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

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Abstract

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

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

JEL classi cation : D10, D91, J18, J12, J22, K36

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1 Introduction

Marital breakdown often has severe nancial 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, such as 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 erce political debates about reducing post-marital maintenance payments

To examine the consequences of post-marital maintenance policies for couples' welfare, I develop a dynamic structural model of married and divorced couples' decision-making. In my model divorced ex-spouses are linked by maintenance payments, which depend on both ex-spouses' labor earnings, their number of children and who the children stay with after divorce.

Decision-making of divorced couples is modeled as non-cooperative (dynamic) game. In deciding model as a policy lab to conduct counterfactual experiments. Based on such policy experiments I show that the (ex-ante) welfare maximizing policy is characterized by increased (tripled) child support payments and slightly lower alimony payments (12.5% lower), relative to the Danish status quo policy. Increasing child support induces married couples to specialize more, leads to smoother consumption paths around divorce and to a moderate reduction in labor supply among divorced women. Increasing alimony payments in contrast fails to provide insurance: Alimony payments lead to a strong reduction in labor supply among divorced men and women. Because of the strong labor supply reduction, increasing alimony payments leads to larger consumption drops upon divorce for women (i.e., womens consumption around divorce becomes less smooth). I thus show that alimony payments may have the opposite of the e ect that is intended by policymakers.

To study how close maintenance policies can bring couples to e ciency, I compare the welfare maximizing policy to a rst best scenario, in which frictions (limited commitment and non-cooperation in divorce) are removed from the model. The rst 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 well-being, I nd that the rst 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 o that is relevant for studying maintenance policies. In my model maintenance payments provide insurance to the lower earner in couples and facilitate e cient intra-household specialization, but distort divorcees' labor supply incentives. This paper provides the rst study of how maintenance payments should be designed in light of this trade o . I thereby add to a small literature that studies alimony and child support payments (see, e.g., Weiss and Willis (1985); Weiss and Willis (1993); Del Boca and Flinn (1995); Flinn (2000)).[4] Previous studies in this literature have used static models of divorced couples decision-mak7(ecome 0.5 t(ng,6 -20.323 Td [(raed409 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)).[5] Less attention has been paid to policies like child support and alimony payments, that make spouses nancially 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.[6]

As a third contribution, this paper examines a rst 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, limited commitment and non-cooperation in divorce. Removing these frictions yields the rst best scenario. The rst friction, 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)). The second friction, non-cooperation in divorce, featured 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. [7] 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 rst best allocation, allows me to study in what respects the welfare maximizing maintenance policy falls short relative to the rst best allocation. In particular, I nd that the rst 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 institu-

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

[6] 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.

[7] 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.

Figure 1: Child support rules

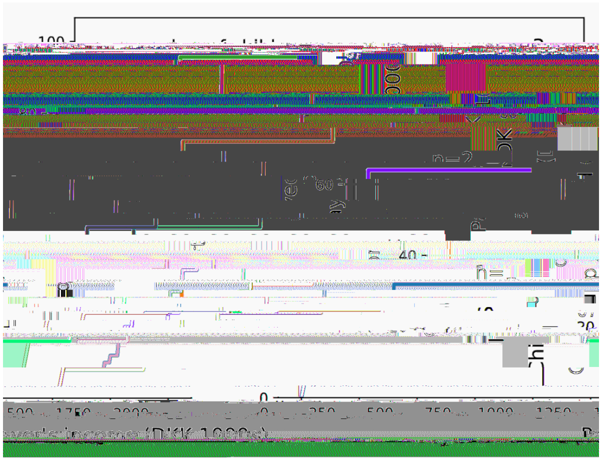
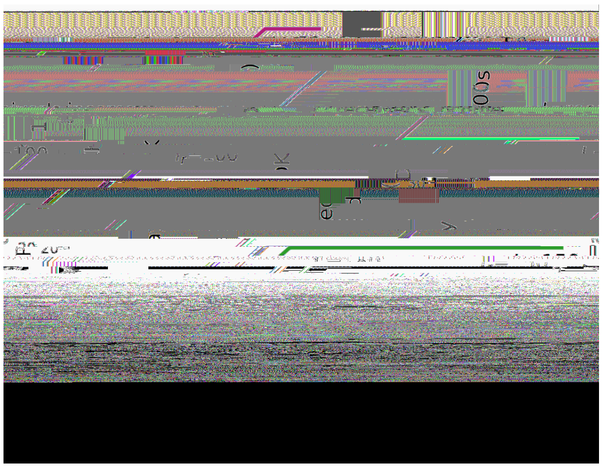


Figure 2: Alimony rules



Notes: Each figure is plotted for the 2004 value of the respective policy parameter (i.e., for $B = 9420$ and $= 0{:}2$).

to the custodial parent s, where B is a basic money amount and $a(n_s; I_s)$ 1 is a factor that is increasing in the child support payer's labor earnings I_s and the number of children n_s. The functional form of $a(n_s; I_s)$ 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_s. Child

I_s. Alimony payments may last for up to ten years, but end if the receiving ex-spouse remarries or cohabits with a new partner.

2.3 Maintenance Payments

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

$$M_f (n_f$$

a previous relationship.[15] The nal sample includes 279,197 couples (558,394 individuals) and 4,912,474 couple-year observations. Table E.1 presents summary statistics for the nal sample.

Table 1: Summary statistics, Danish register data

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

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

For the estimation of the structural model I further make use of information on housework hours. These data are obtained from the Danish Time Use Survey which was conducted in 2001 among a 2,105 households representative sample of the Danish population.[16] 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.

[15] 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.

