

# Untying the Knot: How Child Support and Alimony Affect Couples' Decisions and Welfare

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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 and survey data. The model captures the policy trade off between providing insurance to the lower earner and enabling couples to specialize efficiently, on the one hand, and maintaining labor supply incentives for divorcees, on the other hand. I use the estimated model to study various counterfactual policy scenarios. I find that alimony payments come with strong labor supply disincentives and as a consequence fail to provide consumption insurance. The welfare maximizing policy involves increasing the lump sum component of child support, increasing the dependence of child support on the payer's income and reducing alimony payments relative to the Danish status quo. Switching to the welfare maximizing policy makes women better and men worse off, but comparisons to first best allocations show that Pareto improvements are feasible, highlighting a limitation of child support and alimony 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 earner in divorcing couples. The U.S. 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). For this reason most societies have divorce laws that mandate post-marital maintenance payments, alimony and child support, to insure the lower earner in couples against losing access to their partner’s income upon divorce.

Over the past decade fierce political debates about reducing post-marital maintenance payments have emerged in several countries, including the U.S., Germany, the U.K. and France. These debates were typically dominated by two economic arguments: Those in favor of reducing maintenance payments emphasized that divorcees who receive high maintenance payments have little incentive to work and become economically self-sufficient. Those in favor of high maintenance payments argued that people who invest less in their careers after getting married, e.g., because they spend time on child-care and housework, should be insured against the drop in financial resources upon divorce. How relevant is each of these arguments quantitatively? And how should maintenance payments be designed to balance both arguments?

In this paper I provide the first study of how maintenance payments should be designed to balance an important policy trade off. In particular, I ask how child support and alimony payments should be designed to provide insurance to the lower earner in couples and enable couples to specialize efficiently, on the one hand, while maintaining labor supply incentives for divorcees, on the other hand. I further take into account that maintenance payments may influence divorce rates as well as women’s and men’s bargaining power in the household.

A number of empirical studies document that alimony and child support payments influence the labor market behavior of married and divorced couples. Several studies find that increasing child support leads to a reduction in divorced fathers’ labor supply (Holzer et al. (2005); Cancian et al. (2013)). There is also evidence that introducing alimony for existing couples leads to a decrease in women’s and an increase in men’s labor supply (Rangel (2006); Chiappori et al. (2016); Goussé and Leturcq (2018)).<sup>1</sup> The empirical evidence strongly suggests that maintenance payments influence couples’ behavior. Nonetheless, to draw conclusions about how maintenance payments affect couples’ welfare, a joint economic framework of couples’ consumption, labor supply and time allocation and (endogenous) divorce is needed.

To examine the consequences of post-marital maintenance payments for couples’ welfare, I develop a dynamic structural model of married and divorced couples’ decision-making. In my model divorced

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<sup>1</sup>Looking at a broader set of outcomes Aizer and McLanahan (2006) find that strengthened child support enforcement leads men to have fewer out of wedlock births, Tannenbaum (2019) finds that stronger child support enforcement leads to fewer marriages after non-marital pregnancies and fewer abortions and Rossin-Slater and Wüst (2018) find that child support increases divorced fathers’ post-separation fertility and reduces father-child co-residence. Rossin-Slater and Wüst (2018) do not find a significant impact of child support on divorced parents’ labor force participation or wages. Considering divorce law changes more generally, empirical studies find effects of introducing unilateral divorce on divorce rates (e.g., Friedberg (1998) and Wolfers (2006)) and labor supply of married and divorced couples (e.g., Gray (1998); Stevenson (2007) and Stevenson (2008)). The magnitude of the effects often depend on the asset division regime, e.g., Voena (2015).

ex-spouses are linked by maintenance payments, which depend on both ex-spouses' labor earnings, their number of children and on who takes child custody.

Decision-making of divorced couples is modeled as non-cooperative (dynamic) game. In deciding about their labor supply, each ex-spouse takes into account how own choices influence her/his ex-spouse's choices and how the stream of maintenance payments is affected. Accounting for the strategic interdependence in ex-spouses' dynamic labor supply decisions, which arises because of maintenance payments, is a novel feature relative to the previous literature.

Married spouses are influenced by maintenance payments as their outside options (their values of divorce) are affected by maintenance payments. In modeling decision-making in marriage I build on the limited commitment framework (see [Kocherlakota \(1996\)](#); [Ligon et al. \(2002\)](#) and [Marcet and Marimon \(2011\)](#)) that has previously been used to model intertemporal household decision-making, e.g., by [Mazzocco \(2007\)](#), [Voena \(2015\)](#), [Fernández and Wong \(2016\)](#) and [Low et al. \(2018\)](#).<sup>2</sup> Married spouses experience "love shocks", which account for non-economic reasons for staying married. If one spouse prefers divorce to staying married (e.g., because of a bad love shock draw) this may lead to a shift in bargaining power from the spouse who prefers staying 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 or lead to divorce. The 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.<sup>3</sup> By this mechanism maintenance payments weaken the individual incentives to supply labor and thus increase the possibilities for intra-household specialization according to comparative advantage.<sup>4</sup> Maintenance payments thus facilitate efficient household specialization, while lowering maintenance payments promotes two-earner households.

The model is estimated using rich longitudinal data from Danish administrative records together with data from the Danish Time Use survey (DTUS). Besides marital histories, labor supply wages and assets, the administrative data include information on the amount post-marital maintenance payments between ex-spouses, the number of (biological) children a couple has together, the children's age and who the children stay with, if a couple divorces. I complement these data with information on housework hours and individual consumption from the DTUS. First, I use the data to verify that maintenance payments in Denmark are well enforced, i.e., that non-compliance is low and that on average observed maintenance payments correspond to what is specified by Danish divorce law. Second, I conduct event study regressions to document the evolution of work hours, wages and assets around divorce. Using simple accounting identities together with structural assumptions on household decision-making further allows me to impute individual consumption and document the evolution of women's and men's consumption levels around divorce. Third, I use the data

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<sup>2</sup>See [Chiappori and Mazzocco \(2017\)](#) for a detailed description of limited commitment framework applied to household decision-making.

<sup>3</sup>See [Doepke and Tertilt \(2016\)](#) for an analysis of the impact of divorce risk on savings.

<sup>4</sup>[Lafortune and Low \(2017\)](#) and [Lafortune and Low \(2019\)](#) explore a similar mechanism by which post-divorce asset division fosters household specialization.

to estimate the parameters of my structural model. In the estimation I target average labor supply, wages and housework conditional on marital status and number of children, the evolution of the divorce hazard over the life-cycle as well as event-study coefficients that capture the evolution of work hours and wages around divorce. The model further replicates the (untargeted) evolution of relative consumption around divorce.

To assess how maintenance payments affect couples' decisions and welfare, I use the estimated model as a policy lab to conduct counterfactual experiments. I approximate the Danish maintenance schedule in a lower dimensional policy space in which each policy parameter controls one aspect of child support or alimony payments. In the policy space I study a child support policy is given by a lump sum component, dependence of child support on the non-custodial parent's income, dependence on the divorced parents' income gap and curvature in the ex-couple's number of children. Alimony policies are given by the dependence of alimony on the income difference between higher and lower earning ex-spouse.

I first compare how different policy changes influence labor supply and consumption. I find that most policy changes that increase child support (raising the lump sum component, increasing the dependence on the payer's income or reducing the concavity in number of children) lead to smoother consumption paths around divorce and to a moderate reduction in labor supply among divorced women. By contrast, increasing alimony payments or strengthening the dependence of child support on divorced parents' income difference, leads to strong reductions in labor supply among divorced men and women. As a consequence these policy changes do not reduce but amplify the consumption drop experienced by women upon divorce. The underlying mechanism is that these policies strengthen strategic motives, by which men lower their work hours (thereby lowering child support and alimony) to incentivize their ex-wives to work more. I thus find that some maintenance policies work as intended, while others fail to provide consumption insurance, i.e., do not have the effect that is intended by policymakers.

Second, within the considered policy space I search for the policy maximizing ex-ante utilitarian welfare. I find that the welfare maximizing policy reform would be to 1. increase the lump sum amount of child support by 44% 2. strengthen the dependence of child support on the non-custodial parent's income by 18% 3. leave the dependence of child support on the income gap between custodial and non-custodial parent at close to zero 4. make child support slightly convex in the number of children (rather than concave) and 5. reduce the dependence of alimony on the income gap between higher and lower earner by 20%. Implementing this policy change would increase child support payments by 56%, reduce alimony payments by 13.5% and increase overall maintenance payments by 28%.

Third, 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 allocation is characterized by full consumption insurance and a higher degree of specialization among married couples, relative to the status quo and the welfare maximizing policy. In terms of women's and men's ex-ante wellbeing, I find that the first

best allocation is a Pareto improvement relative to the status quo, while under the welfare maximizing maintenance policy women fare better, while men fare worse than under the status quo.

The contribution of this paper is threefold. First, I develop and estimate a model that incorporates a novel trade off that is relevant for studying maintenance policies. In my model maintenance payments provide insurance to the lower earner in couples and facilitate efficient intra-household specialization, but distort divorcees' labor supply incentives. This paper provides the first study of how maintenance payments should be designed in light of this trade off. I thereby add to a small literature that studies alimony and child support payments using economic models (see, e.g., [Weiss and Willis \(1985\)](#); [Weiss and Willis \(1993\)](#); [Del Boca and Flinn \(1995\)](#); [Flinn \(2000\)](#); [Del Boca and Ribero \(2001\)](#); [Chiappori and Weiss \(2007\)](#)).<sup>5</sup> Previous studies in this literature have used static models of divorced couples' decision-making to study, e.g., how compliance with maintenance policies ([Del Boca and Flinn \(1995\)](#)) and cooperation between ex-spouses ([Flinn \(2000\)](#)) can be encouraged by policymakers. Considering maintenance payments in a dynamic environment allows me to study how married couples, who face a risk of divorcing later in life, are affected by child support and alimony policies. It further allows me to analyze how alimony and child support interact with channels by which married spouses can self-insure, like human capital accumulation and savings.

Second, my research contributes to a literature that estimates dynamic economic models to study the impact of divorce law changes on household decisions and welfare. A large part of this literature is focused on studying switches from mutual-consent to unilateral divorce and asset division upon divorce (e.g., [Chiappori et al. \(2002\)](#); [Voena \(2015\)](#); [Bayot and Voena \(2015\)](#); [Fernández and Wong \(2016\)](#) and [Reynoso \(2018\)](#)).<sup>6</sup> Less attention has been paid to policies like child support and alimony payments, that make spouses financially interdependent beyond divorce. A notable exception is a study by [Brown et al. \(2015\)](#), who study the impact of child support on child investments and fertility. My paper adds to this literature by examining child support and alimony payments in a framework that fully accounts for the strategic interdependence that such policies induce between ex-spouses' labor supply and savings decisions. Accounting for the strategic link between ex-spouses and by considering both extensive and intensive margin adjustments of women's and men's labor supply allows me to give a complete account of the labor supply disincentives incurred by maintenance policies.<sup>7</sup>

As a third contribution, this paper examines a first best scenario that serves as benchmark of what can be attained by maintenance policies (and divorce law changes more generally). I identify two key frictions that maintenance policies can help mitigate. The first friction is limited commitment, i.e., the inability of married couples to make binding promises about future allocations. The second friction is a missing market for binding agreements beyond divorce, reflected by non-cooperative decision-making in divorce. Removing

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<sup>5</sup> For an overview of this literature see [Del Boca \(2003\)](#).

<sup>6</sup> See [Abraham and Lacro \(2015\)](#) for a theoretical analysis of optimal asset division upon divorce.

<sup>7</sup> Previous studies in the literature focus exclusively on the extensive margin of female labor supply and take it as given that men always work full time.

both these frictions yields the first best scenario. Limited commitment has received a lot of attention in the previous literature (see [Mazzocco \(2007\)](#); [Voena \(2015\)](#); [Fernández and Wong \(2016\)](#); [Lise and Yamada \(2018\)](#)). Non-cooperation in divorce features in most models of divorcees decision-making, but few have studied the welfare loss that non-cooperation in divorce entails and to what extent this loss can be overcome by policy.<sup>8</sup> Using a decomposition I show that non-cooperation in divorce plays a larger role than the limited commitment friction. By providing this analysis I extend the work of previous studies that have examined welfare consequences of divorce law changes (e.g., [Brown et al. \(2015\)](#); [Voena \(2015\)](#); [Fernández and Wong \(2016\)](#)). Contrasting the welfare maximizing maintenance policy to the first best allocation, allows me to study in what respects the welfare maximizing maintenance policy falls short relative to the first best allocation. In particular, I find that the first best scenario is a Pareto improvement over the welfare maximizing maintenance policy, indicating that there is scope for improvements in couples' welfare beyond what is attained by the welfare maximizing maintenance policy.

The remainder of this paper is organized as follows. The following section describes the institutional background. Section 3 describes the data and presents empirical evidence from event-studies. Section 4 develops my model and Section 5 describes the estimation. In Section 6 I discuss the key frictions in my model and characterize the first best scenario. Section 7 shows results from policy simulations. In Section 8 I draw welfare comparisons, solve for the welfare maximizing policy and contrast it with the first best allocation. Section 9 concludes.

