well as divorced couples bargain (at fixed bargaining weights) over labor supply, housework hours and consumption given the couples joint labor income 3. couples get divorced if and only if divorce is pareto efficient. Divorcees do not experience love shocks ξ_s, do not enjoy economies of scale from joint consumption, do not engage

[31] Flinn (2000) analyzes a framework in which divorced couples endogenously choose between cooperation and non-cooperation and studies to what extent child support enforcement can implement cooperation.

[32] My definition of "first best" does not allow for insurance across households, i.e., does not correspond to the complete markets definition of "first best".

in joint home production and the produced home goods are consumed privately.

Formally, the first best allocation is the solution to the following dynamic problem. Denote the vector of choice variables $\iota_t = (c_{ft}, c_{mt}, h_{ft}, h_{mt}, q_{ft}, q_{mt}, \ell_{ft}, \ell_{mt}, A_{t+1}, D_t)$. For divorced couples the first best allocation solves

$$\begin{aligned}
\iota_t^{fb,div} &= \arg\max_{\iota_t} \;\; \mu_{ft}\big(u_f^{div}(c_{ft}, \ell_{ft}, Q_{ft}) + \beta\mathbb{E}_t[V_{ft+1}^{fb,div}]\big) \\
&\quad +(1-\mu_{ft})\big(u_f^{div}(c_{mt}, \ell_{mt}, Q_{mt}) + \beta\mathbb{E}_t[V_{mt+1}^{fb,div}]\big) \\
\text{s.t.} \quad x_{ft}^{div} + x_{mt}^{div} &= w_{ft}h_{ft} + w_{mt}h_{mt} + (1+r)A_t - A_{t+1} \\
Q_{ft} &= F_Q(q_{ft}, 0) \\
Q_{mt} &= F_Q(0, q_{mt}) \\
H_f &= h_f + \ell_f + q_f \\
H_m &= h_m + \ell_m + q_m,
\end{aligned}$$

where the continuation values are defined by

$$V_{st}^{fb,div} = \quad u_s^{div}\big(c_{st}^{fb,div}, \ell_{st}^{fb,div}, Q_{st}^{fb,div}\big) + \beta\mathbb{E}_t[V_{st+1}^{fb,div}]. \tag{8}$$

For married couples the first best allocation solves

$$\begin{aligned}
\iota_t^{fb,mar} &= \arg\max_{c_{ft}^{fb}, c_{mt}^{fb}} \;\; \mu_{ft}\big(u_f^{mar}(c_{ft}, \ell_{ft}, Q_t, \xi_{ft}) + \beta\mathbb{E}_t[V_{ft+1}^{fb}]\big) \\
&\quad +(1-\mu_{ft})\big(u_f^{mar}(c_{mt}, \ell_{mt}, Q_t, \xi_{mt}) + \beta\mathbb{E}_t[V_{mt+1}^{fb}]\big) \\
\text{s.t.} \quad x_t^{mar} &= w_{ft}h_{ft} + w_{mt}h_{mt} + (1+r)A_t - A_{t+1} \\
Q_t &= F_Q(q_{ft}, q_{mt}) \\
H_f &= h_f + \ell_f + q_f \\
H_m &= h_m + \ell_m + q_m
\end{aligned}$$

where the continuation values are defined by

$$\begin{aligned}
V_{st}^{fb} &= \quad (1-D_t)V_{st}^{fb,mar} + D_t V_{st}^{fb,div} \\
V_{st}^{fb,mar} &= \quad u_s^{mar}(c_{st}^{fb,mar}, \ell_{st}^{fb,mar}, Q_t^{fb,mar}, \xi_{st}) + \beta\mathbb{E}_t[V_{st+1}^{fb}]
\end{aligned}$$

and where $D_t = 1$ is an indicator variable that indicates divorce. Finally married couples get divorced if divorce is pareto efficient, i.e., if (and only if)[33]

$$\mu_{ft} V_{ft}^{fb,div} + (1 - \mu_{ft}) V_{mt}^{fb,div} > \mu_{ft} V_{ft}^{fb,mar} + (1 - \mu_{ft}) V_{mt}^{fb,mar}.$$

6.2 Characterization of the First Best Allocation and Underlying Frictions

To characterize the first best scenario, I solve for the first best allocation at the estimated model parameters and draw comparisons to the allocation obtained under the status quo policy (i.e., under $B = 9420, \tau = 0.2$). In order to study the magnitude of each of the underlying frictions I additionally solve and simulate a version of my model in which only non-cooperation in divorce is removed from the model, while the other friction, limited commitment, is leaved in place.[34]

Table 6 presents a range of outcomes for each of the three scenarios. Comparing the table columns from left to right gives an indication of how outcomes change as frictions are removed step by step, first removing the non-cooperation friction and then the limited commitment friction. A comparison of the first best scenario to the status quo, reveals three main differences. First, consumption insurance is a lot higher under the first best scenario than under the status quo policy, reflecting that in the first best scenario ex-spouses fully mutually insure each other. In particular under the status quo women and men consume almost equally in marriage ($c_f^{mar}/c_m^{mar} = 0.98$) but in divorced couples women's consumption is a lot lower relative to men's ($c_f^{div}/c_m^{div} = 0.63$). In the first best scenario in contrast women and men consume equally both in marriage and divorce ($c_f^{mar}/c_m^{mar} = c_f^{div}/c_m^{div} = 1$), meaning women are insured to the extent that they do not experience any drop in consumption relative to their ex-spouse upon divorce.

As a second notable difference the first best allocation exhibits a higher degree of household specialization than the status quo allocation, reflecting that the frictions in the model prevent married couples from specializing efficiently. Compared to the status quo, under the first best scenario married women's housework hours are higher by 2.3% and work hours are lower by 1.3%, while married men's housework hours are lower by 1.9% and work hours are higher by 0.6%. Among divorced couples, in the first best scenario women work more hours in the household (by 15.1%) and less in the labor market (by 10.8%), while divorced men work less in the household (by 23.8%) and supply more work hours (by 12.0%) under first best, relative to the status quo.

Thirdly, the fraction of couples ever getting a divorce in the first best scenario is lower than

[33] It can be shown that under this condition no allocation in marriage or divorce exists that pareto dominates $c_{ft}^{fb,div}, c_{mt}^{fb,div}, h_{ft}^{fb,div}, h_{mt}^{fb,div}$.

[34] For this version of the model the value of divorce is defined by (8) and the value of marriage by (6).

under the status quo. In the first-best scenario divorced couples cooperate and married couples specialize efficiently, meaning that both the value of marriage and the value of divorce are higher than under the status quo policy. It thus depends on the relative magnitude of the changes in the value of marriage and the value of divorce, whether divorce becomes more or less attractive in the first scenario relative to the status quo. At the estimated structural parameters I find that 28.3% of couples ever get divorced, while only 26.8% divorce under the first best scenario.