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

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

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

Notes: Summary statistics from the Danish Time Use survey 2001. Cross-section of 2,105 households. The data are 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 based 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)). [17]

Figure 3: Maintenance payments, data and imputations

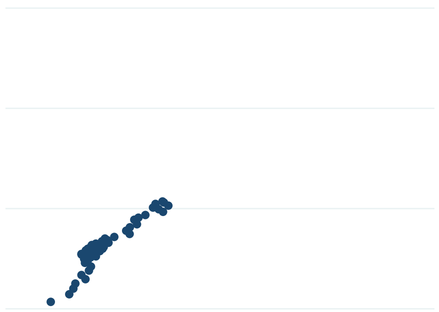
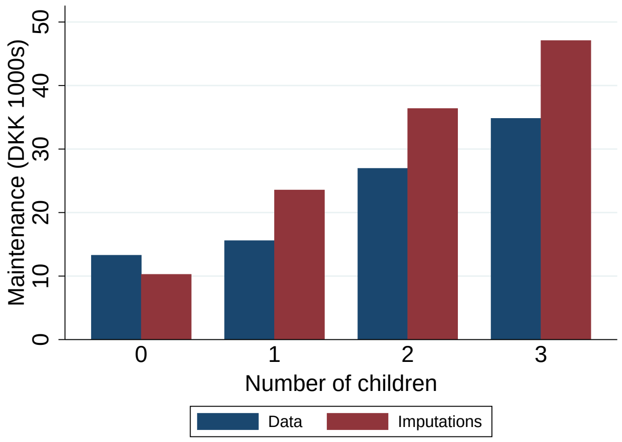


Figure 4: Maintenance payments by payer's labor income, data and imputations

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



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

Figures 3 - 5 show how well the imputations match the observed data regarding several aspects. Figure 3 plots average imputed maintenance payments against observed maintenance payments in a binned scatter plot. The plot exhibits some small deviations, but by and large is clustered around the 45 degree line, con rming that on average the imputations of maintenance payments are close to the payments observed in the data. Figure 4 shows how maintenance payments evolve with the maintenance payer's labor income in the observed data and for my imputations of maintenance payments respectively. Both the maintenance imputations and the maintenance data exhibit a positive gradient in the payer's labor income that is steepest between 300,000 and 500,000 DKK and somewhat atter 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 may deviate to some extent.

3.2 Evidence from Event Studies: Work Hours around Divorce

To understand the relevance of post-marital maintenance payments it is important to know to what extent (and in what direction) divorcing spouses adjust their labor supply upon divorce. This subsection presents empirical evidence on the order of magnitude by which women and men adjust their labor supply before and after getting divorced. I conduct event study regressions that exploit variation in the timing of divorce to separate labor supply changes that are associated with divorce from general marriage duration and time trends.[19]

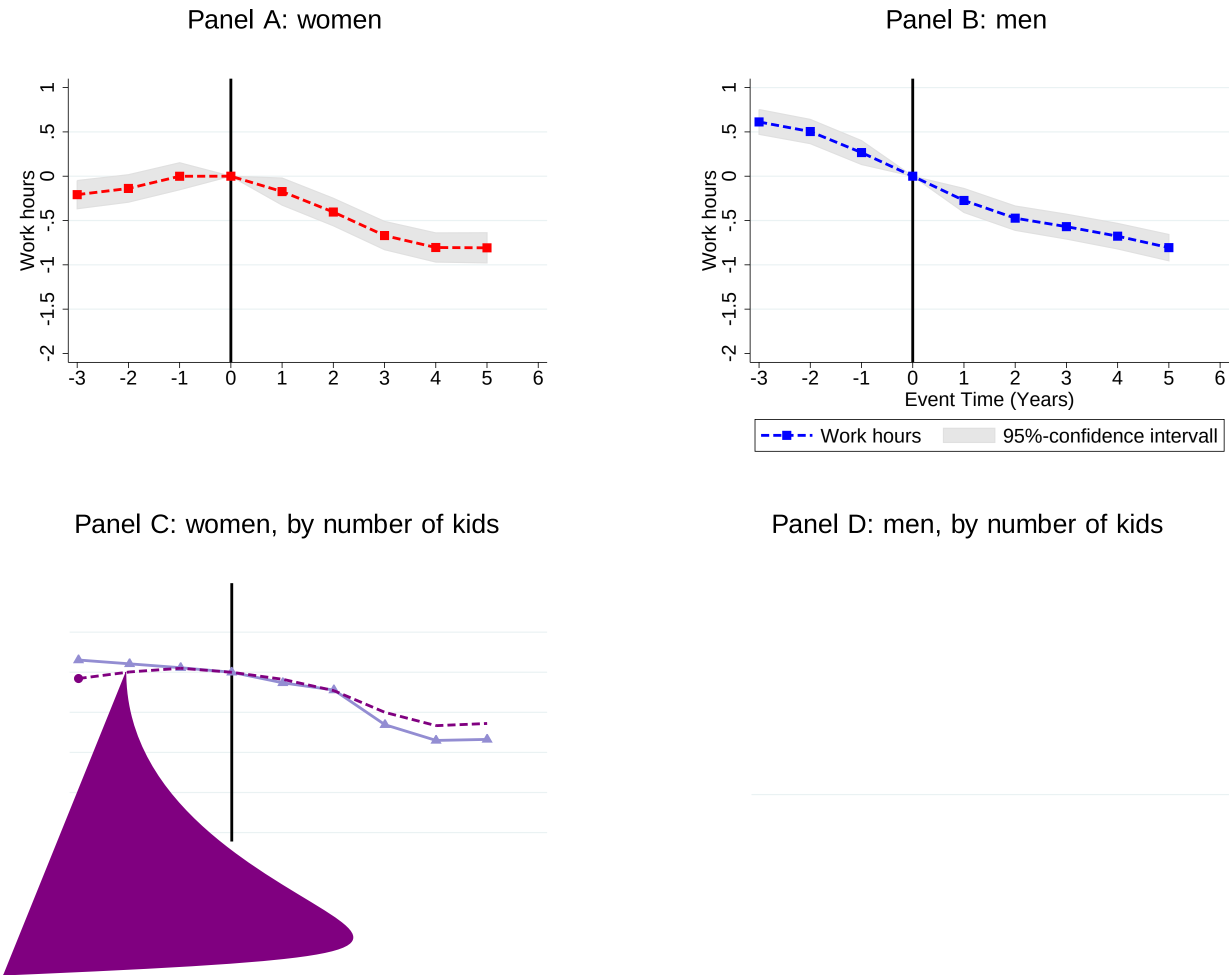
As outcome variable I consider work hours, as recorded in the Danish register data. This measure of work hours corresponds to weekly work hours and distinguishes between 5 work hours bins (<10, 10-19, 20-29, 30-37 and ≥ 38). I code work hours to be equal to 0 in case of non-participation, 38 in case of full-time and equal to the mid-point of the respective bin, if work hours fall into one of the bins. Following the specification used in Kleven et al. (2018) I include calendar year fixed effects as well as fixed effects that control for the time that elapsed since a couple got married for the first time. Denote by h_{ict} the weekly work hours of individual i in calendar year $c \in \{1980, 1981, ..., 2013\}$ in t year after first getting married. I run the following regression separately for women and men

