

A Bad Peace or a Good War:

A Structural Estimation Model of Spousal Conflict and Divorce

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Background

- Spousal conflict and divorce are empirically relevant
- Limited research on spousal conflict
- Unexplored richness of data: National Survey of Families and Households (NSFH)

NSFH Questions about Spousal Conflict

Dispute areas and frequencies:

“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, children?”

responses: “never”, “once a month or less”, ..., “almost every day”

Dispute resolution process:

“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?”

responses: “never”, “seldom”, ..., “always”

NSFH Evidence on Spousal Conflict

Dispute frequencies:

- once a week +: 39 percent
- several times a week +: 23 percent
- almost everyday: 11 percent

Dispute resolution process:

- seldom/never calmly discuss disputes: 27 percent
- often/always heatedly argue or shout: 10 percent

Research Focus

Research goals:

- explain conflict in intact marriage, along with cooperation and divorce
- quantify disutility effect of conflict
- evaluate impact of separation requirements and child support enforcement on spousal negotiation outcomes

Model does not address:

- selection into marriage
- dynamic bargaining

Effects of Spousal Conflict

Impact on spouses (Booth et al., 2001):

- depression
- alcoholism, bad health
- poor parent-child relationship

Impact on children (Grych & Fincham, 2001):

- low self-esteem, depression
- bad health
- conduct problems, trouble with law enforcement
- poor school performance
- low social competence

Emery (1982), Amato et al. (1995), Jekielek (1998):

- conflict may be more detrimental to children than divorce

Family Economics Literature

Spousal conflict as outcome is absent in:

- unitary models (Becker, 1974)
- cooperative bargaining models (Manser & Brown, 1980)
- collective models (Chiappori, 1988)

Models with noncooperation or violence:

- Lundberg & Pollak (1993)
- Tartari (2005)
- Bowlus & Seitz (2006)

Novelty and Contribution

Novel features:

- three outcomes of bargaining: cooperation, conflict, divorce
- noncooperative framework: allows for Pareto inferior outcomes
- two sources of asymmetric information: differential impacts of conflict and divorce
- adequate measure of “destructive” conflict: combines information on dispute frequency and resolution process
- detailed specification of outside options: marriage market conditions, separation requirements, child support enforcement

Preview of Results

Outside options:

- positive effect of favorable marriage market conditions
- negative effect of separation periods
- effect of child support enforcement varies with education

Policy simulations:

- elimination of separation periods: divorce rate rises by 8.4%
- stronger child support enforcement: conflict and divorce rates fall by 18.4% and 9.2%

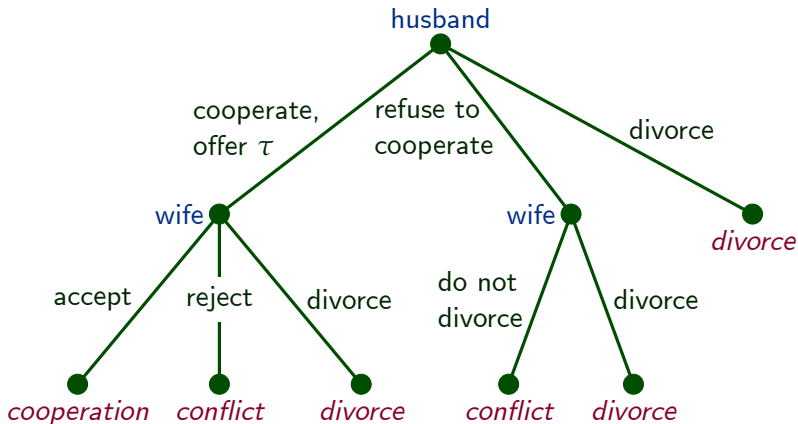
Value of marriage:

- results are intuitive: e.g., young common children have positive effect, spousal age difference has negative effect

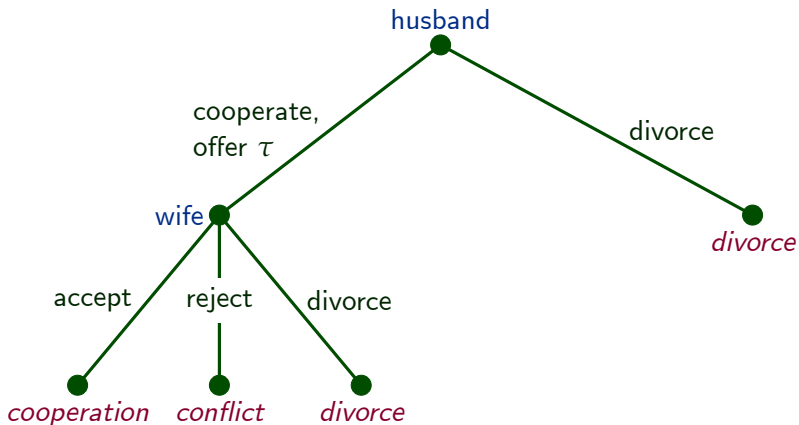
Outline

- Model
- Data and Variables
- Specification and Estimation
- Results
- Conclusion

Bargaining Game Structure



Preview of Simplified Game Structure



Spousal Types and Husband's Beliefs

Two individual traits:

- Bargaining “strength”: “soft” (S) vs. “hard” (H) bargainer
- Divorce prospect: “pessimist” (P) vs. “optimist” (O)

Husband's type (k) and wife's type (l) combine trait levels:

- $k, l \in \{HO, HP, SO, SP\}$
- e.g., type HO stands for “hard bargainer – optimist”

Knowledge about types:

- type is private information
- husband has beliefs $(\delta^{HO}, \delta^{HP}, \delta^{SO}, \delta^{SP})'$