Considering the allocation, where non-cooperation in divorce is removed from the model (column 2), such that limited commitment is the only friction, shows that the obtained allocation is generally very close to the first best allocation. This suggests that non-cooperation in divorce is the main friction that accounts for differences between the status quo and the first best scenario, while limited commitment plays a smaller role.

TABLE 6: Simulated outcomes: removing frictions from the model

Variable	Status quo	Cooperation in divorce (+ limited commitment)	First best
Hours worked female (married)	30.1	29.7	29.7
Housework hours female (married)	17.7	18.1	18.1
Leisure female (married)	2.2	2.3	2.3
Hours worked male (married)	32.9	33.1	33.1
Housework hours male (married)	10.7	10.5	10.5
Leisure male (married)	6.4	6.4	6.4
Consumption ratio $\left(\frac{c_f}{c_m}, \text{married}\right)$	0.98	0.98	1.00
Hours worked female (divorced)	28.6	25.8	25.5
Housework hours female (divorced)	19.8	22.5	22.8
Leisure female (divorced)	1.6	1.7	1.7
Hours worked male (divorced)	31.7	35.4	35.5
Housework hours male (divorced)	12.6	9.7	9.6
Leisure male (divorced)	5.7	4.9	4.9
Consumption ratio $\left(\frac{c_f}{c_m}, \text{divorced}\right)$	0.62	1.00	1.00
% divorced in T	28.3	27.9	26.8

Notes: Mean outcomes by marital status, computed based on model simulations for $N = 20,000$ couples.

7 Policy Simulations

Given the structural parameter estimates I use the model to explore the effects of policy changes on married and divorced couples' behavior. I use the estimated model to simulate policy scenarios across which child support and alimony payments are varied. The following subsections study how married and divcorced couples' time use, consumption allocation and propensity to divorce adjusts as child support and alimony payments are changed.

7.1 The Impact of Child Support on Time Use and Consumption

This subsection considers policy scenarios in which the level of child support payments is varied. In particular I consider changes in the policy parameter B, which controls child support payments and corresponds to a parameter in the Danish real world institutions. The status quo policy parameters in Denmark are ($B = 9420, \tau = 0.2$). For convenience, I consider the normalized policy parameter $b = B/9420$ in the following. Conditional on the non-custodial parent's income, the number of children, child support payments are homogenous of degree one in b, i.e., as b is multiplied by a factor $\alpha > 0$, mandated child support payments are multiplied by the same factor α. In the considered counterfactual experiments I vary b step-wise from no child support ($b = 0$) to quadrupled child support ($b = 4$) while the alimony policy is kept fixed at $\tau = 0.2$.

Child support and couples' time allocation First, I look at how married couples' time allocation changes as child support is increased. The results in table 7 show that higher child support leads to a slightly higher degree of household specialization among married couples. Married women tend to supply less market work and more housework, while married men supply less housework and more market work. Quantitatively, as child support is increased from $b = 0$ to $b = 4$ housework hours among married women increase by 1.7% while their (market) work hours drop by 1.0% and leisure increases by 4.5%. At the same time married men's average housework hours fall by 1.9% while their work hours increase by 0.6% and leisure decreases by 1.5%.

Table 7: The effect of changing child support (b) on married couples' time use

b	0	1	2	3	4
Hours worked female	30.2	30.1	30.0	29.9	29.9
Housework hours female	17.6	17.7	17.7	17.8	17.8
Leisure female	2.2	2.2	2.3	2.3	2.3
Hours worked male	32.8	32.9	33.0	33.0	33.0
Housework hours male	10.7	10.7	10.6	10.6	10.5
Leisure male	6.5	6.4	6.4	6.4	6.4

Notes: Mean time uses of married couples for different child support policy regimes. Computed based on model simulations for $N = 20,000$ couples.

Table 8 shows the corresponding results for divorcees. Increasing child support, leads to a decrease in work hours of divorced women and, perhaps surprisingly, to an increase in work hours among divorced men. This is suggestive of a large income effect that dominates the substitution effect, which pushes towards lower male labor supply as child support is increased. Quantitatively, switching from $b = 0$ to $b = 4$ leads to a reduction in female work hours by 6.1% and to an increase in male work hours by 4.8%. At the same time female housework hours increase by 9.5% and male housework hours decrease by 0.9%. Average leisure time among divorced women increases by 6.3% while leisure time among divorced men decreases by 5.2%.

Table 8: The effect of changing child support (b) on divorced couples' time use

b	0	1	2	3	4
Hours worked female	29.4	28.6	27.9	27.6	27.6
Housework hours female	19.0	19.8	20.4	20.7	20.8
Leisure female	1.6	1.6	1.7	1.7	1.7
Hours worked male	31.1	31.7	32.1	32.4	32.6
Housework hours male	13.1	12.6	12.3	12.0	11.9
Leisure male	5.8	5.7	5.6	5.5	5.5

Notes: Mean time uses of divorced couples for different child support policy regimes. Computed based on model simulations for $N = 20,000$ couples.

Child support and consumption insurance Next, I study the extent to which child support policies are successful in providing consumption insurance. Table 9 shows couples' relative consumption by marital status, which provides a measure of how well individuals are insured against income losses upon divorce under each policy scenario. If child support payments work well as insurance device, the gap between relative consumption in marriage and divorce should narrow as child support is increased. The results in table 9 show that child support policies indeed provide consumption insurance. Under all considered policy scenarios married couples relative consumption is close to 1, i.e., married men and women consume almost equally, while among divorcees women's consumption is a lot lower than men's. As child support is increased the relative consumption of divorced couples increases from 0.57 in the case of no child support ($b = 0$) to 0.78 in the $b = 4$ scenario. While child support is effective in mitigating the drop in relative consumption, full insurance, i.e., equal relative consumption in marriage and divorce, is not attained upon divorce even for high levels of child support.

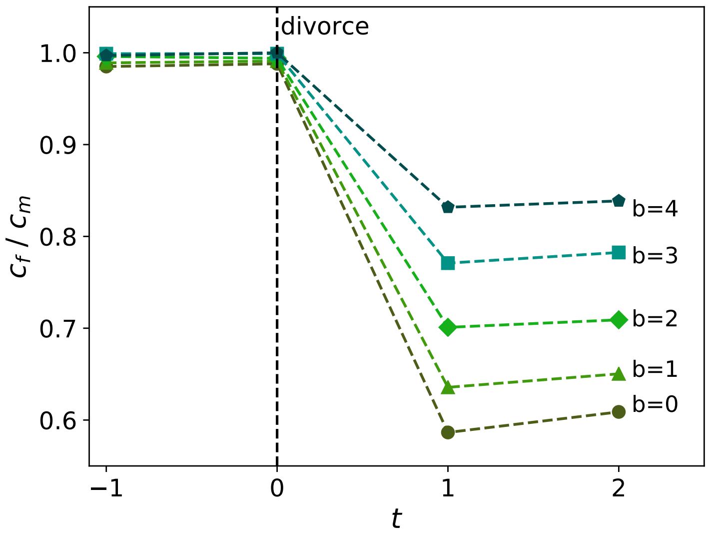
TABLE 9: The effect of changing child support (b) on couples' relative consumption

b	0	1	2	3	4
c_f^{mar}/c_m^{mar}	0.98	0.98	0.99	0.99	1.00
c_f^{div}/c_m^{div}	0.57	0.62	0.67	0.73	0.78

Notes: Mean relative consumption by marital status for different child support policy regimes. Computed based on model simulations for $N = 20,000$ couples.