$$h_{it} = a_{c(i,t)} + b_t + \sum_{r=-3}^{6} \beta_r D_{it+r} + \varepsilon_{it}; \qquad (1)$$

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

years before and 6 years after divorce. Panel A and B in Figure 6 plot the coe cient estimates separately for women and men. Panel C and D in Figure 6 show coe cient estimates from separate regressions by number of children (and for women/men).[20]

Figure 6: Weekly work hours around divorce



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

The graphs show that both men and women reduce their labor supply upon divorce. Following divorce both men an women reduce their weekly work hours by 0:75 hours. For men this is complemented by a 0:5 work hours reduction in the three years preceding divorce.[21] These ndings have interesting implications, in the context of maintenance payments. First, if divorcing

[20] For a better overview panel B and C in Figure 6 do not include con dence intervals. The respective graphs along with 95% con dence intervals are displayed in separate gures, F.1 and F.2.

[21] In a similar analyses for the U.S. Johnson and Skinner (1986) and Mazzocco et al. (2014) nd that women increase and men decrease work hours around divorce. Johnson and Skinner (1986) nd e ects in the years preceding divorce for women. E ects preceding divorce could be due to anticipation of divorce or because of events that cause persistent changes in labor supply as well as persistent changes in the divorce probability.

Preferences

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

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[23]

$$u_s^{mar}(c_s; \ell_s; Q; \ _s) = \frac{c_s^{1+\ _s}}{1+\ _s} + \ _s \frac{\ell_s^{1+\ _s}}{1+\ _s} + \ (n) \frac{Q^{1+}}{1+}$$

where controls the degree of substitutability between q_f and q_m and the factor $a \in [0;1]$ captures productivity di erences between the male and the female time input. The parameters 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 $Q = F_Q(q_f; q_m)$ and in divorce $Q_f = F_Q(q_f; 0)$ and $Q_m = F_Q(q_m; 0)$.

Economies of Scale and Expenditures for Children

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

$$F_x(c_f; c_m; n) = e(n)(c_f + c_m)^{\frac{1}{}}:$$

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form for p_K I impose $p_K(h_{st}) = 1 - \exp(- {}_s h_{st})$, where ${}_s$ controls how responsive the human capital process is to work hours. At the same time K_{st} constantly depreciates with (exogenous) probability p . This leads to the following law of motion for human capital:

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

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.[26] Each ex-spouse makes choices to maximize her/his own discounted lifetime utility, taking into account how decisions a ect the stream of maintenance payments that ows 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.

probabilith--28308((g)d--2830lei31(93(time83041(p)-2883as)-2883es)-3ell--283083828383ushp for average duration of maintenance payments of $\frac{1}{1 \quad p_M}$ time periods. Once discontinued maintenance payments remain at zero (i.e., if $_{t} = 0$ then $_{t+1} = 0$).

In order to determine allocations in this setting I restrict my attention to Markov-Perfect equilibria. To rule out multiplicity of equilibria which often occurs in simultaneous-move games I impose sequential (stackelberg type) decision-making within time periods. In particular I assume that within each time period m chooses rst and f responds optimally to m's choices.[27, 28]

Denote the period t decisions of spouse s by $_s = (c_{st}; h_{st}; q_{st}; `_{st}; A_{st+1}$

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

$$V^{div}_{st}(\;{}^{div}_{t}) = u^{div}_{s}(c_{st}; \ell_{st}; Q_{st}) + \; E_t[V^{div}_{st+1}(\;{}^{div}_{t+1})] \quad (5)$$

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

Division of Assets upon Divorce and Child Custody

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

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

Problem of Married Couples

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

In each time period married couples choose work hours, home production hours, (private) consumption for each spouse and savings in the joint asset A_{t+1}. Define the vector of period t

state variables of a married couple by $^{mar}_{t} = (\ _t ; A_t ; n_t ; K_{ft} ; K_{mt} ; \ _{ft} ; \ _{mt} ; \ _{ft} ; \ _{mt})$ and denote a married couple's choice variables by $_t = (c_{ft} ; c_{mt} ; h_{ft} ; h_{mt} ; q_{ft} ; q_{mt} ; `_{ft} ; `_{mt} ; A_t$

is binding is just indifferent between staying married and getting divorced. Divorce occurs if no value of $_t$ 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

work hours I impose that one year consists of 49 working weeks. I x 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. Finally I x the initial bargaining weight at $_0 = 0:5$, i.e., bargaining power is assumed to be equal at the outset of the model.

