2012

Spousal Conflict and Divorce

Oleksandr Zhylyevskyy
Iowa State University, oz9a@iastate.edu

Spousal Conflict and Divorce

Abstract
The optimal balance between keeping marriages intact, despite spousal conflict, and allowing for divorce is a subject of policy debate in the United States. To explore the trade-offs, I construct a structural model with information asymmetries, which may generate inefficient outcomes. Parameters are estimated using data from the National Survey of Families and Households. I find that eliminating separation periods decreases the conflict rate by 9.2% of its baseline level and increases the divorce rate by 4.0%. Perfect child support enforcement decreases the frequency of conflict and divorce by 2.7% and 21.2%, respectively, and reduces the incidence of inefficient divorces.

Disciplines
Economics

Comments
This is an article from *Journal of Labor Economics* 30 (2012): 915, doi:10.1086/666654. Posted with permission.

Spousal Conflict and Divorce

Oleksandr Zhylyevskyy, *Iowa State University*

The optimal balance between keeping marriages intact, despite spousal conflict, and allowing for divorce is a subject of policy debate in the United States. To explore the trade-offs, I construct a structural model with information asymmetries, which may generate inefficient outcomes. Parameters are estimated using data from the National Survey of Families and Households. I find that eliminating separation periods decreases the conflict rate by 9.2% of its baseline level and increases the divorce rate by 4.0%. Perfect child support enforcement decreases the frequency of conflict and divorce by 2.7% and 21.2%, respectively, and reduces the incidence of inefficient divorces.

I. Introduction

Marriage is vital to the production of many economic, social, and health benefits for individuals, but empirical evidence suggests that spousal conflict is sometimes more detrimental to a harmonious family life than divorce. Thus, the optimal balance between keeping marriages intact, despite intense spousal disputes, and allowing for separation continues to be a

I am indebted to Steven Stern, Leora Friedberg, Amalia Miller, and Brent Kreider for their invaluable advice and support. I am also indebted to Peter Arcidiacono for helpful comments and suggestions. I thank Kia Sorensen for help with confidential data from the National Survey of Families and Households and Kristin Senty for editorial assistance. I also thank participants of seminars at the North American Summer Meetings of the Econometric Society, world conference of the European Association of Labour Economists and the Society of Labor Economists, annual meetings of the Southern Economic Association, the International Atlantic Economic Conference, University of Virginia, Vanderbilt University, and Iowa State University. Financial support from the Bankard Fund for Political Economy, Dissertation Year Fellowship Program, and John M. Olin Program in Law and Economics at the University of Virginia is gratefully acknowledged. Contact the author at oz9a@iastate.edu.

[*Journal of Labor Economics*, 2012, vol. 30, no. 4]

0734-306X/2012/3004-0005$10.00

subject of heated policy debate in the United States, even after years of changes to divorce laws.[1]

In this article, I propose and estimate a structural model of marital interactions to explore why some couples have intense disputes but keep living together, while other couples cooperate, and the rest divorce. The structure of the model is used to derive the likelihood contribution of every couple in the sample. Notably, my modeling approach offers a number of advantages over a simpler analytical approach such as reduced-form modeling. In particular, the structural model proposed here enables a quantification of the incidence of inefficient divorces. It also allows me to characterize differences in male and female preferences for marital conflict.

This article fills a void in the family economics literature by proposing a tractable static model in which marital outcomes are generated in an internally consistent way, which can be viewed as the first step toward a more general dynamic model to feature a spectrum of outcomes, with cooperation at one end and divorce at the other. The article also represents one of the few attempts in the family economics literature to incorporate in the analysis spousal self-reports on conflict behaviors, opinions, and beliefs, which until now have been systematically studied by psychologists and sociologists only.

In the model, spouses bargain noncooperatively over the division of marital surplus and, depending on the outcome of the negotiations, end up in one of three distinct states: cooperation (if they reach an agreement on how to allocate the surplus), conflict (if they stay together after the negotiations have failed), or divorce (if either the husband or the wife unilaterally separates). The probability of each marital state is derived using the structure of the model from inequalities underlying a corresponding Nash equilibrium in the game. The model allows for asymmetric information between the spouses along two dimensions. First, every spouse knows the extent of his or her own utility loss from conflict but is unsure about the impact of conflict on the partner. Second, the spouses know their own postdivorce opportunities but are uncertain about the outside options of each other. This information asymmetry can generate Pareto-inefficient outcomes, including inefficient conflict and inefficient divorce.[2]

I estimate structural parameters by the maximum simulated likelihood method using particularly rich data on almost 3,900 married couples from the National Survey of Families and Households (NSFH). The NSFH

[1] Unlike in a paper by Bowlus and Seitz (2006), the primary focus of this research is on conflicts that do not escalate to physical violence, which is dealt with by the law in a separate fashion.

[2] In line with Lundberg and Pollak (1993), I assume that the state of conflict is always an inefficient outcome. However, I allow for both efficient and inefficient divorces and use the estimated model to quantify the incidence of inefficient divorces.

covers a nationally representative probability sample and contains unique questions that enable construction of indicators of conflict, optimism, or pessimism about one's own divorce prospects and beliefs about the partner's divorce prospects (beliefs about the disutility impact of conflict on the partner are primarily inferred from observable outcomes). Results of goodness-of-fit tests indicate that the estimated model fits the data well.

I examine effects of sociodemographic characteristics, marriage market conditions, and public policy variables on spousal utilities and find that the estimation results are in line with intuition. For example, the difference between spousal education levels, which is an indicator of marital heterogamy, has a negative impact on marital surplus under cooperation, while marriage duration has a positive impact. More favorable conditions in the local marriage market (more specifically, higher availability of potential marriage partners of the opposite sex) tend to increase the wife's divorce payoff. Mandatory separation period requirements tend to reduce spousal divorce payoffs, but the effect is statistically significant only in the case of long-term separation periods. Higher child support collection rates reduce the divorce payoffs of high school educated husbands. In addition, the estimates suggest that married women tend to derive relatively less disutility from marital conflict than do men. Also, the results indicate two types of information asymmetries between the spouses (related to differential effects of conflict and divorce) and imply that a large majority of married individuals are less able to tolerate conflict and think that their outside options are low, which contributes to a high observable rate of cooperation in marriage. Moreover, the model predicts a substantial incidence of inefficiency conditional on divorce being the equilibrium outcome, which underscores the impact of asymmetric information on couples' well-being.

I perform policy experiments to evaluate effects of less stringent separation period requirements and better enforcement of child support obligations on the overall distribution of marital outcomes and the incidence of inefficient divorces. I find that eliminating separation periods can serve as a deterrent to spousal conflict by decreasing the conflict rate by 9.2% of its baseline level. Also, it can increase the divorce rate by 4.0% of the baseline level and increase the probability of the inefficiency in divorce. In comparison, strong enforcement of child support obligations has a potential to reduce the frequency of both conflict and divorce by as much as 2.7% and 21.2% of their respective baseline rates and also reduce the likelihood of the inefficiency in divorce. These results suggest that enforcement of child support obligations is a particularly promising avenue to explore for policy makers who want to facilitate efficient marital outcomes.

The remainder of this article is organized as follows. Section II reviews the literature and discusses novel features of the article. Section III describes the economic model and its main properties. Section IV provides details on the data and the estimation approach. Section V presents estimation results, goodness-of-fit and specification tests, and policy experiments. Section VI concludes by summarizing key features of the article and briefly outlines directions for future work. Proofs and technical details are relegated to appendixes.

II. Contribution to the Literature

The phenomenon of conflict in an intact marriage is empirically relevant. For instance, in the NSFH data that I use to estimate the model, 23% of couples report that they have disputes at least several times a week. Moreover, a considerable proportion do not appear to deal with conflict constructively: 27% admit that they seldom calmly discuss serious disagreements, and 10% often shout at each other. Still, nearly all economic models of the household, including traditional (e.g., Becker, Landes, and Michael 1977), cooperative bargaining (e.g., Manser and Brown 1980; McElroy and Horney 1981), and collective models (e.g., Chiappori 1988), consider only the two polar cases, spousal cooperation versus divorce, while ruling out any possibilities in between. A small but growing literature on marital disagreements has addressed such extreme outcomes as spousal homicide, suicide, and physical abuse (see Tauchen, Witte, and Long 1991; Dee 2003; Bowlus and Seitz 2006; Stevenson and Wolfers 2006) but has tended to neglect nonviolent disputes.

Conventional models also typically do not allow for inefficient marital outcomes. However, Udry (1996) shows that a household need not achieve an efficient allocation of resources across production activities of its members, and Duflo and Udry (2004) demonstrate that spouses do not fully insure each other against short-term variation in individual incomes. This evidence suggests that the Pareto efficiency of marital outcomes should be carefully investigated and not simply imposed at the outset since the outcomes may sometimes be inefficient (see Lundberg and Pollak 1996).

Also, nearly all conventional models rule out asymmetric information within the marriage. However, available data on spousal opinions and beliefs indicate that such an asymmetry exists (Friedberg and Stern 2006). To illustrate, 16% of wives in my estimation sample say that their own overall happiness would be the same or better after divorce, when the husbands, on the contrary, believe that the wife's happiness would be worse. Similarly, 18% of husbands report that their own happiness would stay the same or improve, when the wives, in fact, believe it would worsen. Thus, it may be desirable to relax a typical assumption of perfect information within a couple, in line with an original insight of Becker (1991) that some information asymmetries persist in marriage (see a similar discussion in Becker et al. 1977).[3]

[3] See also Peters (1986) for a description of how private information about divorce payoffs may lead to an inefficient marital outcome.

This research builds on Lundberg and Pollak's (1993) idea of an inefficient noncooperative marital equilibrium and can be also linked to structural analyses of Tartari (2005), Bowlus and Seitz (2006), and Friedberg and Stern (2006). However, it differs from these papers and other existing literature in a number of novel ways.

Lundberg and Pollak (1993) adopt the cooperative bargaining framework, but unlike prior papers that use divorce threat points, they specify spousal outside options in terms of the payoffs from an inefficient equilibrium within the marriage. The inefficient equilibrium could result from a game in which the spouses independently supply and underprovide household public goods. However, since cooperative bargaining a priori rules out inefficient equilibriums, Lundberg and Pollak's model cannot actually generate noncooperation as an observable outcome. Their model also does not allow for divorce. In contrast, I specify marital interaction as a noncooperative rather than cooperative game. Thus, the model can produce any one of three potential outcomes—cooperation, conflict, or divorce (some of which may be Pareto inefficient)—in an internally consistent way.

Tartari (2005) analyzes the relationship between marital status and a child's cognitive achievement by specifying that the parental mode of interaction, with or without conflict, affects the production of offspring quality. Spouses can exert costly efforts to increase the likelihood of a conflict-free relationship, but the actual mode of spousal interaction is randomly drawn by nature. My approach to endogenizing conflict is different: conflict indicates a situation in which a couple failed to reach an agreement about the division of marital surplus but chose not to divorce. Moreover, unlike Tartari, I allow for asymmetric information between spouses.

Bowlus and Seitz (2006) study responses of wives to physical abuse and find that women are more likely to divorce violent partners and can strategically use employment as a deterrent to abuse. Importantly, domestic violence in their model can only occur if the husband derives a positive utility premium from abuse. Also, divorce can only happen if the wife chooses to separate, while the husband cannot initiate divorce on his own. On the contrary, conflict in my model is associated with a utility loss relative to cooperation, and both spouses are allowed to unilaterally divorce, which is in line with the divorce legislation in nearly all US states. Additionally, my article differs from Bowlus and Seitz's analysis by focusing primarily on nonviolent disputes.

Friedberg and Stern (2006) assume that spouses play a one-stage game in which the husband offers a side payment to the wife that allocates marital surplus, whereas the wife can either accept or reject the offer (acceptance implies cooperation, and rejection results in divorce). The spouses know their own outside options but may have incorrect beliefs about the divorce prospects of each other. This information asymmetry leads to a lower expected match value than the one under perfect information. My model is methodologically similar, but it additionally includes conflict as an outcome of bargaining and incorporates an extra source of information asymmetry related to the disutility impact of conflict on individuals. Moreover, I parameterize spousal outside options in terms of separation requirements and the strength of child support enforcement, which allows me to investigate effects of public policies involving these two aspects of divorce regulations.

To a large degree, this article is motivated by a comprehensive analysis of symptoms of spousal conflict in the psychology literature (see Booth, Crouter, and Clements 2001; Grych and Fincham 2001). Although few of the discovered effects in this literature have been plausibly shown to be causal, there is little doubt that even nonviolent conflicts indicate negative outcomes for the family well-being. In particular, marital disagreements are tied to alcoholism, depression, and various illnesses. In contrast to the route taken by the psychology literature, my modeling approach allows me to directly examine the disutility derived by spouses from conflict, rather than to focus on its many concurrent symptoms (anxiety, depression, etc.). Unfortunately, the approach does not allow me to separately estimate a potential direct impact of conflict on children. From the perspective of labor economics, it may be interesting to know whether parental conflict has any long-term effects on children, for instance, whether it affects their educational attainment and labor market outcomes. Such research issues are not the focus of this article and may be best addressed using a model in the spirit of Tartari (2005).

III. Economic Model

A. Setup

The focus of this article is on outcomes that arise in a marriage rather than on issues such as why many individuals eventually marry but others choose to stay single, why some individuals look for a mate for a long time until they are relatively old but others marry at a young age, and how exactly men and women sort into marriage, all of which have been studied in the literature. Thus, to keep analytical complexity at a manageable level, I take a marriage of two agents, called "husband" and "wife," as given.[4] The hus-

[4] Combining marital search and spousal bargaining in one model is a difficult task, and I am not aware of any paper that has attempted to endogenize marital match formation simultaneously with cooperation, conflict, and divorce. Moreover, since the NSFH does not collect marriage histories from spouses of primary respondents, such a complex model would be impossible to estimate using the available data. It is worth noting that in the empirical specification of the model, I will control for a potential impact of marriage duration (along with other sociodemographic characteristics of a couple) on spousal utilities. Also, I will test for potential dependence of beliefs on marriage duration.