To address concerns that the patterns shown in table 9 could mainly be driven by differences between couples who do get divorced and couples who do not get divorced, figure 8 presents event study graphs, that show the drop in relative consumption upon divorce (at $t = 0$). This graph only includes individuals who do get divorced. The drop in relative consumption closely corresponds to the differences in relative consumption between married and divorced couples shown in table 9. This shows that differences between couples who do get divorced and couples who do not get divorced are not a main driver of the results shown in table 9.

Figure 8: Event Study: Relative Consumption



Notes: The figure shows average relative consumption of couples around divorce for different alimony policy regimes. Computations are based on simulations for $N = 20,000$ couples. The figure includes couples that get divorced and are observed for 2 time periods before and 2 time periods after getting divorced (a time period corresponds to 3 years).

7.2 The Impact of Alimony on Time Use and Consumption

I now turn to studying policy scenarios in which the level of alimony payments is changed and draw comparisons to the results for child support policies presented in the previous subsection. I consider changes in the policy parameter τ, which controls alimony payments and corresponds to a real world parameter in the Danish institutions. Its status quo value is $\tau = 0.2$, which means that the higher-earning spouse needs to pay one fifth of the difference between the ex-spouses' labor incomes, net of child support payments, to the lower-earning spouse.[35] For a given amount of both ex-spouses incomes and given that the caps on alimony payments are non-binding, alimony payments are homogenous of degree one in τ, i.e., as τ is multplied by a factor $\alpha > 0$, alimony payments are multiplied by the same factor α. I consider counterfactual policy experiments in which I vary τ across $\{0, 0.1, 0.2, 0.3, 0.4\}$, while child support is kept fixed (at $B = 1.2$). Alimony payments are thus increased step-wise from no alimony to doubled alimony, relative to the status quo in Denmark.[36]

[35] If the caps on alimony or on overall maintenance payments are binding, the relationship between τ and the amount of alimony payments is more complicated. See section 2 for details.

[36] More precisely, alimony payments are doubled for divorced couples conditional on both ex-spouses labor incomes and child support payments and given that the caps on alimony payments and on overall maintenance payments are non-binding.

Alimony and couples' time allocation Table 10 shows how changes in alimony payments impact married couples' time allocation. Among married women increasing the alimony policy parameter τ, leads to a decrease in work hours and an increase in housework and leisure. In contrast there is virtually no impact on the time allocation of married men. Quantitatively, switching from $\tau = 0$ to $\tau = 0.4$ leads to a reduction in married women's work hours by 2.1% and an increase in married women's housework hours and leisure time by 3.2% and 1.6%, respectively.

Table 10: The effect of changing alimony (τ) on married couples' time use

τ	0	0.1	0.2	0.3	0.4
Hours worked female	30.3	30.2	30.1	30.0	30.0
Housework hours female	17.5	17.6	17.7	17.8	17.8
Leisure female	2.2	2.2	2.2	2.3	2.3
Hours worked male	32.8	32.9	32.9	33.0	33.0
Housework hours male	10.7	10.7	10.7	10.6	10.6
Leisure male	6.5	6.4	6.4	6.4	6.4

Notes: Mean time uses of married couples for different alimony policy regimes. Computed based on model simulations for $N = 20,000$ couples.

Table 11 shows the corresponding results for divorced couples. In response to a switch from $\tau = 0$ to $\tau = 0.4$ the average work hours of divorced women drop by 36.1%. This is accompanied by both rising average housework hours (by 64%) and rising average leisure time (by 28.6%). For divorced men I find that average work hours fall by 5.9%, while housework hours and leisure time increase by 18.1% and 10.4% respectively among male divorcees.

Interestingly these results show that increasing alimony leads to much starker labor supply disincentives for both divorced women and divorced men than increasing child support. A plausible explanation is that alimony payments depend on the difference of ex-spouses' incomes. As a consequence both alimony payer and receiver can manipulate alimony payments to their advantage by reducing work hours. Child support in contrast only depends on one ex-spouse's (the non-custodial parent's) income, while the child support reciever cannot manipulate child support payments by reducing work hours. Alimony payments thus have both an income and a substitution effect for both spouses, while child support have both effects for the paying spouse, but only an income effect for the child support receiver.

Table 11: The effect of changing alimony (τ) on divorced couples' time use

τ	0	0.1	0.2	0.3	0.4
Hours worked female	31.0	29.9	28.6	27.4	27.3
Housework hours female	17.5	18.6	19.8	20.9	21.0
Leisure female	1.5	1.6	1.6	1.7	1.7
Hours worked male	33.1	32.4	31.7	31.1	30.5
Housework hours male	11.5	12.1	12.6	13.1	13.6
Leisure male	5.4	5.6	5.7	5.8	5.9

Notes: Mean time uses of divorced couples for different alimony policy regimes. Computed based on model simulations for $N = 20,000$ couples.

Alimony and consumption insurance As a measure of how successful alimony payments are in providing consumption insurance table 12 shows couples' relative consumption by marital status for different values of the alimony policy parameter τ. Under all considered scenarios married men and women consume almost equally, while divorced women consume a lot less than divorced men. Increasing alimony payments does not narrow of the gap between divorced women's and men's consumption, but on the contrary, as alimony payments are increased relative consumption among divorcees decreases even further. The reason for the failure of alimony payments to provide consumption insurance, is that alimony payments entail strong labor supply disincentives for divorced women. These disincentives are stronger than those for men (see table 11). Overall the drop in divorced women's labor supply, causes a drop in labor income, which overrides any positive consumption effect of receiving alimony payments.

