

A Bad Peace or a Good War: A Model of Spousal Conflict

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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 welfare effect of conflict
- evaluate impact of separation requirements and child support enforcement on spousal bargaining outcomes

Model does not address:

- selection into marriage
- bargaining dynamics

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

Amato et al. (1995), Jekielek (1998), Hanson (1999):

- 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 (e.g., Friedberg & Stern, 2006): 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 divorce payoffs: marriage market conditions, separation requirements, child support enforcement

Preview of Results

Divorce payoffs:

- 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 share rises by 8.4%
- stronger child support enforcement: conflict and divorce shares fall by 18.4% and 9.2%

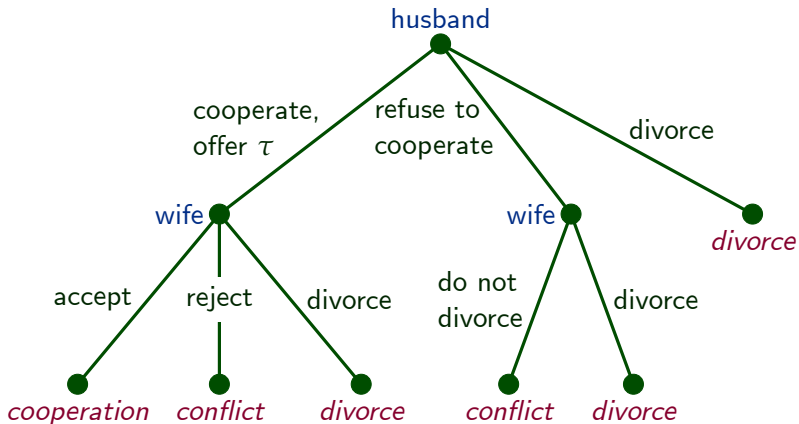
Intact marriage payoffs:

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

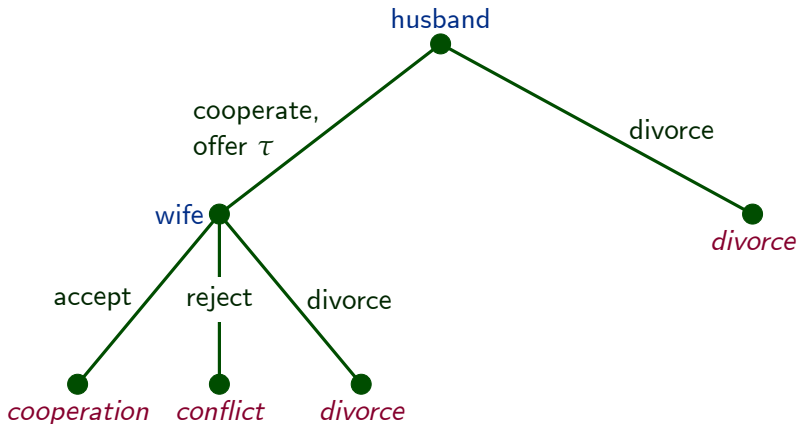
Outline

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

Bargaining Game Structure



Preview of Simplified Game Structure



Spousal Types and Husband's Beliefs

Two sources of unobserved heterogeneity:

- 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:

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

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

Divorce: optimism matters:

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

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

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 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.