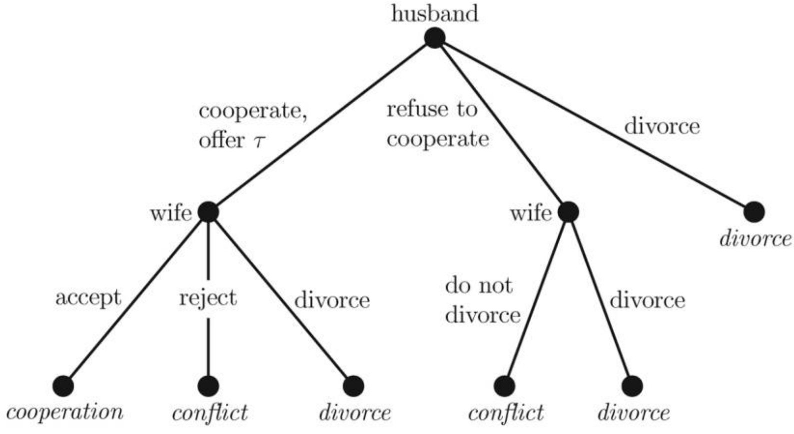

FIG. 1.—Structure of marital game

band and wife play a two-stage game with a schematic structure given in figure 1.

One of the spouses, for example, the husband, moves first and (1) proposes cooperation and offers some transfer τ to allocate marital surplus or (2) refuses to cooperate but abstains from separating or (3) announces divorce. The strategies are respectively denoted as $(\tau;\mathcal{C})$, $\mathcal{R}$, and $\mathcal{D}$, and transfer τ represents a transfer of utility between the spouses (the value of τ may be negative). The wife observes her husband's action and makes her move. If he chose $(\tau;\mathcal{C})$, she (1) accepts the offer or (2) rejects it without separating or (3) announces divorce. If he picked action $\mathcal{R}$, she either (1) abstains from separating or (2) announces divorce. If the husband chose $\mathcal{D}$, the game results in divorce and ends before the wife gets to move. The assumption about the order of the moves is made here since the NSFH contains no information on the specifics of the actual bargaining protocol. In fact, I estimate the model twice: first, by specifying that the husband moves first and, second, by specifying that the wife moves first. Parameter estimates are qualitatively similar between these two cases. However, the estimated model in which the husband moves first has a higher value of the sample log-likelihood function at the optimum. Hence, it is selected for presentation in this article.[5]

[5] Notably, the imposed sequential structure of the game helps to avoid multiplicity of equilibriums that would arise in a setting with simultaneous spousal moves, complicating identification and estimation. As a more flexible alternative to the approach in this article, one could potentially consider a model in which nature chooses the husband to be the first mover with probability p and the wife with probability $1-p$. However, there is no information in the NSFH to credibly identify this p.

The game results in one of three mutually exclusive and exhaustive outcomes, which are referred to as "marital states." The marital state of cooperation occurs if the husband makes a transfer offer and the wife accepts it. The state of conflict happens if either the husband offers a transfer, but the wife rejects it, or he refuses to cooperate, and she abstains from separating. The state of divorce is the result of a unilateral decision by a spouse to terminate the marriage, which is in line with the current divorce legislation.

All characteristics of a spouse are observable to the partner, except for two individual traits. First, the spouse may be differentially affected by conflict. I refer to this trait as "bargaining strength" and, for simplicity, restrict it to two potential levels. Specifically, the spouse may derive either (1) a large disutility from conflict (in which case the spouse is said to be a "soft bargainer") or (2) a small disutility from conflict ("hard bargainer"). Second, the spouse may be differentially affected by divorce. This trait is called "optimism" and, again, is limited to two levels: the spouse anticipates his or her outside option to be either (1) high (the spouse is an "optimist") or (2) low ("pessimist").[6]

Spousal type is a combination of the trait levels. There are four possible types: "hard bargainer–optimist," "hard bargainer–pessimist," "soft bargainer–optimist," and "soft bargainer–pessimist," denoted as HO, HP, SO, and SP, respectively. I index husband's types by k and wife's types by l. Also, I denote the probability that the husband assigns to the event that his wife's true type is l by δ^l, where $0 \leq \delta^l \leq 1$ for any l, and $\Sigma_l \delta^l = 1$. Thus, the husband's beliefs about the wife may be represented by a vector $(\delta^{\mathrm{HO}}, \delta^{\mathrm{HP}}, \delta^{\mathrm{SO}}, \delta^{\mathrm{SP}})'$. The husband's uncertainty about the wife's true type induces asymmetric information in the negotiation process. Notably, the structure of the game and the specification of the payoffs below imply that beliefs of the wife about the husband's type do not affect the outcome of the game.[7]

Spouses receive payoffs in the form of utilities that are specific to marital state, one's sex, and possibly also one's own true type but not the partner's type. The set of all possible payoff values is common knowledge. In the state of cooperation, given transfer τ, the husband obtains utility $u_h(-\tau)$, and the wife receives $u_w(\tau)$, irrespective of their types. The transfer τ is used to

[6] The notions of "optimism" and "pessimism" are introduced to facilitate the discussion of player types. They specifically refer to the value of the outside option and need not be related to one's tendency to over- or underestimate success in life. A similar caveat applies to the notion of "bargaining strength," which is, effectively, one's ability to endure conflict that may arise from bargaining in marriage but not necessarily in conflicts in other contexts.

[7] More specifically, the beliefs of the wife about the husband's true type do not affect the outcome of the game in which the husband moves first. However, they would affect the marital outcome if the wife were to move first.

allocate marital surplus between the spouses. The symbolic minus before τ in $u_h(\cdot)$ indicates that the husband is worse off when he makes a higher transfer to the wife. In reality, marital surplus is "produced" using many factors such as spousal characteristics and marital capital. To keep the model simple, I do not specify a production function of the surplus. However, by parameterizing the payoffs in terms of characteristics of the couple in the empirical application, I will effectively estimate how various characteristics affect the surplus. Functions $u_h(\cdot)$ and $u_w(\cdot)$ are assumed to be continuous and monotone in τ; namely, $u_h(-\tau^1) < u_h(-\tau^2)$ and $u_w(\tau^1) > u_w(\tau^2)$ if $\tau^1 > \tau^2$, and their domain is a transfer set $[\tau_{\min}, \tau_{\max}]$, where $\tau_{\min}$ and $\tau_{\max}$ are (in absolute value) very large negative and positive numbers, respectively. The restriction on the domain allows me to rigorously establish several properties of the game but plays no practical role in the empirical application.

In the state of conflict, no transfer is made, and the payoff of the husband, denoted as v_h^k, and the payoff of the wife, v_w^l, depend on their respective bargaining strengths. A husband who is a hard bargainer–optimist or a hard bargainer–pessimist receives v_h^H (i.e., $v_h^{\mathrm{HO}} = v_h^{\mathrm{HP}} = v_h^H$), and soft bargainers receive v_h^S ($v_h^{\mathrm{SO}} = v_h^{\mathrm{SP}} = v_h^S$). The payoffs of the wife are defined analogously. By definition of the trait of bargaining strength, $v_h^S < v_h^H$ and $v_w^S < v_w^H$. Following Lundberg and Pollak (1993), I assume that spousal payoffs in the state of conflict are below the utility possibility frontier that results from cooperation. In fact, conflict can reduce marital surplus through several channels. For example, spouses in conflict may enjoy time spent with each other by far less than cooperating spouses. Also, spouses in conflict may underprovide household public goods, which would result in an inefficient outcome as in Lundberg and Pollak's setting. In addition, a lower surplus can result from psychological side effects of conflict (e.g., sadness or anxiety). Formally, the assumption implies that there exists a transfer $\tau^0 \in [\tau_{\min}, \tau_{\max}]$ such that each spouse would be better off if they cooperated: $u_h(-\tau^0) > v_h^H$ and $u_w(\tau^0) > v_w^H$. In addition, I specify that transfers $\tau_{\min}$ and $\tau_{\max}$ correspond to unbearably large sacrifices of utility on the part of the wife and the husband, respectively, so that conflict would be preferred: $v_w^S > u_w(\tau_{\min})$ and $v_h^S > u_h(-\tau_{\max})$.

In the state of divorce, the husband's utility, denoted as y_h^k, and the wife's utility, y_w^l, are specific to the trait of optimism. A husband who is a hard bargainer–optimist or a soft bargainer–optimist receives utility y_h^O (i.e., $y_h^{\mathrm{HO}} = y_h^{\mathrm{SO}} = y_h^O$), and pessimists receive y_h^P ($y_h^{\mathrm{HP}} = y_h^{\mathrm{SP}} = y_h^P$). The payoffs of the wife are defined analogously. By definition of the trait of optimism, $y_h^P < y_h^O$ and $y_w^P < y_w^O$. It should be noted that all the payoffs are ex ante payoffs (i.e., given information at the beginning of the game).

B. Solution

I solve the game by backward induction focusing on equilibriums in pure strategies. Suppose that the husband proposes cooperation and offers transfer τ. The wife of type l accepts the offer if $u_w(\tau) \geq y_w^l$ and $u_w(\tau) \geq v_w^l$.[8] She rejects it but abstains from separating if $v_w^l \geq y_w^l$ and $v_w^l > u_w(\tau)$. Finally, she announces divorce if $y_w^l > v_w^l$ and $y_w^l > u_w(\tau)$. Alternatively, suppose the husband refuses to cooperate. If $v_w^l \geq y_w^l$, the wife optimally chooses not to separate. Otherwise, she is better off by announcing divorce.

The husband can anticipate responses of the four wife's types to any of his actions, but since the wife's true type is unknown to him, he picks a strategy by maximizing expected utility. Formally, let the expected utilities of the husband of type k corresponding to strategies $(\tau; \mathcal{C})$, $\mathcal{R}$, and $\mathcal{D}$ be respectively denoted as $\hat{E}\mathcal{V}_h^k(\tau; \mathcal{C})$, $\hat{E}\mathcal{V}_h^k(\mathcal{R})$, and $\hat{E}\mathcal{V}_h^k(\mathcal{D})$, where $\hat{E}$ stands for expectation in terms of his beliefs. To write the expected utilities concisely, I employ indicator functions with vector arguments: 1(condition 1, … , condition m)′ is one, if conditions 1 through m are all true, and is zero, otherwise. Specifically, if the husband proposes cooperation and offers transfer τ, his expected utility is

$$\hat{E}\mathcal{V}_h^k(\tau; \mathcal{C}) = \sum_l \delta^l \left[u_h(-\tau) \times 1 \begin{pmatrix} u_w(\tau) \geq y_w^l \\ u_w(\tau) \geq v_w^l \end{pmatrix} + v_h^k \times 1 \begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau) \end{pmatrix} + y_h^k \times 1 \begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau) \end{pmatrix} \right].$$

If he refuses to cooperate, the expected utility is

$$\hat{E}\mathcal{V}_h^k(\mathcal{R}) = \sum_l \delta^l \left[v_h^k \times 1\left(v_w^l \geq y_w^l\right) + y_h^k \times 1\left(y_w^l > v_w^l\right) \right].$$

If the husband announces divorce, his expected utility is $\hat{E}\mathcal{V}_h^k(\mathcal{D}) = y_h^k$. Thus, the problem of the husband of type k can be stated as

$$\max_{\{\mathcal{C}, \mathcal{R}, \mathcal{D}\}} \left\{ \max_\tau \hat{E}\mathcal{V}_h^k(\tau; \mathcal{C}),\ \hat{E}\mathcal{V}_h^k(\mathcal{R}),\ \hat{E}\mathcal{V}_h^k(\mathcal{D}) \right\}.$$

Formally, since the husband has uncountably many transfer choices, the spousal game is infinite. Moreover, the expected utility of proposing cooperation, $\hat{E}\mathcal{V}_h^k(\tau; \mathcal{C})$, is generally discontinuous in τ.[9] Therefore, I cannot apply standard theorems to prove that an equilibrium always exists. However, it is possible to address the issue of equilibrium existence after a simplification of the game's structure.

[8] Spousal actions are explicitly specified for equalities to avoid indeterminacy.

[9] I refer interested readers to Zhylyevskyy (2008) for graphical illustrations of the discontinuity and graphical examples of how the spousal game is played out, depending on specific configurations of the payoffs and the beliefs.

First, in the following theorem, I show that there is a set of a priori dominated transfers (all proofs are in app. A).[10]

THEOREM 1. $\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) \leq \max\{\hat{E}\mathcal{V}_h^k(\mathcal{R}), \hat{E}\mathcal{V}_h^k(\mathcal{D})\}$ for all transfers in set $\{\tau : u_h(-\tau) < y_h^k\}$.

Intuitively, large transfers adversely affect the husband, and he should never offer them since better options are available. Thus, I define the set of a priori undominated transfers as $T^k = \{\tau : u_h(-\tau) \geq y_h^k, \tau_{\min} \leq \tau \leq \tau_{\max}\}$ and will analyze transfers from T^k only.

Second, it is possible to establish an important property of function $\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C})$.

THEOREM 2. $\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C})$ is upper semicontinuous on T^k.

The property is important because whenever the set T^k is nonempty, $\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C})$ attains its maximum on it (Jost 2003, lemma 12.6), and therefore, $\max_{\tau \in T^k}\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C})$ is well defined.

Third, I prove a dominance result for the husband's strategies.

THEOREM 3. For any k, (1) if T^k is empty, then $\hat{E}\mathcal{V}_h^k(\mathcal{D}) \geq \hat{E}\mathcal{V}_h^k(\mathcal{R})$, and (2) if T^k is not empty, then $\max_{\tau \in T^k}\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) \geq \hat{E}\mathcal{V}_h^k(\mathcal{R})$.

The theorem shows that if the outside option of the husband is so high that all transfers are a priori dominated, and thus T^k is empty, there is no reason for him to stay married in the first place. Otherwise, the husband need not consider inciting a conflict on his own as he could, in fact, do better by offering some transfer from T^k. Hence, the game can be simplified by eliminating husband's strategy $\mathcal{R}$.

Finally, I establish the existence of an equilibrium.

THEOREM 4. An equilibrium of the game always exists.

C. Role of Asymmetric Information

To investigate the role of asymmetric information in generating the state of conflict, I consider an alternative model in which individuals have private information about divorce prospects but, unlike in the original model, perfectly observe the bargaining strength of their partners. Since the bargaining strength of the partner is now common knowledge, the alternative model is a special case of the original one with just two player types—optimist (O) and pessimist (P)—and, for notational convenience, I can drop the type superscripts on spousal payoffs from conflict.

I show that the alternative model has an important property.

[10] To avoid ambiguity, it should be noted that the following theorems do not impose any auxiliary assumptions on the game. They only show that a simplification of the game structure is possible on the basis of the previously stated assumptions.

THEOREM 5. The alternative model cannot generate the state of conflict if at least one of the following three conditions holds: (1) $y_w^l > v_w$ for all l, (2) husband's beliefs are such that $\delta^P > 0$, or (3) $y_w^l \leq v_w$ for all l.