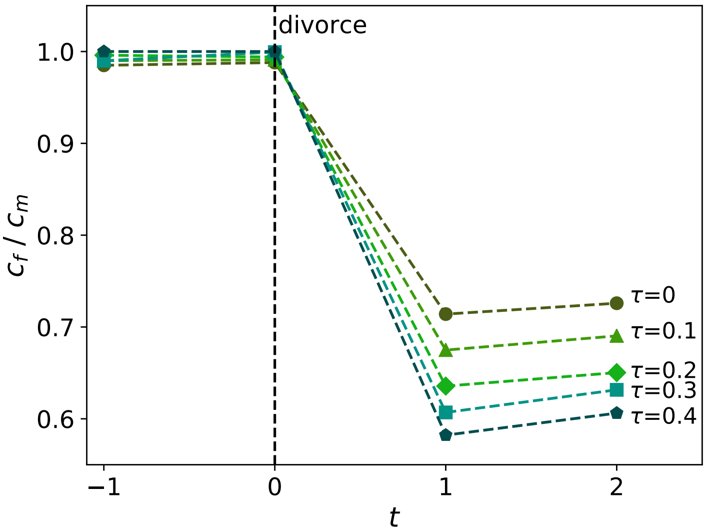
Figure 9 presents event study graphs, that show the drop in relative consumption upon divorce (at $t = 0$). This graph only includes individuals who do get divorced, showing that the results from table 12 are not driven by differences between couples who do get divorced and couples who do not get divorced.

Table 12: The effect of changing alimony (τ) on couples' relative consumption

τ	0	0.1	0.2	0.3	0.4
c_f^{mar}/c_m^{mar}	0.98	0.98	0.98	0.99	0.99
c_f^{div}/c_m^{div}	0.65	0.64	0.62	0.59	0.59

Notes: Mean relative consumption by marital status for different alimony policy regimes. Computed based on model simulations for $N = 20,000$ couples.

Figure 9: Event Study: Relative Consumption



Notes: The figure shows average relative consumption of couples around divorce for different alimony policy regimes. Computations are based on simulations for $N = 20,000$ couples. The figure includes couples that get divorced and are observed for 2 time periods before and 2 time periods after getting divorced (a time period corresponds to 3 years).

7.3 The Impact of Child Support and Alimony on Divorce Rates

In general divorce law changes can be expected to influence divorce rates, although ex-ante the direction of the effect that maintenance payments have on divorce rates is unclear.[37] For the large majority of divorced couples in my sample the ex-wife is receiving maintenance payments and the ex-husband needs to make these payments, i.e., when maintenance payments are increased divorce is becoming more attractive for women and less attractive for men. Whether this leads to

[37] Chiappori et al. (2015) and Clark (2001) show that the Becker-Coase Theorem according to which divorce law changes do not impact divorce rates only holds under restrictive assumptions, if households consume both public and private goods.

a change in divorce rates and in what direction divorce rates change depends among other things on the weight that individuals attach to their financial situation after divorce, when deciding whether to stay with their partner or get divorced. Tables 13 and 14 show the impact of changing child support and alimony respectively (i.e., changing b and τ) on the % of couples who ever get divorced.

Table 13: The effect of changing child support (b) on divorce rates

b	0	1	2	3	4
ever divorced (%)	28.4	28.3	28.1	27.8	27.5

Notes: Divorce rates for different child support policy regimes, computed based on model simulations for $N = 20,000$ couples.

Table 14: The effect of changing alimony (τ) on divorce rates

τ	0	0.1	0.2	0.3	0.4
ever divorced (%)	28.8	28.6	28.3	27.9	27.4

Notes: Divorce rates for different alimony policy regimes, computed based on model simulations for $N = 20,000$ couples.

8 Welfare Analysis

Given the underlying policy trade-off between providing insurance to the lower earner in married couples, enabling married couples to specialize efficiently and maintaining labor supply incentives it is interesting to ask what the “best” maintenance policy is. In this section I draw welfare comparisons between different policy regimes and solve for the welfare maximizing maintenance policy (i.e., the welfare maximizing combination of b and τ). Moreover I compare maintenance policies by how close they bring couples to the first best scenario characterized in section 6.

8.1 Welfare comparisons and optimal policy

To measure the welfare consequences of changes in post-marital maintenance policies I consider the ex-ante well-being of women and men. More precisely, I use the sum of time period 0 expected discounted utilities of women $\mathbb{E}\big[V_{f0}^{mar}\big]$ and men $\mathbb{E}\big[V_{m0}^{mar}\big]$[38] as welfare criterion (i.e., the utilitarian welfare criterion with equal weights)

$$W = \big(\mathbb{E}\big[V_{f0}^{mar}\big] + \mathbb{E}\big[V_{m0}^{mar}\big]\big).$$

I first consider the welfare consequences of ceteris paribus changing child support (varying b) and alimony payments (varying τ), while keeping the other policy fixed at the status quo. The results are displayed in figures 10 and 11. Figure 10 shows that increasing child support by a factor of 2.5 relative to the status quo is welfare maximizing child support policy if alimony is kept fixed at the status quo level. For alimony in contrast a slight reduction (by 12.5%) relative to the status quo is welfare maximizing if child support is kept fixed at the status quo level.

FIGURE 10: Welfare comparisons: changing child support (b)

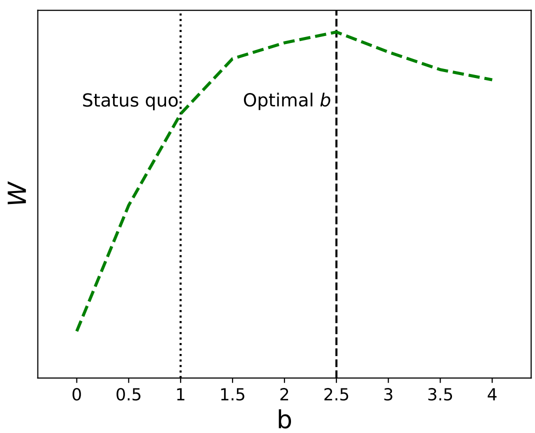
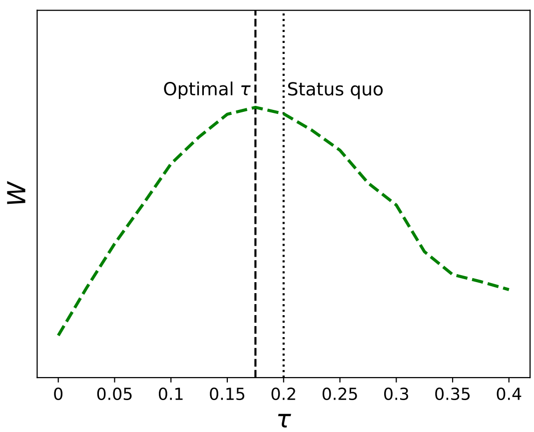


FIGURE 11: Welfare comparisons: changing alimony (τ)



Notes: The figures show the utilitarian welfare criterion (at equal weights) for counterfactual policy scenarios. Figure 12 displays policy scenarios across which child support (b) is changed. Figure 13 displays scenarios across which alimony payments are changed (τ is changed). Each figure is based on model simulations for 20,000 couples.

To find the optimal maintenance policy, I search for the combination of (b, τ) that maximizes W and find that $b = 3$, $\tau = 0.175$ is the welfare maximizing child support/ alimony combination. A welfare maximizing reform would thus be to triple child support and slightly reduce alimony payments.