## 2 Institutional Background

In most OECD countries divorce law formulates rules which determine the amount of maintenance payments which needs to be made between divorced ex-spouses. These rules typically formulate how maintenance payments are to be computed based on both ex-spouses' labor incomes, the ex-couple's number of children and the childrens' age.<sup>9</sup> 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.<sup>10</sup> I use Denmark as an example to study the impact of maintenance payments for three interrelated reasons: First, in Denmark rigid rules are applied to determine the amount of maintenance payments from ex-spouse's labor incomes, and number of children<sup>11</sup>, second, maintenance payments are strongly enforced by the Danish government and third, Danish administrative records that contain information on maintenance payments allow me to study the extent to which the institutional rules are reflected in actual payments. Danish divorce law distinguishes between child support

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<sup>8</sup>A notable exception is [Flinn \(2000\)](#), who analyzes a framework in which divorced couples endogenously choose between cooperation and non-cooperation and studies to what extent policymakers can encourage cooperation between ex-spouses.

<sup>9</sup>See [de Vaus et al. \(2017\)](#) and [Skinner et al. \(2007\)](#) for comparisons of maintenance payments in the OECD.

<sup>10</sup>Low compliance rates were found, e.g., for the US (see [Weiss and Willis \(1985\)](#), [Del Boca and Flinn \(1995\)](#) and [Case et al. \(2003\)](#)).

<sup>11</sup>See [Skinner et al. \(2007\)](#) for an overview of which countries apply rigid rules versus broad guidelines.

FIGURE 1: Child support rules

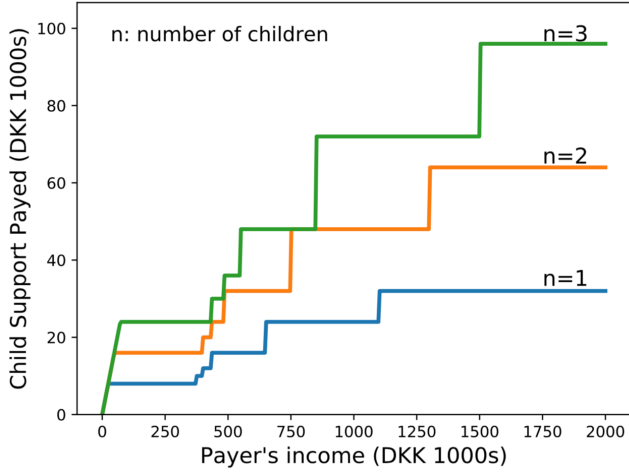
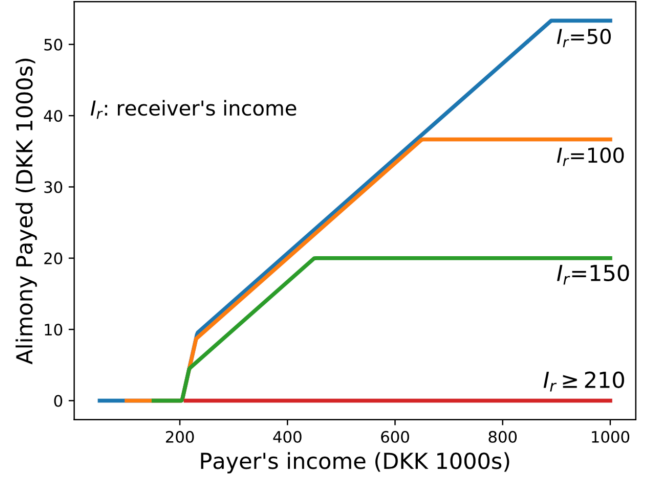


FIGURE 2: Alimony rules



*Notes:* These figures show the 2004 rules for child support and alimony, respectively.

and alimony payments (as is the case in most countries). Child support and alimony depend on different economic variables and are computed differently, but are not earmarked for specific purposes, i.e., child support payments do not need to be used for expenses related to children.

In the following I describe the rules that are used to determine the size and duration of child support and alimony payments in Denmark.<sup>12</sup>

## 2.1 Child Support

Child support is to be paid 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 before taxes 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 gross labor earnings  $I_{\tilde{s}}$ . Then the non-custodial parent  $\tilde{s}$  is mandated to make monthly child support payments

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

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 gross 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 be made as long as the child is under the age of 18.

<sup>12</sup>Qualitatively the following descriptions apply to a wide range of countries. All functional forms and quantities inserted for policy parameters are specific to Denmark.

## 2.2 Alimony

Alimony payments are to be paid from the higher earning to the lower earning ex-spouse within a divorced couple. These payments are mandated independently of whether the divorced couple 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 before taxes, i.e.,  $I_s > I_{\tilde{s}}$ . As a simple rule of thumb alimony payments equal a fraction  $\tau$  of the monthly labor income difference, i.e.,

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

For a wide range of incomes this rule of thumb exactly determines maintenance payments, but there are exceptions taking the form of caps that ensure that the maintenance receiver does not end up receiving too much and that the payer is not left with too little. For a description of these caps and the formal functional form of alimony payments,  $\text{alim}(I_s, I_{\tilde{s}}, \tau)$ , including 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 before taxes. 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

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

In the estimation of my dynamic model I account for post-marital maintenance payments by adding the exact amounts of maintenance payments,  $M_f$  and  $M_m$ , that are to be paid/received according to the Danish divorce law to the budget constraint of the ex-wife and ex-husband. For conducting counterfactual policy experiments I approximate the Danish institutional setting in a lower dimensional policy space each policy parameter has a clear connection to one aspect of child support or alimony payments. <sup>13</sup>

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<sup>13</sup>This policy space and the approximation are described in detail in Section 7.



### 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  $\geq 38$ ).<sup>14</sup> Moreover I observe each individual's marital history (starting from 1980) and number of children as recorded in the Danish birth register.<sup>15</sup> 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.<sup>16</sup> 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.<sup>17</sup> The final sample includes 322,732 couples (645,464 individuals) and 4,312,826 couple-year observations. Table 1 presents summary statistics for the final sample.

TABLE 1: Summary statistics, Danish register data

Variable	Mean	Std. Dev.
Age	38.65	7.60
Employed female	0.91	0.29
Employed male	0.95	0.22
Weekly hours worked female (cond. on working)	33.70	7.69
Weekly hours worked male (cond. on working)	34.24	8.42
Annual earnings female (DKK 1000s)	230	151
Annual earnings male (DKK 1000s)	317	233
No. of children (cond. on married)	1.48	1.00
% divorced after 15 years	23.58	42.45
% divorced after 25 years	27.16	44.48

*Notes:* Summary statistics from Danish register data. Pooled sample of 4,312,826 couple-year observations.

For the estimation of the structural model I further make use of information on housework hours and relative consumption in couples. These data are obtained from the *Danish Time Use Survey*, which was

<sup>14</sup>See Lund and Vejlin (2015) for a detailed description of the measurement of hours worked in Danish register data.

<sup>15</sup>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).

<sup>16</sup>Maintenance payments are recorded by tax authorities. The data source is the maintenance payer's tax declaration.

<sup>17</sup>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.

conducted in 2001 among a 2,105 households representative sample of the Danish population.<sup>18</sup> Table 2 presents summary statistics computed by re-weighting 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.

TABLE 2: Summary statistics, Danish time use survey

Variable	Mean	Std. dev.
<i>Couples with children</i>		
Housework hours female (married/cohabiting)	18.82	9.93
Housework hours female (divorced/single)	19.92	8.94
Housework hours male (married/cohabiting)	10.83	8.08
Housework hours male (divorced/single)	12.48	7.62
<i>Couples without children</i>		
Housework hours female (married/cohabiting)	18.82	9.93
Housework hours female (divorced/single)	19.92	8.94
Housework hours male (married/cohabiting)	10.83	8.08
Housework hours male (divorced/single)	12.48	7.62
<i>Full sample</i>		
Male consumption/ female consumption (married/cohabiting)	0.92	0.33

*Notes:* Summary statistics from the Danish Time Use survey 2001. Cross-section of 2,105 households. The data are re-weighted 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 on U.S. data generally found low compliance with maintenance policies data and was therefore mainly focused 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)).<sup>19</sup> 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.<sup>20</sup>

To explore to what extent maintenance payments correspond to the institutional rules on the intensive margin I impute annual 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

<sup>18</sup>For a detailed description of the data see Browning and Gørtz (2012).

<sup>19</sup>For a survey of these studies see Del Boca (2003).

<sup>20</sup>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 (2018))

maintenance payments recorded in the administrative data.

Regarding the extensive margin I compute the fraction of divorcees who are mandated to pay maintenance but are observed to make zero payments in the first three years after divorce, which is at 5% in my data.<sup>21</sup>

FIGURE 3: Maintenance payments, data and imputations

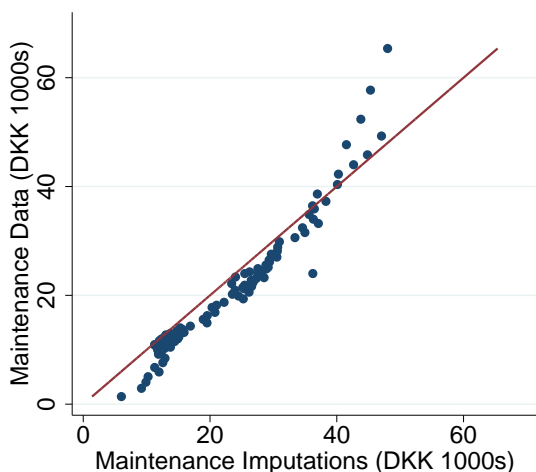


FIGURE 4: Maintenance payments by payer's labor income, data and imputations

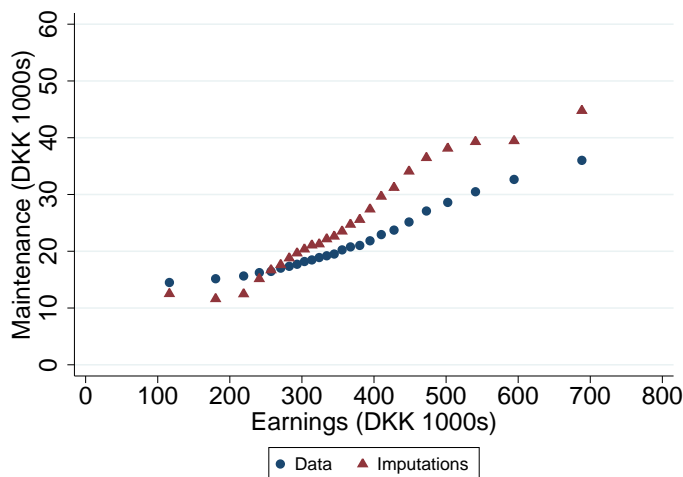
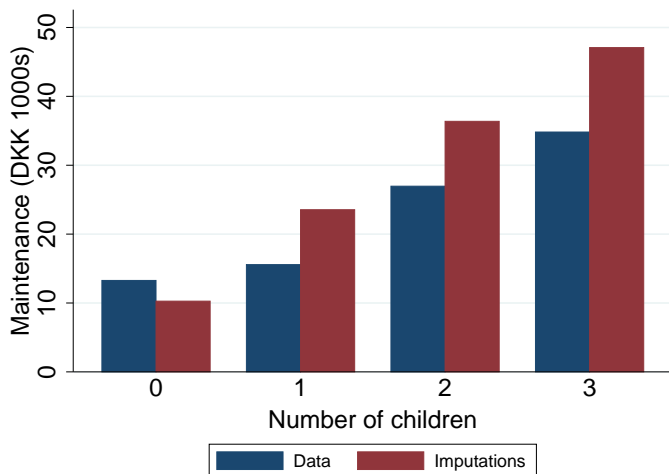


FIGURE 5: Maintenance payments by no. children, data and imputations



*Notes:* The figures are based on the population of divorced couples in my sample. Figure 3 and 4 display binned scatter-plots, where each dot corresponds to a percentile of the underlying distribution.

Regarding the intensive margin Figures 3 - 5 illustrate how well the imputations match the observed data for divorced couples with positive observed maintenance payments. 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

<sup>21</sup>The number of divorcees mandated to pay maintenance, but observed to make zero payments in the first year after divorce is substantially higher at 17%, i.e., 12% of divorcees do not start to comply right away, but come around within the first three years.

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 institutional rules about maintenance payments are reflected in the actual payments, although the precise amounts deviate to some extent.

### **3.2 Evidence from Event Studies: Work Hours, Wages, Assets and Consumption around Divorce**

This subsection presents empirical evidence on the magnitude by which work hours, wages, assets and consumption are adjusted around divorce. A subset of the empirical patterns documented in this section are used as estimation targets in the structural estimation.

I use data on labor force status, work hours, wages and assets from Danish administrative records. Consumption is imputed from labor incomes (wages times work hours), maintenance payments and changes in asset holdings, using additional information from other data sources on equivalence scales, taxes and the intrahousehold allocation of consumption. The empirical results of this section show that women as well as men tend to reduce work hours around divorce, while there is little change in wages. Women dissave more compared to men in the first 6 years after divorce. Nevertheless women’s imputed consumption drops substantially while male consumption rises. Consumption inequality between divorcing spouses surges.

I conduct event study regressions that exploit variation in the timing of divorce to separate changes that are associated with divorce from age and time trends.<sup>22</sup> The event studies are estimated on a balanced panel of divorcing spouses who are observed continuously for at least two years before and six years after divorce. My base sample includes 42,290 divorcing couples, who satisfy these criteria.

The measure of work hours I use corresponds to weekly work hours and distinguishes between 5 work hours bins 1-9, 10-19, 20-29, 30-37 and full time ( $\geq 38$  hours). I code work hours to equal 0 in case of non-participation, 38 in case of full-time and, if work hours fall into one of the bins, equal to the mid-point of the respective bin. I control for age as well as calendar year fixed effects, following the specification used in [Kleven et al. \(2019\)](#).

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<sup>22</sup>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.