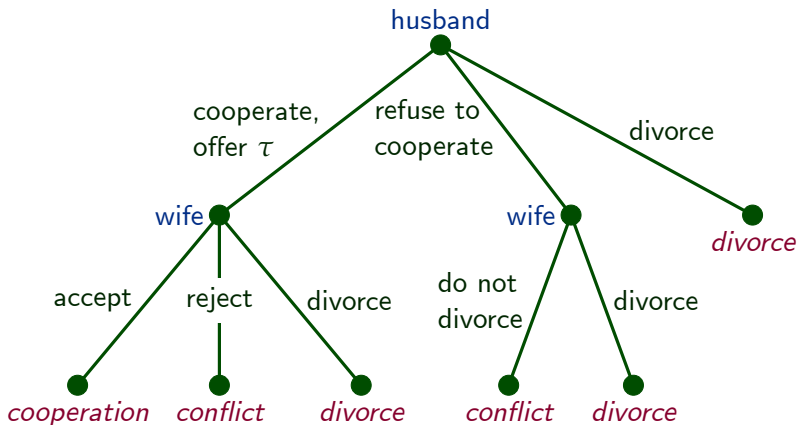
Theorem

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

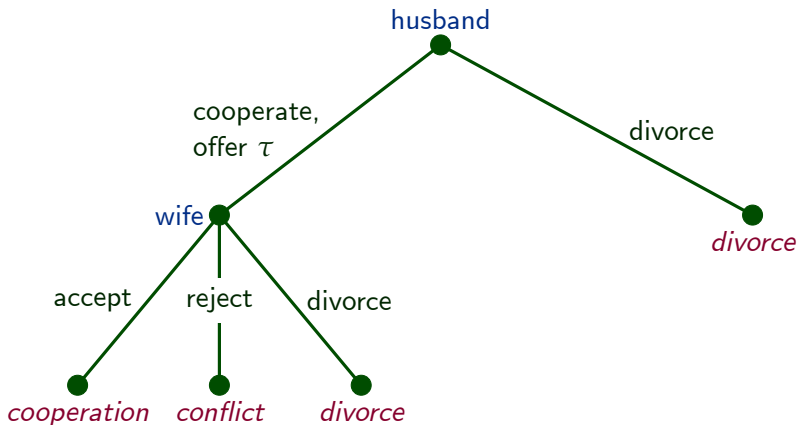
$$\max_{\{\mathcal{C}, \mathcal{D}\}} \left\{ \max_{\tau \in T^k} \hat{E}V_h^k(\tau; \mathcal{C}), \hat{E}V_h^k(\mathcal{D}) \right\}$$

always exists.

Simplified Game Structure



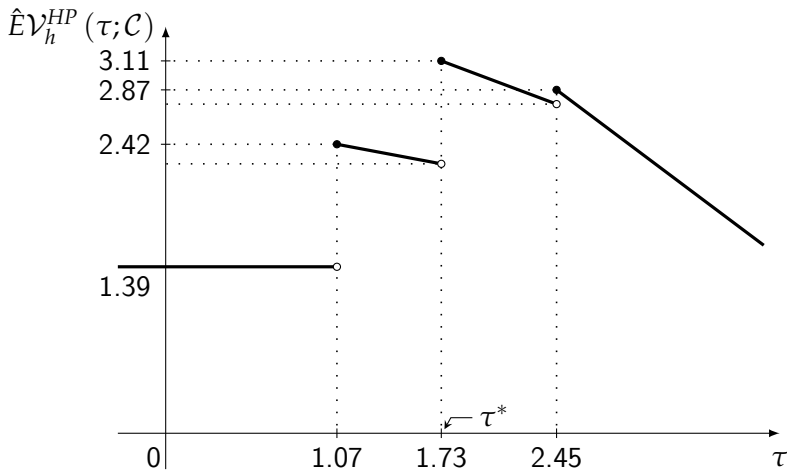
Simplified Game Structure



Numerical Example: Setup

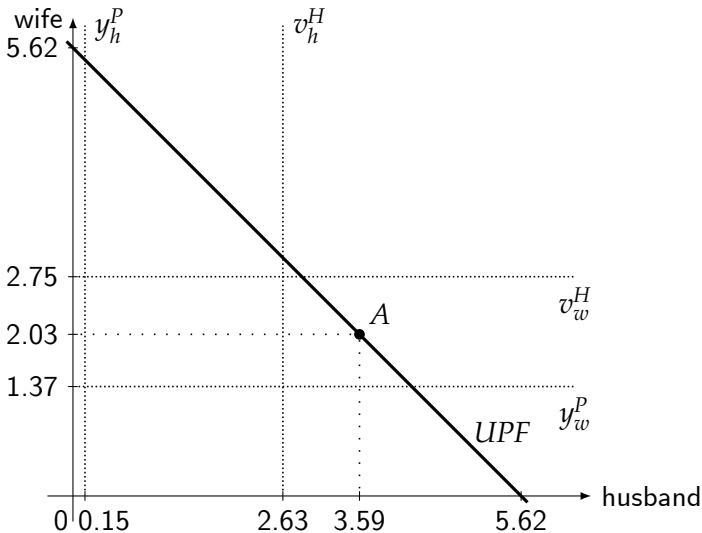
- Actual couple from NSFH:
 - husband: 43 y.o., white, protestant, high school degree, availability ratio: 1.27
 - wife: 40 y.o., white, protestant, high school degree, availability ratio: 0.99
 - spouses own home, have 12 y.o. child, live in a state with no separation requirements and 13% CSE collection 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

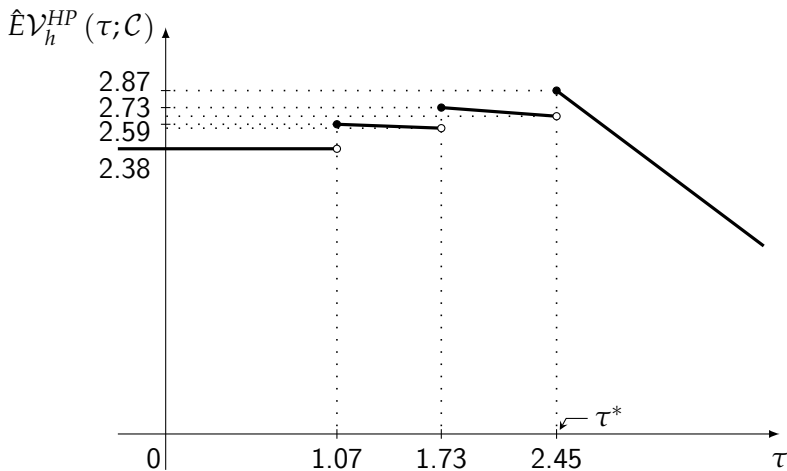


“Uninformed” husband: $\delta^{HO} = \delta^{HP} = \delta^{SO} = \delta^{SP} = 0.25$