[38] Note that the variables that expectations are taken over include n_0 the initial number of kids a couple has, i.e., welfare is evaluated for the average couple at the beginning of marriage.

8.2 Comparison to first best

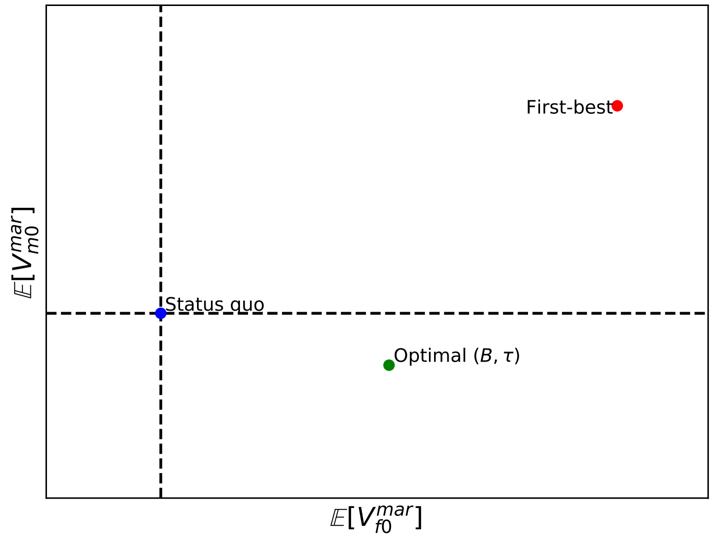
To assess how close the optimal child support/ alimony combination can bring couples to the first best scenario, I compare allocations and couples' welfare under the status quo policy ($b = 1, \tau = 0.2$) to the optimal maintenance policy ($b = 3, \tau = 0.175$) and the first best scenario. Table 15 presents outcomes for each of the three scenarios and figure 12 compares women's and men's ex-ante welfare for each scenario. Comparing the columns of table 15 from left to right shows that all considered outcomes are closer to first best under the optimal maintenance policy than under the status quo, i.e., the optimal maintenance policy induces couples to adjust their behavior towards the first best allocation.

Table 15: Mean outcomes: status quo, optimal maintenance policy and first best

Variable	Status quo	(B^*, τ^*)	First best
Hours worked female (married)	30.1	30.0	29.7
Housework hours female (married)	17.7	17.7	18.1
Leisure female (married)	2.2	2.3	2.3
Hours worked male (married)	32.9	33.0	33.1
Housework hours male (married)	10.7	10.6	10.5
Leisure male (married)	6.4	6.4	6.4
Consumption ratio $\left(\frac{c_f}{c_m}, \text{married}\right)$	0.98	0.99	1.00
Hours worked female (divorced)	28.6	27.9	25.5
Housework hours female (divorced)	19.8	20.4	22.8
Leisure female (divorced)	1.6	1.7	1.7
Hours worked male (divorced)	31.7	32.1	35.5
Housework hours male (divorced)	12.6	12.3	9.6
Leisure male (divorced)	5.7	5.6	4.9
Consumption ratio $\left(\frac{c_f}{c_m}, \text{divorced}\right)$	0.62	0.67	1.00
% divorced in T	28.3	28.0	26.8

Notes : Mean outcomes by marital status for status quo, optimal maintenance policy and first best scenario.Computed based on model simulations for $N = 20,000$ couples.

Figure 12: Welfare comparison: status quo, optimal maintenance policy and first best



Notes: The figure shows the mean expected discounted utility for women and men under the status quo policy, the optimal maintenance policy and the first best scenario. Computed based on model simulations for $N = 20,000$ couples.

Figure 12 shows that the first best allocatio makes both women and men on average better off relative to the status quo, i.e. is a pareto improvement over the status quo (on average). The optimal maintenance policy in contrast makes women better off, while men are worse off than under the status quo. This indicates that there is scope for further improvement beyond the optimal maintenance policy according to my model and that allocations are feasible that make both women and men ex-ante better off.

9 Conclusion

This paper addresses the question how post-marital maintenance payments affects couples' decision-making and how maintenance policies (child support and alimony policies) should be designed. I construct a dynamic economic model and estimate its structural parameters by method of simulated moments estimation, matching a range of empirical moments from rich Danish administrative data and time use data. The data include information on marriage and divorce, child custody, maintenance payments and housework hours. My model incorporates two driving forces that speak in favor of maintenance payments: providing insurance to the lower earner in married couples and enabling married couples to specialize efficiently, as well as a mechanism that speaks against maintenance payments: maintenance payments lower the labor supply incentives of divorcees. The aim of policy is to balance this trade-off.

The model takes into account that divorced ex-spouses are linked by maintenance payments. Divorcees interact non-cooperatively. The strategic interaction that arises because ex-couples are linked through maintenance payments, is fully modelled. Married spouses make decisions cooperatively, subject to limited commitment. Another key model ingredient are "learning-by-doing" returns to work experience, which instill a conflict between individual incentives and what is optimal from the couples perspective. From the individuals perspective it is optimal work a lot to accumulate returns to work experience and thereby self-insure against income losses upon divorce, while from the couples perspective it is optimal to specialize, i.e. to have one spouse work little and focus on housework. Maintenance payments reduce the need for self-insurance and thereby facilitate household specialization. Moreover, maintenance payments impact married spouses' outside options and thereby may affect divorce rates and trigger shifts in intrahousehold bargaining power.

To asses how maintenance policies affect couples' decisions and welfare, I use the estimated model as a policy lab to conduct counterfactual experiments. Based on such experiments I show that the (ex-ante) welfare maximizing policy is characterized by increased (tripled) child support payments and slightly lower alimony payments (12.5% lower), relative to the Danish status quo policy. Increasing child support induces married couples to specialize more, leads to smoother consumption paths around divorce and to a moderate reduction in labor supply among divorced women. Increasing alimony payments in contrast fails to provide insurance: Alimony payments lead to a strong reduction in labor supply among divorced men and women. Because of the strong labor supply reduction, increasing alimony payments leads to larger consumption drops upon divorce (i.e., consumption around divorce becomes less smooth).

To study how close maintenance policies can bring couples to efficiency, I compare the welfare maximizing policy to a first best scenario, in which frictions (limited commitment and non-cooperation in divorce) are removed from the model. The first best-scenario is characterized by full consumption insurance and a higher degree of specialization among married couples, relative to the welfare maximizing policy. In terms of women's and men's ex-ante wellbeing, the first best scenario is a pareto improvement over the welfare maximizing maintenance policy and the status quo policy, indicating that there is scope for improvement in couples well-being beyond what is attained by the welfare maximizing maintenance policy.