Payoffs

Cooperation: payoffs are type invariant:

$$u_h(-\tau) \text{ and } u_w(\tau)$$

Conflict: bargaining “strength” matters:

$$v_h^k = \begin{cases} v_h^H, k = HO, HP \\ v_h^S, k = SO, SP \end{cases}$$

$$v_h^H > v_h^S$$

Divorce: optimism matters:

$$y_h^k = \begin{cases} y_h^O, k = HO, SO \\ y_h^P, k = HP, SP \end{cases}$$

$$y_h^O > y_h^P$$

Payoffs

Cooperation: payoffs are type invariant:

$$u_h(-\tau) \text{ and } u_w(\tau)$$

Conflict: bargaining “strength” matters:

$$v_h^k = \begin{cases} v_h^H, k = HO, HP \\ v_h^S, k = SO, SP \end{cases} \quad \text{and} \quad v_w^l = \begin{cases} v_w^H, l = HO, HP \\ v_w^S, l = SO, SP \end{cases}$$

$$v_h^H > v_h^S \qquad v_w^H > v_w^S$$

Divorce: optimism matters:

$$y_h^k = \begin{cases} y_h^O, k = HO, SO \\ y_h^P, k = HP, SP \end{cases} \quad \text{and} \quad y_w^l = \begin{cases} y_w^O, l = HO, SO \\ y_w^P, l = HP, SP \end{cases}$$

$$y_h^O > y_h^P \qquad y_w^O > y_w^P$$

Solution Approach

Backward recursion:

stage 2: wife maximizes her utility

stage 1: husband anticipates wife's best response,
maximizes his *expected* utility

Husband's strategies and expected utilities:

- strategies: $(\tau; \mathcal{C}), \mathcal{R}, \mathcal{D}$
- expected utilities: $\hat{E}\mathcal{V}_h^k(\tau; \mathcal{C}), \hat{E}\mathcal{V}_h^k(\mathcal{R}), \hat{E}\mathcal{V}_h^k(\mathcal{D})$ ► expressions

Technical issues:

- uncountably many transfers: game is infinite
- $\hat{E}\mathcal{V}_h^k(\tau; \mathcal{C})$ is discontinuous in transfer τ

Game Properties

Theorem

All strategies $(\tau; \mathcal{C})$ with $\tau : u_h(-\tau) < y_h^k$ are dominated.

Theorem

Strategy \mathcal{R} is dominated.

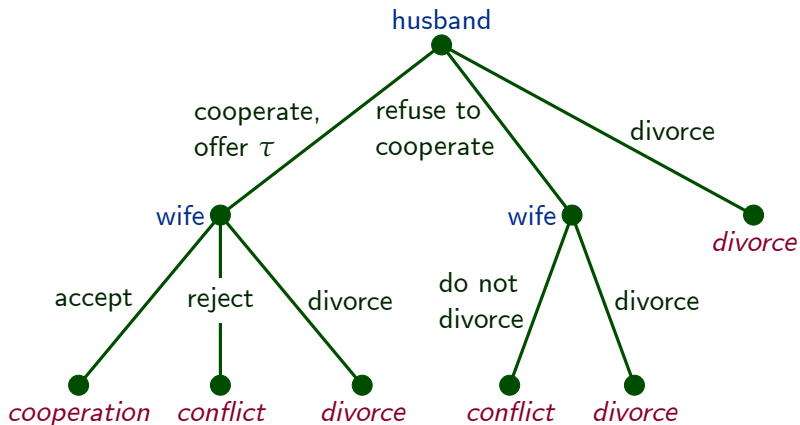
Theorem

Let $T^k = \{\tau : u_h(-\tau) \geq y_h^k\}$. Solution to husband's problem:

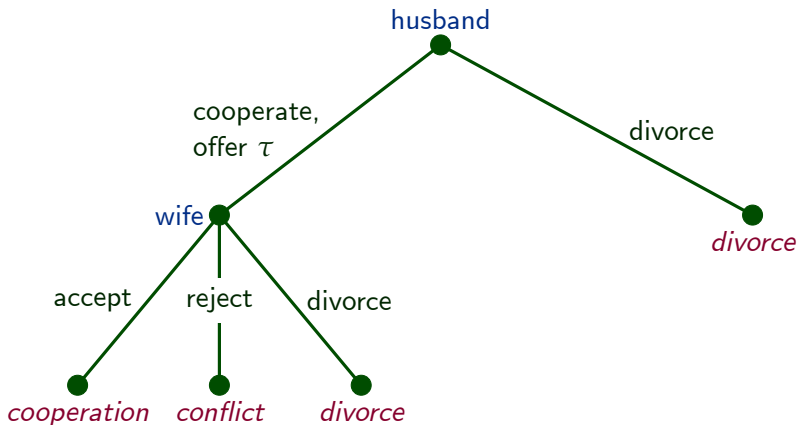
$$\max_{\{\mathcal{C}, \mathcal{D}\}} \left\{ \max_{\tau \in T^k} \hat{E}V_h^k(\tau; \mathcal{C}), \hat{E}V_h^k(\mathcal{D}) \right\}$$

always exists.