**Wages, Work Hours and Assets** Denote by  $y_{it}$  the outcome variable of interest for individual  $i$  at age  $t$ . I run the following regression separately for women and men for work hours and wages as outcomes

$$y_{it} = a_t + b_{c(i,t)} + \sum_{k=-2}^6 \beta_k \cdot d_{it-k} + \nu_{it}, \quad (1)$$

where  $d_{it}$  is a dummy variable that indicates whether individual  $i$  gets divorced at age  $t$ .  $a_t$  are age fixed effects  $b_{c(i,t)}$  are calendar time fixed effects, where  $c(i,t) \in \{1980, 1981, \dots, 2013\}$  denotes the calendar year in which  $i$  is of age  $t$ . I normalize the coefficient estimates  $\hat{\beta}_k$  by adding the average of the considered outcome at divorce  $\widehat{E}[y_{it}|d_{it} = 1]$ . Panel A and B in Figure 6 plot the normalized coefficient estimates  $\hat{\beta}_k + \widehat{E}[y_{it}|d_{it} = 1]$  for work hours and wages, separately for women and men. For assets I run three separate regressions, one for married couples over the last two years prior to divorce and one each regressions for divorced women and men over the first six years post divorce. In these regressions I exclude couples with assets above the 98th or below the 2nd percentile. The normalized coefficient estimates are presented in panel C of Figure 6. The estimates show that men and women tend to reduce their work hours over the first 6 years after divorce by, 2.5% and 2.9% respectively. Wages, by contrast, remain relatively flat, but are slightly increasing for women and slightly declining for men. The estimation results on assets show that women own slightly more assets than men in the first three years after divorce, but dissave faster than men and, 6 years after divorce, on average own close to zero assets.

**Consumption** Using data on labor incomes, changes in asset positions and maintenance payments further allows me to impute household consumption expenditures, using simple accounting identities. Denote by  $D_{it}$  a dummy variable that indicates if  $i$  is divorced at age  $t$ . Then the consumption expenditures of individual  $i$ 's household,  $E_{it}$ , are imputed by

$$E_{it} = \begin{cases} w_{it}^{net} h_{it} + \tilde{w}_{it}^{net} \tilde{h}_{it} + A_{it} - (1+r)^{-1} A_{it+1}, & \text{if } D_{it} = 0, \\ w_{it}^{net} h_{it} + M_{it} + A_{it} - (1+r)^{-1} A_{it+1}, & \text{if } D_{it} = 1, \end{cases}$$

where  $r$  is the per annum interest rate,  $w_{it}^{net}$  is  $i$ 's after tax wage  $h_{it}$  are  $i$ 's work hours,  $\tilde{w}_{it}^{net}$ ,  $\tilde{h}_{it}$  are the after tax wage and work hours of  $i$ 's spouse, and  $A_{it}$  are household level assets.  $M_{it}$  are maintenance payments (positive if received and negative if paid by  $i$ ). As an approximation of the Danish tax schedule I set  $w_{it}^{net} = (1 - \nu)w_{it}$  and set the linear tax rate to equal  $\nu = 0.47$ , following [Trabandt and Uhlig \(2011\)](#).<sup>23</sup>

To arrive at individual consumption, I invoke equivalence scales to account for expenditures for children and economies of scale in the household. I assume the followig expenditure functions for married and

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<sup>23</sup>[Trabandt and Uhlig \(2011\)](#) provide a linear approximation of the Danish tax schedule based on national product and income accounts data.

divorced households

$$E_{it} = \begin{cases} e(n_{it})(c_{it}^\rho + \tilde{c}_{it}^\rho)^{\frac{1}{\rho}} & \text{if } D_{it} = 0, \\ e(n_{it})c_{it} & \text{if } D_{it} = 1, \end{cases}$$

where  $n_{it}$  is the number of children living in  $i$ 's household and the McClements scale  $e$  determines expenditures for children as fraction of their parents' consumption,  $c_{it}$  denotes  $i$ 's consumption and  $\tilde{c}_{it}$  denotes  $i$ 's spouse's consumption at age  $t$ .<sup>24</sup> For  $\rho > 1$  this specification admits for economies of scale in married households, I set  $\rho = 1.403$ , which is an intermediate value for the magnitude of economies of scale estimated in previous studies (see Voena (2015)). Imputing the individual consumption levels of married couples furthermore requires to fix a value for the ratio of male consumption divided by female consumption. I fix this ratio to equal the average value of male consumption divided by female consumption observed in the DTUS data,  $z = 0.92$ . Denote by  $s = s(i) \in \{f, m\}$  the gender of individual  $i$  ( $f$  for female,  $m$  for male). Individual consumption is imputed by

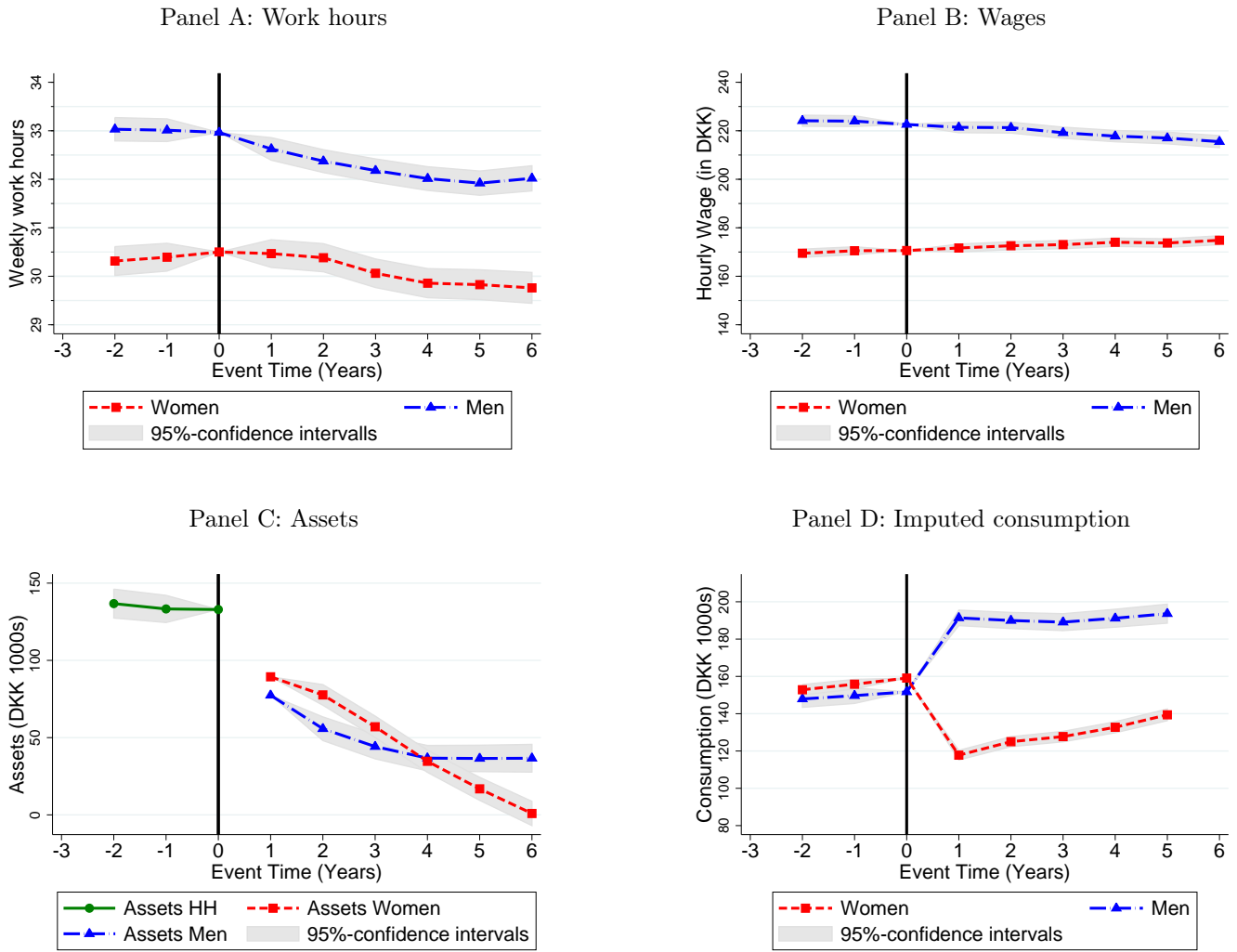
$$c_{it} = \begin{cases} (1 + z^\rho)^{-\frac{1}{\rho}} e(n_{it})^{-1} E_{it} & \text{if } D_{it} = 0, s(i) = f, \\ (1 + z^{-\rho})^{-\frac{1}{\rho}} e(n_{it})^{-1} E_{it} & \text{if } D_{it} = 0, s(i) = m, \\ e(n_{it})^{-1} E_{it} & \text{if } D_{it} = 1. \end{cases}$$

For part of my sample these imputations yield negative consumption or unrealistically high consumption values. I therefore drop couples with negative consumption or consumption abot the 95th or below the 5th percentile. I use these imputations to estimate specification (10), separately for women and men, with  $c_{it}$  as outcome variable. Panel D of Figure 6 presents the normalized coefficient estimates, showing that women's consumption drops by 25% and recovers to 12.5% below pre-divorce level over the subsequent 5 years. Male consumption by contrast rises by 13% and remains at that level. Figure 7 shows that the mean gender consumption gap (the average of female divided by male consumption) drops from 1.09 to 0.74 and only slowly recovers to 0.83. Upon divorce gender inequality between divorcing spouses surges.

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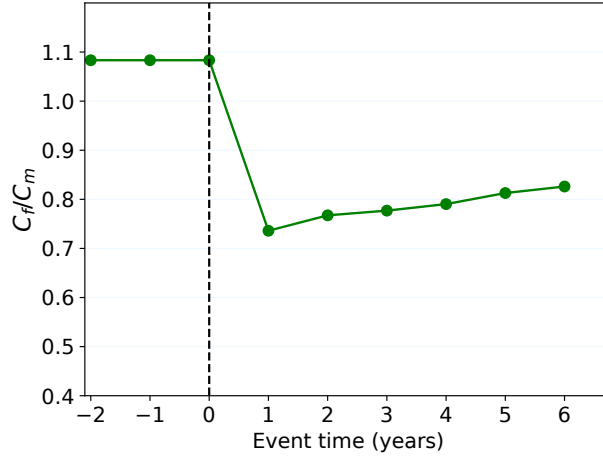
<sup>24</sup>I set  $e(0) = 1$ ,  $e(1) = 1.23$ ,  $e(2) = 1.46$  and  $e(n) = 1.69$  for  $n > 3$ . To be consistent with my structural model in which couples are restricted to have at most three children, I treat households with more than three children (less than 5% of my sample) as if they had exactly three children.

FIGURE 6: Event studies around divorce



*Notes:* The figures display the evolution of work hours, wages, assets and (imputed) consumption around divorced. Displayed patterns are normalized coefficient estimates from event study regressions. The event study regressions are run separately for women and men and include age and calendar year fixed effects and are based on a balanced panel of 42,290 divorcing couples, who are observed for at least two years prior and six years post divorce.

FIGURE 7: Relative consumption around divorce



*Notes:* The figure displays mean relative consumption around divorce computed from imputations of consumption based on the Danish administrative data and the DTUS. The imputations for consumption are obtained as described in section 3.

## 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  $t \in \{1, 2, \dots, T\}$  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 heterogeneous 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 exogenous probability  $p(t, n_t)$ , which is a function of  $t$  and  $n_t$ , the number of children already present in the household.

25

As household formation is taken as given the model 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

<sup>25</sup>Not modeling 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. (2017) for dynamic structural model of career choices and fertility and Doepke and Kindermann (2019) for a household bargaining model with endogenous fertility.



post-marital maintenance payments.

## Preferences

Model agents  $s \in \{f, m\}$  derive utility from private consumption  $c_{st}$ , from a household good  $Q_t$  and from leisure time  $\ell_{st}$ .<sup>26</sup> The household good represents a couple's childrens' well-being as well as goods and services produced within the household, like home made meals and cleaning up.  $Q_t$  is produced from time inputs  $q_{ft}, q_{mt}$  and is a public good within married couples, but becomes private when a couple divorces (i.e., in divorce there are separate household goods,  $Q_{ft}$  and  $Q_{mt}$ ).

Intra-period 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 intra-period utility function of married spouses  $s \in \{f, m\}$  is given by

$$u_s^{mar}(c_{st}, \ell_{st}, Q_t, \xi_{st}) = \frac{c_{st}^{1+\eta_s}}{1+\eta_s} + \psi_s \frac{\ell_{st}^{1+\gamma_s}}{1+\gamma_s} + \lambda(n_t) \frac{Q_t^{1+\kappa}}{1+\kappa} + \xi_{st},$$

where  $n_t$  denotes the number of children in the household and  $\lambda(n_t) = B \cdot (1 + b \cdot n_t)$ , i.e., the relevance of the household good for utility depends on the number of children present in the household. In order to account for persistence in the taste for marriage  $\xi_{st}$  is assumed to follow a random walk with shocks correlated across  $s$ . Specifying  $\xi_{st}$  to be individual specific rather than specific to the couple, allows for greater flexibility in marital status dynamics.<sup>27</sup>

The intra-period utility function of divorced ex-spouses is given by

$$u_s^{div}(c_{st}, h_{st}, Q_{st}) = \frac{c_{st}^{1+\eta_s}}{1+\eta_s} + \psi_s \frac{\ell_{st}^{1+\gamma_s}}{1+\gamma_s} + \lambda(n_{st}) \frac{Q_{st}^{1+\kappa}}{1+\kappa},$$

where the  $s$  subscript on  $Q_{st}$  accounts for the fact that the household good  $Q$  is not public within divorced couples and  $n_{st}$  denotes the number of children living with spouse  $s$  after divorce.