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A Maintenance Payments, Details and Functional Forms

In this Appendix I present details on how maintenance payments are computed and the exact functional forms for computing child support and alimony payments. From 1980 to 2013 the policy parameters have been adjusted from year to year by the Danish state administration to account for inflation. Throughout the paper I use the year 2004 values of the Danish maintenance policy parameters and deflate wages (and other money amounts) taking 2004 as base year.[39]

Child support, functional form Child support cs depends on the number of children an ex-couple has and the non-custodial parents labor income. Suppose ex-spouse s is the custodial parent of n_s children. If the non-custodial ex-spouse $\tilde{s}$ earns annual labor income $I_{\tilde{s}}$ then the child support that $\tilde{s}$ needs to pay to s is given by

$$cs(n_s, I_{\tilde{s}}, B) = nB \cdot \left(1 + \sum_{k=0}^{K} a_k \mathbf{1}\{b_k(n) \leq I_{\tilde{s}} < b_{k+1}(n)\}\right) \tag{9}$$

Where the year 2004 values of the parameters that enter into (9) are $B = 9420$ (DKK), $K = 5$ (i.e. child support varies across 6 income brackets across) as well as the values of a_k and $b_k(n)$, which are given in tables A.1 and A.2.

TABLE A.1: Child support parameters 1

a_0	a_1	a_2	a_3	a_4
1	1.25	1.5	2	3

Notes: Source: Danish State Administration (*Statsforvaltning*).

[39] Information on policy parameters for past years was provided by the Danish State Administration (*Statsforvaltning*)

TABLE A.2: Child support parameters 2

n	1	2	3
$b_0(n)$	0	0	0
$b_1(n)$	320	340	370
$b_2(n)$	340	370	410
$b_3(n)$	370	410	460
$b_4(n)$	550	650	750
$b_5(n)$	1000	1250	1400
$b_6(n)$	$+\infty$	$+\infty$	$+\infty$

Notes: Source: Danish State Administration (*Statsforvaltning*).

Alimony, functional form Alimony payments depend on both spouses labor incomes. Denote by l the lower earner and by h the higher earner in terms of annual labor income net of child support payments and by $\tilde{I}_l$, $\tilde{I}_h$ the respective annual labor incomes net of child support. Then the alimony payments that l is entitled to receive from h are given by

$$alim(\tilde{I}_H, \tilde{I}_L) = \begin{cases} \tau \cdot (\tilde{I}_H - \tilde{I}_L) & \text{if } \tilde{I}_L \geq C_1 \text{ and } \tilde{I}_H - C_2 \geq \tau \cdot (\tilde{I}_H - \tilde{I}_L) \text{ and } C_3 - \tilde{I}_L \geq \tau \cdot (\tilde{I}_H - \tilde{I}_L) \\ \tau \cdot (\tilde{I}_H - C_1) & \text{if } \tilde{I}_L < C_1 \text{ and } \tilde{I}_H - C_2 \geq \tau \cdot (\tilde{I}_H - \tilde{I}_L) \text{ and } C_3 - \tilde{I}_L \geq \tau \cdot (\tilde{I}_H - \tilde{I}_L) \\ \max\{\tilde{I}_H - C_2, 0\} & \text{if } \tilde{I}_H - C_2 < \tau \cdot (\tilde{I}_H - \tilde{I}_L) \\ \max\{C_3 - \tilde{I}_L, 0\} & \text{if } C_3 - \tilde{I}_L < \tau \cdot (\tilde{I}_H - \tilde{I}_L) \end{cases} \tag{10}$$

By this functional form it is ensured that, 1. if the receiver's labor income is below C_1, alimony payments are capped by $\tau \cdot (I_s - C_1)$, 2. the maintenance payer's labor earnings net of maintenance payments are at least C_2, 3. the maintenance receiver's labor earnings plus maintenance payments are capped by C_3. The 2004 values for the parameters that enter into (10) are given by $\tau = 0.2$, $C_1 = 90000$, $C_2 = 204000$ and $C_3 = 230000$.

B Computational Details

This appendix provides details on the numerical solution and the structural estimation of the model.

Model solution The model is solved by backwards recursion, i.e. for each time period t the model agents' problem is solved at a grid of points in the state space, taking the continuation values in $t+1$ as given. I first solve the model for divorced couples (i.e., I solve for the values of divorce $V_{ft}^{div}, V_{mt}^{div}$) and then solve the decision problem of married couples, using the values of divorce as input.

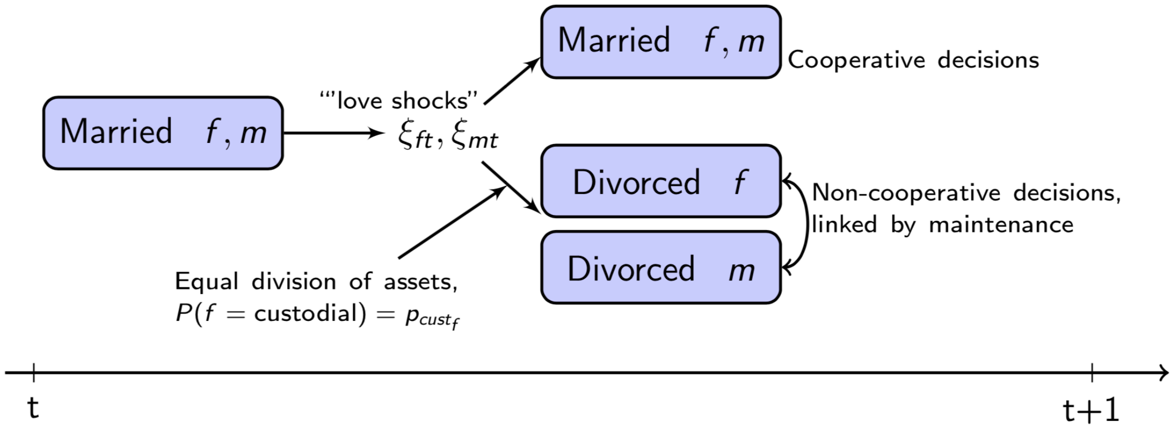
Approximations For the model solution I solve the model for a discrete grid of points in the state space and use numerical approximation techniques to compute continuation values and best response functions of divorcees at points off the discrete grid. In particular I use *linear interpolation* to interpolate between points on the asset grid A_t, A_{ft}, A_{mt} and the relative bargaining weight in married couples μ_{ft}, and *Gauss-Hermite quadrature* (see Judd, 1998) to approximate integrals taken over the distribution of the wage shocks, $\epsilon_{st} \overset{iid}{\sim} \mathcal{N}(0, \sigma_{s\epsilon})$. For the approximation of the random walk according to which the "love shocks" ξ_{ft}, ξ_{mt} evolve I use Rouwenhorst's method for discretizing highly persistent processes (see Kopecky and Suen, 2010 and Fella et al., 2017).

Computation I implement the model solution in *Python*. As the state space is large (129,600 points for divorced couples and 945,000 points for married couples) the model solution is computationally demanding. I parallelize iterations over points the state space across 40 cores on a high performance cluster and use a just in time compiler to achieve further speed improvements. Using this setup one model solution takes between 20 and 25 minutes.