Simplified Game Structure



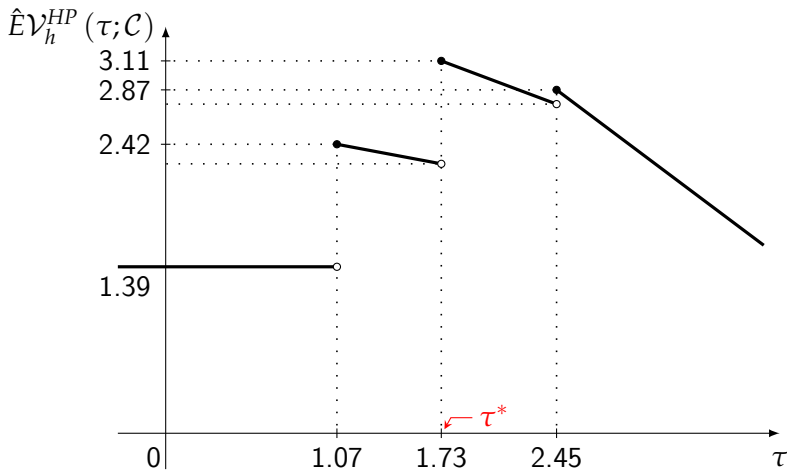
Simplified Game Structure



Numerical Example: Setup

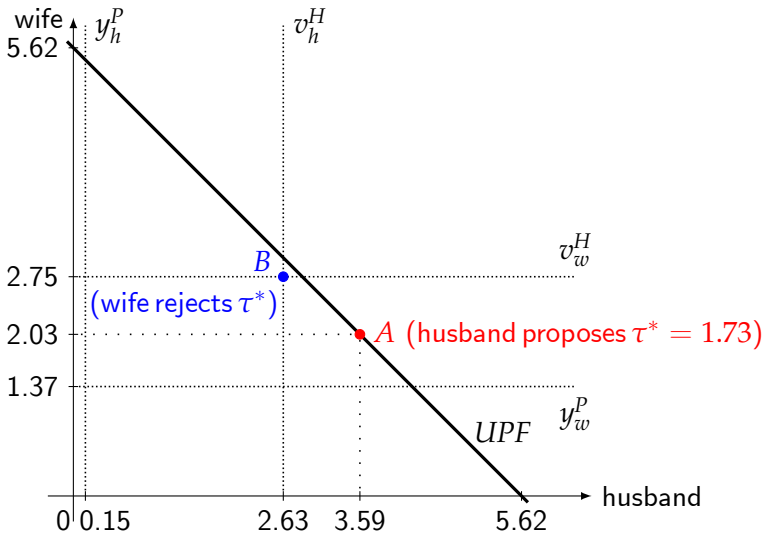
- Actual couple from NSFH:
 - husband: 43 y.o., white, protestant, high school degree
 - wife: 40 y.o., white, protestant, high school degree
 - spouses own home, have 12 y.o. child, live in a state with no separation requirements and 13% CSE collection rate
- Payoffs are computed using estimated parameters
- Assumption: husband's type is HP , wife's type is HP
- Two cases:
 - "uninformed" husband: $\delta^{HO} = \delta^{HP} = \delta^{SO} = \delta^{SP} = 0.25$
 - "informed" husband: $\delta^{HP} = 0.85, \delta^{HO} = \delta^{SO} = \delta^{SP} = 0.05$

Numerical Example: “Uninformed” Husband

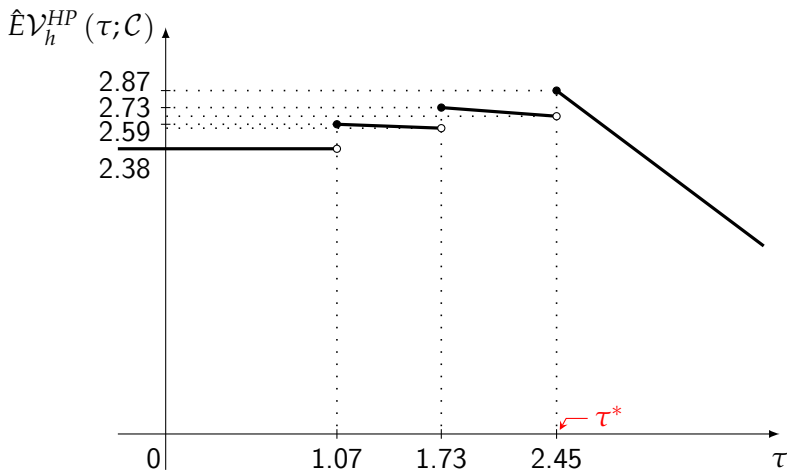


“Uninformed” husband: $\delta^{HO} = \delta^{HP} = \delta^{SO} = \delta^{SP} = 0.25$

Numerical Example: “Uninformed” Husband

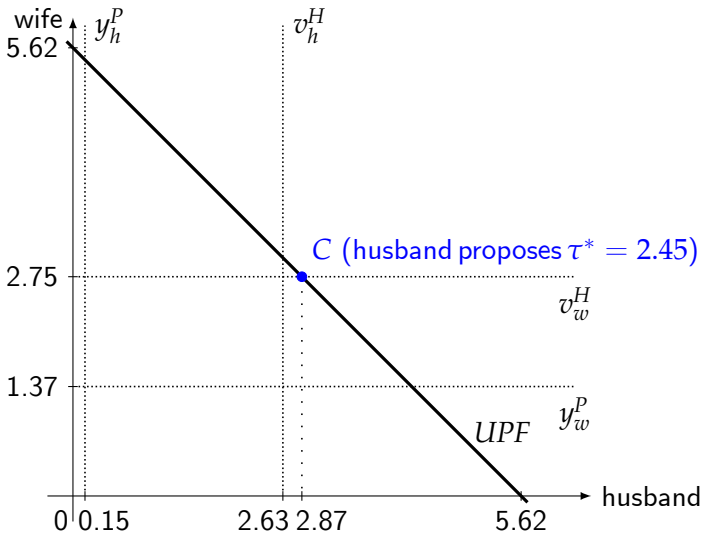


Numerical Example: “Informed” Husband



“Informed” husband: $\delta^{HP} = 0.85, \delta^{HO} = \delta^{SO} = \delta^{SP} = 0.05$

Numerical Example: "Informed" Husband



NSFH Sample

National Survey of Families and Households (NSFH):

- nationally representative panel of households
- 2 data collection waves: 1987-88 and 1992-94
- variety of information on family life
- spouses answered separate questionnaires
- initial sample: 5,270 married couples

Analyzed sample:

- 3,878 married couples
- reasons for exclusion from initial sample:
 - missing data (575 couples)
 - attrition (477 couples)
 - spousal death (340 couples)

Location-Specific Variables

- Availability ratio (Goldman et al., 1984):
 - specific to county, sex, race, age, and education
 - source: 1990 Census (5-percent PUMS)
- State-specific separation period requirements:
 - sources: Freed & Walker (1991), Friedberg (1998)
- State-specific CSE collection rate (Nixon, 1997):
 - sources: Office of CSE reports to Congress