## Home Production

Each spouse  $s \in \{f, m\}$  has a time budget  $H_s$ , which in each time period is allocated between work, home production and leisure time, i.e.,  $H_s = h_{st} + q_{st} + \ell_{st}$ . The technology by which the household good  $Q_t$  is produced takes female and male home production time  $q_{ft}, q_{mt}$  as inputs and has a constant elasticity of substitution form

$$Q_t = F_Q(q_{ft}, q_{mt}) = (aq_{ft}^\sigma + (1-a)q_{mt}^\sigma)^{\frac{1}{\sigma}},$$

where  $\sigma$  controls the degree of substitutability between  $q_{ft}$  and  $q_{mt}$  and the factor  $a \in [0, 1]$  captures

<sup>26</sup>Time subscripts are suppressed for convenience.

<sup>27</sup>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.

productivity differences between the male and the female time input. The parameters  $\sigma$  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 separate household good, i.e., during marriage  $Q_t = F_Q(q_{ft}, q_{mt})$  and in divorce  $Q_{ft} = F_Q(q_{ft}, 0)$  and  $Q_{mt} = F_Q(q_{mt}, 0)$ .

## 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))

$$F_x(c_{ft}, c_{mt}, n_t) = e(n_t)(c_{ft}^\rho + c_{mt}^\rho)^{\frac{1}{\rho}}.$$

For  $\rho \geq 1$  and given expenditures  $x_t = F_x(c_{ft}, c_{mt}, n_t)$  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.  $e(n_t) \geq 1$  is an equivalence scale that accounts for expenditures for children, where  $e(0) = 1$  and  $e(n_t)$  is strictly increasing in  $n_t$ . A married couple with  $n_t$  children and private consumption levels  $c_{ft}, c_{mt}$  hence has expenditures  $x_t^{mar} = F_x(c_{ft}, c_{mt}, n_t)$ . The individual expenditures of divorcees  $f, m$  with consumption levels  $c_{ft}, c_{mt}$  are  $x_{ft}^{div} = F_x(c_{ft}, 0, n_{ft})$  and  $x_{mt}^{div} = F_x(0, c_{mt}, n_{mt})$ , meaning there are no economies of scale in divorced households 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  $\epsilon_{st}$

$$\ln(w_{st}) = \phi_{0s} + \phi_{1s}K_{st} + \epsilon_{st},$$

$$\epsilon_{st} \stackrel{iid}{\sim} \mathcal{N}(0, \sigma_{\epsilon_s}).$$

Human capital  $K_{st}$  is discrete with values  $\{0, 1, 2, \dots, K_{\max}\}$  and is accumulated through learning by doing.

<sup>28</sup> 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. As functional form for  $p_K$  I impose  $p_K(h_{st}) = 1 - \exp(-\alpha_s h_{st})$ , where  $\alpha_s$  controls how responsive the human capital process is to work hours. At the same time  $K_{st}$  constantly depreciates with (exogenous) probability  $p_{\delta_s}$ . This leads to the

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<sup>28</sup>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  $K_{\max} = 4$ .

following law of motion for human capital:

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

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.<sup>29</sup> 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  $A_{st+1}$ , subject to the budget constraint

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

where  $r$  denotes the risk free interest rate, maintenance payments are denoted by  $M_{ft} = -M_{mt} = M_f(n_{ft}, n_{mt}, w_{ft}h_{ft}, w_{mt}h_{mt})$ , and  $\nu$  is the marginal tax rate. Received maintenance payments are taxed and paid maintenance is tax deductible, hence  $\nu$  is multiplied with the sum of labor income and maintenance payments. Note that  $f$ 's work hours decision 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  $\Xi_t$  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

<sup>29</sup>Flinn (2000) analyzes a framework in which the interaction mode between divorcees is endogenous.

(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.<sup>30</sup>,<sup>31</sup>

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  $\iota_{mt}$  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<sup>32</sup>

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

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

$$\begin{aligned} \iota_{mt}^* &= \arg \max_{\iota_{mt}} u_m^{div}(c_{mt}, \ell_{mt}, Q_{mt}) + \beta \mathbb{E}_t[V_{mt+1}^{div}(\tilde{\Omega}_{t+1}^{div})] \\ \text{s.t. } x_{mt}^{div} &= (1 - \nu)(w_{mt}h_{mt} + \Xi_t M_m(n_{ft}, n_{mt}, w_{ft}\tilde{h}_{ft}, w_{mt}h_{mt})) + (1 + r)A_{mt} - A_{mt+1} \\ Q_{mt} &= F_Q(0, q_{mt}) \\ H_m &= h_{mt} + q_{mt} + \ell_{mt}, \end{aligned} \quad (4)$$

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

$$V_{st}^{div}(\Omega_t^{div}) = u_s^{div}(c_{st}^*, \ell_{st}^*, Q_{st}^*) + \beta \mathbb{E}_t[V_{st+1}^{div}(\Omega_{t+1}^{div})] \quad (5)$$

where  $c_{st}^*, h_{st}^*, Q_{st}^*$  denote the respective components of  $\iota_{st}^*$  and  $\Omega_{t+1}^{div}$  is the vector of state variables given optimal period  $t$  choices of  $f$  and  $m$ . Given the period  $T$  value of divorce  $V_{sT}^{div}$  (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  $V_{st}^{div}$  for every period  $t \in \{1, \dots, T - 1\}$  for  $s \in \{f, m\}$ .

<sup>30</sup>(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.

<sup>31</sup>Changing the timing of the game such that  $f$  moves first tends to produce unrealistically low levels of male labor supply.

<sup>32</sup> $f$ '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 suppress the functional dependence in my notation.

## 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  $\Omega_t^{mar} = (\mu_t, A_t, n_t, K_{ft}, K_{mt}, \epsilon_{ft}, \epsilon_{mt}, \xi_{ft}, \xi_{mt})$  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 relative bargaining power  $\mu_t$  the couple solves the constrained maximization problem

$$\begin{aligned}
 \iota_t^* &= \arg \max_{\iota_t} \mu_t [u_f^{mar}(c_{ft}, \ell_{ft}, Q_t, \xi_{ft}) + \beta \mathbb{E}_t[V_{ft+1}]] \\
 &\quad + u_m^{mar}(c_{mt}, \ell_{mt}, Q_t, \xi_{mt}) + \beta \mathbb{E}_t[V_{mt+1}] \\
 \text{s.t. } x_t^{mar} &= (1 - \nu)(w_{ft}h_{ft} + w_{mt}h_{mt}) + (1 + r)A_t - A_{t+1} \\
 Q_t &= F_Q(q_{ft}, q_{mt}) \\
 H_f &= h_{ft} + q_{ft} + \ell_{ft} \\
 H_m &= h_{mt} + q_{mt} + \ell_{mt}
 \end{aligned} \tag{6}$$

and the value of marriage for spouse  $s$  is

$$V_{st}^{mar}(\Omega_t^{mar}) = u_s(c_{st}^*, \ell_{st}^*, Q_t^*, \xi_{st}) + \beta \mathbb{E}_t[V_{st+1}], \quad (7)$$

where  $c_{st}^*, q_{st}^*, \ell_{st}^*$  are the respective components of  $\iota^*$  and  $Q_t^*$  is the quantity of the home good that is produced at  $q_{ft}^*, q_{mt}^*$  and  $\nu$  is the tax rate.<sup>33</sup>

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  $\mu_t$  both spouses participation constraints are satisfied, i.e.,

$$V_{st}^{mar}(\Omega_t^{mar}) \geq V_{st}^{div}(\Omega_t^{div}) \quad \text{for } s \in \{f, m\}, \quad (8)$$

then it is individually rational for both spouses to stay married. In this case the couple stays married and makes decisions according to (6). If however the participation constraint (8) 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  $\mu_t$  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 intra-household 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 and external data sources. Next, several model parameters are estimated directly from the Danish register 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

<sup>33</sup>Taxation in Denmark is based on individual filing for married couples, but certain deductions can be transferred between spouses (see, e.g., [Kleven and Schultz \(2014\)](#)). For simplicity I abstract from these deductions and treat taxation as fully individual based.

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 and Directly Estimated 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 a model time period to correspond to three years to keep the computational complexity manageable and in line with previous studies (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 they first get married and who live for 12 years as retirees after their working life ends. For both spouses,  $f$  and  $m$  the domain of weekly work hours is restricted to four values: non-participation (0 hours) three levels of part-time work (10, 25 and 34 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
Annual discount factor:	0.98	Attanasio et al. (2008)
Risk aversion ( $\eta$ ):	-1.5	Attanasio et al. (2008)
Annual interest rate:	0.02	-
Economies of scale ( $\rho$ ):	1.4023	implied by McClements scale (see Voena (2015))
Number of time periods ( $T$ ):	10	-
Duration of retirement ( $TR$ ):	4 time periods	-
Weekly work hours domain:	{0, 10, 25, 34, 38}	-
Tax rate:	0.46	Trabandt and Uhlig (2011)

*Notes:* Displayed are all model parameters that are pre-set. 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 one model time period, which is three years.

Another subgroup of parameters is directly estimated from Danish Register data and the DTUS without resorting to the structural model. These parameters and their estimated values are summarized in Table 4. For details on the procedures by which these parameters are estimated see Appendix D.

TABLE 4: Directly estimated parameters

Parameter	Value	Data source
Initial relative bargaining power, $\mu_0$ :	1.13	DTUS
$P(\text{custodial} = f)$ :	0.86	Danish register data
Prob. of non-compliance, $P(\Xi_t = 0 \text{ for all } t)$ :	0.05	Danish register data
Prob. maintenance discontinued, $P(\Xi_{t+1} = 0   \Xi_t = 1)$ :	0.12	Danish register data
Initial distribution of children, $p_{n_1}(n)$ :	see Appendix D	Danish birth register
Fertility process, $p_n(n_t, t)$ :	see Appendix D	Danish birth register

*Notes:* Reported are model parameters that are estimated directly without making use of the structural model, along with the estimated values, and the data source used for estimation. See Appendix D for details on the procedure by which each parameter is estimated and the values for the fertility parameters.

## 5.2 Method of Simulated Moments Estimation

The remaining model parameters that are estimated using the method of simulated moments are the parameters governing preferences for leisure  $\gamma_s$ ,  $\psi_s$  and preferences for the home good  $B_f$ ,  $B_m$ ,  $b$ ,  $\kappa$ , the parameters governing home production  $a$ ,  $\sigma$ , the love shock parameters  $\mu_\xi$ ,  $\sigma_\xi$  and the parameters governing the wage processes  $\phi_{0s}$ ,  $\phi_{1s}$ ,  $\sigma_{\epsilon_s}$ ,  $\alpha_s$ ,  $p_{\delta_s}$  for  $s \in \{f, m\}$ . I denote the vector of structural model parameters estimated by MSM by  $\theta$ . For a given  $\theta$  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  $\hat{\theta}$  are obtained by minimizing the distance between simulated model moments and their empirical counterparts  $\hat{m}$

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

The empirical moments I target are conditional averages of weekly work hours, housework hours and wages, where I condition on marital status (married/ divorced) and number of children.<sup>34</sup> I also target the fraction of ever divorced couples by time that elapsed since couples got married. As a third set of moments I target event study coefficient estimates from event studies discussed in Section 3 that capture the evolution of male and female work hours and wages around divorce. Overall I target 89 empirical moments. As weighting matrix  $\widehat{W}$  I use the diagonal matrix with the inversed variances of the empirical moments as diagonal entries.<sup>35</sup> The MSM parameter estimates are presented in Table 5 together with asymptotic standard errors (see, e.g., Newey and McFadden (1994)).

<sup>34</sup>As the data from the DTUS feature few observations on people with two or more children I compute joint moments for this group, i.e., target average housework hours separately for three groups: people with no children, people with one child and people with two or more children.

<sup>35</sup>Altonji and Segal (1996) show that using the efficient weighting matrix leads to undesirable finite sample properties.



### 5.3 Model Fit

For an assessment of the model fit Figure 9 contrasts average outcomes computed from model simulations with the respective empirical moments computed from my data. In particular Panel A of Figure 9 shows average work hours and housework hours (conditional on marital status, but averaged over number of children), Panel B displays shows the fraction of ever divorced couples by the time that elapsed since marriage and Panel C and D display the coefficient estimates from event studies conducted on the observed data and on simulated data from my model, respectively. <sup>36</sup>

Overall the model matches the considered empirical moments very well, although the model somewhat over-predicts the initial drop in women's work hours after divorce and slightly underpredicts male wages before divorce. To give the full picture of how well my model fits all the targeted empirical moments conditional on number of children Table E.1 contrasts work hours and housework hours with their counterparts from model simulations at the estimated parameters. Relative to Figure 9, Table E.1 additionally shows how well my model captures heterogeneity in the observed outcomes across couples with different numbers of children. The estimated model fits many of the targeted conditional moments closely, but is a bit sparse on work hours and housework hours of divorced women and men without children (the model underpredicts their leisure). The model has a hard time generating  $\cap$ -shaped patterns of work hours in number of children, and thus provides a less convincing fit for some groups, e.g., married women with no children or three children tend to work shorter hours than married women with one or two children.

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<sup>36</sup>Note that since one model period equals three years, the model only generates variation at this frequency.