Table 3: Pre-set parameters

I estimate $p_{n_1}(n)$ and $p_n(t; n_t)$ by computing the corresponding sample means and Markov transition probabilities from the Danish birth register data. The estimates for p_{n_1} are reported in Table 4. The matrix of estimated Markov transition probabilities is presented in Table 5. Note that for $t \quad 4$ (i.e., after 12 years of marriage) birth probabilities generally are practically equal to 0.

Table 4: Distribution of initial no. of children

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

Notes: Source: Danish birth register.

Table 5: 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
$p_n(t \quad 5; n_5 = n)$	0.00	0.00	0.00

Notes: Source: Danish birth register.

5.3 Method of Simulated Moments Estimation

The remaining model parameters that are estimated using the method of simulated moments are (for $s \in \{f, m\}$) the parameters governing preferences for leisure $_s$; $_s$ and preferences for the home good B; b; , the parameters governing home production a; , the love shock parameters ; ; r and the parameters governing the wage processes $_{0s}$; $_{1s}$; $_{;s}$; $_s$; $p_{;s}$. I denote the vector of structural model parameters estimated by MSM by . For a given I solve the structural model by backwards recursion, simulate data for 20,000 hypothetical couples and compute the vector of simulated moments $m( )$. MSM-estimates $\hat{}$ are obtained by minimizing the distance between simulated model moments and their empirical counterparts $\hat{m}$

$$\min (m( ) \quad \hat{m})' W (m( ) \quad \hat{m}):$$

The empirical moments I target are conditional averages of working hours, housework hours and wages, where I condition on marital status (married/ divorced) and number of children.[31] I also target the fraction of ever divorced couples by time that elapsed since couples got married. Overall I target 53 empirical moments.

As weighting matrix $\hat{W}$ I use the diagonal matrix with the inversed variances of the empirical moments as diagonal entries.[32] The MSM parameter estimates are presented in Table 6 together with asymptotic standard errors (see, e.g., Newey and McFadden (1994)). For an assessment of the model t Figure 7 contrasts average outcomes computed from model simulations with the respective empirical moments computed from my data. In particular Panel A-C of Figure 7 show average work hours, housework hours and wages (computed separately by marital status, but averaged over number of children). Panel D shows the fraction of ever divorced couples by the time that elapsed, since they rst got married. Overall the model matches the considered data moments well, even though the model simulations deviate slightly from the data for married men's wages and work hours (my model slightly under-predicts these moments) and divorced women's housework hours (which are slightly over-predicted by my model). To give the full picture of how well my model ts all 53 targeted empirical moments Table E.1 contrasts all targeted empirical moments with their counterparts from model simulations at the estimated parameters. Relative to Figure 7, Table E.1 also shows how well my model captures heterogeneity in the observed outcomes across couples with di erent numbers of children. Even though the model is a bit sparse on couples with no kids, the model generally captures heterogeneity by number of children well. E.g., for couples with children the model does a good job at capturing the variation work hours and housework hours across number of children.

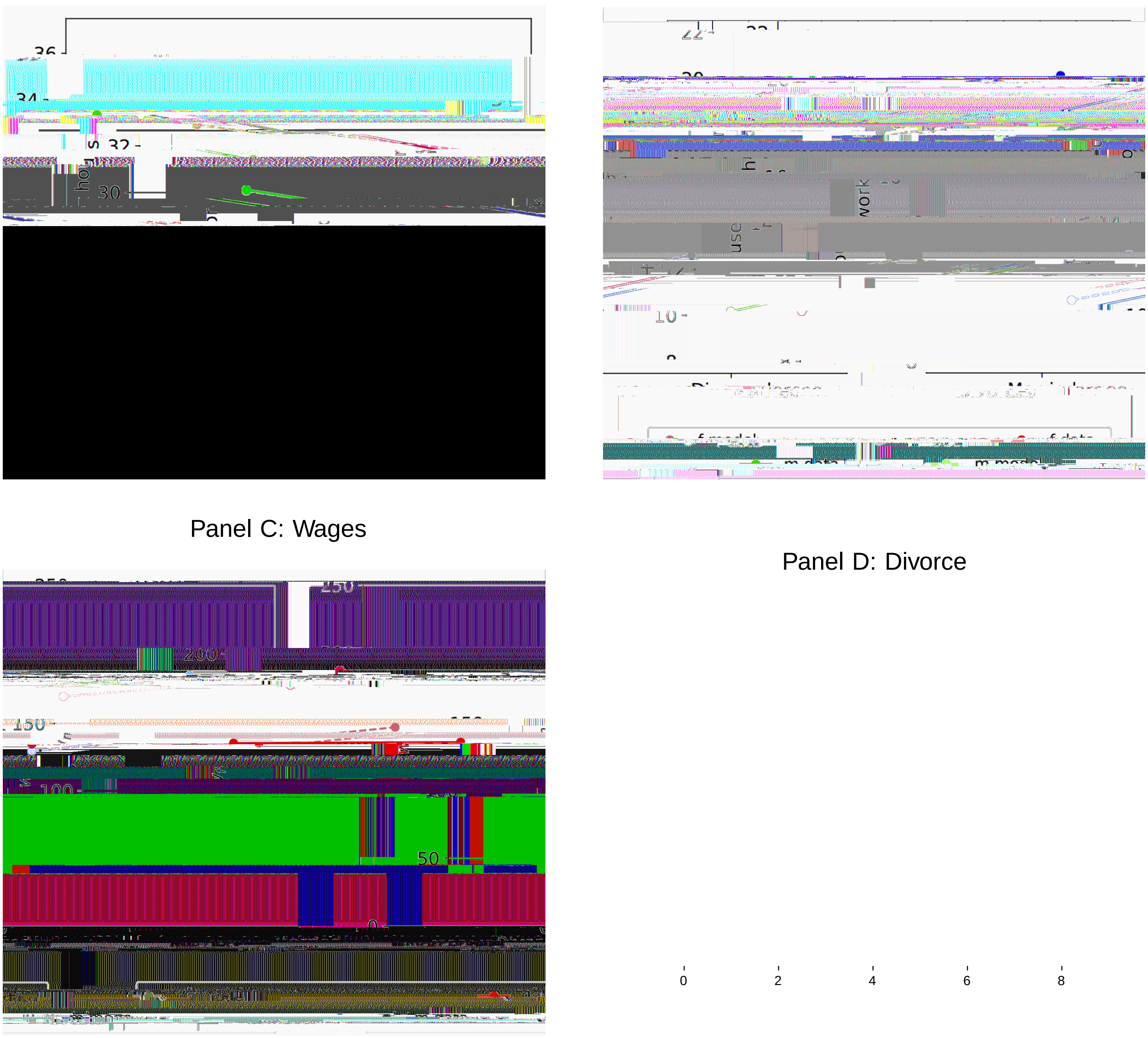
[31] As the data from the Danish Time Use Survey feature few observations on people with two or more children I compute joint moments for this group, i.e., target average housework hours separately for three groups: people with no children, people with one child and people with two or more children.