Variable	Mean	Std. Dev.	Min	Max
male-specific availability ratio	1.25	(0.24)	0.56	2.43
female-specific availability ratio	0.84	(0.16)	0.22	1.45
$\frac{1}{2}$ year \leq separation \leq 1 year	0.18	(0.39)	0	1
separation $>$ 1 year	0.33	(0.47)	0	1
CSE collection rate	0.19	(0.06)	0.06	0.35

Individual Characteristics

Variable	Mean	Std. Dev.	Min	Max
children, < 6 year old	0.45	(0.73)	0	5
children, ≥ 6 year old	0.57	(0.94)	0	5
children, wife's	0.14	(0.47)	0	5
marital duration	14.51	(13.23)	0	63.58
home ownership	0.75	(0.43)	0	1
age, husband's	41.02	(13.75)	17	90
age, abs. difference	3.62	(3.84)	0	38
black husband	0.09	(0.29)	0	1
catholic husband	0.23	(0.42)	0	1
religion, difference	0.33	(0.47)	0	1
high school, husband	0.51	(0.50)	0	1
college, husband	0.33	(0.47)	0	1
education, difference	0.38	(0.48)	0	1

Beliefs and Opinions

- Husband reports what he believes about *his wife's* overall happiness after divorce
- Spouses report what they think about *their own* happiness after divorce

Variable	Mean	Std. Dev.	Min	Max
same happiness, belief	0.19	(0.39)	0	1
more happy, belief	0.08	(0.27)	0	1
same happiness, husband	0.17	(0.38)	0	1
more happy, husband	0.06	(0.23)	0	1
worthy person, husband	0.38	(0.49)	0	1
same happiness, wife	0.15	(0.36)	0	1
more happy, wife	0.07	(0.26)	0	1
worthy person, wife	0.42	(0.49)	0	1

Marital State

Dispute areas and frequencies:

“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, children?”

responses: “never”, “once a month or less”, ..., “almost every day”

Dispute resolution process:

“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?”

responses: “never”, “seldom”, ..., “always”

Marital State

- Conflict:
 - disagree about at least one aspect of marriage as of wave 2
 - disputes occur several times a week or more often
 - seldom/never calmly discuss disputes or often/always shout
- Cooperation:
 - intact couples not in state of conflict
- Divorce:
 - legally divorced or separated as of wave 2

Marital State	Frequency	Share (%)
Cooperation	2,948	76.02
Conflict	416	10.73
Divorce	514	13.25
Total	3,878	100.00

Overview of Estimation and Identification

Estimation strategy:

- find conditions for equilibria in spousal game
- express marital state probabilities to apply GHK method
- estimate parameters by simulated maximum likelihood

Identification strategy:

- use covariation of explanatory variables in wave 1 with observable marital states in wave 2
- helpful data variation for parameter identification:
 - individual characteristics \Rightarrow intact marriage payoffs
 - location-specific variables \Rightarrow divorce payoffs
 - spouses' opinions about themselves \Rightarrow type probabilities
 - husband's opinion about wife's happiness \Rightarrow beliefs

Parameterized Payoffs

Cooperation: payoffs are type invariant:

$$u_h(-\tau) \text{ and } u_w(\tau)$$

Conflict: bargaining “strength” matters:

$$v_h^k = \begin{cases} v_h^H, k = HO, HP \\ v_h^S, k = SO, SP \end{cases} \quad \text{and} \quad v_w^l = \begin{cases} v_w^H, l = HO, HP \\ v_w^S, l = SO, SP \end{cases}$$

$$v_h^H > v_h^S \quad v_w^H > v_w^S$$

Divorce: optimism matters:

$$y_h^k = \begin{cases} y_h^O, k = HO, SO \\ y_h^P, k = HP, SP \end{cases} \quad \text{and} \quad y_w^l = \begin{cases} y_w^O, l = HO, SO \\ y_w^P, l = HP, SP \end{cases}$$

$$y_h^O > y_h^P \quad y_w^O > y_w^P$$

Parameterized Payoffs

	Husband	Wife
<i>Cooperation:</i>	$u_h = x' \alpha_h - \tau + \theta_1$	$u_w = x' \alpha_w + \tau + \theta_3$
<i>Conflict:</i>	$v_h^S = x' \beta_h + \theta_2$ $v_h^H = v_h^S + \beta_h^H$	$v_w^S = x' \beta_w + \theta_4$ $v_w^H = v_w^S + \beta_w^H$
<i>Divorce:</i>	$y_h^P = z_h' \gamma_h$ $y_h^O = y_h^P + \gamma_h^O$	$y_w^P = z_w' \gamma_w$ $y_w^O = y_w^P + \gamma_w^O$

- x : vector of individual characteristics ▶ list of variables
- z_h, z_w : vectors of location-specific variables ▶ lists of variables
- type-specific constants: $\beta_h^H, \beta_w^H, \gamma_h^O, \gamma_w^O > 0$
- cannot separately identify α_h and α_w ; estimate $\alpha \equiv \alpha_h + \alpha_w$

Parameterized Type Probabilities and Beliefs

Type probabilities (Degan & Merlo, 2006):

$$\pi_h^k = \frac{\exp(a'_h \lambda_h^k)}{\sum_j \exp(a'_h \lambda_h^j)}, \quad \pi_w^l = \frac{\exp(a'_w \lambda_w^l)}{\sum_j \exp(a'_w \lambda_w^j)}$$

- a_h, a_w : vectors of spousal opinions ▶ lists of variables
- normalization: $\lambda_h^{SP} = 0$ and $\lambda_w^{SP} = 0$

Husband's beliefs:

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

- b : vector of husband's reported beliefs ▶ list of variables
- normalization: $\rho^{SP} = 0$ and $\eta^{SP} = 0$