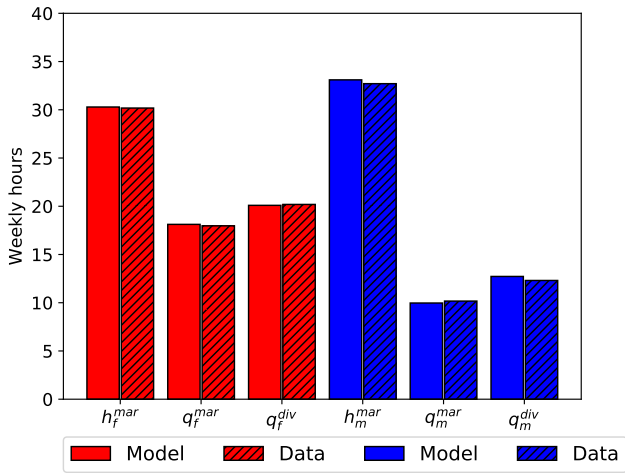
TABLE 5: MSM parameter estimates

Parameter	Estimate	Standard error
Leisure preferences		
$\gamma_f$	-2.7	0.0249
$\psi_f$	0.37	0.0101
$\gamma_m$	-2.5	0.0125
$\psi_m$	6.98	0.0031
Home good preferences		
$B_f$	0.0090	$0.15 \cdot 10^{-3}$
$B_m$	0.0056	$0.48 \cdot 10^{-3}$
$b$	0.25	0.0077
$\kappa$	-1.45	0.023
Home good production		
$a$	0.53	0.057
$\sigma$	0.28	0.0046
Marriage preferences		
$\mu_\xi$	0.0094	$0.22 \cdot 10^{-3}$
$\sigma_\xi$	0.16	0.0061
Wage processes		
$\phi_{0f}$	4.44	0.077
$\phi_{1f}$	0.40	0.036
$\alpha_f$	$0.87 \cdot 10^{-4}$	$0.29 \cdot 10^{-4}$
$\sigma_{\epsilon_f}$	0.26	0.01
$\delta_f$	0.17	0.02
$\phi_{0m}$	4.69	0.11
$\phi_{1m}$	0.40	0.028
$\alpha_m$	$0.71 \cdot 10^{-4}$	$0.46 \cdot 10^{-4}$
$\sigma_{\epsilon_m}$	0.22	0.01
$\delta_m$	0.21	$0.02 \cdot 10^{-3}$

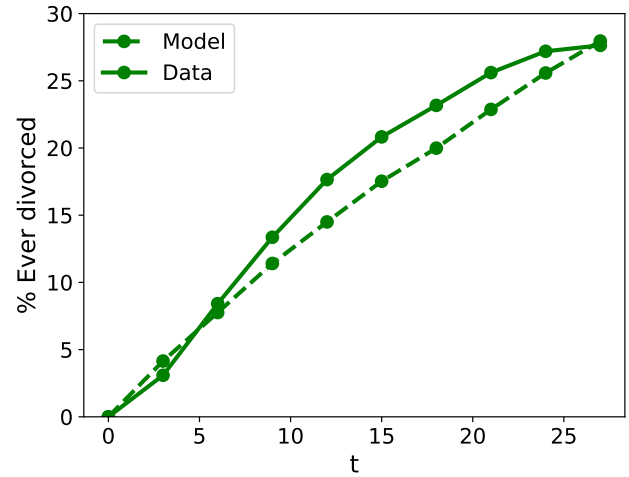
*Notes:* Displayed are model parameters estimated by MSM and asymptotic standard errors. The estimates are obtained by fitting average work hours, housework hours and wages conditional on marital status and number of children, as well as the fraction of ever divorced couples conditional over time elapsed since getting married.

FIGURE 8: Model fit

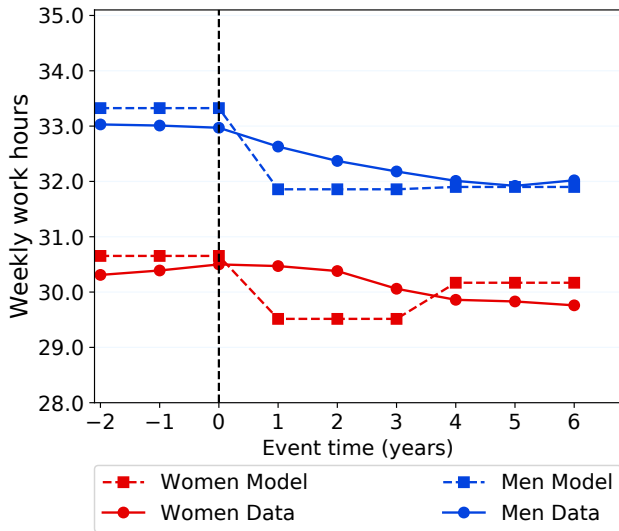
Panel A: Weekly work and housework hours



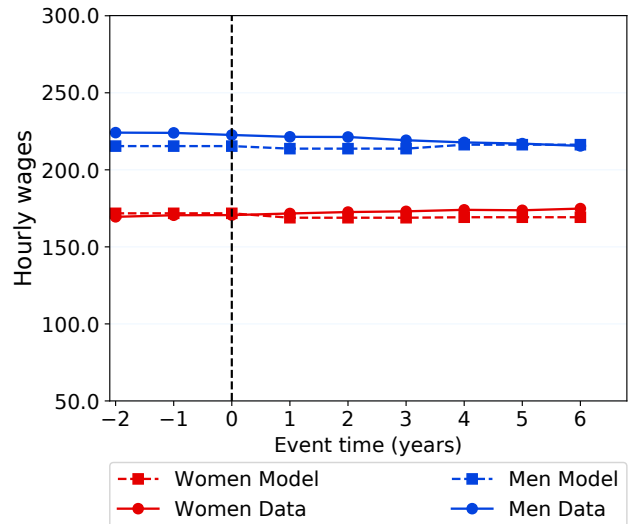
Panel B: % ever divorced



Panel C: Work hours around divorce

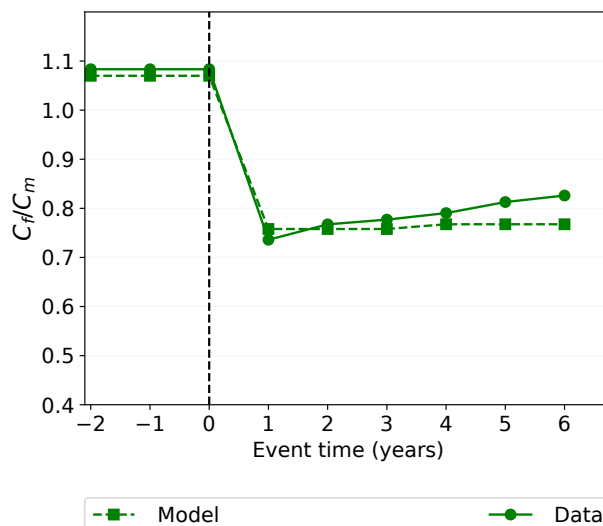


Panel D: Wages around divorce



*Notes:* The figures display mean data moments and simulated model moments separately for women/men. Panel A displays mean work hours of married men and women and housework hours of married and divorced women and men. Data moments on housework are computed based on the DTUS. Panel B displays the evolution of ever divorced couples as a fraction of the total population over time (elapsed since first marriage). Panel C and D present coefficients estimated from event studies around divorce for wages and work hours. Note that one model period equals three years, i.e., the model only generates variation at this frequency.

FIGURE 9: Untargeted moments: relative consumption around divorce



*Notes:* The figure displays mean relative consumption around divorce computed from imputations of consumption based on the Danish administrative data and the DTUS contrasted with relative consumption from model simulations at the estimated parameters. The imputations for consumption are obtained as described in Section 3.

## 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 \(2018\)](#)). 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.

A second friction is non-cooperation in divorce. Many 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.<sup>37</sup> 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. Another consequence of non-cooperation in divorce are strong incentives for married individuals to work and accumulate human capital to self-insure. These individual incentives to supply 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

<sup>37</sup>[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.

specialization and thus help married households to realize specialization gains.

## 6.1 Definition of First Best

This subsection characterizes a first best scenario in which both frictions, limited commitment and non-cooperation in divorce are removed from the model.<sup>38</sup> In the first best scenario 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 I consider yields an ex-ante Pareto-efficient allocation and is characterized by the following features: 1. within couples income risk is fully shared between spouses/ex-spouses for the entire time horizon of the model, 2. married as well as divorced couples bargain at equal 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  $\xi_{st}$ , do not enjoy economies of scale from joint consumption, do not engage in joint home production and the produced home goods are consumed privately.

Formally, the first best allocation solves a dynamic problem in which married as well as divorced couples make pareto-efficient decisions, subject to a fixed Pareto-weight,  $\mu$ . 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

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

where the continuation values are defined by

$$V_{st}^{fb,div} = u_s^{div}(c_{st}^{fb,div}, \ell_{st}^{fb,div}, Q_{st}^{fb,div}) + \beta \mathbb{E}_t[V_{st+1}^{fb,div}]. \quad (9)$$

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<sup>38</sup>This definition of “first best” does not allow for insurance across households, i.e., does not correspond to the complete markets definition of “first best”.

For married couples the first best allocation solves

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

where the continuation values are defined by

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

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) <sup>39</sup>

$$\mu V_{ft}^{fb,div} + V_{mt}^{fb,div} > \mu V_{ft}^{fb,mar} + V_{mt}^{fb,mar}.$$

## 6.2 Characterization of the First Best Allocation

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. 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 left in place. <sup>40</sup> For both these hypothetical scenarios I fix relative bargaining power at its estimated initial value,  $\mu = \mu_0 = 1.13$ . <sup>41</sup>

Table 6 presents a range of average 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

<sup>39</sup>It can be shown that under this condition no allocation in marriage or divorce exists that Pareto dominates  $c_{ft}^{fb,div}, c_{mt}^{fb,div}, h_{ft}^{fb,div}, h_{mt}^{fb,div}$ .

<sup>40</sup>I.e., for this version of the model the value of divorce is defined by (9) and the value of marriage by (7).

<sup>41</sup>Letting married and divorced couples bargain at fixed bargaining weights defines a class of first best (i.e., ex-ante Pareto-efficient) allocations, dependent on the Pareto-weight  $\mu$ . Recall that the initial relative bargaining weight is estimated at  $\mu_0 = 1.13$ , see section 5. Hence the first best allocation under  $\mu = \mu_0 = 1.13$  is a reasonable benchmark for policy.

scenario ex-spouses fully mutually insure each other. In particular under the status quo women consume on average slightly more than men in marriage ( $c_f^{mar}/c_m^{mar} = 1.04$ ) but in divorce women's consumption is a lot lower relative to men's ( $c_f^{div}/c_m^{div} = 0.7$ ). In the first best scenario, in contrast, women and men consume equally both in marriage and divorce ( $c_f^{mar}/c_m^{mar} = c_f^{div}/c_m^{div} = 1.09$ ), meaning women are insured in the sense that they do not experience any drop in consumption relative to their ex-spouse upon divorce.

As a second notable difference under the first best allocation housework hours are higher and work hours slightly lower for married women and men, reflecting that the frictions in the model incentivize women and men to supply more labor during marriage to accumulate human capital and thereby self-insure against financial losses upon divorce. The first best scenario exhibits a higher degree of household specialization in the sense that the fraction of housework exercised by the wife,  $q_f^{mar}/(q_f^{mar} + q_m^{mar})$ , is higher and the fraction of market work exercised by the wife,  $h_f^{mar}/(h_f^{mar} + h_m^{mar})$ , is lower under the first best allocation compared to the status quo. Among divorced couples, in the first best scenario women work more hours in the household (by 15%) and less in the labor market (by 9%), while divorced men work less in the household (by 6%) and supply more work hours (by 3%) under first best, relative to the status quo.

Third, the fraction of couples ever getting divorced in the first best scenario is lower than 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% of couples ever get divorced, while only 25.8% divorce under the first best scenario.

Considering the allocation, where non-cooperation in divorce is removed from the model (column two), 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 small role.

TABLE 6: Mean outcomes: under the status quo, under cooperation in divorce and limited commitment in marriage, and in the first best scenario

Variable	Status quo	Coop. in divorce + limited comm. in marriage	First best $\mu = 1.13$
Work hours female (divorced)	28.7	25.8	24.6
Housework hours female (divorced)	20.3	22.8	24.1
Leisure female (divorced)	1.2	1.3	1.3
Work hours male (divorced)	31.6	32.4	33.3
Housework hours male (divorced)	12.7	12.0	11.3
Leisure male (divorced)	5.7	5.6	5.4
Consumption ratio ( $\frac{c_f}{c_m}$ , divorced)	0.70	1.09	1.09
Work hours female (married)	30.3	29.6	29.5
Housework hours female (married)	18.1	18.6	18.8
Leisure female (married)	1.6	1.7	1.7
Work hours male (married)	33.1	33.1	32.9
Housework hours male (married)	10.0	10.0	10.2
Leisure male (married)	6.9	6.9	6.9
Consumption ratio ( $\frac{c_f}{c_m}$ , married)	1.04	1.08	1.09
% divorced in $T$	28.0	26.4	25.8

*Notes* : Mean outcomes by marital status for status quo, a hypothetical scenario with cooperation in divorce but limited commitment in marriage, and first best scenario. Computed based on model simulations for  $N = 20,000$  couples.