It follows that the state of conflict can now happen only if restrictions $y_w^P \leq v_w < y_w^O$ and $\delta^P = 0$ are simultaneously true. The latter restriction, $\delta^P = 0$, is particularly problematic. First, it implies that husbands in all conflicting couples have identical degenerate beliefs about their wives. Second, since the vector of beliefs is parameterized in the empirical application as having continuous support, the likelihood contribution of any conflicting couple would always be zero. Hence, the alternative model cannot plausibly explain the data on marital outcomes.

IV. Data and Estimation Approach

A. National Survey of Families and Households

The main data source for the empirical analysis is the NSFH, which provides a broad range of information on family life in the United States (see Sweet, Bumpass, and Call 1988). The NSFH covers a nationally representative probability sample with oversampling of minority groups. Married couples comprise a subsample of the survey, and a set of sampling weights is separately available for them.

The NSFH collects rich data that are particularly suitable to the empirical analysis. Specifically, I observe spousal reports on the frequency of disagreements and on the process of dispute resolution. I also get information on a spouse's postmarital prospects and beliefs about the partner's well-being after hypothetical divorce. Moreover, I observe a range of sociodemographic characteristics, and the NSFH staff merged individual data with state- and county-level information that is described later.

The NSFH is a panel with three completed waves of data collection, the first two of which are used to estimate the model. Wave 1 was conducted in 1987–88 and includes 13,007 households, of which 10,005 were resurveyed during wave 2 in 1992–94 (more than half of the respondents are single). The average time interval between the first and the second interviews is approximately 5.5 years. Due to financial constraints, wave 3 (2001–2) was completed for a smaller selected subsample of families, and since these data may be nonrandom, I do not use them in the estimation.

In total, the estimation sample consists of 3,878 couples and is constructed as follows. I take all 5,270 married couples who participated in the first data collection wave. From these, I exclude 575 couples with missing data, 477 couples that were not reinterviewed during the second wave for reasons other than death, and 340 couples in which a spouse died between the first and the second waves.

A separate analysis of sample attrition shows that the above exclusions do not introduce any considerable distortion with respect to observable sociodemographic characteristics. As expected, spouses in couples with a respondent's death are relatively old. Spouses in couples that were not reinterviewed during wave 2 (for reasons other than death) tend to be less educated. Hispanics appear to drop from the sample at a higher rate than whites or blacks.[11] Also, the majority of noninterview cases occurred because a couple refused to participate in wave 2 rather than because spouses moved and the NSFH subsequently failed to locate them. In addition, I compared the estimation sample to the corresponding population group using the 5% Public Use Microdata Sample (PUMS) for the 1990 census (Bureau of the Census 1995). Discrepancies between characteristics of the sample and the population tend to be small.[12]

B. Marital State

The marital state of a couple—cooperation, conflict, or divorce—is the outcome variable to be explained and is determined on the basis of the second NSFH interview (1992–94). A couple is in the state of divorce if spouses, who were married during wave 1, are reported as "divorced" or "separated due to marital problem" in the wave 2 status file. I follow many papers in the family economics literature by treating separated couples identically to the divorced ones. In the United States, divorcing couples often go through a lengthy legal process before a court issues a final divorce decree. Thus, many couples who report being separated (but not yet divorced) in wave 2 may, in fact, be already on the path to formal divorce. To further explore the issue of whether it is reasonable to assign the state of divorce to separated couples, I perform an additional data analysis using the NSFH marriage history file compiled after wave 3. The file indicates a total of 2,715 instances of marital separation over the lifetime of all wave 3 respondents (note that only a fraction of the wave 2 respondents were reinterviewed in wave 3). Of these, 2,594 separations (i.e., 96%) eventually resulted in divorce. Although this finding is only suggestive of the eventual fate of separations reported in wave 2, it supports my approach.[13]

The task of assigning conflict to an intact couple is more challenging. The psychology literature distinguishes between "constructive" and "destructive" disagreements. Constructive disagreements involve disputes that are not intense and are quickly resolved. Destructive disagreements are the

[11] MaCurdy, Mroz, and Gritz (1998) report a similar finding for Hispanics in their analysis of attrition in the National Longitudinal Survey of Youth 1979.

[12] Details on the analysis of the sample attrition and comparison of the estimation sample to the US population can be found in Zhylyevskyy (2008).

[13] Also, it should be noted that separated spouses are not asked questions used in this article to determine the state of conflict.

Table 1
Distribution of Marital State Variable

Marital State	Observed Frequency	Weighted Fraction (%)
Cooperation	2,948	78.65
Conflict	416	10.27
Divorce	514	11.08
Total	3,878	100.00

NOTE.—Weighted fractions are calculated using the National Survey of Families and Households (NSFH) sample weights. Marital state is determined on the basis of the NSFH wave 2 interview.

opposite: they happen with high frequency and are not easily and quickly settled (Grych and Fincham 2001).

In the model, the state of conflict refers to a situation in which a couple engages in destructive and, hence, inefficient disagreements. I identify such instances using questions about frequencies of disputes and the process of conflict resolution. Specifically, all husbands and wives are asked: "The following is a list of subjects on which couples often have disagreements. How often, if at all, in the past year have you had open disagreements about each of the following: household tasks, money, spending time together, sex, in-laws, the children?" The response categories range from "never" to "almost every day." To mitigate a potential problem of underreporting, I infer the frequency of disagreements as the maximum of the corresponding husband's and wife's frequencies. Also, spouses report how they deal with disputes: "There are various ways that married couples deal with serious disagreements. When you have a serious disagreement with your husband/wife, how often do you: discuss your disagreements calmly, argue heatedly or shout at each other?" Possible responses in each case range from "never" to "always." I assign the state of conflict to an intact couple if the following conditions are met. First, the spouses must disagree about at least one aspect of their relationship several times a week or more often. Second, at least one spouse must admit that they seldom or never calmly discuss disagreements or often or always heatedly argue with each other.[14] The remaining intact couples are in the state of cooperation. The distribution of the marital state variable in the estimation sample is given in table 1; 79% of couples are in

[14] The state of conflict is treated as an equilibrium outcome rather than as a purely transitory state on the road from marital cooperation to divorce, in which case one would expect all couples in conflict to eventually divorce. To explore this issue, I use the NSFH marriage history file, which contains information on the status as of wave 3 of 202 couples who were in conflict in wave 2 (note that only a subsample of respondents were reinterviewed in wave 3). Of these, only 24 couples have divorced. Although this evidence is only suggestive since the information on the status of many couples is not available, it appears to provide relatively little support for treating conflict as a purely transitory state followed by divorce.

the state of cooperation, 10% are in the state of conflict, and 11% are in the state of divorce.

C. Explanatory Variables

For convenience, explanatory variables are grouped into three categories: (1) opinions and beliefs, (2) individual characteristics, and (3) location-specific information. All of them pertain to the time of the NSFH wave 1 (in contrast, the outcome variable, marital state, is determined using data from wave 2). The first category, opinions and beliefs, consists of individual responses that may provide some information about spouses' own types and about beliefs regarding the partner's type. In particular, everyone is asked: "Even though it may be very unlikely, think for a moment about how various areas of your life might be different if you separated. For each of the following areas, how do you think things would change?" I focus on the question about overall happiness after a hypothetical separation, which may be informative about the trait of optimism, and create two indicator variables: for spouses who report that their happiness after separation would stay the same and for those who report that it would be better or much better. The base category includes spouses who report that their happiness would be worse or much worse. It is important to note that in the empirical application, I take a flexible approach by inferring the true types probabilistically using the created indicator variables. Thus, my suggested interpretation of what the responses might actually mean does not drive the estimation.

Spouses are asked analogous questions about hypothetical divorce opportunities of their partners, which may be informative about their beliefs regarding the partner's type. I create an indicator for husbands who believe that the overall happiness of their wives would be the same and an indicator for husbands who believe it would be better or much better (these two indicators are used to infer the husband's beliefs rather than player types).

In addition, everyone reports whether they agree or disagree with the following statement: "I feel that I'm a person of worth, at least on an equal plane with others." The responses are not easy to interpret (e.g., they may reveal individuals who are more likely to just divorce when the transfer is not enough to keep them in the cooperation state), but I believe they may be informative about spousal types. In particular, individuals who strongly feel they are on an equal plane with others may be the ones who are more eager to defend their own point of view in disputes and, thus, indicate a higher tolerance of enduring conflict in comparison to individuals who have a low opinion of their own worthiness. Hence, I create an indicator for spouses who express strong agreement and use it together with other indicator variables to infer spousal types. It may be helpful to note that observable frequencies of marital states vary with the responses in line with my interpretation. Among couples in which no spouse expresses strong agreement with the statement, the fraction of those who are in cooperation, conflict, and divorce is 79.84%, 7.50%, and 12.66%, respectively. In comparison, among couples in which at least one spouse expresses strong agreement, the corresponding fractions are 78.34%, 11.09%, and 10.57%, indicating a higher incidence of conflict. Summary statistics for the indicator variables related to spousal types and beliefs are given in table B1 (app. B). Interestingly, 23% of husbands and 22% of wives say their happiness would stay the same or improve after a hypothetical divorce.

The group of individual characteristics that are used to model the payoffs in the game comprises standard sociodemographic data such as age, race, religious affiliation, and education, all of which are measured as of the NSFH wave 1. I group reported religious beliefs in accordance with a classification of Melton (1977) and create indicators for the husband's affiliation with the Roman Catholic Church and the difference in the spousal religious affiliations. Other differences in spousal characteristics such as between spousal ages and educational attainments are also included. Education categories represent the highest completed level of schooling (the base category is "no high school degree"). In addition, I control for the duration of marriage (measured as of wave 1) and the number of own children of the wife (i.e., the husband's stepchildren), if any.[15] Summary statistics are presented in table B2.

Two remarks about the included sociodemographic characteristics are in order. First, I make an effort to control for characteristics that are unlikely to be endogenous with respect to bargaining in marriage. In contrast, characteristics that are sometimes found in the literature to be divorce predictors but likely to be endogenous—such as the number of common children of the spouses, home ownership, employment, and income—are not included in the estimation. However, I control for the number of the wife's own children since it is her predetermined characteristic and not an outcome of fertility decisions within the current marriage.

Second, given the features of the available data and the static nature of the model, it is important to account for marriage duration, which may help to mitigate the initial conditions problem potentially present in the analysis. In particular, I use in the estimation a cross-section of married couples at different stages of the life cycle. Thus, it is possible that the couples in the analysis systematically differ with respect to unobservable characteristics. More specifically, couples with longer marriage durations may have larger stocks of unobservable marital capital, which can significantly affect the production of marital surplus and family decision making. To control for such potential effects, I include marriage duration among the determinants of the payoffs. In fact, estimation results presented in Section V indicate that marriage duration has a strong positive impact on the payoff from cooper-

[15] The number of couples with the wife's stepchildren is negligible.

ation. In addition, it is conceivable that marriage duration affects beliefs because marriages that have lasted longer are dynamically selected on the basis of the individual traits of optimism and bargaining strength. In that case, duration should also be incorporated in the specification of the type probability functions in the belief vector. However, one of the Lagrange multiplier tests reported in Section V.E indicates that coefficients on marriage duration in these functions are not statistically different from zero. Therefore, I estimate and present results for a model that does not incorporate marriage duration in beliefs. It is worth noting that the empirical specification of the model includes all available spousal responses regarding individual traits. Thus, the test result simply suggests that marriage duration has no statistically significant additional impact on the estimated beliefs after the responses have been accounted for.

Explanatory variables related to geographical location include proxies for local marriage market conditions, as well as some specifics of the divorce legislation and enforcement of child support obligations at the state level (see table B3 for summary statistics). These variables can affect spousal outside options (McElroy 1990), and therefore, I use them to model the divorce payoffs but not the payoffs from cooperation or conflict. It should be noted that the exclusion of these variables from the specification of the utilities of remaining married can be rationalized in the context of any "generic" model of marriage rather than only in the case of the specific game theoretic model proposed in this article. Also, in the context of my model, these variables can have an indirect effect on the division of marital surplus because a change in the outside options can shift bargaining power from one spouse to the other.

Local marriage market conditions influence the ease of finding a new mate after divorce. As is common in the literature, I approximate them using the availability ratio, which is the ratio of the number of marriageable individuals of one sex to the size of a corresponding group of the opposite sex (Goldman, Westoff, and Hammerslough 1984; Fossett and Kiecolt 1991). The availability ratio is a refined version of the concept of sex ratio. The ratios are computed at a county level on the basis of the 1990 5% PUMS and are specific to race, sex, age, and education.[16]

Divorce statutes in many states provide for mandatory separation periods before divorce (Freed and Walker 1991; Friedberg 1998), which can increase divorce costs of separating couples (other divorce legislation focuses primarily on allocating property and child custody rights). Formally, a separation period is the requirement for spouses to live apart without cohabitation for a specified period of time before a court can issue a final divorce decree. The shortest period across states that have separation requirements

[16] Zhylyevskyy (2008) discusses in detail the methodology of computing availability ratios, including the actual formulas.

is 6 months. Since the impact of a period may vary with its length, I create two indicator variables: for individuals who live in a state with a separation period between 6 months and 1 year (18% of the sample) and for individuals in a state with a period lasting more than a year (33%). The base category comprises individuals who live in states with no separation requirements.

Divorce payoffs can also depend on how well court-ordered child support payments are enforced since some noncustodial parents (usually, fathers) would abstain from transferring resources to custodial parents if the probability of being punished for violating the support order were low (Weiss and Willis 1985). In fact, the variation in the strength of child support enforcement (CSE) across states has received considerable attention at the national level (US House Committee on Ways and Means 1991). To approximate the strength of the enforcement in a particular state, I use the CSE collection rate reported by the state enforcement agency (Nixon 1997). More specifically, I average annual CSE collection rates from 1987 to 1994 and assign the result to couples with children (childless couples are assigned the value of zero).

D. Parameterization

The payoffs of every player type are common knowledge in the game. However, the econometrician does not observe many factors known to the spouses that may affect their utilities such as love and physical attractiveness. Therefore, the parameterized payoffs can have both deterministic and stochastic components in the empirical application. Let vector x include the individual characteristics as of the NSFH wave 1 related to age, race, religion, and so on (see Sec. IV.C for a discussion), and a constant term. The payoffs of the husband and the wife in the state of cooperation are specified as $u_h(-\tau) = x'\alpha_h - \tau + \theta_1$ and $u_w(\tau) = x'\alpha_w + \tau + \theta_3$, respectively, where α_h and α_w are the coefficients and θ_1 and θ_3 are error terms. As explained in Section IV.F, I can only identify the sum of the coefficients, $\alpha = \alpha_h + \alpha_w$, which measures the impact of the characteristics on the joint surplus under cooperation.