Distributions of Unobservables

Unobservable components of payoffs:

$$\theta_{4 \times 1} \sim i.i.d. N(0, \Sigma)$$

Unobservable components of beliefs:

$$\eta_{3 \times 1} \sim i.i.d. N(0, \Omega)$$

Divorce Payoffs

Variable	Husband		Wife	
	Coeff.	Std. Err.	Coeff.	Std. Err.
male-specific availability ratio	0.264	(0.244)	–	
female-specific availability ratio	–		1.369**	(0.342)
$\frac{1}{2}$ year \leq separation \leq 1 year	–0.269*	(0.158)	0.032	(0.099)
separation > 1 year	–0.309**	(0.134)	–0.162	(0.114)
CSE collection rate	0.165	(0.253)	1.938**	(0.819)
coll. rate \times high sch., husband	–1.633**	(0.653)	–	
coll. rate \times college, husband	–0.819	(0.565)	–	
coll. rate \times high sch., wife	–		–1.802**	(0.713)
coll. rate \times college, wife	–		–0.894	(0.626)
optimist's constant	3.710**	(0.295)	0.655**	(0.103)

* and ** denote significance at 10 and 5 percent levels, respectively.

Cooperation Payoff

Variable	Coeff.	Std. Err.
constant	4.702**	(0.303)
children, < 6 y.o.	0.274**	(0.102)
children, ≥ 6 y.o.	-0.055	(0.072)
children, wife's	-0.261**	(0.107)
marital duration	0.093**	(0.014)
home ownership	-0.134	(0.127)
age, husband's	0.033**	(0.010)
age, abs. difference	-0.041**	(0.018)
black husband	0.543**	(0.254)
catholic husband	0.182	(0.125)
religion, difference	0.067	(0.096)
high sch., husband	0.010	(0.048)
college, husband	0.195	(0.145)
education, difference	-0.378**	(0.113)

* and ** denote significance at 10 and 5 percent levels, respectively.

Conflict Payoffs

Variable	Husband		Wife	
	Coeff.	Std. Err.	Coeff.	Std. Err.
constant	-2.624**	(0.678)	-1.620**	(0.319)
children, < 6 y.o.	0.623**	(0.108)	0.554**	(0.095)
children, ≥ 6 y.o.	0.453**	(0.070)	0.498**	(0.057)
children, wife's	0.310**	(0.108)	0.406**	(0.148)
marital duration	0.015	(0.011)	-0.017**	(0.006)
home ownership	1.544**	(0.233)	-0.261*	(0.150)
age, husband's	0.113**	(0.011)	0.000	(0.002)
age, abs. difference	-0.224**	(0.027)	-0.002	(0.007)
black husband	-1.274**	(0.367)	0.593**	(0.228)
catholic husband	0.495**	(0.150)	0.367**	(0.131)
religion, difference	-0.929**	(0.199)	-0.019	(0.053)
high sch., husband	0.238*	(0.141)	-0.500**	(0.147)
college, husband	0.009	(0.042)	-0.960**	(0.175)
education, difference	-0.066	(0.095)	0.259**	(0.116)
hard barg. constant	2.391**	(0.529)	4.101**	(0.125)

* and ** denote significance at 10 and 5 percent levels, respectively.

Counterfactuals: Separation Period Requirements

Experiment 1: replace periods > 1 year with periods ≤ 1 year

Experiment 2: eliminate periods ≤ 1 year *and*
replace periods > 1 year with periods ≤ 1 year

Experiment 3: eliminate all periods

Distribution of Couples (%)

Marital State	Baseline	Exper. 1	Exper. 2	Exper. 3
Cooperation	78.65	78.81	78.53	77.97
Conflict	10.27	9.85	9.89	10.02
Divorce	11.08	11.34	11.58	12.01
Total	100.00	100.00	100.00	100.00

Counterfactuals: Child Support Enforcement

Experiment 4: double collection rate

Experiment 5: increase collection rate to 50%

Experiment 6: increase collection rate to 100%

Distribution of Couples (%)

Marital State	Baseline	Exper. 4	Exper. 5	Exper. 6
Cooperation	78.65	79.42	79.95	81.56
Conflict	10.27	9.85	9.52	8.38
Divorce	11.08	10.73	10.53	10.06
Total	100.00	100.00	100.00	100.00

Conclusion

Key contributions:

- spousal conflict is outcome of bargaining
- model allows for Pareto inferior outcomes and information asymmetry
- conflict indicator incorporates data on dispute resolution
- policy variables in divorce payoffs

Directions for future research:

- multi-issue bargaining
- dynamic bargaining

Questions?

Appendix Outline I

- Appendix
 - Responses about Dispute Areas
 - Responses about Dispute Resolution Process
 - Husband's Expected Utilities
 - Explanatory Vectors
 - Vectors of Opinions and Beliefs
 - Data Vector
 - Parameter Vector
 - Implementation of Estimation Strategy
 - Integration Bounds
 - Integration Bounds Example
 - Integration Bounds Example (Continued)
 - Type Probabilities and Beliefs
 - Disutility Impact of Conflict
 - Divorce Payoffs (No P.E. Vars)

Appendix Outline II

- Cooperation Payoff (No P.E. Vars)
- Conflict Payoffs (No P.E. Vars)
- Type Probabilities and Beliefs (No P.E. Vars)
- Nonstructural Trinomial Model
- Nonstructural Trinomial Model (No P.E. Vars)
- Availability Ratios in U.S.