[32] Altonji and Segal (1996) show that using the e cient weighting matrix leads to undesirable nite sample properties.

Figure 7: Model t

Panel A: Weekly work hours

Panel B: Weekly housework hours



Notes: The gures display mean data moments (solid lines) and simulated model moments (dotted lines) by marital status and separately for women/men. Data moments on work hours, housework hours and divorce are computed from Danish register data. Data moments on housework are computed based on the Danish Time Use Survey. Model moments are computed based on simulations for N 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.

The second friction is non-cooperation in divorce. Because of non-cooperation in divorce there is no mutual insurance between divorcees, i.e., there is an inefficient lack of insurance against in-

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

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

where the continuation values are defined by

$$V_{st}^{fb;div} = u_s^{div}\left(c_{st}^{fb;div}; \ell_{st}^{fb;div}; Q_{st}^{fb;div}\right) + \beta E_t[V_{st+1}^{fb;div}]: \qquad (9)$$

For married couples the first best allocation solves

$$\begin{aligned}
\Omega_t^{fb;mar} &= \arg\max_{\Omega_t} \mu_t \left(u_f^{mar}(c_{ft}; \ell_{ft}; Q_t; \theta_{ft}) + \beta E_t[V_{ft+1}^{fb}] \right) \\
&\quad + (1-\mu_t)\left(u_f^{mar}(c_{mt}; \ell_{mt}; Q_t; \theta_{mt}) + \beta E_t[V_{mt+1}^{fb}] \right) \\
\text{s.t.} \quad x_t^{mar} &= w_{ft} h_{ft} + w_{mt} h_{mt} + (1+r)A_t - A_{t+1} \\
Q_t &= F_Q(q_{ft}; q_{mt}) \\
H_f &= h_f + \ell_f + q_f \\
H_m &= h_m + \ell_m + q_m
\end{aligned}$$

where the continuation values are defined by

$$\begin{aligned}
V_{st}^{fb} &= (1-D_t)V_{st}^{fb;mar} + D_t V_{st}^{fb;div} \\
V_{st}^{fb;mar} &= u_s^{mar}(c_{st}^{fb;mar}; \ell_{st}^{fb;mar}; Q_t^{fb;mar}; \theta_{st}) + \beta E_t[V_{st+1}^{fb}]
\end{aligned}$$

and where $D_t = 1$ is an indicator variable that indicates divorce. Finally married couples get

7.1 The Impact of Child Support on Time Use and Consumption

This subsection considers policy scenarios in which the level of child support payments is varied. In particular I consider changes in the policy parameter B, which controls child support payments and corresponds to a parameter in the Danish real world institutions. The status quo policy parameters in Denmark are $(B = 9420; \quad = 0{:}2)$. For convenience, I consider the normalized policy parameter $b = B/9420$ in the following. Conditional on the non-custodial parent's income, the number of children, child support payments are homogeneous of degree one in b, i.e., as b is multiplied by a factor $\quad > 0$, mandated child support payments are multiplied by the same factor . In the considered counterfactual experiments I vary b step-wise from no child support $(b = 0)$ to quadrupled child support $(b = 4)$ while the alimony policy is kept xed at $\quad = 0{:}2$.

Child support and couples' time allocation First, I look at how married couples' time allocation changes as child support is increased. The results in Table 8 show that higher child support leads to a slightly higher degree of household specialization among married couples. Married women tend to supply less market work and more housework, while married men supply less housework and more market work. Quantitatively, as child support is increased from $b = 0$ to $b = 4$ housework hours among married women increase by 1.7% while their (market) work hours drop by 1.k among divorced men. This is suggestive of a large income effect that dominates the substitution effect, which pushes towards higher male labor supply as child support is increased. Quantitatively, switching from $b = 0$ to $b = 4$ leads to a reduction in female work hours by 6.1% and to an increase in male work hours by 4.8%. At the same time female housework hours increase by 9.5% and male housework hours decrease by 0.9%. Average leisure time among divorced women increases by 6.3% while leisure time among divorced men decreases by 5.2%.