In the state of conflict, the payoffs depend on a player's trait of bargaining strength. The utilities of soft bargainers are $v_h^S = x'\beta_h + \theta_2$ and $v_w^S = x'\beta_w + \theta_4$, respectively, where β_h and β_w represent the coefficients, and θ_2 and θ_4 are error terms. Since hard bargainers must be better off than soft bargainers, I specify that their payoffs differ by a positive constant: $v_h^H = v_h^S + \beta_h^H$ and $v_w^H = v_w^S + \beta_w^H$, where $\beta_h^H > 0$ and $\beta_w^H > 0$ are the constants to estimate. In contrast to the utilities from cooperation, the payoffs from conflict to the husband and the wife are separately identifiable (see Sec. IV.F). The vector representing the payoff error terms, θ, is assumed to be independent and identically distributed (i.i.d.) across couples as a normal random vector, $\theta \sim$ i.i.d. $N(0, \Sigma)$, where Σ is the covariance matrix.

For identification reasons (see Sec. IV.F), vector x cannot be used to also parameterize the divorce payoffs. Instead, I employ location-specific variables (table B3). Let vector z_h consist of the male-specific availability ratio, indicators for legal separation periods, and the collection rate and its interactions with the husband's education. Vector z_w contains the same variables, with some specific to the wife (e.g., the female-specific availability ratio). The interaction terms help to account for potentially varying effects of the CSE across wealth groups, with education proxying for wealth after divorce (I choose not to use observable income because of its potential endogeneity with respect to spousal decisions in marriage). By parameterizing the divorce payoffs with vectors z_h and z_w, I implicitly assume that the location-specific variables are exogenous in the sense that they do not affect the distribution of the unobservable payoff error vector θ and do not provide additional information about spousal types and beliefs (on top of the corresponding individual responses in the survey). Also, the payoffs in the state of divorce depend on the personal trait of optimism. Thus, I specify the utilities of the pessimistic husband and wife as $y_h^P = z_h'\gamma_h$ and $y_w^P = z_w'\gamma_w$, respectively, where γ_h and γ_w are the coefficients. Since optimists must be ex ante better off than pessimists, I assume that their payoffs differ by a positive constant: $y_h^O = y_h^P + \gamma_h^O$ and $y_w^O = y_w^P + \gamma_w^O$, where $\gamma_h^O > 0$ and $\gamma_w^O > 0$ are the constants to estimate.

Every player in the game knows his or her own true type (but not the partner's type). However, the econometrician only observes discrete answers about divorce prospects and selected opinions. Therefore, I choose to infer the spousal types probabilistically by extending an approach proposed by Degan and Merlo (2006). Let vector a_h include a constant term and the following three indicators: if the husband thinks his overall happiness would be the same after divorce, if he thinks it would be better or much better, and if he strongly agrees that he is a person of worth (table B1). Let vector a_w contain analogous variables for the wife. I specify that the husband is of type k and the wife is of type l with probabilities

$$\pi_h^k = \frac{\exp(a_h'\lambda_h^k)}{\sum_j \exp(a_h'\lambda_h^j)} \quad \text{and} \quad \pi_w^l = \frac{\exp(a_w'\lambda_w^l)}{\sum_j \exp(a_w'\lambda_w^j)},$$

where λ_h^k and λ_w^l for $k, l \neq \mathrm{SP}$ represent the coefficients, and $\lambda_h^{\mathrm{SP}} = \lambda_w^{\mathrm{SP}} = 0$ by normalization. The chosen form is convenient because it restricts the values of the type probabilities to a unit simplex.

Finally, the husband knows his own beliefs in the game, but the econometrician only observes discrete answers of the husband about hypothetical divorce opportunities of the wife. Hence, I specify that the belief vector $(\delta^{\mathrm{HO}}, \delta^{\mathrm{HP}}, \delta^{\mathrm{SO}}, \delta^{\mathrm{SP}})'$ is randomly distributed on a unit simplex. Let vector b include a constant term and the following two indicators: if the husband believes his wife's overall happiness would be the same after divorce and if he believes it would be better or much better (table B1). I parameterize the probability that the husband assigns to the event that his wife's type is l as

$$\delta^l = \frac{\exp\,(b'\rho^l + \eta^l)}{\sum_j \exp\,(b'\rho^j + \eta^j)},$$

where ρ^l for $l \neq \mathrm{SP}$ stands for the vector of coefficients, η^l for $l \neq \mathrm{SP}$ is an error term, and $\rho^{\mathrm{SP}} = 0$ and $\eta^{\mathrm{SP}} = 0$ by normalization. The vector representing the belief error terms, η, accounts for the information the husband has about his wife's type that he does not reveal in the NSFH interview (e.g., what he knows about her trait of bargaining strength). I assume that η is i.i.d. across couples as a normal random vector, $\eta \sim$ i.i.d. $N(0, \Omega)$, where Ω is the covariance matrix.

E. Estimation Strategy

All parameters of the empirical model are estimated simultaneously by the maximum simulated likelihood method. The structure of the model is exploited in the estimation procedure to derive the likelihood contribution of every couple.

The likelihood contribution of a couple in a marital state s (cooperation, conflict, or divorce) is the probability that the state s is an equilibrium outcome of the game. Since the three marital states are mutually exclusive and exhaustive, it suffices to find the probabilities of only two of them, namely, s = cooperation and s = conflict. Let X represent all available data for a couple, $X = (x, z_h, z_w, a_h, a_w, b)$, and let Γ represent all model parameters, $\Gamma = (\alpha, \beta_h, \beta_h^H, \beta_w, \beta_w^H, \gamma_h, \gamma_h^O, \gamma_w, \gamma_w^O, \{\lambda_h^j, \lambda_w^j, \rho^j\}_{j \neq \mathrm{SP}}, \Sigma, \Omega)$. The first step is to express the probabilities of the states of cooperation and conflict in terms of corresponding conditional probabilities given spousal types:

$$\Pr\,[s = \text{cooperation}|X, \Gamma] = \sum_{k,l} \pi_h^k \times \pi_w^l \times \Pr\,[s = \text{cooperation}|k, l, X, \Gamma], \tag{1}$$

$$\Pr\,[s = \text{conflict}|X, \Gamma] = \sum_{k,l} \pi_h^k \times \pi_w^l \times \Pr\,[s = \text{conflict}|k, l, X, \Gamma], \tag{2}$$

where $\pi_h^k = \exp\,(a_h'\lambda_h^k)/\Sigma_j \exp\,(a_h'\lambda_h^j)$ and $\pi_w^l = \exp\,(a_w'\lambda_w^l)/\Sigma_j \exp\,(a_w'\lambda_w^j)$, as defined earlier. To obtain equations (1) and (2), I implicitly assume that the husband's responses about his overall happiness after a hypothetical divorce and his being a person of worth are informative about the husband's true type but provide no information about the wife's type in addition to the information already contained in the wife's responses (and vice versa for the wife's responses). Thus, the probability of a husband-wife type pair (k, l) is specified as the product of π_h^k and π_w^l. This specification is conditional on spousal responses and does not preclude an "intracouple" correlation of spousal types in the unconditional distribution of true types in the population of married individuals since the responses of the husband may be correlated with the responses of the wife.

The second step in deriving the likelihood contribution is to employ the theoretical results from Section III to specify restrictions under which cooperation and conflict are equilibrium outcomes of the game, conditional on the player types, and then compute the probability measure of the set of the error terms θ and η on which the restrictions hold. Consider the state of cooperation, which occurs if the husband offers an acceptable transfer to the wife:

$$\begin{aligned} &\Pr\,[s = \text{cooperation}|k, l, X, \Gamma] \\ &= E_{\theta,\eta}\Big[1\{\tau^* = \arg\max_{\tau\in T^k(\theta,X,\Gamma)} \hat{E}\mathcal{V}_h^k(\tau; \mathcal{C}, \theta, \eta, X, \Gamma), \hat{E}\mathcal{V}_h^k(\tau^*; \mathcal{C}, \theta, \eta, X, \Gamma) \\ &\qquad \geq y_h^k(X, \Gamma), u_w(\tau^*; \theta, X, \Gamma) \\ &\qquad \geq v_w^l(\theta, X, \Gamma), u_w(\tau^*; \theta, X, \Gamma) \geq y_w^l(X, \Gamma)\}'\Big], \end{aligned} \tag{3}$$

where $E_{\theta,\eta}[\cdot]$ denotes expectation under the joint probability measure of θ and η.

The first and second conditions in the indicator function in equation (3) mean that for the husband of type k, transfer τ^* maximizes his expected utility of cooperating, and the husband decides to offer τ^* rather than to announce divorce. The third and fourth conditions mean that the utility that the wife of type l gets from accepting τ^* is at least as high as the utility from rejecting the offer or announcing divorce. Thus, it is optimal for her to accept this τ^*. The expected value of the indicator function is the conditional probability of cooperation given the spousal types k and l.

The conditional probability of the state of conflict is obtained analogously. This state occurs if the husband offers a transfer but the wife rejects it without announcing divorce:

$$\begin{aligned} &\Pr\,[s = \text{conflict}|k, l, X, \Gamma] \\ &= E_{\theta,\eta}\Big[1\{\tau^* = \arg\max_{\tau\in T^k(\theta,X,\Gamma)} \hat{E}\mathcal{V}_h^k(\tau, \mathcal{C}, \theta, \eta, X, \Gamma), \hat{E}\mathcal{V}_h^k(\tau^*; \mathcal{C}, \theta, \eta, X, \Gamma) \\ &\qquad \geq y_h^k(X, \Gamma), v_w^l(\theta, X, \Gamma) \\ &\qquad > u_w(\tau^*; \theta, x, \Gamma), v_w^l(\theta, X, \Gamma) \geq y_w^l(X, \Gamma)\}'\Big], \end{aligned} \tag{4}$$

where the third and fourth conditions in the indicator function now imply that the wife of type l decides to reject τ^* but abstains from announcing divorce.

To implement equations (3) and (4) in estimation, I devise an algorithm to transform the conditional expected values of the indicator functions so that they can be computed by the Geweke-Hajivassiliou-Keane (GHK) simulation method, which is known to have good numerical properties (Börsch-Supan and Hajivassiliou 1993; Hajivassiliou, McFadden, and Ruud 1996). The algorithm exploits the structure of the model and is presented in appendix C. Once the conditional probabilities have been evaluated by simulation for all possible combinations of spousal types, I calculate the likelihood contribution of a couple in the state of cooperation using equation (1) and a couple in the state of conflict using equation (2). The likelihood contribution of a couple in the state of divorce is calculated as $\Pr[s = \text{divorce}|X, \Gamma] = 1 - \Pr[s = \text{cooperation}|X, \Gamma] - \Pr[s = \text{conflict}|X, \Gamma]$.

F. Identification

To identify the parameters of the model, I exploit cross-sectional covariation of the explanatory variables with marital states. The variation in sociodemographic characteristics helps to identify the coefficients in the cooperation and conflict payoffs, if some characteristics (e.g., shorter marriage duration) are observed more commonly among couples in conflict than in cooperation. The variation in the location-specific variables helps to identify parameters in the divorce utilities, if some characteristics (e.g., long-term separation periods) are correlated with a lower incidence of divorce, for example. Differential responses of spouses about their happiness after a hypothetical divorce and about being a person of worth help to identify the coefficients in the type probability functions. Differential responses of husbands about hypothetical postdivorce happiness of their wives are helpful in the identification of the parameters in the belief functions.

A few important remarks about the identification of the payoffs are in order. Notably, the identification of the utility parameters is affected by the assumption of transferable spousal utilities under cooperation and nontransferable utilities in conflict and divorce. In particular, I cannot separately estimate coefficients α_h and α_w in the specification of the cooperation utilities $u_h(-\tau)$ and $u_w(\tau)$. Instead, I can only identify their sum, $\alpha = \alpha_h + \alpha_w$, which represents the impact of the vector of individual characteristics x on the joint spousal value of the cooperative marriage relative to divorce. In fact, since the spousal cooperation utilities are transferable, the outcome of the game depends on the position of the entire utility possibility frontier that results from cooperation rather than on $u_h(-\tau)$ and $u_w(\tau)$ separately. Also, since these utilities are linear in the transfer, the position of the frontier depends only on their sum. In other words, supposing that the husband's utility from cooperation is plotted on the horizontal axis and the wife's utility is on the vertical axis, if the husband's utility rises, the frontier shifts to the right, but this change is observationally equivalent to an upward shift of the frontier due to an increase in the wife's utility. The specific mathematical reason for the identification limitation here is that the integration bounds in the computation of the likelihood contribution (see Sec. IV.E and app. C) depend on $x'(\alpha_h + \alpha_w)$, rather than on $x'\alpha_h$ and $x'\alpha_w$ separately. In contrast, I am able to separately identify the utilities of the husband and the wife from conflict and divorce. These utilities are nontransferable between the spouses, and the effect of the husband's utility on the outcome of the game in this case can be distinguished from the effect of the wife's utility.

Next, recall that the vector of individual characteristics x is included in the specification of the cooperation and conflict payoffs. If x were additionally included in the specification of the divorce payoffs, the corresponding effects could not be simultaneously estimated. The underlying reason is that an equilibrium of the game is invariant with respect to a positive affine transformation of the payoffs, and consequently, the spousal utility levels are not identifiable. Thus, I choose to exclude x from the specification of the divorce payoffs. This exclusion does not mean that spousal characteristics x are irrelevant after separation, but rather it implies that the estimated effect of x in the states of cooperation and conflict must be interpreted as being relative to the impact of x in the state of divorce. Another implication of the invariance is that I cannot identify the utility scale. Therefore, when estimating the model, I normalize corresponding diagonal elements of the covariance matrix Σ to 1.

Structural errors η (reflecting the discreteness of the reported husbands' beliefs) and θ (reflecting unobserved factors that influence the payoffs) are identified via the occurrence of marital states that cannot be otherwise explained using the observable data. The model implies that if, for two couples with identical values of spousal payoffs, one ended up in the state of cooperation and the other in the state of conflict, it must be that the husbands held different beliefs. The model also implies that if, for two couples with identical observable characteristics and belief vectors, one ended up in the state of cooperation and the other in the state of divorce, it must be that the couples differed in their stochastic utility components.