Responses about Dispute Areas

Area	Same Category*	Same or Adjacent [†]
Household tasks	48.09	84.66
Money	47.40	84.96
Spending time together	45.90	81.38
Sex	51.39	84.45
In-laws	57.86	90.05
Children	40.95	79.76

*Percentage of couples where husband and wife chose same category for disagreement frequency

[†]Percentage of couples where husband and wife chose same or adjacent categories for disagreement frequency

Responses about Dispute Resolution Process

Method	Same Category*	Same or Adjacent [†]
Calmly discuss	36.07	80.22
Heatedly argue	45.08	88.81

*Percentage of couples where husband and wife chose same category for resolution frequency

[†]Percentage of couples where husband and wife chose same or adjacent categories for resolution frequency

Husband's Expected Utilities

Action $(\tau; \mathcal{C})$:

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

Action \mathcal{R} :

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

Action \mathcal{D} :

$$\hat{E}\mathcal{V}_h^k(\mathcal{D}) = y_h^k$$

Explanatory Vectors

x	z_h	z_w
constant	male-spec. avail. ratio	female-spec. avail. ratio
children, < 6 y.o.	$\frac{1}{2}$ y. \leq separation \leq 1 y.	$\frac{1}{2}$ y. \leq separation \leq 1 y.
children, ≥ 6 y.o.	separation > 1 year	separation > 1 year
children, wife's	collection rate	collection rate
marital duration	coll. rate \times h.s., husb.	coll. rate \times h.s., wife
home ownership	coll. rate \times col., husb.	coll. rate \times col., wife
age, husb.'s		
age, abs. diff.		
black husb.		
catholic husb.		
religion, diff.		
high sch., husb.		
college, husb.		
education, diff.		

◀ back to parameterized payoffs

Vectors of Opinions and Beliefs

a_h	a_w	b
constant	constant	constant
same happiness, husb.	same happiness, wife	same happiness
more happy, husb.	more happy, wife	more happy
worthy person, husb.	worthy person, wife	

[◀ back to parameterized types and beliefs](#)

Data Vector

- x marital and spousal characteristics
- z_h location-specific characteristics of husband
- z_w location-specific characteristics of wife
- a_h husband's own divorce prospect and opinions
- a_w wife's own divorce prospect and opinions
- b husband's beliefs about wife's divorce prospect

◀ back to implementation

Parameter Vector

- α parameters of $u_h + u_w$
- β_h parameters of v_h^S and v_h^H
- β_h^H hard bargainer's constant for husband, $\beta_h^H > 0$
- β_w parameters of v_w^S and v_w^H
- β_w^H hard bargainer's constant for wife, $\beta_w^H > 0$
- γ_h parameters of y_h^P and y_h^O
- γ_h^O optimist's constant for husband, $\gamma_h^O > 0$
- γ_w parameters of y_w^P and y_w^O
- γ_w^O optimist's constant for wife, $\gamma_w^O > 0$
- λ_h^k parameters of π_h^k , $k = \{HO, HP, SO, SP\}$
- λ_w^l parameters of π_w^l , $l = \{HO, HP, SO, SP\}$
- ρ^l parameters of δ^l , $l = \{HO, HP, SO, SP\}$
- Σ covariance matrix of θ
- Ω covariance matrix of η

◀ back to implementation

Implementation of Estimation Strategy

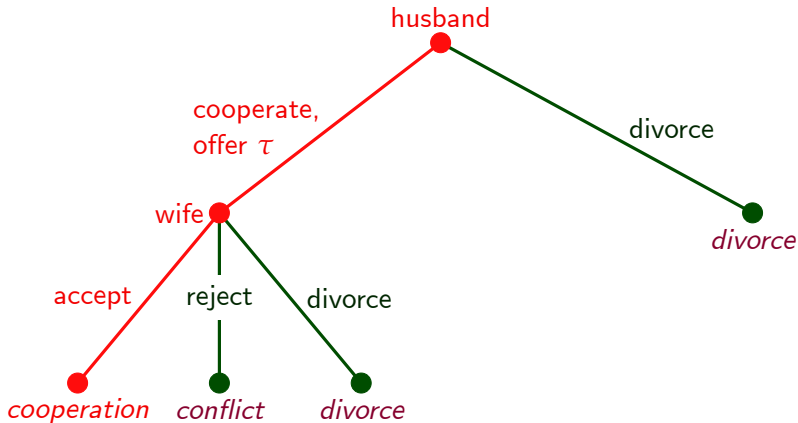
Notation:

- marital state: s
- data: X ▶ list of variables
- parameters: Γ ▶ list of parameters

Marital state probability:

$$\Pr [s = \textit{coop.} | X, \Gamma] = \sum_k \sum_l \pi_h^k \cdot \pi_w^l \cdot \Pr [s = \textit{coop.} | k, l, X, \Gamma]$$

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Conditional marital state probability:

$$\Pr [s = \text{coop.} | k, l, X, \Gamma] = E_{\theta, \eta} \mathbf{1} \left(\begin{array}{l} \tau^* = \arg \max_{\tau} \hat{E} \mathcal{V}_h^k (\tau; \mathcal{C}), \\ \hat{E} \mathcal{V}_h^k (\tau^*; \mathcal{C}) \geq y_h^k, \\ u_w (\tau^*) \geq v_w^l, \\ u_w (\tau^*) \geq y_w^l \end{array} \right)$$

Integration Bounds

Simulation approach:

- transform $E_{\theta,\eta} 1(\theta, \eta \in S) = \int_S f(\theta, \eta) d\theta d\eta$: solve for integration bounds that represent set S
- simulate $\int_S f(\theta, \eta) d\theta d\eta$ with GHK

Transformation algorithm:

- step 1: partition θ_4 domain; then, on each interval:
- step 2: find discontinuity points of $\hat{E}\mathcal{V}_h^k(\tau; \mathcal{C})$
- step 3: find acceptable transfer(s) to wife of type l
- step 4: write out inequalities when husband of type k chooses to offer such transfer(s)
- step 5: solve inequalities for integration bounds ▶ example
- step 6: repeat steps 2 – 5 for all θ_4 intervals

Integration Bounds Example

The example shows a small part of the integration region for the state of *cooperation* when husband's type is k (generic) and wife's type is SP ($l = SP$):

$$I_5^C = \int_{\mathbb{R}^3} \int_{f_1}^{f_2 + \infty} \int_{-\infty}^{+\infty} \int_{f_3(\eta, \theta_4)}^{+\infty} \int_{f_4(\eta, \theta_2, \theta_3)}^{f_5(\eta, \theta_2, \theta_3, \theta_4)} f(\theta, \eta) d\theta_1 d\theta_2 d\theta_3 d\theta_4 d\eta$$