Table 9: The effect of changing child support (b) on divorced couples' time use

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

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

Child support and consumption insurance Next, I study the extent to which child support policies are successful in providing consumption insurance. Table 10 shows couples' relative consumption by marital status, which provides a measure of how well individuals are insured against income losses upon divorce under each policy scenario. If child support payments work well as insurance device, the gap between relative consumption in marriage and divorce should narrow as child support is increased. The results in Table 10 show that child support policies indeed provide consumption insurance. Under all considered policy scenarios married couples relative consumption is close to 1, i.e., married men and women consume almost equally, while among divorcees women's consumption is a lot lower than men's. As child support is increased the relative consumption of divorced couples increases from 0.57 in the case of no child support ($b = 0$) to 0.78 in the $b = 4$ scenario. While child support is effective in mitigating the drop in relative consumption, full insurance, i.e., equal relative consumption in marriage and divorce, is not attained upon divorce even for high levels of child support.

Table 10: The e ect of changing child support (b) on couples' relative consumption

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

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

;= To address concerns that the patterns shown in Table 10 could mainly be driven by di erences between couples who do get divorced and couples who do not get divorced, Figure 8 presents event

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

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

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

Table 12 shows the corresponding results for divorced couples. In response to a switch from $= 0$ to $= 0.4$ the average work hours of divorced women drop by 36.1%. This is accompanied by both rising average housework hours (by 64%) and rising average leisure time (by 28.6%). For divorced men I find that average work hours fall by 5.9%, while housework hours and leisure time increase by 18.1% and 10.4% respectively among male divorcees.

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

Table 12: The e ect of changing alimony ( ) on divorced couples' time use

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

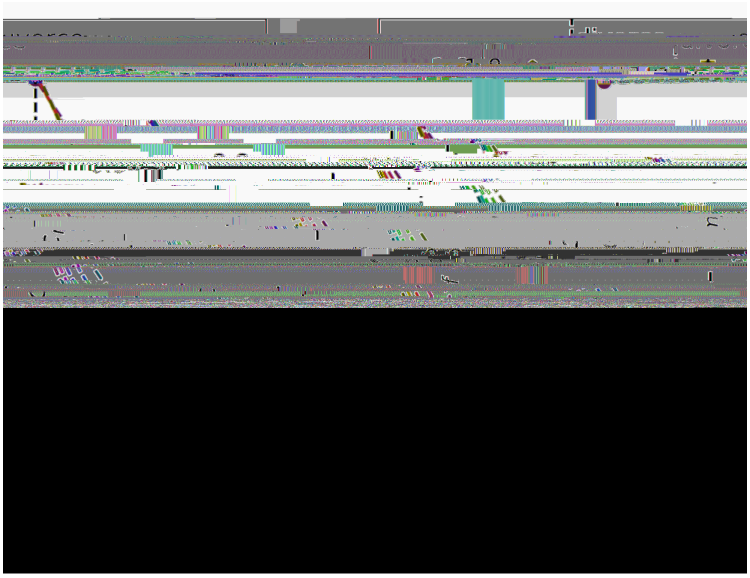
Notes:

Table 13: The effect of changing alimony ( ) on couples' relative consumption

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

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

Figure 9: Event study: relative consumption



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

7.3 The Impact of Child Support and Alimony on Divorce Rates

8.1 Welfare Comparisons and Optimal Policy

payments. [41]

8.2 Comparison to First Best

To assess how close the optimal child support/ alimony combination can bring couples to the first best scenario, I compare allocations and couples' welfare under the status quo policy $(b = 1; \ = 0.2)$ to the optimal maintenance policy $(b = 3; \ = 0.175)$ and the first best scenario. Table 16 presents outcomes for each of the three scenarios and Figure 12 compares women's and men's ex-ante welfare for each scenario. Comparing the columns of Table 16 from left to right shows that all considered outcomes are closer to first best under the optimal maintenance policy than under the status quo, i.e., the optimal maintenance policy induces couples to adjust their behavior towards the first best allocation.

[41] More specifically, I compute the welfare criterion W for each value of $(b; \ )$ in $\{0; 0.5; 1; \ldots; 4\}$ $\{0; 0.05; 0.1; \ldots; 0.4\}$. The reported welfare maximizing $(b; \ )$ is the maximizer over this grid.

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

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

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

9 Conclusion

This paper addresses the question how post-marital maintenance payments a ects couples' decision-making and how maintenance policies (child support and alimony policies) should be designed. I construct a dynamic economic model and estimate its structural parameters by method of simulated moments estimation, matching a range of empirical moments from rich Danish administrative data and time use data. The data include information on marriage and divorce, child custody, maintenance payments and housework hours. My model incorporates two driving forces that speak in favor of maintenance payments: providing insurance to the lower earner in married couples andpaora7g6(pa)2epa aim of policy is to balance this trade-o .

The model takes into account that divorced ex-spouses are linked by maintenance payments. Divorcees interact non-cooperatively. The strategic interaction that arises because ex-couples are linked through maintenance payments, is fully modeled. Married spouses make decisions cooperatively, subject to limited commitment. Another key model ingredient are learning-by-doing returns to work experience, which instill a con ict between individual incentives and what is optimal from the couples perspective. From the individuals perspective it is optimal work a lot to accumulate returns to work experience and thereby self-insure against income losses upon divorce,

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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 in ation. Throughout the paper I use the year 2004 values of the Danish maintenance policy parameters and de ate wages (and other money amounts) taking 2004 as base year.[42]

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 $-s$ earns annual labor income I_{-s} then the child support that $-s$ needs to pay to s is given by

$$cs(n_S; I_{-s}; B) = nB\left(1 + \sum_{k=0}^{K} a_k 1\{b_k(n) \leq I_{-s} < b_{k+1}(n)\}\right) \tag{10}$$

Where the year 2004 values of the parameters that enter into (10) are $B = 9420$ (DKK), $K = 5$ (i.e., child support varies across 6 income brackets across) as well as the values of a_k and $b_k(n)$, which are given in Tables A.1 and A.2.