## 7 Policy Simulations

In this section I explore how counterfactual changes to child support and alimony payments affect married and divorced couples' consumption, time use and propensity to divorce. I conduct policy experiments in a parsimoniously parameterized policy space with parameters that each have a clear connection to meaningful aspects of child support and alimony payments. To this end I approximate the complex Danish institutional setting described in Section 2 as follows. To approximate alimony payments I use the Danish rule of thumb, i.e., I assume alimony payments equal

$$\text{alim}_{ft} = -\text{alim}_{mt} = \tau \cdot (w_{mt}h_{mt} - w_{ft}h_{ft}),$$

where if  $\text{alim}_{ft} > 0$  if payments are made from ex-husband to ex-wife and  $\text{alim}_{ft} < 0$  if payments are made from ex-wife to ex-husband. By using the rule of thumb formula I abstract from caps that limit alimony payments in cases where the alimony payer would end up with "too little" or the alimony receiver would



end up with "too much" (see Appendix A). These caps are non-binding for 98% of divorcees in my sample, so that abstracting from them yields a close approximation of the exact alimony formula.

To approximate child support payments I project the Danish child support schedule on a lower dimensional policy space given by

$$cs_{ft} = -cs_{mt} = \begin{cases} n_{ft}^{b_n} [b_0 + b_1 w_{mt} h_{mt} + b_2 (w_{mt} h_{mt} - w_{ft} h_{ft})] & \text{if custodial} = f, \\ -n_{mt}^{b_n} [b_0 + b_1 w_{ft} h_{ft} + b_2 (w_{ft} h_{ft} - w_{mt} h_{mt})] & \text{if custodial} = m. \end{cases}$$

In this lower dimensional space each policy parameter has a clear connection to one aspect of child support policy.  $b_0$  controls a lump sum component of child support that is independent of the divorcees labor incomes,  $b_1$  governs the responsiveness of child support payments to the non-custodial parents income, and  $b_2$  determines the dependence on the income gap between non-custodial and custodial parent. The dependence of child support payments on the number of children is controlled by  $b_n$  and the chosen functional form allows for concavity ( $b_n < 1$ ) or convexity ( $b_n > 1$ ) of child support payments in the number of children. Real world child support payments throughout my sample are independent of the custodial parents income, i.e.,  $b_2 = 0$ . Values for  $b_0, b_1$  and  $b_n$  that approximate the real world child support schedule are obtained by non-linear least squares. The approximated status quo maintenance policy is given by  $\tilde{b}_0 = 24060$ ,  $\tilde{b}_1 = 0.028$ ,  $\tilde{b}_n = 0.79$ ,  $\tilde{\tau} = 0.2$ . Details on the approximation procedure and the goodness are provided in Appendix F.

## 7.1 The Impact of Maintenance Payments on Time Use and Consumption

This subsection describes how counterfactual changes in child support and alimony affect divorced and married couples' time use and consumption. I simulate counterfactual policy changes in the child support schedule  $(b_0, b_1, b_2, b_n)$  and the alimony policy  $\tau$ . For comparability I consider variations in each of the child support schedule parameters  $b_k$ , ( $k \in \{0, 1, 2, n\}$ ) that would ceteris paribus increase child support payments by the same amount. I denote by  $b'_k$  a parameter value that would ceteris paribus double and by  $b''_k$  a value that would ceteris paribus triple child support payments, relative to the status quo policy,  $\tilde{b}_k$ .

**Maintenance payments and couples' time allocation** Table 7 shows how divorced couples' mean time allocation changes if child support payments are varied. Several things about the results are notable. First, when child support payments are increased, divorced women on average substitute away from market work towards housework. This holds generally irrespective of which policy parameter is changed  $b_k$ , ( $k \in \{0, 1, 2, n\}$ ) and the magnitudes of the responses are similar. Policy changes that would ceteris paribus triple child support lead to a 5-6% decrease in divorced women's average work hours and a 7-8% increase in their average housework hours.

Second, increasing the lump sum component,  $b_0$ , or the curvature in number of children,  $b_n$ , increases

divorced men’s average work hours, pointing to large income effects that push towards higher male labor supply if child support is increased. Quantitatively, increasing  $b_0$  or  $b_n$  such that child support ceteris paribus would be tripled, leads to an increase of male work hours by 4% and 2%, respectively. Increasing the slope in the child support payer’s income,  $b_1$ , leads to a minimal increase in divorced men’s labor supply.

Third, in response to increasing the dependence of child support on the gap between the divorced parents’ incomes (i.e, increasing  $b_2$ ) divorced men, who are pre-dominantly child support payers, strongly reduce their work hours, by 4% and 10% respectively in response to policy changes that would ceteris paribus double or triple child support. The explanation for this stark reduction in divorced men’s labor supply is that increasing the dependence of payments on both payer’s and receiver’s labor income, strengthens strategic motives. Divorced men lower their work hours (thereby lowering child support and alimony) to incentivize their ex-wives to work more, which reduces the amount child support (and alimony) they have to pay.

TABLE 7: The effect of varying child support on divorced couples’ time use

Intercept, $b_0$	0	Status quo	$b'_0$	$b''_0$
Work hours female	29.3	28.7	27.8	26.9
Housework hours female	19.6	20.1	21.0	21.8
Work hours male	31.2	31.6	32.3	32.8
Housework hours male	13.0	12.7	12.2	11.8
Slope in payer’s income, $b_1$	0	Status quo	$b'_1$	$b''_1$
Work hours female	29.1	28.7	28.0	27.3
Housework hours female	19.7	20.1	20.8	21.5
Work hours male	31.4	31.6	31.7	31.7
Housework hours male	12.8	12.7	12.6	12.6
Slope in income gap, $b_2$	0	Status quo	$b'_2$	$b''_2$
Work hours female	-	28.7	27.3	27.0
Housework hours female	-	20.1	21.5	21.7
Work hours male	-	31.6	30.4	28.2
Housework hours male	-	12.7	13.7	15.4
Curvature in no. of children, $b_n$	0	Status quo	$b'_n$	$b''_n$
Work hours female	29.0	28.7	27.9	27.0
Housework hours female	19.8	20.1	20.9	21.8
Work hours male	31.4	31.6	31.9	31.7
Housework hours male	12.9	12.7	12.4	12.6

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

Table 8 shows how changes in alimony payments affect divorced couples' mean time allocation. I consider counterfactual scenarios in which the alimony parameter  $\tau$  is increased step-wise from  $\tau = 0$  (no alimony) to  $\tau = 0.4$ . On average divorced women and men reduce their work hours in response to higher alimony payments. Qualitatively the effect of increasing alimony thus resembles the effect of increasing the dependence of child support on the gap between the divorced parents' incomes (increasing  $b_2$ ). Both these policies strengthen the dependence of maintenance payments on divorced couples' income differences. The effect of increasing  $b_2$  is strongest for couples with many children, while increasing alimony payments affects all divorced couples equally.<sup>42</sup> Quantitatively a switch from the status quo,  $\tau = 0.2$ , to  $\tau = 0.4$  leads to reduction of divorced women's mean work hours by 7% and divorced men's mean work hours by 6%.

TABLE 8: The effect of varying alimony ( $\tau$ ) on divorced couples' time use

$\tau$	0	0.1	0.2	0.3	0.4
Work hours female	30.7	29.7	28.7	27.8	26.8
Housework hours female	18.2	19.1	20.1	21.0	21.9
Work hours male	32.2	32.0	31.6	30.8	29.6
Housework hours male	12.2	12.4	12.7	13.3	14.3

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

Results on how married couples time allocation responds to changes in child support and alimony payments are presented in Tables G.1 and G.2. Increasing child support or alimony payments leads to a small shift in married women's time use from market work to housework and a slight shift in married men's time use in the opposite direction. Increasing child support or alimony thus leads to an increase in household specialization in married couples that however is modest in size. Quantitatively none of the considered policy changes leads married women or men to change average work or housework hours by more than 1%.

**Maintenance payments and consumption insurance** Next, I consider the extent to which child support and alimony are successful in providing consumption insurance. To this end I use the estimated model to simulate data that I then use in event study regressions that capture the evolution of women's and men's consumption around divorce. To control non-parametrically for time trends I include time period fixed effects. Denote by  $\tilde{c}_{jft}, \tilde{c}_{jmt}$ , simulated consumption levels for couple  $j$  (i.e., simulation draw  $j$ ) in model period  $t$ . I run the following regression, separately for women and men

$$\tilde{c}_{jst} = a_{st} + \sum_{k=0}^2 \beta_{sk} \cdot \tilde{d}_{jt-k} + \nu_{jst}, \quad (10)$$

<sup>42</sup>The two policy parameters counteract each other in couples where the higher earner is the custodial parent. Empirically this is a very rare case.

where  $\tilde{d}_{jt}$  indicates whether the simulated couple  $j$  gets divorced in  $t$ . Recall that a model time period corresponds to three years. I consider a time window of three years before and six years after divorce. To capture the evolution of consumption around divorce I define  $\Delta c_s = \frac{\beta_{s2} - \beta_{s0}}{\beta_{s0}}$ , the relative difference between the event study coefficients in the last time period before and two time periods (six years) after divorce. This measure captures the consumption drop (or consumption hike) that women and men experience upon divorce, relative to the time fixed effects,  $a_{st}$ .

The results in Table 9 show that under the status quo policy divorcing women experience a 28% drop in consumption six years after divorce relative to the last period of marriage, while men experience a 3% consumption hike. These changes in consumption are measured relative to the general time trends captured by the fixed effects  $a_{st}$ . Increasing child support by raising the lump sum component,  $b_0$ , the slope in the non-custodial parent's income,  $b_1$ , or the curvature in the number of children,  $b_n$ , all mitigate the drop in divorcing women's consumption by 4-6 p.p. and lead to a relatively modest drop of male consumption by 9-11 p.p. By contrast increasing the dependence of child support on the parents income gap (increasing  $b_2$ ) does not mitigate but amplifies the consumption drop for women, while also leading to a consumption drop for men. The driver behind this result are the strong labor supply disincentives that arise when making child support payments dependent on the the gap between divorced parents' incomes, as discussed in the previous subsection. In response men reduce their work hours counteracting the increase in child support payments, while women also work less. Together these effects contribute to a drop in women's consumption.

Similarly and for the same reasons alimony payments fail to provide consumption insurance. Table 9 shows that increasing alimony amplifies rather than mitigates the consumption drop experienced by divorcing women and also leads to a consumption drop for divorcing men. Again the reason are strong labor supply disincentives that are associated with increasing alimony payments as is discussed in the previous subsection.

TABLE 9: The effect of varying child support on divorcing couples' consumption

Intercept, $b_0$	0	Status quo	$b'_0$	$b''_0$
$\Delta c_f$	-0.29	-0.28	-0.26	-0.23
$\Delta c_m$	0.05	0.03	-0.02	-0.06
Slope in payer's income, $b_1$	0	Status quo	$b'_1$	$b''_1$
$\Delta c_f$	-0.29	-0.28	-0.26	-0.24
$\Delta c_m$	0.06	0.03	-0.03	-0.08
Slope in income gap, $b_2$	0	Status quo	$b'_2$	$b''_2$
$\Delta c_f$	-	-0.28	-0.30	-0.33
$\Delta c_m$	-	0.03	-0.05	-0.11
Curvature in no. of children, $b_n$	0	Status quo	$b'_n$	$b''_n$
$\Delta c_f$	-0.29	-0.28	-0.26	-0.22
$\Delta c_m$	0.05	0.03	-0.02	-0.07

*Notes:* Mean change in consumption upon divorce for different child support policy regimes. Computed based on model simulations for  $N = 20,000$  couples.

TABLE 10: The effect of varying alimony on divorcing couples' consumption

$\tau$	0	0.1	0.2	0.3	0.4
$\Delta c_f$	-0.26	-0.27	-0.28	-0.29	-0.31
$\Delta c_m$	0.11	0.08	0.03	-0.02	-0.09

*Notes:* Mean change in consumption upon divorce for different alimony policy regimes. Computed based on model simulations for  $N = 20,000$  couples.

## 7.2 The Impact of Maintenance Payments on Divorce Rates

Divorce law changes in general may influence divorce rates, although ex-ante the direction of the effect that maintenance payments have on divorce rates is unclear.<sup>43</sup> 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 a change in divorce rates and in what direction among other things depends on the degree to which divorce decisions are driven by economic motives versus purely emotional motives.<sup>44</sup> Tables 11 and 12 show the impact of changing child support and alimony respectively on the fraction of couples who ever get divorced. The results show that generally increasing maintenance payments slightly lowers divorce rates, both for child support and for alimony policy changes.

<sup>43</sup>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.

<sup>44</sup>In my model emotional motives for divorce are captured by the love shocks.

TABLE 11: The effect of varying child support on divorce rates

	0	Status quo	$b'_k$	$b''_k$
Intercept, $b_0$	28.3	28.0	27.8	27.7
Slope in payer's income, $b_1$	28.4	28.0	27.5	27.2
Slope in income gap, $b_2$	28.5	28.0	27.5	27.1
Curvature in no. of children, $b_n$	28.4	28.0	27.7	27.5

*Notes:* Displayed are fractions of couples ever getting divorced for different child support policy regimes. Computed based on model simulations for  $N = 20,000$  couples.  $b'_k$  and  $b''_k$  denote parameter values that would ceteris paribus double and triple child support payments relative to the status quo policy.

TABLE 12: The effect of varying alimony on divorce rates

$\tau$	0	0.1	0.2	0.3	0.4
ever divorced (%)	28.6	28.3	28.0	27.7	27.4

*Notes:* Displayed are fractions of couples ever getting divorced for different alimony policy regimes. Computed based on model simulations for  $N = 20,000$  couples.

## 8 Welfare Analysis

In light of the policy trade-off between providing insurance, enabling married couples to specialize efficiently and maintaining labor supply incentives, it is interesting to ask what a welfare maximizing child support and alimony policy looks like. In this section I draw welfare comparisons between different child support and alimony policy regimes and solve for the welfare maximizing policy. Moreover I asses how close maintenance policies bring couples to first best allocations (characterized in Section 6).