Definitions:

$$f_1 = y_w^P - \bar{v}_w^H$$

$$f_2 = \min \left\{ y_w^P - \bar{v}_w^S, y_w^O - \bar{v}_w^H \right\}$$

$$f_3(\eta, \theta_4) = y_h^k - \bar{v}_h^k + \frac{\delta^{SP}(\eta)}{\delta^{HP}(\eta)} \left(y_w^P - \bar{v}_w^H \right) - \frac{\delta^{SP}(\eta)}{\delta^{HP}(\eta)} \theta_4$$

Integration Bounds Example (Continued)

Definitions (continued):

$$f_4(\eta, \theta_2, \theta_3) = -\bar{u}_h - \bar{u}_w - \theta_3 + \max \left\{ \begin{array}{l} y_h^k + y_w^P, \\ y_w^P + \frac{(\delta^{HP}(\eta) + \delta^{SP}(\eta))y_h^k - \delta^{HP}(\eta)(\bar{v}_h^k + \theta_2)}{\delta^{SP}(\eta)} \end{array} \right\}$$

$$f_5(\eta, \theta_2, \theta_3, \theta_4) = -\bar{u}_h - \bar{u}_w - \theta_3 + \min \left\{ \begin{array}{l} \bar{v}_h^k + \theta_2 + \frac{(\delta^{HP}(\eta) + \delta^{SP}(\eta))(\bar{v}_w^H + \theta_4) - \delta^{SP}(\eta)y_w^P}{\delta^{HP}(\eta)}, \\ \frac{(\delta^{HO}(\eta) + \delta^{SO}(\eta))y_h^k + \delta^{HP}(\eta)(\bar{v}_h^k + \theta_2) + y_w^O - \delta^{SP}(\eta)y_w^P}{1 - \delta^{SP}(\eta)} \end{array} \right\}$$

◀ back to integration bounds

Type Probabilities and Beliefs

Spousal Type	True Types		Beliefs
	Husband	Wife	Husband
<i>HO</i> (hard bargainer – optimist)	0.106	0.040	0.170
<i>HP</i> (hard bargainer – pessimist)	0.141	0.249	0.027
<i>SO</i> (soft bargainer – optimist)	0.019	0.048	0.112
<i>SP</i> (soft bargainer – pessimist)	0.734	0.663	0.691

Disutility Impact of Conflict

- Lower bound:

$$LB = E \left[u_h + u_w - v_h^H - v_w^H \right]$$

- Upper bound:

$$UB = E \left[u_h + u_w - v_h^S - v_w^H \right]$$

- Estimated sample averages:

$$\widehat{LB} = 1.45$$

$$\widehat{UB} = 3.84$$

Note: unit of measurement is *util* (a standard deviation of normally distributed stochastic component of payoff)

Divorce Payoffs (No P.E. Vars)

Variable	Husband		Wife	
	Coeff.	Std. Err.	Coeff.	Std. Err.
male-specific availability ratio	0.321	(0.334)	—	
female-specific availability ratio	—		0.946**	(0.481)
$\frac{1}{2}$ year \leq separation \leq 1 year	-0.229	(0.163)	0.081	(0.150)
separation > 1 year	-0.178	(0.132)	-0.256	(0.159)
collection rate	-0.162	(0.263)	1.989**	(0.901)
coll. rate \times high sch., husband	-1.645**	(0.734)	—	
coll. rate \times college, husband	-0.888	(0.652)	—	
coll. rate \times high sch., wife	—		-1.820**	(0.823)
coll. rate \times college, wife	—		-0.829	(0.669)
optimist's constant	3.750**	(0.411)	0.668**	(0.160)

* and ** denote significance at 10 and 5 percent levels, respectively.

Cooperation Payoff (No P.E. Vars)

Variable	Coeff.	Std. Err.
constant	4.496**	(0.689)
children, < 6 y.o.	—	—
children, ≥ 6 y.o.	—	—
children, wife's	-0.451**	(0.168)
marital duration	—	—
home ownership	—	—
age, husband's	0.090**	(0.014)
age, abs. diff.	-0.111**	(0.029)
black husband	0.435	(0.319)
catholic husband	0.287	(0.203)
religion, diff.	-0.033	(0.103)
high sch., husband	0.067	(0.147)
college, husband	0.120	(0.222)
education, diff.	-0.231	(0.167)

* and ** denote significance at 10 and 5 percent levels, respectively.

Conflict Payoffs (No P.E. Vars)

Variable	Husband		Wife	
	Coeff.	Std. Err.	Coeff.	Std. Err.
constant	-2.522**	(0.753)	-1.170**	(0.592)
children, < 6 y.o.	—		—	
children, ≥ 6 y.o.	—		—	
children, wife's	0.333**	(0.162)	0.643**	(0.175)
marital duration	—		—	
home ownership	—		—	
age, husband's	0.102**	(0.019)	-0.033**	(0.008)
age, abs. diff.	-0.113**	(0.041)	0.061**	(0.024)
black husband	-0.982*	(0.584)	0.821**	(0.287)
catholic husband	0.641*	(0.344)	0.218	(0.160)
religion, diff.	-0.799**	(0.360)	0.215	(0.149)
high sch., husband	0.144	(0.193)	-0.416**	(0.207)
college, husband	0.251	(0.275)	-0.818**	(0.235)
education, diff.	-0.164	(0.204)	0.162	(0.141)
hard barg. constant	2.274**	(0.657)	3.503**	(0.396)

* and ** denote significance at 10 and 5 percent levels, respectively.