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a a a

Table A.2: Child support parameters 2

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

Notes: Source: Danish State Administration (Statsforvaltning).

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

$$\text{alim}(\tilde{\Gamma}_H;\tilde{\Gamma}_L) = \begin{cases} \alpha(\tilde{\Gamma}_H - \tilde{\Gamma}_L) & \text{if } \tilde{\Gamma}_L \geq C_1 \text{ and } \tilde{\Gamma}_H - C_2 \geq \alpha(\tilde{\Gamma}_H - \tilde{\Gamma}_L) \text{ and } C_3 - \tilde{\Gamma}_L \geq \alpha(\tilde{\Gamma}_H - \tilde{\Gamma}_L) \\ \alpha(\tilde{\Gamma}_H - C_1) & \text{if } \tilde{\Gamma}_L < C_1 \text{ and } \tilde{\Gamma}_H - C_2 \geq \alpha(\tilde{\Gamma}_H - \tilde{\Gamma}_L) \text{ and } C_3 - \tilde{\Gamma}_L \geq \alpha(\tilde{\Gamma}_H - \tilde{\Gamma}_L) \\ \max\{\tilde{\Gamma}_H - C_2; 0\} & \text{if } \tilde{\Gamma}_H - C_2 < \alpha(\tilde{\Gamma}_H - \tilde{\Gamma}_L) \\ \max\{C_3 - \tilde{\Gamma}_L; 0\} & \text{if } C_3 - \tilde{\Gamma}_L < \alpha(\tilde{\Gamma}_H - \tilde{\Gamma}_L) \end{cases} \quad (11)$$

By this functional form it is ensured that, 1. if the receiver's labor income is below C_1, alimony payments are capped by $\alpha(I_s - C_1)$, 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 (11) are given by $\alpha = 0.2$, $C_1 = 90000$, $C_2 = 204000$ and $C_3 = 230000$.

B Computational Details

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

Model solution The model is solved by backwards recursion, i.e., for each time period t the model agents' problem is solved at a grid of points in the state space, taking the continuation values in $t+1$ as given. I rst 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 o 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 $_{ft}$, and Gauss-Hermite quadrature (see Judd (1998)) to approximate integrals taken over the distribution of the wage shocks, $_{st}$ ^{iid} $N(0; {}_s)$. For the approximation of the random walk according to which the love shocks $_{ft}$; $_{mt}$ evolve I use Rouwenhorst's method for discretizing highly persistent processes (see Kopecky and Suen (2010) and Fella et al. (2017)).

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

Estimation For the minimization of the MSM criterion function I use basin-hopping, a global optimization routine. The basin-hopping algorithm uses the Nelder-Mead algorithm for nding local minima and upon sucessful completion of the Nelder-Mead

C Timing of Events

Figure C.1: Timing of events for married couples

I define the dependent variable by

$$cust_i = \begin{cases} 0 & \text{mother takes custody} \\ 1 & \text{father takes custody.} \end{cases}$$

In 9% of all divorce cases in my sample couples with multiple children split custody, i.e., some children stay with each parent. I categorize these cases as follows. If parents split custody such that the majority of children stay with one parent I classify this parent as custodial parent. If parents split custody equally I randomly classify one parent as custodial parent with probability 0.5.

As right hand side variables X_i I consider marriage duration (t) and number of children n_t at the time of divorce. The estimated empirical model is summarized by

$$cust_i = 1\{X_i \beta > \epsilon_i\}$$
$$\epsilon_i \sim N(0;1)$$

The coefficient estimates $\hat{\beta}$ are presented in Table D.2. The estimates show that a higher number of children is associated with a lower propensity of the father to take custody. Longer marriage duration in contrast is associated with a higher propensity of the father to take custody. Note that in more extensive empirical specifications, where age of the youngest child is added as right hand side variable the coefficient estimate of marriage duration becomes insignificant (see Table D.4). As the age of the youngest child and marriage duration are highly correlated at 0.68. It seems plausible that marriage duration mostly picks up the association between $cust_i$ and the age of the youngest child.

Table D.1: Child custody, probit model

Child custody:	$cust_i$
Number of children (n)	-0.115
	(0.0160)
Marriage duration (t)	0.0287
	(0.0022)
Constant	-1.493
	(0.0379)
Observations	32313

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

Table D.2: Child custody, probit model - prediction and marginal e ects

	At avg. X_i	Sample avg.
P(father takes custody)	0.0770	0.0795
	(0.0015)	(0.0015)
Partial e ect, number of children (n)	-0.0167	-0.0168
	(0.0023)	(0.0023)
Partial e ect, marriage duration (t)	0.0041	0.0042
	(0.0003)	(0.0003)
Observations	32313	32313

Standard errors in parantheses
$p < 0{:}1$, $p < 0{:}05$, $p < 0{:}01$

Table D.3: Child custody, multinomial probit

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

Table D.6: Child custody, multinomial probit (extensive speci cation)

Child custody:	$cust_i = 1$	$cust_i = 2$
Number of children (n)	-0.125	0.834
	(0.0271)	(0.0235)
Marriage duration (t)		