### 8.1 Welfare Comparisons and Optimal Policy

To study how child support and alimony policies affect couples' welfare, I consider the ex-ante well-being of women and men. In particular I consider the sum of time period zero expected discounted utilities of women,  $\mathbb{E}[V_{f0}^{mar}]$ , and men,  $\mathbb{E}[V_{m0}^{mar}]$ , as welfare criterion (i.e., the utilitarian welfare criterion with equal weights) <sup>45</sup>

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

To find the welfare maximizing policy, I search for the combination of policy parameters  $(b_0, b_1, b_2, b_n, \tau)$  that maximizes  $W$ . Figure H.1 and Figure H.2 display the dependence of the welfare criterion,  $W$ , on each

<sup>45</sup>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.

policy parameter. I find that the combination of policy parameters that jointly maximizes welfare is

$$\begin{aligned} (b_0^*, b_1^*, b_2^*, b_n^*, \tau^*) &= (34.677, 0.033, 0.002, 1.07, 0.16) \\ &= (1.44\tilde{b}_0, 1.18\tilde{b}_1, 0.002, 1.34\tilde{b}_n, 0.8\tilde{\tau}).^{46} \end{aligned}$$

A welfare maximizing policy reform would thus 1. increase the lump sum amount of child support by 44% 2. strengthen the dependence of child support on the non-custodial parent's income by 18% 3. leave the dependence of child support on the income gap between custodial and non-custodial parent at close to zero 4. make child support slightly convex in the number of children (rather than concave) and 5. reduce the dependence of alimony on the income gap between higher and lower earner by 20% relative to the status quo. Switching to this policy would increase child support payments by 56%, reduce alimony payments by 13.5% and increase overall maintenance payments by 28%.

## 8.2 Comparison to First Best

In this subsection I compare the welfare maximizing policy to first best scenarios that serve as benchmark of what policy could attain. I draw comparisons to two natural benchmark scenarios: The first best allocation under equal bargaining power,  $\mu = 1$  and the first best allocation under the initial relative bargaining weight of married couples,  $\mu = 1.13$ . The first best allocation under equal bargaining weights would be chosen by a social planner who attaches equal welfare weights to women and men, a natural benchmark for policy. The first best allocation under the initial relative bargaining weight,  $\mu = 1.13$ , is the allocation that would be attained if frictions were eliminated and couples would continue to make decisions under the status quo distribution of bargaining power within the household.

Table 13 presents outcomes for the status quo, the welfare maximizing policy and the two benchmark first best scenarios. The welfare maximizing policy brings couples closer to the considered first best scenarios in several aspects: First, compared to the status quo the first best scenarios are both characterized by full mutual consumption insurance between spouses ( $c_f^{mar}/c_m^{mar} = c_f^{div}/c_m^{div}$ ). The welfare maximizing policy, while not attaining full mutual insurance, reduces the mean ratio of female to male consumption in divorced couples bringing it closer to the mean consumption ratio of married couples. Second, both considered first best scenarios exhibit a higher degree of household specialization, i.e., in married couples the fraction of overall housework exercised by the wife,  $q_f^{mar}/(q_f^{mar} + q_m^{mar})$ , is higher and the fraction of market work exercised by the wife,  $h_f^{mar}/(h_f^{mar} + h_m^{mar})$ , is lower in the first best scenarios than under the status quo. The welfare maximizing policy leads to a degree of household specialization that is higher than under the status quo, but not as high as under the considered first best scenarios. Similarly, the first best scenarios imply that divorced couples should specialize more, relative to the status quo, i.e., that divorced women should shift their time allocation from work to housework, while divorced men should do the opposite. A shift in that direction is achieved under the welfare maximizing policy. Third the fraction of couples divorcing is

lower under both considered first best scenarios relative to the status quo. Under the welfare maximizing policy this fraction is slightly reduced, but still close to its status quo level.

TABLE 13: Mean outcomes: status quo, optimal maintenance policy and first best

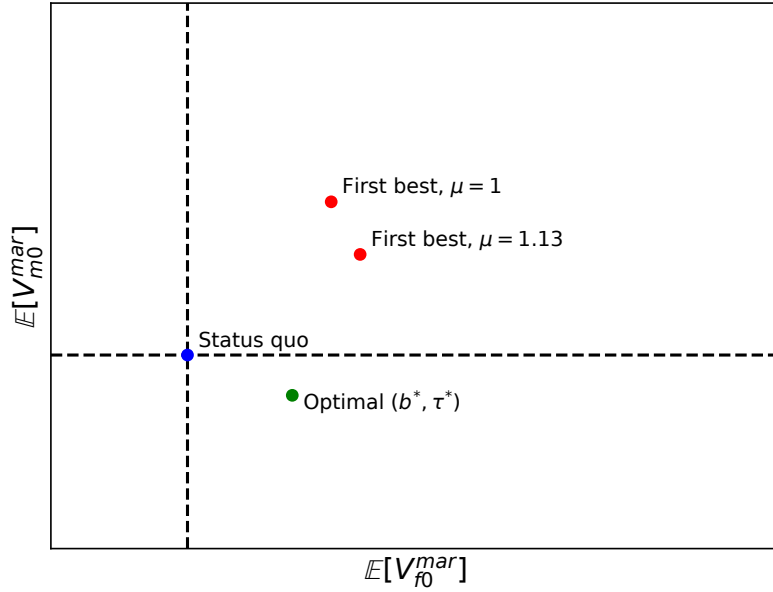
Variable	Status quo	$(b^*, \tau^*)$	First best $\mu = 1$	First best $\mu = 1.13$
Work hours female (divorced)	28.7	27.9	25.0	24.6
Housework hours female (divorced)	20.1	20.9	23.7	24.1
Leisure female (divorced)	1.2	1.2	1.3	1.3
Work hours male (divorced)	31.6	32.9	32.9	33.3
Housework hours male (divorced)	12.7	11.4	11.6	11.3
Leisure male (divorced)	5.7	5.6	5.5	5.4
Consumption ratio $(\frac{c_f}{c_m}, \text{divorced})$	0.70	0.78	1.00	1.09
Work hours female (married)	30.3	30.1	29.8	29.5
Housework hours female (married)	18.1	18.3	18.5	18.8
Leisure female (married)	1.6	1.6	1.6	1.7
Work hours male (married)	33.1	33.1	33.1	32.9
Housework hours male (married)	10.0	10.0	10.0	10.2
Leisure male (married)	6.9	6.9	6.9	6.9
Consumption ratio $(\frac{c_f}{c_m}, \text{married})$	1.04	1.04	1.00	1.09
% divorced in $T$	28.0	27.8	26.0	25.8

*Notes* : Mean outcomes by marital status for the status quo, the welfare maximizing policy and first best scenarios under  $\mu = 1.13$  and  $\mu = 1$ . Computed based on model simulations for  $N = 20,000$  couples.

Next I compare women's and men's ex-ante utility under each of the considered scenarios. Figure 10 shows that compared to the status quo both considered first best allocations make women as well as men better off, i.e., on average switching to either of these scenarios is a Pareto improvement over the status quo. The welfare maximizing policy in contrast makes women better off, while men are made worse off relative to the status quo. As the gain in ex-ante utility for women exceeds the loss in ex-ante utility for men, switching to this policy is a welfare gain relative to the status quo, but not a Pareto improvement. Both considered first best allocations Pareto dominate the welfare maximizing policy indicating that there is scope for welfare improvements beyond what child support and alimony policies in the analyzed policy space can attain.



FIGURE 10: 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.

## 9 Conclusion

In this paper I study how child support and alimony payments affect married and divorced couples' decision-making and how such payments should be designed to maximize couples' welfare. In particular I use rich Danish administrative data and time use data to estimate a dynamic model of couples' decision-making that captures the policy trade off between providing insurance and incentivizing efficient household specialization, while maintaining labor supply incentives.

I find that increasing child support typically leads to smoother consumption paths around divorce and to a moderate reduction in labor supply among divorced women. By increasing alimony payments leads to strong labor supply disincentives and as a consequence fails to smoothen consumption around divorce. The welfare maximizing policy involves increasing child support payments and lowering alimony payments relative to the Danish status quo.

Comparisons to hypothetical first best scenarios show that there is scope for Pareto improvements beyond what can be attained by child support and alimony policies. The first best allocations as well as the welfare maximizing policy are characterized by less gender (consumption) inequality among divorcees and a higher degree of specialization among married couples relative to the Danish status quo.

Beyond what is studied in this paper it would be interesting to allow for remarriage in the analysis (e.g., as in Voena (2015)). For divorcees who remarry and form two earner households soon after divorce, labor supply disincentives from maintenance payments might become stronger. At the same time the need for insurance can be expected to be lower for remarrying individuals, who can be supported by their new

spouse.

Another interesting extension would be to study how married couples fertility choices are affected by child support and alimony policies. In particular child support, could potentially induce couples to have more children and thereby influence labor supply decisions and human capital accumulation of married couples. It is unclear if such effects would be quantitatively relevant. In my analysis I generally find very modest responses of married couples to changes in maintenance payments, so the impact on fertility might be similarly small.

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# Appendix

## 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.<sup>47</sup>

**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

$$cs(n_s, I_{\tilde{s}}, B) = nB \cdot \sum_{k=0}^K a_k \mathbf{1}\{b_k(n) \leq I_{\tilde{s}} < b_{k+1}(n)\} \quad (11)$$

Where the year 2004 values of the parameters that enter into (11) are  $B = 9420$  (DKK),  $K = 5$  (i.e., child support varies across 6 income brackets) 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 policy 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*).

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<sup>47</sup>Information on policy parameters for past years was provided by the Danish State Administration (*Statsforvaltning*)

TABLE A.2: Child support policy 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 ex-spouses' labor incomes. Generally alimony payments equal a fraction  $\tau$  of the ex-couples labor income difference. Additionally there are several caps on alimony payments that 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  $C_3$ .

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

$$alim(\tilde{I}_H, \tilde{I}_L) = \begin{cases} \tau \cdot (\tilde{I}_H - \tilde{I}_L) & \text{if } \tilde{I}_L \geq C_1 \text{ and } \tilde{I}_H - C_2 \geq \tau \cdot (\tilde{I}_H - \tilde{I}_L) \text{ and } C_3 - \tilde{I}_L \geq \tau \cdot (\tilde{I}_H - \tilde{I}_L) \\ \tau \cdot (\tilde{I}_H - C_1) & \text{if } \tilde{I}_L < C_1 \text{ and } \tilde{I}_H - C_2 \geq \tau \cdot (\tilde{I}_H - \tilde{I}_L) \text{ and } C_3 - \tilde{I}_L \geq \tau \cdot (\tilde{I}_H - \tilde{I}_L) \\ \max\{\tilde{I}_H - C_2, 0\} & \text{if } \tilde{I}_H - C_2 < \tau \cdot (\tilde{I}_H - \tilde{I}_L) \\ \max\{C_3 - \tilde{I}_L, 0\} & \text{if } C_3 - \tilde{I}_L < \tau \cdot (\tilde{I}_H - \tilde{I}_L) \end{cases} \quad (12)$$

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 (12) 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.

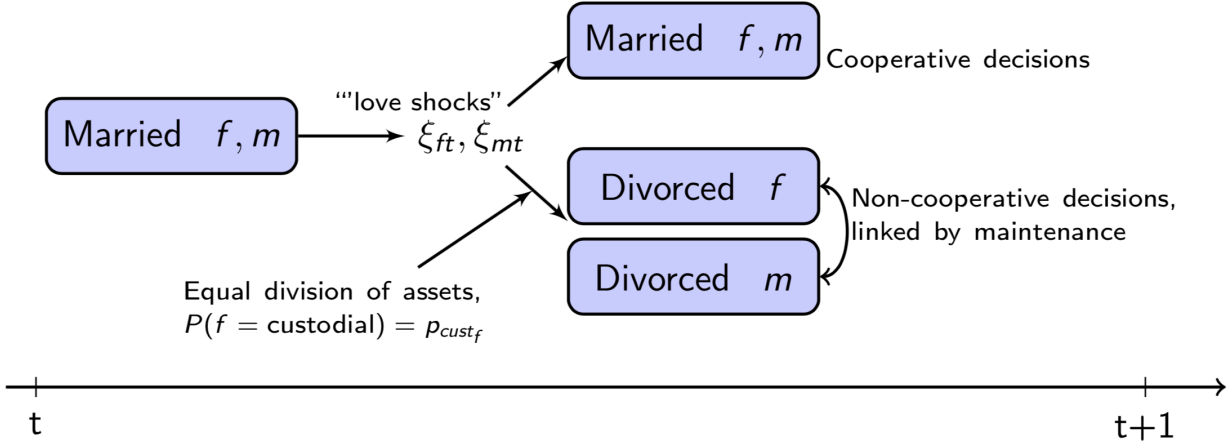
**Model solution** The model is solved by backwards recursion, i.e., for each time period  $t$  the model agents' problem is solved on a grid of points in the state space, taking the continuation values in  $t + 1$  as given. I first solve the model for divorced couples (i.e., I solve for the values 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  $\mu_{ft}$ , and *Gauss-Hermite quadrature* (see Judd (1998)) to approximate integrals taken over the distribution of the wage shocks,  $\epsilon_{st} \stackrel{iid}{\sim} \mathcal{N}(0, \sigma_{s\epsilon})$ . For the approximation of the random walk according to which the “love shocks”  $\xi_{ft}, \xi_{mt}$  evolve I use Rouwenhorst's method for discretizing highly persistent processes (see Kopecky and Suen (2010) and Fella et al. (2019)).