V. Results

A. Payoff Parameters

Table 2 shows estimates of the utility parameters that indicate by how much individual characteristics contribute to the joint value of cooperative marriage relative to their impact on the divorce payoffs. I detect positive utility effects of the husband's age, of the husband being black and Catholic, and of marriage duration. The latter utility effect may be indicative of a positive impact of the stock of marital capital on the production of marital surplus under cooperation. In turn, the indicators of marital heterogamy (i.e., the difference between characteristics of the husband and the wife) tend

Table 2
Utility Parameters in State of Cooperation

Variable	Coefficient	SE
Constant	5.602**	.815
Age, husband's[a]	.025**	.012
Age, absolute difference[a]	.007	.022
Black husband	.576**	.227
Catholic husband	.318**	.153
Religion, difference	−.035	.135
High school, husband[b]	.176	.233
College, husband[b]	.072	.279
Education, difference	−.308**	.131
Marriage duration[a]	.080**	.017
Wife's children	−.296**	.091

NOTE.—Coefficients denote the effect of variables on the sum of spousal utilities in the state of cooperation relative to the impact in the state of divorce. The value of the sample log-likelihood function is −2,410.603.
[a] Variable is standardized in estimation. I report the impact of a 1-year increase.
[b] The omitted education category is "no high school degree."
** $p < .05$.

to have a negative effect on the joint payoff. For example, if spouses have different education, it lowers the payoff. The result suggests that there may be positive complementarities between spousal characteristics in the production of marital surplus. Perhaps when spouses have similar education, they are more likely to share interests and value time spent with each other by more than spouses with different education. Conversely, heterogeneous couples may be less efficient in the production of the surplus. In line with this interpretation, I find a negative utility impact of the difference in religious affiliations, but it is not precisely estimated. In addition, I find that a wife's own child (i.e., the husband's stepchild) lowers the joint payoff, which suggests that stepchildren may have a negative effect on the production of marital surplus.

Table 3 lists coefficients that determine by how much spousal characteristics contribute to payoffs from conflict relative to divorce. Unlike in the state of cooperation, the husband's payoff and the wife's payoff are now separately identifiable. I find sizable utility premia associated with the one's ability to endure marital conflict (i.e., the premia from being a hard bargainer), and the utility premium effect appears to be particularly strong in the wife's case. The husband's age, race, and college education are estimated to have opposite effects on the spousal payoffs from conflict. More specifically, I find that an increase in the husband's age raises his utility but lowers the wife's utility. At the same time, an increase in the age difference between the spouses lowers the husband's payoff but raises the wife's payoff. If the husband is black, it appears to decrease his utility but increase the wife's utility. If the husband has a college degree, it increases his payoff but decreases the wife's payoff. To explain these results, it is important to recall

Table 3
Utility Parameters in State of Conflict

	Husband		Wife	
Variable	Coefficient	SE	Coefficient	SE
Constant	−2.991**	.744	−.873	.558
Hard bargainer's premium	2.528**	.475	4.332**	.006
Age, husband's[a]	.101**	.014	−.036**	.011
Age, absolute difference[a]	−.201**	.027	.087**	.023
Black husband	−1.281**	.517	.816**	.218
Catholic husband	.864**	.182	.276**	.136
Religion, difference	−1.002**	.187	.155	.140
High school, husband[b]	−.157	.312	−.302	.188
College, husband[b]	.725**	.346	−1.009**	.214
Education, difference	−.137	.174	.141	.130
Marriage duration[a]	−.015	.021	−.002	.011
Wife's children	.334**	.118	.319**	.136

NOTE.—Coefficients denote the effect of variables on spousal utilities in the state of conflict relative to the impact in the state of divorce.
[a] Variable is standardized in estimation. I report the impact of a 1-year increase.
[b] The omitted education category is "no high school degree."
** $p < .05$.

that the utility effect of every variable in the state of conflict is estimated relative to its impact in the state of divorce. Thus, the estimated positive effects of age and college education on the husband in conflict may be due to a large disutility from divorce among husbands who are older and more educated (perhaps such husbands expect to be ordered by the court to make large wealth transfers to the ex-wives after divorce). Conversely, these husband's characteristics may positively affect the wife's utility from divorce, which would explain why they are estimated to have a negative impact on the wife in conflict. The estimated differential effects in the state of conflict of the age difference and of the husband being black may also be due to differential effects of these characteristics on the payoffs from divorce. In addition, I find that the husband being Catholic raises the payoff from conflict for both spouses. This result may be indicative of higher tolerance of conflict or larger separation costs among Catholics given that the Roman Catholic Church strongly opposes divorce. The estimated negative effect of the difference in religious affiliations on the husband's utility may be due to a higher intensity of conflicts between spouses who do not share each other's faith (perhaps they are less likely to use support of religious community to resolve conflicts). Finally, I find that presence of the wife's children increases the spousal payoffs from conflict. Perhaps conflicts in couples with stepchildren are less intense, which would explain the positive coefficients.

Interestingly, the estimates indicate differences in male and female preferences for conflict. To facilitate the discussion here, I use the term "util," which is defined as 1 standard deviation of the error that represents a

Table 4
Utility Parameters in State of Divorce

	Husband		Wife	
Variable	Coefficient	SE	Coefficient	SE
Optimist's premium	3.782**	.380	.768**	.139
Male-specific availability ratio	.467	.401		
Female-specific availability ratio			1.944**	.529
1/2 year ≤ separation ≤ 1 year	−.109	.142	.044	.165
Separation > 1 year	−.242*	.133	−.329**	.130
Collection rate	.293	1.107	1.486	1.201
Collection rate × high school, husband[a]	−1.851[b]	1.221		
Collection rate × college, husband[a]	−.681	1.552		
Collection rate × high school, wife[a]			−1.999*	1.092
Collection rate × college, wife[a]			−1.095	1.220

[a] Omitted education category is "no high school degree."
[b] Effect of the collection rate on high-school-educated husbands is .293 + (−1.851) = −1.558 ($p < .05$).
* $p < .10$.
** $p < .05$.

stochastic utility component (this definition is motivated by a normalization in the covariance matrix Σ). Also, I employ the NSFH sample weights so that the reported results are representative of the US population of married individuals. Using the obtained payoff parameters and estimates of individual type probabilities (see more on the type probabilities in the following subsection), I compute that husbands would on average derive −2.144 utils from conflict, while wives would on average derive −0.157 utils (note that some spouses can derive positive utility from conflict, depending on their sociodemographic characteristics). Thus, the estimates indicate that married women tend to derive relatively less disutility from conflict than do men. The difference between the male and the female preferences is also evident when considering type-specific payoffs. In particular, if everyone were a hard bargainer, husbands would on average derive −0.223 utils from conflict, while wives would derive 3.089 utils. In turn, if everyone were a soft bargainer, husbands would on average derive −2.751 utils, while wives would derive −1.243 utils. In summary, the empirical model suggests that women are overall more tolerant of marital conflict than are men.

Table 4 shows effects of the location-specific variables on spousal payoffs in the state of divorce. Recall that the spousal utilities in this state are modeled using, among other variables, an availability ratio that is specific to the sex of the spouse and interactions between the CSE collection rate and the spouse's education (education is used as a proxy for wealth after divorce). I estimate sizable utility premia associated with the one's optimism regarding divorce prospects, and the utility premium effect appears to be larger in the husband's case. In addition, the estimates indicate that more favorable marriage market conditions (i.e., a higher availability ratio) increase the payoff from divorce for women. In contrast, the impact of the

Table 5
Sample Means of Type Probabilities and Beliefs

	True Types[a]		
Spousal Type	Husband	Wife	Beliefs, Husband[b]
HO (hard bargainer–optimist)	.089	.039	.165
HP (hard bargainer–pessimist)	.154	.212	.036
SO (soft bargainer–optimist)	.016	.059	.130
SP (soft bargainer–pessimist)	.741	.690	.669

[a] Sample mean estimated probability of a player type.
[b] Simulated sample mean probability that a husband assigns to the wife's type.

availability ratio on the husband's utility is not statistically significant. These differential effects may be due to a difference in the marginal impact of partner availability for men and women. In particular, data summary statistics suggest that men typically face more favorable marriage markets than women (see table B3). Thus, a low estimated utility impact of the availability ratio on the husband but a high impact on the wife should not be surprising. In turn, the separation period requirements tend to decrease the divorce payoffs. However, only the effects of long-term separation periods (i.e., periods exceeding 1 year) are found to be statistically significant. This result is consistent with long-term separation periods having larger monetary, time, and psychological costs in the divorce process in comparison to short-term periods and suggests that separation period requirements may affect divorce decisions. In addition, the estimates indicate that the strength of CSE at the state level may differentially affect spousal payoffs from divorce (the impact of CSE is only relevant for couples with children). Moreover, the impact of CSE appears to vary with education. In particular, I detect a negative and statistically significant effect of stronger CSE on husbands with a high school degree. However, no statistically significant effects are found for husbands without a high school degree and with a college degree. In comparison, the effects are not precisely estimated for wives, which suggests that the impact of the strength of CSE on the wife's divorce payoff may be weak.

B. Spousal Types and Beliefs

Table 5 reports sample means of the type probabilities for both spouses and sample means of simulated husband's beliefs about the wife's true type. Almost three-fourths of husbands and more than two-thirds of wives in the sample are of the type soft bargainer–pessimist. In conjunction with the utility estimates discussed earlier, these results indicate that a majority of spouses derive a substantial disutility from conflict and have a low assessment of their own hypothetical postdivorce opportunities, which contributes to the high observable rate of cooperation in marriage. The mean true type probabilities for wives differ from the mean husbands' beliefs. More specifically, husbands on average tend to underestimate the prevalence of the hard bargaining trait among their wives and overestimate the prevalence of the wives' optimism about the outside option. This result indicates the information asymmetries between spouses that may lead to inefficient outcomes.

C. Goodness-of-Fit Tests

To evaluate how well the estimated model fits the data, I perform a battery of χ^2 goodness-of-fit tests (Bartoszyński and Niewiadomska-Bugaj 1996, sec. 17.2). The battery includes (1) tests based on partitioning the sample by combinations of the explanatory variables and (2) tests based on partitioning by combinations of predicted marital state probabilities. Each test involves splitting the sample into subsamples and then evaluating how closely the predicted distribution of couples across the marital states matches the actual distribution. The null hypothesis is that the distributions are not statistically different, which would indicate good model performance.

In a typical test based on partitioning by combinations of the explanatory variables, I split the sample into six groups of approximately equal size (ensuring identical group sizes is difficult because many variables are discretely measured). For example, the sample is first split into terciles by the husband's age (from the youngest to the oldest husband). Every such tercile is then additionally split in half by marriage duration (from the shortest to the longest marriage). The resulting six groups comprise roughly 650 couples each. I compute the value of a goodness-of-fit test statistic in each of these six groups and then sum the group statistics to compute a sample goodness-of-fit test statistic for this particular partitioning.[17] Table 6 presents the computed p-values in this example. They indicate that the model is a good fit to the data. It should be noted that changing the order of the variables (e.g., partitioning by marriage duration first and then by the husband's age) may result in different groups and comprise a new test.

By following a similar procedure, I perform over a hundred different goodness-of-fit tests, while employing all possible binary combinations of the explanatory variables provided that the groups in a partitioning are sufficiently large for the test to be informative.[18] The p-values of the sample statistics in the tests range from 0.102 to 0.999. Thus, the null hypothesis of a good in-sample fit of the model cannot be rejected at a conventional significance level in any case.

[17] Under the null hypothesis, a group statistic is distributed as a χ^2 random variable with two degrees of freedom, and the sample statistic is distributed as $\chi^2(12)$.

[18] The subsamples of couples with black husbands and with the wife's own children are already too small to be subdivided further.

Table 6
Example of a Goodness-of-Fit Test Where Sample Is Partitioned by Age and Duration

	Second Split: Marriage Duration	
First Split: Age, Husband's	Bottom Half	Top Half
Tercile 1	.737	.786
Tercile 2	.116	.217
Tercile 3	.503	.294

NOTE.—p-values of χ^2 goodness-of-fit test statistics; p-value of sample statistic = .423.

Table 7
Summary of Goodness-of-Fit Tests Where Sample Is Partitioned by Combinations of State Probabilities

First Split	Second Split	p-value[a]
$\widehat{\Pr}$ [s = cooperation]	$\widehat{\Pr}$ [s = conflict]	.488
$\widehat{\Pr}$ [s = cooperation]	$\widehat{\Pr}$ [s = divorce]	.268
$\widehat{\Pr}$ [s = conflict]	$\widehat{\Pr}$ [s = cooperation]	.357
$\widehat{\Pr}$ [s = conflict]	$\widehat{\Pr}$ [s = divorce]	.309
$\widehat{\Pr}$ [s = divorce]	$\widehat{\Pr}$ [s = cooperation]	.277
$\widehat{\Pr}$ [s = divorce]	$\widehat{\Pr}$ [s = conflict]	.779

NOTE.—To perform the tests, the sample is partitioned as follows. First, it is split into terciles by values of the predicted marital state probability (first split). Second, each resulting tercile is further split into three subsets by the predicted probability (second split). $\widehat{\Pr}$ [·] = predicted probability.

[a] p-value of the χ^2 goodness-of-fit sample statistic.

In every goodness-of-fit test based on partitioning by combinations of predicted marital state probabilities, I split the sample into nine equally sized groups according to probabilities of two states. For example, the sample is first split into terciles by the predicted probability of cooperation (from the lowest to the highest value). Every such tercile is then additionally split into three equally sized subsets by the predicted probability of conflict (again, from the lowest to the highest value). The procedure results in nine groups comprising 431 couples each. Similar to the tests based on partitioning by combinations of the explanatory variables, I compute the group and the sample goodness-of-fit test statistics. Table 7 presents a summary of the tests, including the p-values of the sample statistics. The results indicate that the hypothesis of a good in-sample fit cannot be rejected at a conventional significance level in any case. In summary, all performed goodness-of-fit tests indicate that the estimated model fits the data well.

D. Evidence on Out-of-Sample Performance

The NSFH wave 3 (2001–2) data are nonrandom because the survey selectively dropped a large fraction of the original respondents in order to save on interviewing costs. As such, these data are not employed in the estimation but rather are used only to assess whether the model may perform reasonably out of sample. Given the data limitations, the evidence presented below is only suggestive and should not be viewed as a definitive test of the model's validity.