Type Probabilities and Beliefs (No P.E. Vars)

Spousal Type	True Types		Beliefs
	Husband	Wife	Husband
<i>HO</i> (hard bargainer – optimist)	0.097	0.038	0.148
<i>HP</i> (hard bargainer – pessimist)	0.148	0.222	0.037
<i>SO</i> (soft bargainer – optimist)	0.020	0.053	0.119
<i>SP</i> (soft bargainer – pessimist)	0.735	0.687	0.696

Nonstructural Trinomial Model

Variable	<i>Conflict</i>		<i>Divorce</i>	
	Coeff.	Std. Err.	Coeff.	Std. Err.
constant	-2.312**	(0.558)	-2.668**	(0.574)
children, < 6 y.o.	0.038	(0.061)	-0.061	(0.061)
children, ≥ 6 y.o.	0.115**	(0.048)	0.085	(0.052)
children, wife's	0.133	(0.083)	0.152**	(0.077)
marital duration	-0.006	(0.007)	-0.035**	(0.007)
home ownership	-0.220**	(0.091)	-0.272**	(0.086)
age, husband's	-0.025**	(0.007)	-0.027**	(0.007)
age, abs. difference	0.029**	(0.012)	0.047**	(0.012)
black husband	0.404**	(0.135)	0.425**	(0.140)
catholic husband	0.169*	(0.090)	-0.121	(0.093)
religion, difference	0.127	(0.082)	0.159**	(0.080)
high sch., husband	-0.298*	(0.167)	-0.091	(0.187)
college, husband	-0.353*	(0.186)	-0.409**	(0.201)
education, difference	0.130	(0.081)	0.170**	(0.081)
male-specific availability ratio	0.862**	(0.281)	0.538*	(0.302)
female-specific availability ratio	-0.315	(0.383)	0.710*	(0.372)
$\frac{1}{2}$ year ≤ separation ≤ 1 year	-0.181*	(0.110)	-0.101	(0.105)
separation > 1 year	0.021	(0.086)	-0.211**	(0.087)
CSE collection rate	2.215*	(1.235)	2.505**	(1.264)
coll. rate × high sch., husband	-0.442	(1.153)	-1.215	(1.211)
coll. rate × college, husband	-0.453	(1.297)	-0.533	(1.342)
coll. rate × high sch., wife	-0.973	(0.853)	-1.377*	(0.827)
coll. rate × college, wife	-1.612*	(0.970)	-1.652*	(0.935)

* and ** denote significance at 10 and 5 percent level, respectively.

Nonstructural Trinomial Model (No P.E. Vars)

Variable	<i>Conflict</i>		<i>Divorce</i>	
	Coeff.	Std. Err.	Coeff.	Std. Err.
constant	-2.369**	(0.543)	-3.013**	(0.554)
children, < 6 y.o.	—	—	—	—
children, ≥ 6 y.o.	—	—	—	—
children, wife's	0.104	(0.078)	0.235**	(0.071)
marital duration	—	—	—	—
home ownership	—	—	—	—
age, husband's	-0.032**	(0.005)	-0.052**	(0.005)
age, abs. diff.	0.035**	(0.010)	0.074**	(0.010)
black husband	0.451**	(0.133)	0.460**	(0.137)
catholic husband	0.175**	(0.089)	-0.108	(0.092)
religion, diff.	0.118	(0.081)	0.195**	(0.078)
high sch., husband	-0.272*	(0.164)	0.005	(0.180)
college, husband	-0.348*	(0.184)	-0.293	(0.196)
education, diff.	0.120	(0.081)	0.171**	(0.080)
male-specific avail. ratio	0.818**	(0.276)	0.565*	(0.294)
female-specific avail. ratio	-0.345	(0.380)	0.813**	(0.365)
separation, ≤ 1 year	-0.200*	(0.109)	-0.108	(0.103)
separation, > 1 year	0.019	(0.085)	-0.201**	(0.086)
collection rate	3.290**	(1.159)	3.083**	(1.190)
coll. rate × high sch., husband	-0.820	(1.139)	-1.857	(1.183)
coll. rate × college, husband	-0.714	(1.286)	-1.177	(1.318)
coll. rate × high sch., wife	-1.262	(0.842)	-1.633**	(0.818)
coll. rate × college, wife	-2.049**	(0.949)	-1.878**	(0.918)

* and ** denote significance at 10 and 5 percent level, respectively.

Availability Ratios in U.S.

Education	Age	Men		Women		
		White	Black	Age	White	Black
no high school	[20, 29]	1.01	1.33	[18, 27]	0.92	0.78
high school	[20, 29]	1.21	1.45	[18, 27]	1.13	0.98
college	[20, 29]	1.03	1.09	[18, 27]	0.97	0.87
no high school	[30, 34]	0.89	1.18	[28, 32]	0.78	0.68
high school	[30, 34]	1.10	1.33	[28, 32]	0.97	0.83
college	[30, 34]	1.00	1.08	[28, 32]	0.89	0.76
no high school	[35, 39]	0.90	1.17	[33, 37]	0.68	0.61
high school	[35, 39]	1.12	1.36	[33, 37]	0.88	0.73
college	[35, 39]	1.03	1.15	[33, 37]	0.87	0.68
no high school	[40, 44]	0.98	1.23	[38, 42]	0.67	0.68
high school	[40, 44]	1.21	1.42	[38, 42]	0.85	0.74
college	[40, 44]	1.08	1.22	[38, 42]	0.86	0.67
no high school	[45, 54]	1.15	1.34	[43, 52]	0.74	0.80
high school	[45, 54]	1.38	1.48	[43, 52]	0.86	0.77
college	[45, 54]	1.19	1.29	[43, 52]	0.84	0.66
no high school	[55, 64]	1.24	1.42	[53, 62]	0.69	0.79
high school	[55, 64]	1.40	1.41	[53, 62]	0.72	0.65
college	[55, 64]	1.14	1.20	[53, 62]	0.66	0.49
no high school	[65, ∞)	1.76	1.82	[63, ∞)	0.67	0.79
high school	[65, ∞)	1.80	1.48	[63, ∞)	0.63	0.58
college	[65, ∞)	1.42	1.16	[63, ∞)	0.53	0.36