Estimation For the minimization of the MSM criterion function I use *basin-hopping*, a global optimization routine. The *basin-hopping* algorithm uses the *Nelder-Mead* algorithm for finding local minima and upon sucessful completion of the *Nelder-Mead* pertubes the coordinates of the obtained local minimum (stochastically) and reiterates the local minimization procedure several times. Upon completion of several local minimization steps the algorithm selects the smallest of the obtained local minima.

C Timing of Events

Figure C.1: Timing of events for married couples



D Model fit

Table D.1: Model fit, work hours and housework hours

Moment	Children	Model	Data	Std. dev. (data)
Hours worked female (married)	0	31.7	30.4	12.4
	1	30.7	30.3	11.1
	2	29.8	30.4	11.4
	3	28.4	28.3	13.1
Hours worked female (divorced)	0	30.8	28.0	14.5
	1	29.5	28.9	13.5
	2	28.0	29.0	13.5
	3	27.0	25.5	15.2
Hours worked male (married)	0	33.3	31.9	12.1
	1	33.2	33.2	10.5
	2	32.8	33.7	10.6
	3	32.0	33.1	12.1
Hours worked male (divorced)	0	30.1	28.5	14.6
	1	31.4	31.2	12.9
	2	31.8	31.9	12.3
	3	32.8	31.5	13.2
Housework hours female (married)	0	15.8	13.6	1.8
	1	17.0	16.5	1.4
	≥ 2	18.7	19.3	1.8
Housework hours female (divorced)	0	17.5	9.6	3.2
	1	18.9	19.0	6.6
	≥ 2	20.9	21.9	6.6
Housework hours male (married)	0	9.6	10.5	1.1
	1	10.2	10.5	1.2
	≥ 2	11.4	9.9	2.4
Housework hours male (divorced)	0	13.8	8.0	6.9
	1	12.9	11.1	6.9
	≥ 2	12.1	13.5	6.9

Notes: Moments from model simulations for 20,000 couples at the MSM-estimated parameter values and targeted data moments. Data moments are computed from Danish administrative data (on 279,197 couples), with the exception of mean housework hours, which are obtained from the *Danish Time Use Survey* (which includes 2,105 households).

E Tables

Table E.1: Child custody, multinomial probit

Child custody:	$cust_i = 1$	$cust_i = 2$
Number of children (n)	-0.237***	0.702***
	(0.0240)	(0.0200)
Marriage duration (t)	0.041***	0.032***
	(0.0030)	(0.0028)
Constant	-1.861***	-3.024***
	(0.0540)	(0.0509)
Observations	32313	

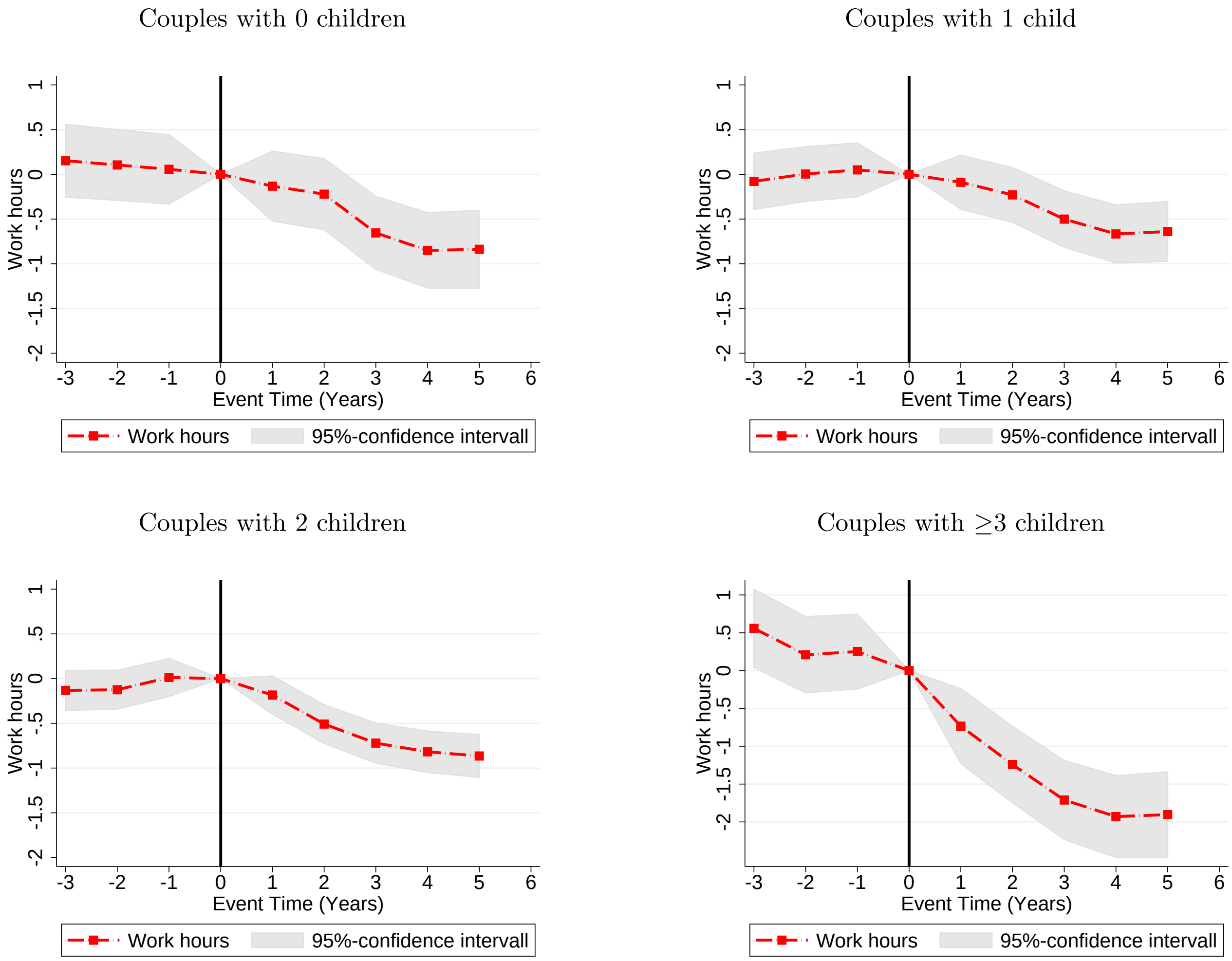
Standard errors in parantheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table E.2: Fertility process, $p_n(t, n_t)$

	$n = 0$	$n = 1$	$n = 2$
$p_n(t = 1, n_1 = n)$	0.25	0.23	0.05
$p_n(t = 2, n_2 = n)$	0.08	0.19	0.04
$p_n(t = 3, n_3 = n)$	0.02	0.06	0.03
$p_n(t = 4, n_4 = n)$	0.01	0.01	0.01
$p_n(t \geq 5, n_5 = n)$	0.00	0.00	0.00