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

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

F Figures

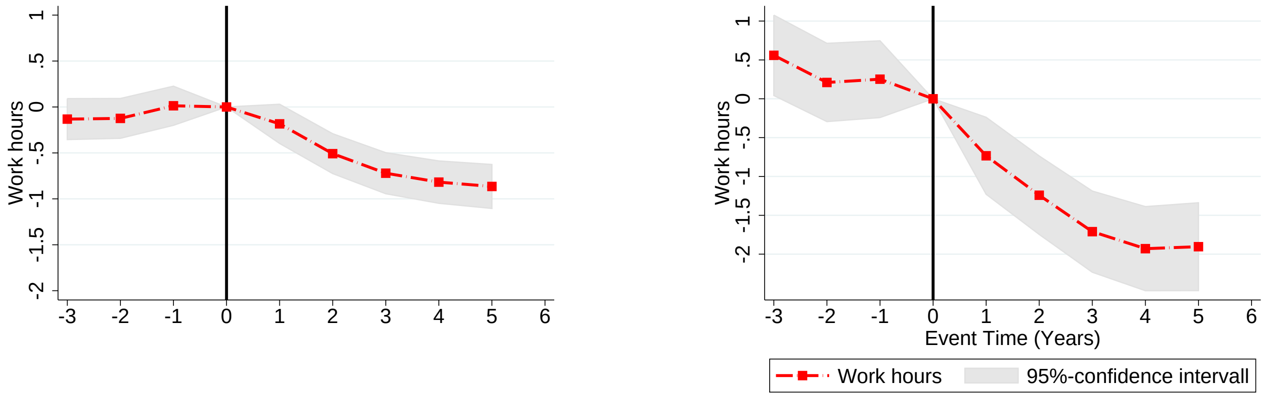
Figure F.1: Women's weekly work around divorce, by number of children

Couples with 0 children

Couples with 1 child

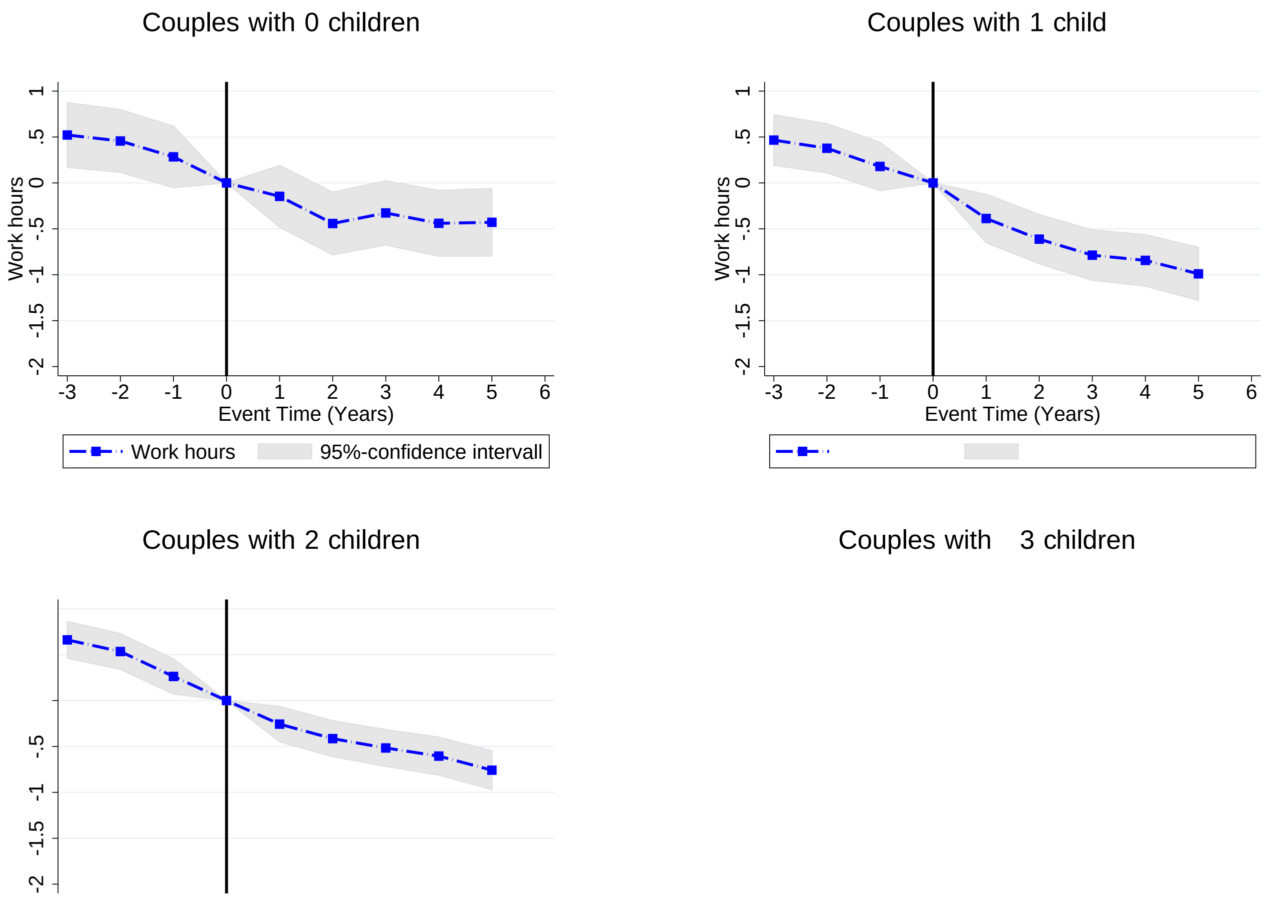
Couples with 2 children

Couples with 3 children



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

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



<u>Notes</u>: Each gure contains coe cient estimates of 1 for men, seperately by number of children. Included are all men in my sample, that are observed for at least 3 periods prior and 6 periods after getting divorced.