Since the time lag between waves 2 and 3 is more than 50% longer than between waves 1 and 2 (i.e., 8.5 vs. 5.5 years, respectively), it makes little sense to use actual marital states from wave 3 in out-of-sample predictions. Instead, I employ family history records to infer whether couples are still intact 5.5 years after wave 2. A notable limitation of this approach is that I am able to assess the model's out-of-sample performance only in terms of its ability to predict the incidence of divorce. In total, I have information about 2,002 couples who were married as of wave 2 and did not experience the death of a spouse afterward. The actual divorce rate among these couples 5.5 years after wave 2 is 7.99%. Using the estimated model parameters, I predict a rate of 8.98%, which indicates that the model may overpredict divorce out of sample. However, the relative magnitude of the overprediction is on the order of 12%, which seems small.

E. Specification Tests

First, I investigate whether the divorce payoffs might be misspecified and might need to incorporate additional explanatory variables. In the United States, individual states have different legal regimes of property division after divorce (Freed and Walker 1991). In particular, "community property" states mandate an equal division of assets acquired during marriage between the ex-spouses. In "common law" states, assets are split according to who has legal title to them. In contrast, "equitable distribution" states allow courts substantial discretion in allocating property. Research to date suggests that the regime of property division after divorce might affect divorce payoffs (Gray 1998; Stevenson 2007). To check whether the regime might influence divorce utilities, I create indicators for the common law and community property regimes using information on each couple's state of residence (equitable distribution is the base category), include these indicators in the specification of the husband's and wife's divorce payoffs, and then test whether the coefficients on the indicators are statistically different from zero, using a Lagrange multiplier test (the null hypothesis is that the coefficients are zero). The p-value of the test statistic is .595, which indicates that the regime of property division has no statistically significant effect and suggests that the divorce payoffs are not misspecified.

In addition, I test whether the strength of CSE might differentially affect couples with two or more children, in comparison to couples with only one child. More specifically, I create an indicator for couples with two or more common children, include interactions of this indicator with the CSE variable and the CSE variable interacted with the spousal education levels in the divorce payoffs, and perform a Lagrange multiplier test to check whether the corresponding coefficients are statistically different from zero.

The p-value of the test statistic is .266, which indicates no differential effect and again suggests that the divorce payoffs are not misspecified.

Second, as discussed in Section IV.C, marriage duration can affect beliefs because marriages that have lasted longer are dynamically selected on the basis of individual traits. In that case, the type probability functions in the belief vector would be misspecified and should additionally incorporate marriage duration. To investigate whether coefficients on marriage duration in these functions are statistically different from zero, I perform a Lagrange multiplier test (the null hypothesis is that the coefficients are zero). The p-value of the test statistic is .464, which indicates that duration has no statistically significant effect here and suggests that the estimated belief functions are, in fact, not misspecified. It should be noted that the empirical specification of the beliefs already incorporates all available relevant spousal responses. Thus, the performed test simply indicates that marriage duration has no statistically significant additional impact after controlling for the responses.

F. Alternative Versions of the Model

To check the robustness of the baseline findings presented earlier, I estimate two alternative versions of the model by varying the specification of the cooperation and the conflict payoffs. In particular, the model is reestimated while excluding marriage duration from the payoffs. In this case, the magnitude of the estimated parameters changes slightly. For instance, the husband's age, which is correlated with the excluded marriage duration, is now estimated to have a larger impact on the payoff from cooperation. Also, there are some changes in terms of statistical significance of the estimates. However, the results seem to change little qualitatively.

In addition, the model is reestimated while including in the payoffs potentially endogenous variables such as the number of common children and an indicator of home ownership.[19] In this case, I find that children tend to increase the joint utility from cooperation and the conflict payoffs of both spouses, while home ownership tends to increase the husband's utility from conflict. However, I detect few qualitative differences from the baseline results in terms of the effect of the other variables (i.e., the variables in the baseline model) and only find small changes in the magnitude and statistical significance of the coefficients on these variables overall.

[19] The estimates may be inconsistent and must be interpreted with caution because the added variables may be correlated with the unobservable payoff components. For example, consider home ownership. It is conceivable that couples with a low marital match may perceive divorce as a likely eventual outcome, and in order to minimize future divorce costs, they may choose to rent rather than buy a house (presumably, divorce will be less costly when there are fewer assets to split between the ex-spouses). Likewise, fertility decisions in marriage may also be endogenous.

G. Incidence of Inefficient Divorce

A notable feature of the modeling approach in this article is that it allows me to quantify the incidence of inefficient divorces. Divorce is inefficient (but need not occur) provided that the sum of the spousal payoffs from divorce is less than the joint payoff from cooperation, $y_h^k + y_w^l < u_h + u_w$, because in this case both the husband and the wife can potentially attain a higher utility level by cooperating rather than by divorcing.[20] Thus, to calculate the probability that the marital outcome of a divorced couple with characteristics X is, in fact, inefficient, I need to compute the probability of the event $y_h^k + y_w^l < u_h + u_w$ conditional on divorce being the equilibrium outcome of the game; that is, $\Pr[y_h^k + y_w^l < u_h + u_w | s = \text{divorce}, X, \Gamma]$. Using standard probability rules and the fact that cooperation, conflict, and divorce are mutually exclusive and exhaustive, this conditional probability can be expressed as

$$
\begin{aligned}
&\Pr[y_h^k + y_w^l < u_h + u_w | s = \text{divorce}, X, \Gamma] \\
&= (\Pr[s = \text{divorce}|X, \Gamma])^{-1} \times \Pr[y_h^k + y_w^l < u_h + u_w, s = \text{divorce}|X, \Gamma] \\
&= (\Pr[s = \text{divorce}|X, \Gamma])^{-1} \times \sum_{k,l} \pi_h^k \pi_w^l (\Pr[y_h^k + y_w^l < u_h + u_w | k, l, X, \Gamma] \\
&\quad - \Pr[y_h^k + y_w^l < u_h + u_w, s = \text{cooperation}|k, l, X, \Gamma] \\
&\quad - \Pr[y_h^k + y_w^l < u_h + u_w, s = \text{conflict}|k, l, X, \Gamma]).
\end{aligned}
$$

To calculate the components of the conditional probability formula (5), I apply techniques that are analogous to the ones outlined in Section IV.E and appendix C.

By using the estimated model parameters and evaluating formula (5) on observable data for the couples, I find that the model predicts the frequency of the inefficiency given the divorce outcome at 22.58% overall. This result indicates a substantial incidence of inefficient marital outcomes, as implied by the model.

H. Policy Experiments

It is difficult to imagine that government action can directly address the root cause of inefficient marital outcomes in the model, namely, the presence of asymmetric information between the spouses. Instead, I consider two types of public policies that have been subject to change in recent decades and can affect spousal divorce prospects: separation period requirements and CSE. I investigate how changes in these policies can alter (1) the overall incidence of marital conflict and divorce and (2) the incidence of the

[20] For example, the husband's utility under cooperation can potentially be $u_h = y_h^k + (\varepsilon/2)$, and the wife's utility can be $u_w = y_w^l + (\varepsilon/2)$, where $\varepsilon = u_h + u_w - y_h^k - y_w^l > 0$, given an appropriately specified transfer. In that case, $u_h > y_h^k$ and $u_w > y_w^l$, which indicates the inefficiency of divorce.

Table 8
Results of Policy Experiments

Marital State	Baseline	Experiment A	Experiment B
Cooperation (%)	78.65	79.15	81.28
Conflict (%)	10.27	9.33	9.99
Divorce (%)	11.08	11.52	8.73
Total (%)	100.00	100.00	100.00
Pr [inefficiency|divorce]	.2258	.2314	.1608

NOTE.—Distributions are calculated using the National Survey of Families and Households (NSFH) sample weights. In experiment A, all separation periods are eliminated. In experiment B, the child support enforcement collection rate is increased to 100%.

inefficiency in divorce. Notably, I only consider effects of policy changes on married couples and do not address potential effects on marital search and match formation among single individuals.[21] The experiments are conducted using 100,000 randomly drawn (with replacement) couples from the sample, and fractions of couples in each marital state are calculated using the NSFH sample weights to be representative of the US population.

A few comments about the experiments are in order. Recall that the model explicitly incorporates utility transfer offers to sustain cooperation, and the marital outcome depends on whether the offer is accepted. The magnitude of the offered transfer is, in part, determined by the divorce payoffs, which are parameterized using the separation period requirements and the strength of CSE. Thus, I quantify effects of policy changes while accounting for the fact that the transfer offer can change in response to a policy-induced change in the divorce payoffs. In effect, the policy experiments analyzed here operate through the spousal bargaining channel. It is worth noting that although similar policy simulations might be implemented in the context of a reduced-form model, such a model would not account for a possible change in the utility transfer offer, and moreover, it would not allow me to quantify a possible change in the incidence of inefficient divorces.

First, I analyze a hypothetical scenario in which all separation periods are eliminated. The predicted distribution of marital states and the probability of marital outcome inefficiency conditional on divorce under this scenario are reported as experiment A in table 8 and can be compared to the baseline case there. According to the results, eliminating separation requirements appears to be a deterrent to marital conflict. In particular, the incidence of conflict falls by 0.94 percentage points (from 10.27% to 9.33%), or 9.2% of the baseline level of the conflict frequency. Also, elimination of separation periods leads to a higher incidence of divorce. Specifically, the fraction of

[21] For an example of theoretical analysis of a potential impact on single individuals, I refer interested readers to Rasul (2006).

divorced couples rises by 0.44 percentage points, or 4.0% of the baseline rate. This finding is intuitive because eliminating separation periods tends to increase spousal divorce utilities (see table 4). In addition, the results indicate that relatively more divorces are inefficient under this scenario since the conditional probability of the inefficiency given divorce is higher overall than in the baseline case (i.e., $0.2314 > 0.2258$). Thus, on the one hand, eliminating separation requirements increases the incidence of efficient marital outcomes by reducing the frequency of conflict (conflict is always inefficient). However, on the other hand, the effect is partly offset because of the increased frequency of inefficient divorce.

Second, I consider a hypothetical scenario of a perfect enforcement of child support payments, in which case the CSE collection rate is set at 100%. The results of the policy experiment are reported as experiment B in table 8. Notably, stronger CSE decreases both the incidence of marital conflict and the incidence of divorce, relative to the baseline case. Specifically, the fraction of couples in conflict falls by 0.28 percentage points, or 2.7% of the baseline level. In turn, the fraction of couples in divorce declines by 2.35 percentage points, or 21.2% of the baseline rate. In addition, the results indicate that relatively fewer divorces are inefficient under this scenario since the conditional probability of the inefficiency given divorce is lower overall than in the baseline case (i.e., $0.1608 < 0.2258$). Therefore, stronger CSE unambiguously increases the incidence of efficient marital outcomes by reducing the frequency of conflicts and the frequency of inefficient divorces.

VI. Conclusion

In this article, I propose and estimate a structural model of spousal interactions to explore why some couples have intense disputes but keep living together, while other couples cooperate, and the rest divorce. The model enables a quantification of the incidence of inefficient divorces and allows me to assess the difference in male and female preferences for marital conflict.

This article has several novel features that distinguish it from other papers on marriage in the family economics literature. First, conflict is treated as an equilibrium marital outcome, which is distinct from the outcomes of cooperation and divorce. Second, spousal interactions are modeled using a noncooperative game, which helps me to endogenize Pareto-inefficient outcomes and incorporate asymmetric information. Third, I exploit richness of the NSFH data to construct an indicator of conflict that encompasses both the frequency and the intensity of spousal disputes. Fourth, I assess how public policies related to separation period requirements and enforcement of child support obligations can affect the distribution of marital outcomes and the incidence of inefficient divorces.

The estimation results appear to be intuitive. For instance, the difference between spousal education levels has a negative effect on utility from cooperation, while marriage duration has a positive effect. More favorable conditions in the local marriage market tend to increase the wife's divorce payoff, while mandatory separation periods tend to decrease the spousal payoffs, especially in the case of long-term periods. In addition, the estimates imply that a large majority of spouses are less able to tolerate conflict and think that their outside options are low. Also, the results suggest that women are overall more tolerant of marital conflict than are men and indicate a substantial incidence of inefficient divorces.

In policy experiments, I find that eliminating separation periods can serve as a deterrent to conflict but can also increase the divorce rate, as well as the incidence of the inefficiency in divorce. In turn, strong CSE can decrease the frequency of both conflict and divorce and reduce the incidence of the inefficiency. These results suggest that improving CSE may facilitate efficient marital outcomes.

I conclude by pointing out two directions for future research. First, the available data on marital conflict seem to include more information than can be fully described by only two states of an intact marriage (i.e., cooperation and conflict) since spouses may report disputes over several distinct areas of the relationship. It may be interesting to investigate whether multi-issue bargaining models (e.g., Lang and Rosenthal 2001; Busch and Horstmann 2002) could be extended to address the multidimensionality of family negotiations. Second, due to data limitations, I estimated a static model of spousal interactions. As more data are collected, a dynamic model should be developed to explore the evolution of negotiation strategies and private information in marriage, as well as possible interdependence between match formation and spousal bargaining.

Appendix A

Proofs

Proof of Theorem 1

To start with, note that for any l,

$$1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau) \end{pmatrix} + 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau) \end{pmatrix} + 1\begin{pmatrix} u_w(\tau) \geq y_w^l \\ u_w(\tau) \geq v_w^l \end{pmatrix} = 1,$$

$$1(y_w^l > v_w^l) + 1(v_w^l \geq y_w^l) = 1.$$

Then, for convenience, rewrite $\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C})$ and $\hat{E}\mathcal{V}_h^k(\mathcal{R})$ as

$$\begin{aligned}\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) = y_h^k\sum_l \delta^l 1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau)\end{pmatrix} + v_h^k\sum_l \delta^l 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau)\end{pmatrix} \\ + u_h(-\tau)\sum_l \delta^l 1\begin{pmatrix} u_w(\tau) \geq y_w^l \\ u_w(\tau) \geq v_w^l\end{pmatrix}, \\ \hat{E}\mathcal{V}_h^k(\mathcal{R}) = y_h^k + (v_h^k - y_h^k)\sum_l \delta^l 1(v_w^l \geq y_w^l).\end{aligned}$$

Irrespective of τ, there are two mutually exclusive and exhaustive possibilities: either $v_h^k < y_h^k$ or $v_h^k \geq y_h^k$.