**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 successful completion of the *Nelder-Mead* perturbs 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 Directly estimated parameters

**Initial relative bargaining power** To inform my choice of the initial relative bargaining power  $\mu_0$  I use data on couples consumption from the DTUS. Survey respondents in the DTUS report their own and their spouses private consumption level. I reweight the data to match the age distribution of my main sample. The average ratio between male and female consumption based on the reweighted data is 0.92. My structural model implies the following relationship between relative consumption and relative bargaining power

$$\mu_t = \left( \frac{c_{ft}}{c_{mt}} \right)^\eta$$

. I use this relationship to inform my choice of the initial relative bargaining power  $\mu_0$ , i.e., I set  $\mu_0 = (0.92)^\eta = (0.92)^{-1.5} = 1.13$ .

**Child Custody** To estimate the probability that the mother takes custody after divorce,  $P(\text{custodial} = f)$ , I use Danish register data on children's main residence after divorce. Among divorcing parents in my sample I observe that three years after divorce in 79% of cases all children live with their mother, in 8% of all cases all children live with their father, while in 13% of all cases some children live with each

parent. These numbers are very stable over a time horizon of 10 years after divorce. I attribute half of the cases in which some children live with each parent to female and male custody respectively, i.e., I set  $P(\text{custodial} = f) = 0.86$ . A limitation of my data is that I cannot identify parents who take joint physical custody after divorce. Based on Danish survey data from 2007 [Rossin-Slater and Wüst \(2018\)](#) report that 22% of divorced fathers have either joint or sole physical custody.

**Maintenance** I estimate the probability of non-compliance,  $P(\Xi_t = 0 \text{ for all } t)$ , and the probability of discontinuation of maintenance payments  $P(\Xi_{t+1} = 0 | \Xi_t = 1)$  using data maintenance payments between divorced couples from Danish register data. I set  $P(\Xi_t = 0 \text{ for all } t) = 0.05$ , the fraction of divorcees who are mandated to pay maintenance but are observed to make zero payments in the first three years after divorce. I estimate the probability of discontinuation of maintenance payments  $P(\Xi_{t+1} = 0 | \Xi_t = 1)$  by matching the average duration of maintenance payments in the data. I code maintenance payments as having ended if I observe zero payments in three subsequent years. If maintenance payments are still ongoing at the end of my sample period I assume maintenance payments last until the youngest child turns 18, or at least for 8 years to reflect the duration of alimony payments, which is between 6 and 10 years. The measured average maintenance duration in the data is 8.4 years. It is easy to show that the expected duration of maintenance payments equals  $P(\Xi_{t+1} = 0 | \Xi_t = 1)^{-1}$ . I thus set  $P(\Xi_{t+1} = 0 | \Xi_t = 1) = \frac{1}{8.4} = 0.12$ .

**Initial distribution of children and fertility process** The parameters determining the distribution of the number of children are the initial (period 1) distribution of children

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

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 <sup>48</sup>

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

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 D.1. The matrix of estimated Markov transition probabilities is presented in Table D.2. Note that for  $t \geq 4$  (i.e., after 12 years of marriage) birth probabilities generally are practically equal to 0.

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<sup>48</sup>Note that I allow couples to have at most 3 children, i.e.,  $p_n(t, 3) = 0$  for all  $t$ .

TABLE D.1: Initial no. of children, empirical distribution

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

*Notes:* Source: Danish birth register.

TABLE D.2: Fertility process

	$n = 0$	$n = 1$	$n = 2$
$p_n(t = 1, n_1 = n)$	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

*Notes:* Source: Danish birth register.

## E Model Fit

TABLE E.1: Model fit, work hours and housework hours

Moment	Children	Model	Data	Std. dev. (data)
Hours worked female (married)	0	30.8	29.1	11.8
	1	30.6	30.3	10.2
	2	30.2	30.7	9.7
	3	29.4	27.9	11.9
Hours worked female (divorced)	0	29.5	23.7	12.3
	1	29.0	27.9	12.7
	2	28.6	28.0	13.5
	3	27.8	23.3	13.3
Hours worked male (married)	0	32.8	30.9	12.9
	1	33.1	32.6	11.6
	2	33.2	33.2	13.3
	3	32.9	31.7	11.7
Hours worked male (divorced)	0	29.0	26.1	14.8
	1	30.8	30.5	13.1
	2	32.1	31.1	13.4
	3	32.8	30.0	14.2
Housework hours female (married)	0	17.4	13.6	1.7
	1	17.8	16.5	1.5
	$\geq 2$	18.7	19.3	1.4
Housework hours female (divorced)	0	19.2	9.6	6.9
	1	19.8	19.0	6.8
	$\geq 2$	20.6	21.9	6.8
Housework hours male (married)	0	9.5	10.5	1.1
	1	9.7	10.5	1.5
	$\geq 2$	10.3	9.9	1.2
Housework hours male (divorced)	0	14.6	8.0	6.8
	1	13.2	11.1	6.9
	$\geq 2$	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 322,732 couples), with the exception of mean housework hours, which are obtained from the *Danish Time Use Survey* (which includes 2,105 households).

## F Approximating Child Support in a Low-Dimensional Policy Space

In order to conduct counterfactual policy experiments in a policy space with a manageable number of parameters that have meaningful interpretations, I approximate the complex Danish child support schedule in a lower dimensional space.

First, I use maintenance payments as observed in my data and deduct alimony payments as predicted by the exact alimony formular given in Appendix A, thereby obtaining approximate data on real world child support payments.<sup>49</sup> Denote the thusly obtained approximate data on child support by  $\tilde{c}s_{it}$ . I then use  $\tilde{c}s_{it}$  as dependent variable in a non-linear least squares regression on the lower-dimensional child support policy space, given by (13). Note that for the approximation I fix  $b_2$ , as under the Danish status quo child support policy child support payments do not depend on the custodial parent's income. The thusly obtained coefficient estimates are  $\hat{b}_0 = 8020$ ,  $\hat{b}_1 = 0.028$  and  $\hat{b}_n = 0.79$ . The R-squared of this nonlinear least squares regression is 95%. Note that the value of  $\hat{b}_0$  depends on the considered frequency of child support payments. The parameter estimates are obtained using approximate data on annual child support payments. To arrive at the frequency of my model in which one time period corresponds to three years  $\hat{b}_0$  thus needs to be tripled.

$$\arg \min_{b_0, b_1, b_n} (\tilde{c}s_{it} - n_{it}^{b_n} (b_0 + b_1 I_{it}))^2 \quad (13)$$

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<sup>49</sup>Recall that my data do not include seperate observations on child support and alimony, but do include maintenance payments, i.e., the sum of child support and alimony.

## G Additional Tables

TABLE G.1: The effect of varying child support on married couples' time use

Intercept, $b_0$	0	Status quo	$b'_0$	$b''_0$
Work hours female	30.31	30.29	30.25	30.23
Housework hours female	18.10	18.12	18.16	18.18
Work hours male	33.09	33.10	33.13	33.17
Housework hours male	9.98	9.97	9.94	9.92
Slope in payer's income, $b_1$	0	Status quo	$b'_1$	$b''_1$
Work hours female	30.32	30.29	30.25	30.22
Housework hours female	18.09	18.12	18.16	18.19
Work hours male	33.09	33.10	33.13	33.14
Housework hours male	9.98	9.97	9.95	9.93
Slope in income gap, $b_2$	0	Status quo	$b'_2$	$b''_2$
Work hours female	-	30.29	30.25	30.23
Housework hours female	-	18.12	18.16	18.18
Work hours male	-	33.10	33.11	33.11
Housework hours male	-	9.97	9.96	9.96
Curvature in no. of children, $b_n$	0	Status quo	$b'_n$	$b''_n$
Work hours female	30.30	30.29	30.26	30.25
Housework hours female	18.11	18.12	18.15	18.15
Work hours male	33.09	33.10	33.13	33.17
Housework hours male	9.98	9.97	9.95	9.92

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

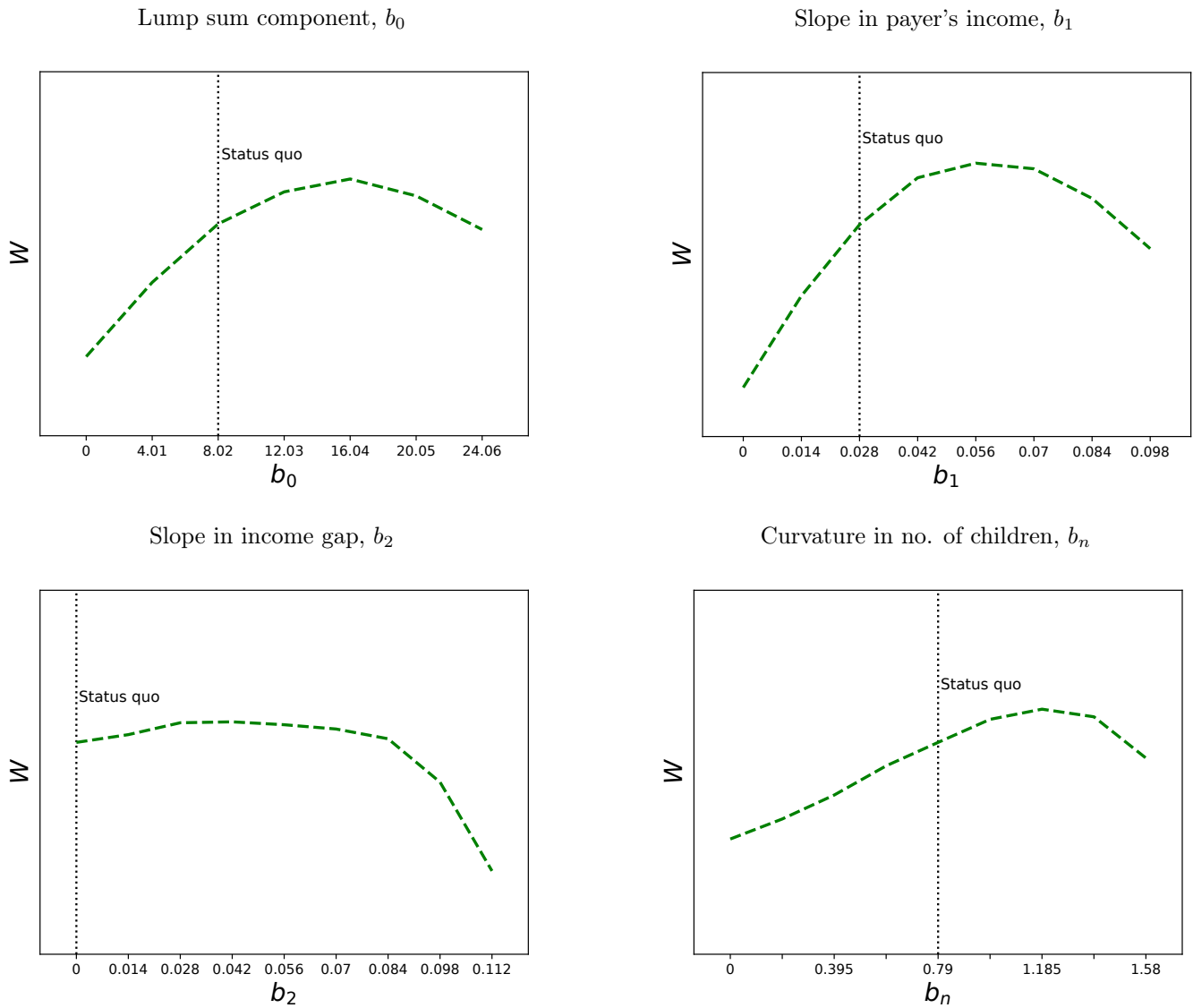
TABLE G.2: The effect of varying alimony ( $\tau$ ) on married couples' time use

$\tau$	0	0.1	0.2	0.3	0.4
Work hours female	30.38	30.33	30.29	30.25	30.23
Housework hours female	18.03	18.08	18.12	18.16	18.17
Work hours male	33.07	33.09	33.10	33.11	33.12
Housework hours male	10.00	9.98	9.97	9.96	9.95

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

## H Additional Figures

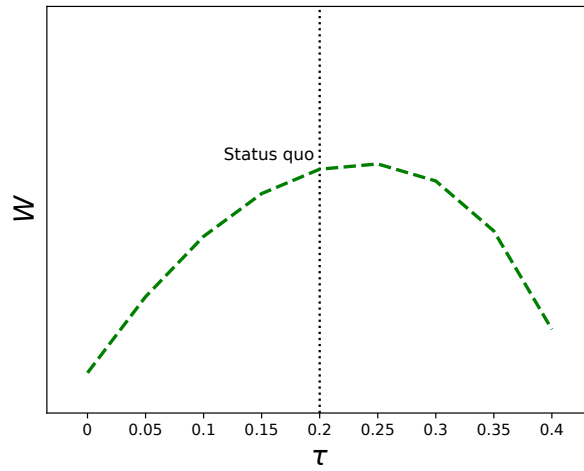
FIGURE H.1: Welfare comparisons, varying child support



*Notes:* Plotted is the utilitarian welfare criterion (under equal weights,  $\lambda = 1$ ) for counterfactual policy scenarios in which aspects of child support payments are changed. Each figure is based on model simulations for 20,000 couples.



FIGURE H.2: Welfare comparisons, varying alimony payments,  $\tau$



Notes: Plotted is the utilitarian welfare criterion (under equal weights,  $\lambda = 1$ ) for counterfactual policy scenarios in which alimony changes are varied. Each figure is based on model simulations for 20,000 couples.