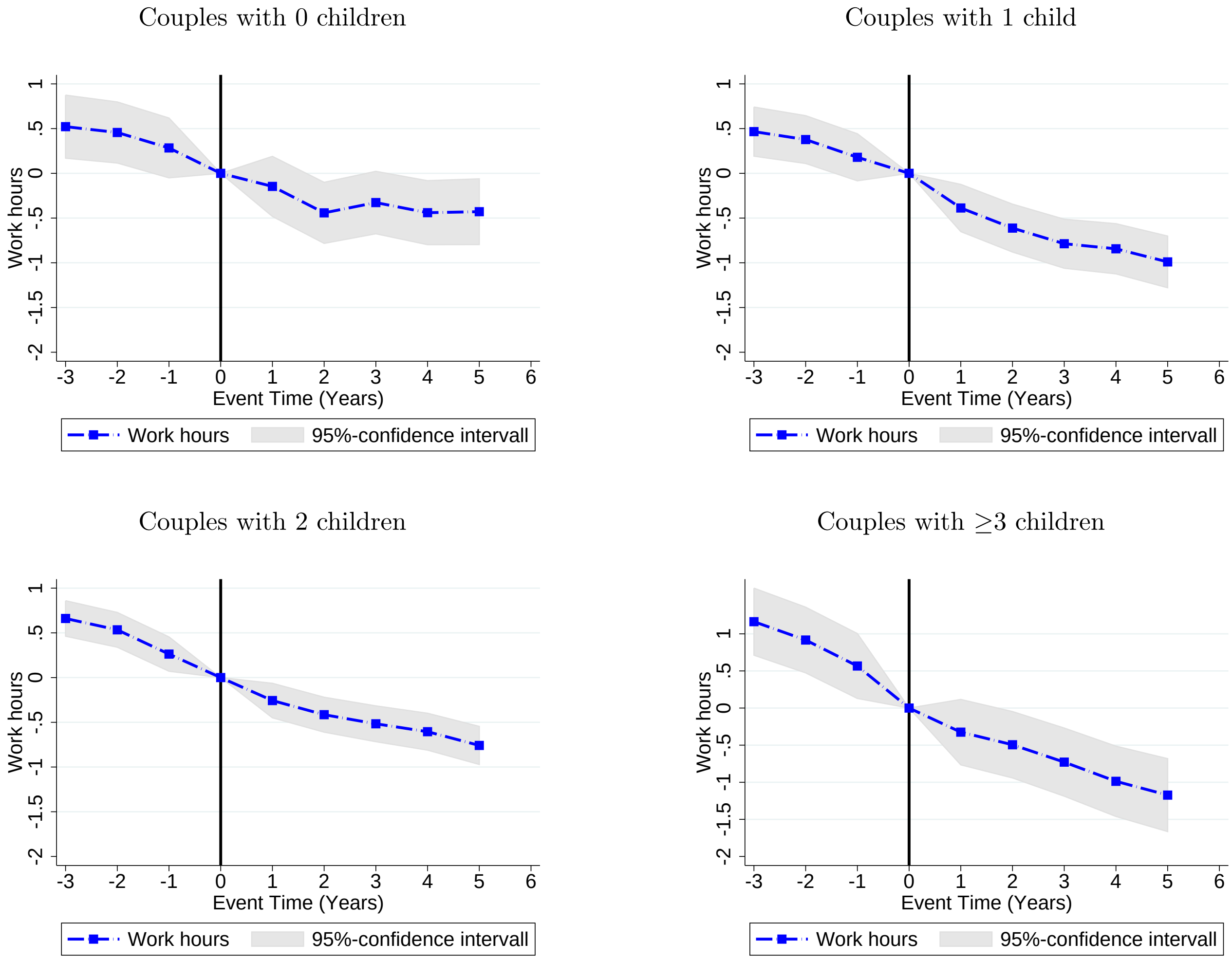
F Figures

Figure F.1: Women's weekly work around divorce, by number of children



Notes: Each figure contains coefficient estimates of 1 for women, seperately by number of children. Included are all women in my sample, that are observed for at least 3 periods prior and 6 periods after getting divorced.

Figure F.2: Men's weekly work around divorce, by number of children



Notes: Each figure contains coefficient estimates of 1 for men, seperately by number of children. Included are all men in my sample, that are observed for at least 3 periods prior and 6 periods after getting divorced.

G Additional Tables

Table G.1: Child custody, probit (extensive specification)

Child:	$\mathrm{cust_i}$
Number of children (n)	-0.0425**
	(0.0181)
Marriage duration (t)	0.0025
	(0.0031)
Earnings f (in DKK 10,000s)	0.0013*
	(0.0007)
Earnings m (in DKK 10,000s)	-0.0005
	(0.0000)
Age youngest child	0.0426***
	(0.0034)
Constant	-1.735***
	(0.0490)
Observations	32313

Standard errors in parantheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table G.2: Child custody, multinomial probit

Child custody:	$cust_i = 1$	$cust_i = 2$
Number of children (n)	-0.237***	0.702***
	(0.0240)	(0.0200)
Marriage duration (t)	0.041***	0.032***
	(0.0030)	(0.0028)
Constant	-1.861***	-3.024***
	(0.0540)	(0.0509)
Observations	32313	

Standard errors in parantheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table G.3: Child custody, multinomial probit (extensive specification)

Child custody:	$cust_i = 1$	$cust_i = 2$
Number of children (n)	-0.125***	0.834***
	(0.0271)	(0.0235)
Marriage duration (t)	0.001	-0.005
	(0.00440)	(0.0040)
Earnings f (in DKK 10,000s)	0.003***	0.006***
	(0.0010)	(0.0009)
Earnings m (in DKK 10,000s)	-0.001**	-0.001
	(0.0006)	(0.0006)
Age youngest child	0.064***	0.0585***
	(0.0048)	(0.0044)
Constant	-2.273***	-3.567***
	(0.0540)	(0.0509)
Observations	32313	

Standard errors in parantheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table G.4: Child custody, multinomial probit (extensive specification)

Child custody:	$cust_i = 1$	$cust_i = 2$
Number of children (n)	-0.125***	0.834***
	(0.0271)	(0.0235)
Marriage duration (t)	0.001	-0.005
	(0.00440)	(0.0040)
Earnings f (in DKK 10,000s)	0.003***	0.006***
	(0.0010)	(0.0009)
Earnings m (in DKK 10,000s)	-0.001**	-0.001
	(0.0006)	(0.0006)
Age youngest child	0.064***	0.0585***
	(0.0048)	(0.0044)
Constant	-2.273***	-3.567***
	(0.0540)	(0.0509)
Observations	32313	

Standard errors in parantheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$