Consider arbitrary τ such that $u_h(-\tau) < y_h^k$. Suppose it is the case that $v_h^k < y_h^k$. Then,

$$\begin{aligned}\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) \leq y_h^k\sum_l \delta^l 1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau)\end{pmatrix} \\ + y_h^k\sum_l \delta^l 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau)\end{pmatrix} + y_h^k\sum_l \delta^l 1\begin{pmatrix} u_w(\tau) \geq y_w^l \\ u_w(\tau) \geq v_w^l\end{pmatrix} \\ = y_h^k \equiv \hat{E}\mathcal{V}_h^k(\mathcal{D}) \leq \max\{\hat{E}\mathcal{V}_h^k(\mathcal{R}),\ \hat{E}\mathcal{V}_h^k(\mathcal{D})\}.\end{aligned}$$

Next, suppose it is the case that $v_h^k \geq y_h^k$. Then,

$$\begin{aligned}\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) \leq v_h^k\sum_l \delta^l 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau)\end{pmatrix} \\ + y_h^k\sum_l \delta^l\left[1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau)\end{pmatrix} + 1\begin{pmatrix} u_w(\tau) \geq y_w^l \\ u_w(\tau) \geq v_w^l\end{pmatrix}\right] \\ = y_h^k + [v_h^k - y_h^k]\sum_l \delta^l 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau)\end{pmatrix}.\end{aligned}$$

By properties of indicator functions,

$$1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau)\end{pmatrix} \leq 1(v_w^l \geq y_w^l).$$

It follows that

$$\begin{aligned}\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) \leq y_h^k + [v_h^k - y_h^k]\sum_l \delta^l 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau)\end{pmatrix} \\ \leq y_h^k + (v_h^k - y_h^k)\sum_l \delta^l 1(v_w^l \geq y_w^l) = \hat{E}\mathcal{V}_h^k(\mathcal{R}) \\ \leq \max\{\hat{E}\mathcal{V}_h^k(\mathcal{R}),\ \hat{E}\mathcal{V}_h^k(\mathcal{D})\}.\end{aligned}$$

QED

Further proofs can be facilitated by three lemmas that are based on properties of semicontinuous functions (see Rudin 1987; Jost 2003).

LEMMA 1. For any l, functions

$$1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau) \end{pmatrix} \quad \text{and} \quad 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau) \end{pmatrix}$$

are lower semicontinuous in τ.

Proof. The functions can be expressed as

$$1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau) \end{pmatrix} = 1(y_w^l > v_w^l) \times 1(y_w^l > u_w(\tau)),$$
$$1\begin{pmatrix} v_w^l \geq v_w^l \\ v_w^l > u_w(\tau) \end{pmatrix} = 1(v_w^l \geq y_w^l) \times 1(v_w^l > u_w(\tau)).$$

By continuity of $u_w(\tau)$ in τ, inequalities $y_w^l > u_w(\tau)$ and $v_w^l > u_w(\tau)$ define open sets. Then, $1(y_w^l > u_w(\tau))$ and $1(v_w^l > u_w(\tau))$ are lower semicontinuous as indicator functions of open sets.

With respect to τ, $1(y_w^l > v_w^l)$ and $1(v_w^l \geq y_w^l)$ are nonnegative constants. Therefore, products $1(y_w^l > v_w^l) \times 1(y_w^l > u_w(\tau))$ and $1(v_w^l \geq y_w^l) \times 1(v_w^l > u_w(\tau))$ are lower semicontinuous. QED

LEMMA 2. For any k, function

$$f(\tau) = [v_h^k - u_h(-\tau)] \sum_l \delta^l 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau) \end{pmatrix}$$

is upper semicontinuous in τ.

Proof. Recall that there exists τ^0 such that

$$u_h(-\tau^0) > v_h^H \geq v_h^k, \text{ for any } k,$$

and

$$u_w(\tau^0) > v_w^H \geq v_w^l, \text{ for any } l.$$

Consider arbitrary $\tau \geq \tau^0$. Since $u_w(\tau)$ increases in τ, it is the case that $u_w(\tau) > u_w(\tau^0) > v_w^H \geq v_w^l$. Therefore,

$$1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau) \end{pmatrix} = 0$$

for any l, and $f(\tau) = 0$. Then, $f(\tau)$ is trivially continuous and, thus, upper semicontinuous.

Next, consider arbitrary $\tau < \tau^0$. Since $u_h(-\tau)$ decreases in τ, it is the case that $u_h(-\tau) > u_h(-\tau^0) > v_h^H \geq v_h^k$. Since $u_h(-\tau)$ is also continuous in τ, it follows that for any k, $u_h(-\tau) - v_h^k$ is positive, continuous, and, thus, lower semicontinuous.

Since $\delta^l \geq 0$, lemma 1 implies that

$$\sum_l \delta^l 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau) \end{pmatrix}$$

is a nonnegative lower semicontinuous function in τ. Then,

$$-f(\tau) = [u_b(-\tau) - v_b^k] \sum_l \delta^l 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau) \end{pmatrix}$$

is lower semicontinuous for $\tau < \tau^0$ as the product of two nonnegative lower semicontinuous functions. Then, function $f(\tau)$ is upper semicontinuous for $\tau < \tau^0$. It follows that $f(\tau)$ is upper semicontinuous for all τ. QED

LEMMA 3. For any k, function

$$f(\tau) = [y_b^k - u_b(-\tau)] \sum_l \delta^l 1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau) \end{pmatrix}$$

is upper semicontinuous on T^k.

Proof. Since $\delta^l \geq 0$, lemma 1 implies that

$$\sum_l \delta^l 1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau) \end{pmatrix}$$

is a nonnegative lower semicontinuous function in τ. Recall that for all $\tau \in T^k$, $u_b(-\tau) \geq y_b^k$. Thus, function $u_b(-\tau) - y_b^k$ is nonnegative on T^k. It is also continuous and, thus, lower semicontinuous.

Then, the product of two nonnegative lower semicontinuous functions,

$$-f(\tau) = [u_b(-\tau) - y_b^k] \times \sum_l \delta^l 1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau) \end{pmatrix},$$

is lower semicontinuous for all $\tau \in T^k$. It follows that $f(\tau)$ is upper semicontinuous on T^k. QED

Proof of Theorem 2

It is straightforward to express function $\hat{E}\mathcal{V}_b^k(\tau; \mathcal{C})$ as

$$\hat{E}\mathcal{V}_b^k(\tau; \mathcal{C}) = u_b(-\tau) + [v_b^k - u_b(-\tau)] \sum_l \delta^l 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau) \end{pmatrix}$$
$$+ [y_b^k - u_b(-\tau)] \sum_l \delta^l 1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau) \end{pmatrix}.$$

The first summand is continuous and, thus, upper semicontinuous for all τ. The second summand is upper semicontinuous for all τ by lemma 2. The third summand is upper semicontinuous on T^k by lemma 3. Hence, $\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C})$ is upper semicontinuous on T^k as a finite sum of upper semicontinuous functions. QED

Proof of Theorem 3

Part 1

Observe that if T^k is empty, its complement coincides with set $[\tau_{\min}, \tau_{\max}]$. Now, recall that there exists $\tau^0 \in [\tau_{\min}, \tau_{\max}]$ such that $y_h^k > u_h(-\tau^0) > v_h^H \geq v_h^k$. Then,

$$\begin{aligned}\hat{E}\mathcal{V}_h^k(\mathcal{D}) \equiv y_h^k &= y_h^k \sum_l \delta^l 1(y_w^l > v_w^l) + y_h^k \sum_l \delta^l 1(v_w^l \geq y_w^l) \\ &\geq y_h^k \sum_l \delta^l 1(y_w^l > v_w^l) + v_h^k \sum_l \delta^l 1(v_w^l \geq y_w^l) = \hat{E}\mathcal{V}_h^k(\mathcal{R}).\end{aligned}$$

Part 2

Consider transfer $\tau_{\min}$. For any l it is the case that $v_w^l \geq v_w^s > u_w(\tau_{\min})$ and, therefore,

$$1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau_{\min}) \end{pmatrix} = 1(v_w^l \geq y_w^l)$$

and

$$1\begin{pmatrix} u_w(\tau_{\min}) \geq y_w^l \\ u_w(\tau_{\min}) \geq v_w^l \end{pmatrix} = 0.$$

Since

$$1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau_{\min}) \end{pmatrix} + 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau_{\min}) \end{pmatrix} + 1\begin{pmatrix} u_w(\tau_{\min}) \geq y_w^l \\ u_w(\tau_{\min}) \geq v_w^l \end{pmatrix} = 1,$$

then

$$1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau_{\min}) \end{pmatrix} = 1 - 1(v_w^l \geq y_w^l).$$

It follows that

$$\begin{aligned}\hat{E}\mathcal{V}_h^k(\tau_{\min};\mathcal{C}) &= y_h^k \sum_l \delta^l 1\begin{pmatrix} y_w^l > v_w^l \\ y_w^l > u_w(\tau_{\min})\end{pmatrix} \\ &+ v_h^k \sum_l \delta^l 1\begin{pmatrix} v_w^l \geq y_w^l \\ v_w^l > u_w(\tau_{\min})\end{pmatrix} \\ &+ u_h(-\tau_{\min})\sum_l \delta^l 1\begin{pmatrix} u_w(\tau_{\min}) \geq y_w^l \\ u_w(\tau_{\min}) \geq v_w^l\end{pmatrix} \\ &= y_h^k + [v_h^k - y_h^k]\sum_l \delta^l 1(v_w^l \geq y_w^l) \\ &= y_h^k \sum_l \delta^l 1(y_w^l > v_w^l) + v_h^k \sum_l \delta^l 1(v_w^l \geq y_w^l) = \hat{E}\mathcal{V}_h^k(\mathcal{R}).\end{aligned}$$

By monotonicity of $u_h(\cdot)$, $\tau_{\min} \in T^k$. Then, $\max_{\tau \in T^k} \hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) \geq \hat{E}\mathcal{V}_h^k(\tau_{\min};\mathcal{C}) = \hat{E}\mathcal{V}_h^k(\mathcal{R})$. QED

Proof of Theorem 4

The wife's best response function to a transfer offer τ maps the offer into the set of wife's actions—(1) accept the offer, (2) reject the offer without separating, or (3) divorce—and is explicitly described in Section III.B for an arbitrary wife's type l. Now, consider the optimal strategic choice for arbitrary husband's type k. If set T^k is empty, theorems 1 and 3 imply that $\mathcal{D}$ is the (weakly) dominant strategy of the husband. In this case, an equilibrium can be specified as the husband's strategy $\mathcal{D}$ and the wife's best response function (should the game ever reach an information set where the wife needs to move).

If set T^k is nonempty, theorem 2 implies that function $\hat{E}V_h^k(\tau;\mathcal{C})$ attains its maximum on T^k, and, therefore, I can define $\tau^* = \arg\max_{\tau \in T^k} \hat{E}V_h^k(\tau;\mathcal{C})$. Then, the optimal strategic choice amounts to comparing two real numbers, $\hat{E}V_h^k(\mathcal{D})$ and $\hat{E}V_h^k(\tau^*;\mathcal{C})$. If the former number dominates, an equilibrium is identical to the one outlined in the previous paragraph. Otherwise, an equilibrium comprises the husband's strategy $(\tau^*;\mathcal{C})$ and the wife's best response function. QED

Proof of Theorem 5

Since the alternative model is a special case of the original model, the state of conflict occurs when the husband proposes cooperation and the wife rejects the offer but abstains from separating. I show that each of the three conditions precludes this outcome.

Condition 1. If $y_w^l > v_w$ for all l, then announcing divorce is always a better option for the wife than rejecting the offer without separating.

Condition 2. Obviously, the inequality $y_w^l > v_w$ for all l is either true or false. If it is true, then conflicts for all $\delta^p > 0$ are ruled out by condition 1. Alternatively, suppose that $y_w^l > v_w$ for all l is false or, equivalently, that $v_w \geq y_w^P$.

Observe that if condition 2 holds,

$$\begin{aligned}\sum_l \delta^l 1(v_w \geq y_w^l) &= \delta^O 1(v_w \geq y_w^O) + \delta^P 1(v_w \geq y_w^P) \\ &= \delta^O 1(v_w \geq y_w^O) + \delta^P \geq \delta^P > 0.\end{aligned}$$

Recall that there exists transfer τ^0 such that $u_h(-\tau^0) > v_h$ and $u_w(\tau^0) > v_w$. Now, since $v_w > u_w(\tau_{\min})$ and $u_w(\tau)$ is continuous in τ, by the intermediate value theorem (Jost 2003, theorem 1.14), there exists transfer $\hat{\tau}$ such that $u_w(\hat{\tau}) = v_w$. Moreover, because $u_w(\tau)$ increases in τ, it must be that $\tau^0 > \hat{\tau}$ and, in turn, $u_h(-\hat{\tau}) > u_h(-\tau^0) > v_h$.

There are two mutually exclusive and exhaustive possibilities: either $\hat{\tau} \in T^k$ or $\hat{\tau} \notin T^k$. First, consider the case $\hat{\tau} \in T^k$. I show that the husband would offer such transfer τ^* that the wife would not incite a conflict: $u_w(\tau^*) \geq v_w$, or, equivalently, $\tau^* \geq \hat{\tau}$.

It is straightforward to verify that

$$\hat{E}\mathcal{V}_h^k(\hat{\tau};\mathcal{C}) = y_h^k \sum_l \delta^l 1(y_w^l > v_w) + u_h(-\hat{\tau}) \sum_l \delta^l 1(v_w \geq y_w^l) \geq y_h^k.$$

Hence, $\max_{\tau \in T^k} \hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) \geq \hat{E}\mathcal{V}_h^k(\hat{\tau};\mathcal{C}) \geq y_h^k$, and the husband would be at least as well off by making an offer as by announcing divorce.

Clearly, subset $[\tau_{\min}, \hat{\tau}] \subset T^k$, and it is easy to show that for any $\tau \in [\tau_{\min}, \hat{\tau}]$,

$$\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) = y_h^k \sum_l \delta^l 1(y_w^l > v_w) + v_h \sum_l \delta^l 1(v_w \geq y_w^l).$$

Then, since $v_h < u_h(-\hat{\tau})$ and $\Sigma_l \delta' 1(v_w \geq y_w^l) > 0$, it must be that for all $\tau \in [\tau_{\min}, \hat{\tau}]$,

$$\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) < \hat{E}\mathcal{V}_h^k(\hat{\tau};\mathcal{C}) \leq \max_{\tau \in T^k} \hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}),$$

and therefore, $\tau^* \geq \hat{\tau}$, as desired.

Second, consider the case $\hat{\tau} \notin T^k$. I show that the husband optimally chooses to divorce. Clearly, $u_h(-\hat{\tau}) < y_h^k$, and, therefore, every $\tau \in T^k$ must necessarily satisfy inequality $\tau < \hat{\tau}$. Then, for all $\tau \in T^k$,

$$\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) = y_h^k \sum_l \delta^l 1(y_w^l > v_w) + v_h \sum_l \delta^l 1(v_w \geq y_w^l) < y_h^k$$

because $v_h < u_h(-\hat{\tau}) < y_h^k$, and $\Sigma_1 \delta' 1(v_w \geq y_w^l) > 0$.

Therefore, $\max_{\tau \in T^k} \hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) < \hat{E}\mathcal{V}_h^k(\mathcal{D})$, and the husband is better off by announcing divorce. Hence, irrespective of whether $\hat{\tau} \in T^k$ or $\hat{\tau} \notin T^k$, the state of conflict cannot occur.

Condition 3. If $y_w^l \leq v_w$ for all l, function $\hat{E}\mathcal{V}_h^k(\tau; \mathcal{C})$ takes a very simple form:

$$\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) = v_h 1(v_w > u_w(\tau)) + u_h(-\tau)1(u_w(\tau) \geq v_w).$$

Consider again two mutually exclusive and exhaustive possibilities $\hat{\tau} \in T^k$ and $\hat{\tau} \notin T^k$, where $\hat{\tau}$ is defined in the proof for condition 2. First, suppose that $\hat{\tau} \in T^k$. By definition of $\hat{\tau}$, $u_h(-\hat{\tau}) > v_h$ and $u_w(\hat{\tau}) = v_w$, and, therefore, by monotonicity of $u_h(\cdot)$ and $u_w(\cdot)$, function $\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C})$ jumps from v_h to $u_h(-\hat{\tau})$ at $\tau = \hat{\tau}$ and decreases afterward in τ. Hence, $\max_{\tau \in T^k} \hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) = \hat{E}\mathcal{V}_h^k(\hat{\tau};\mathcal{C}) = u_h(-\hat{\tau}) \geq y_h^k$, and the husband chooses to offer transfer $\hat{\tau}$, which is acceptable to the wife.

Second, suppose that $\hat{\tau} \notin T^k$. As shown earlier, every $\tau \in T^k$ must satisfy inequality $\tau < \hat{\tau}$. Then, for all $\tau \in T^k$,

$$\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C}) = v_h < y_h^k$$

because $v_h < u_h(-\hat{\tau}) < y_h^k$, and, therefore, the husband is better off by announcing divorce. Hence, irrespective of whether $\hat{\tau} \in T^k$ or $\hat{\tau} \notin T^k$, the state of conflict cannot occur. QED

Appendix B
Details on Data

Table B1
Opinions and Beliefs

Variable	Mean	SD	Min	Max	Description
Same happiness, husband	.17	.38	0	1	*H* says his own overall happiness would be the same after divorce
More happy, husband	.06	.23	0	1	*H* says his own overall happiness would be better or much better after divorce
Worthy person, husband	.38	.49	0	1	*H* strongly agrees he is person of worth
Same happiness, wife	.15	.36	0	1	*W* says her own overall happiness would be the same after divorce
More happy, wife	.07	.26	0	1	*W* says her own overall happiness would be better or much better after divorce
Worthy person, wife	.42	.49	0	1	*W* strongly agrees she is person of worth
Same happiness	.19	.39	0	1	*H* believes *w*'s overall happiness would be the same after divorce
More happy	.08	.27	0	1	*H* believes *w*'s overall happiness would be better or much better after divorce

NOTE.—*H* = husband; *w* = wife.

Table B2
Sociodemographic Characteristics

Variable	Mean	SD	Min	Max	Description
Age, husband's	41.02	13.75	17	90	Age of h in years
Age, absolute difference	3.62	3.84	0	38	Absolute value of age difference
Black husband	.09	.29	0	1	H is black
Catholic husband	.23	.42	0	1	H is Roman Catholic
Religion, difference	.33	.47	0	1	H and w report different affiliations
High school, husband	.51	.50	0	1	Highest education of h is high school
College, husband	.33	.47	0	1	Highest education of h is (at least) college
High school, wife[a]	.58	.49	0	1	Highest education of w is high school
College, wife[a]	.29	.45	0	1	Highest education of w is (at least) college
Education, difference	.38	.48	0	1	H and w report different attainments
Marriage duration	14.51	13.23	0	64	Duration of marriage in years
Children, wife's	.14	.47	0	5	Number of own children of w

NOTE.—H = husband; w = wife. A child is an individual who is 18 years old or younger.
[a] Wife's education indicators are used to parameterize the wife's divorce payoff.

Table B3
Location-Specific Variables

Variable	Mean	SD	Min	Max	Description
Male-specific availability ratio	1.25	.24	.56	2.43	Local marriage market availability ratio specific to h
Female-specific availability ratio	.84	.15	.22	1.45	Local marriage market availability ratio specific to w
Separation $\geq 1/2$ year and ≤ 1 year	.18	.39	0	1	H and w reside in state with separation period between 6 months[a] and 1 year
Separation > 1 year	.33	.47	0	1	H and w reside in state with separation period that exceeds 1 year
Collection rate[b]	.19	.06	.06	.35	Child support enforcement collection rate interacted with indicator for presence of children

NOTE.—H = husband; w = wife.
[a] Six months is the minimum period across states with separation requirements.
[b] Statistics are for the subsample of couples with children.

Appendix C

Transformation Algorithm

To compute conditional probabilities (3) and (4) in Section IV.E, I need to evaluate expectations of the corresponding indicator functions.[22] I transform the problem of evaluating the expectations by analytically solving for boundaries of relevant regions of integration of the joint density of errors θ

[22] Note that the expectations involve seven-dimensional integrals since errors θ and η are 4×1 and 3×1 vectors, respectively.

and η. In doing so, I directly exploit the structure of the model. The analytical transformation algorithm consists of the following steps.

First, the domain of error θ_4 is partitioned into intervals. The interval boundaries are chosen so that the expected-value function of the husband of type k, $\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C})$, has a simple closed-form expression on each interval.

Second, I study properties of $\hat{E}\mathcal{V}_h^k(\tau;\mathcal{C})$ on every interval of θ_4. It turns out that the expected-value function has discontinuities in τ but is nonincreasing in τ between adjacent discontinuity points. Thus, the optimal transfer, τ^*, is always at one of the discontinuities.

Third, given a specific wife's type l, I determine which transfers would be accepted by her and which ones would be rejected without the divorce announcement. Acceptable transfers would result in the state of cooperation, and the unacceptable ones would lead to conflict.

Fourth, for every such transfer, I write out a system of inequalities underlying the decision of the husband of type k to offer it, and then I analytically solve the system for integration bounds. In the solution, the errors are systematically arranged in an order that is convenient for further simulation. The steps are repeated for all intervals of θ_4 and all possible spousal types k and l.

Effectively, the algorithm transforms the problem of evaluating the expectations in equations (3) and (4) into a problem of computing several integrals of the form

$$\int_{\mathbb{R}^3}\int_{f_1(\eta)}^{f_2(\eta)}\int_{f_3(\theta_4,\eta)}^{f_4(\theta_4,\eta)}\int_{f_5(\theta_3,\theta_4,\eta)}^{f_6(\theta_3,\theta_4,\eta)}\int_{f_7(\theta_2,\theta_3,\theta_4,\eta)}^{f_8(\theta_2,\theta_3,\theta_4,\eta)}\psi(\theta,\eta)d\theta_1 d\theta_2 d\theta_3 d\theta_4 d\eta,$$

where $\psi(\cdot)$ is the density of the errors, and functions $f_1(\cdot), f_2(\cdot), \ldots, f_8(\cdot)$ are the integration bounds. Given the structure of the integrals, it is straightforward to simulate them with the GHK method. Further details on the algorithm and closed-form solutions for all integration bounds can be found in Zhylyevskyy (2008).

References

Bartoszyński, Robert, and Magdalena Niewiadomska-Bugaj. 1996. *Probability and statistical inference*. New York: Wiley.

Becker, Gary S. 1991. *A treatise on the family*. Rev. ed. Cambridge, MA: Harvard University Press.

Becker, Gary S., Elisabeth M. Landes, and Robert T. Michael. 1977. An economic analysis of marital instability. *Journal of Political Economy* 85, no. 6:1141–88.

Booth, Alan, Ann C. Crouter, and Mari Clements. 2001. *Couples in conflict*. Mahwah, NJ: Erlbaum.

Börsch-Supan, Axel, and Vassilis A. Hajivassiliou. 1993. Smooth unbiased multivariate probability simulators for maximum likelihood estimation of limited dependent variable models. *Journal of Econometrics* 58, no. 3:347–68.

Bowlus, Audra J., and Shannon Seitz. 2006. Domestic violence, employment, and divorce. *International Economic Review* 47, no. 4:1113–49.

Bureau of the Census. 1995. *Census of population and housing, 1990: Public Use Microdata Sample; 5-percent sample*. 3rd Interuniversity Consortium for Political and Social Research release. Washington, DC: US Department of Commerce.

Busch, Lutz-Alexander, and Ignatius J. Horstmann. 2002. The games of negotiations: Ordering issues and implementing agreements. *Games and Economic Behavior* 41, no. 2:169–91.

Chiappori, Pierre-André. 1988. Rational household labor supply. *Econometrica* 56, no. 1:63–90.

Dee, Thomas S. 2003. Until death do you part: The effects of unilateral divorce on spousal homicides. *Economic Inquiry* 41, no. 1:163–82.

Degan, Arianna, and Antonio Merlo. 2006. A structural model of turnout and voting in multiple elections. Unpublished manuscript, Department of Economics, University of Pennsylvania.

Duflo, Esther, and Christopher Udry. 2004. Intrahousehold resource allocation in Cote d'Ivoire: Social norms, separate accounts and consumption choices. Working Paper no. 10498, National Bureau of Economic Research, Cambridge, MA.

Fossett, Mark A., and K. Jill Kiecolt. 1991. A methodological review of the sex ratio: Alternatives for comparative research. *Journal of Marriage and the Family* 53, no. 4:941–57.

Freed, Doris J., and Timothy B. Walker. 1991. Family law in the fifty states: An overview. *Family Law Quarterly* 24, no. 4:309–405.

Friedberg, Leora. 1998. Did unilateral divorce raise divorce rates? Evidence from panel data. *American Economic Review* 88, no. 3:608–27.

Friedberg, Leora, and Steven Stern. 2006. Marriage, divorce, and asymmetric information. Unpublished manuscript, Department of Economics, University of Virginia.

Goldman, Noreen, Charles F. Westoff, and Charles Hammerslough. 1984. Demography of the marriage market in the United States. *Population Index* 50, no. 1:5–25.

Gray, Jeffrey S. 1998. Divorce-law changes, household bargaining, and married women's labor supply. *American Economic Review* 88, no. 3: 628–42.

Grych, John H., and Frank D. Fincham. 2001. *Interparental conflict and child development: Theory, research, and applications*. New York: Cambridge University Press.

Hajivassiliou, Vassilis, Daniel McFadden, and Paul Ruud. 1996. Simulation of multivariate normal rectangle probabilities and their derivatives: Theoretical and computational results. *Journal of Econometrics* 72, nos. 1–2:85–134.

Jost, Jurgen. 2003. *Postmodern analysis*. 2nd ed. Berlin: Springer.

Lang, Kevin, and Robert W. Rosenthal. 2001. Bargaining piecemeal or all at once? *Economic Journal* 111, no. 473:526–40.

Lundberg, Shelly, and Robert A. Pollak. 1993. Separate spheres bargaining and the marriage market. *Journal of Political Economy* 101, no. 6:988–1010.

———. 1996. Bargaining and distribution in marriage. *Journal of Economic Perspectives* 10, no. 4:139–58.

MaCurdy, Thomas, Thomas Mroz, and R. Mark Gritz. 1998. An evaluation of the National Longitudinal Survey on Youth. *Journal of Human Resources* 33, no. 2:345–436.

Manser, Marilyn, and Murray Brown. 1980. Marriage and household decision-making: A bargaining analysis. *International Economic Review* 21, no. 1:31–44.

McElroy, Marjorie B. 1990. The empirical content of Nash-bargained household behavior. *Journal of Human Resources* 25, no. 4:559–83.

McElroy, Marjorie B., and Mary Jean Horney. 1981. Nash-bargained household decisions: Toward a generalization of the theory of demand. *International Economic Review* 22, no. 2:333–49.

Melton, J. Gordon. 1977. *A directory of religious bodies in the United States*. New York: Garland.

Nixon, Lucia. 1997. The effect of child support enforcement on marital dissolution. *Journal of Human Resources* 32, no. 1:159–81.

Peters, H. Elizabeth. 1986. Marriage and divorce: Informational constraints and private contracting. *American Economic Review* 76, no. 3:437–54.

Rasul, Imran. 2006. Marriage markets and divorce laws. *Journal of Law, Economics, and Organization* 22, no. 1:30–69.

Rudin, Walter. 1987. *Real and complex analysis*. 3rd ed. New York: McGraw-Hill.

Stevenson, Betsey. 2007. The impact of divorce laws on marriage-specific capital. *Journal of Labor Economics* 25, no. 1:75–94.

Stevenson, Betsey, and Justin Wolfers. 2006. Bargaining in the shadow of the law: Divorce laws and family distress. *Quarterly Journal of Economics* 121, no. 1:267–88.

Sweet, James, Larry Bumpass, and Vaughn Call. 1988. The design and content of the National Survey of Families and Households. NSFH Working Paper no. 1, University of Wisconsin–Madison.

Tartari, Melissa. 2005. Divorce and the cognitive achievement of children. Unpublished manuscript, Department of Economics, University of Pennsylvania.

Tauchen, Helen V., Ann Dryden Witte, and Sharon K. Long. 1991. Domestic violence: A nonrandom affair. *International Economic Review* 32, no. 2:491–511.
Udry, Christopher. 1996. Gender, agricultural production, and the theory of the household. *Journal of Political Economy* 104, no. 5:1010–46.
US House Committee on Ways and Means. 1991. *Child support enforcement report card*. Washington, DC: US Government Printing Office.
Weiss, Yoram, and Robert J. Willis. 1985. Children as collective goods and divorce settlements. *Journal of Labor Economics* 3, no. 3:268–92.
Zhylyevskyy, Oleksandr. 2008. A bad peace or a good war: A structural estimation model of spousal conflict and divorce. PhD diss., Department of Economics, University of Virginia.