Numerical Example: “Uninformed” Husband

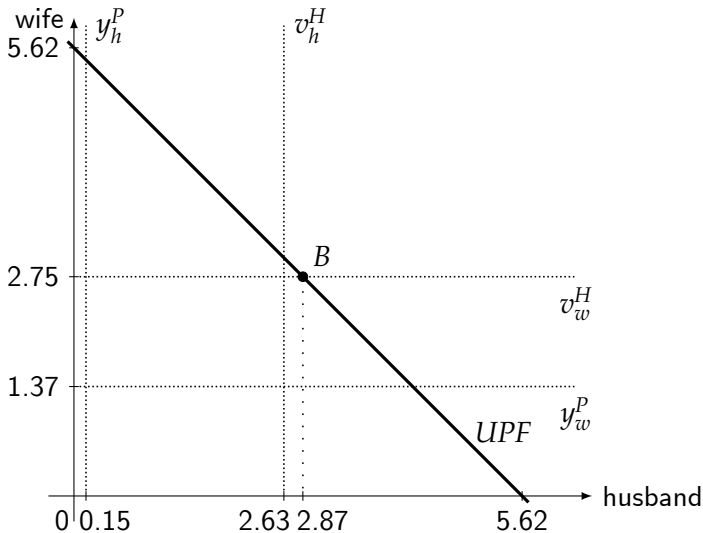


Numerical Example: “Informed” Husband



“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: Friedberg (1998), Freed & Walker (1991)
- 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
separation, \leq 1 year	0.18	(0.39)	0	1
separation, $>$ 1 year	0.33	(0.47)	0	1
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, \geq 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, absolute 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:

- use data as of wave 1 to predict marital state in wave 2
- express marital state probabilities in easy to simulate way
- find parameters by maximum simulated likelihood method

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:

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

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

Divorce: optimism matters:

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

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

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 avail. ratio	0.2638	(0.2440)	—	
female-specific avail. ratio	—		1.3689**	(0.3415)
separation, ≤ 1 year	-0.2685*	(0.1583)	0.0324	(0.0991)
separation, > 1 year	-0.3088**	(0.1344)	-0.1619	(0.1136)
collection rate	0.1647	(0.2525)	1.9384**	(0.8187)
coll. rate \times high sch., husband	-1.6325**	(0.6531)	—	
coll. rate \times college, husband	-0.8186	(0.5649)	—	
coll. rate \times high sch., wife	—		-1.8016**	(0.7129)
coll. rate \times college, wife	—		-0.8938	(0.6258)
optimist's constant	3.7098**	(0.2945)	0.6545**	(0.1029)

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

Cooperation Payoff

Variable	Coeff.	Std. Err.
constant	4.7020**	(0.3030)
children, < 6 y.o.	0.2740**	(0.1022)
children, ≥ 6 y.o.	-0.0553	(0.0722)
children, wife's	-0.2613**	(0.1074)
duration	1.2258**	(0.1793)
home ownership	-0.1342	(0.1271)
age, husband's	0.4583**	(0.1413)
age, abs. diff.	-0.1582**	(0.0694)
black husband	0.5428**	(0.2537)
catholic husband	0.1821	(0.1245)
religion, diff.	0.0673	(0.0955)
high sch., husband	0.0104	(0.0479)
college, husband	0.1952	(0.1454)
education, diff.	-0.3780**	(0.1134)

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

Conflict Payoffs

Variable	Husband		Wife	
	Coeff.	Std. Err.	Coeff.	Std. Err.
constant	-2.6236**	(0.6775)	-1.6200**	(0.3191)
children, < 6 y.o.	0.6232**	(0.1084)	0.5544**	(0.0948)
children, ≥ 6 y.o.	0.4525**	(0.0703)	0.4980**	(0.0568)
children, wife's	0.3099**	(0.1078)	0.4064**	(0.1475)
duration	0.1945	(0.1476)	-0.2243**	(0.0847)
home ownership	1.5444**	(0.2328)	-0.2609*	(0.1495)
age, husband's	1.5605**	(0.1566)	0.0040	(0.0256)
age, abs. diff.	-0.8617**	(0.1055)	-0.0063	(0.0267)
black husband	-1.2738**	(0.3668)	0.5931**	(0.2281)
catholic husband	0.4954**	(0.1496)	0.3668**	(0.1308)
religion, diff.	-0.9291**	(0.1989)	-0.0188	(0.0534)
high sch., husband	0.2382*	(0.1414)	-0.5003**	(0.1470)
college, husband	0.0085	(0.0420)	-0.9601**	(0.1752)
education, diff.	-0.0658	(0.0953)	0.2586**	(0.1162)
hard barg. constant	2.3910**	(0.5289)	4.1009**	(0.1248)

* 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
- bargaining dynamics

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
 - Welfare Effect 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)
- Reduced Form Trinomial Model
- Reduced Form Trinomial Model (No P.E. Vars)

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

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

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} :

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

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

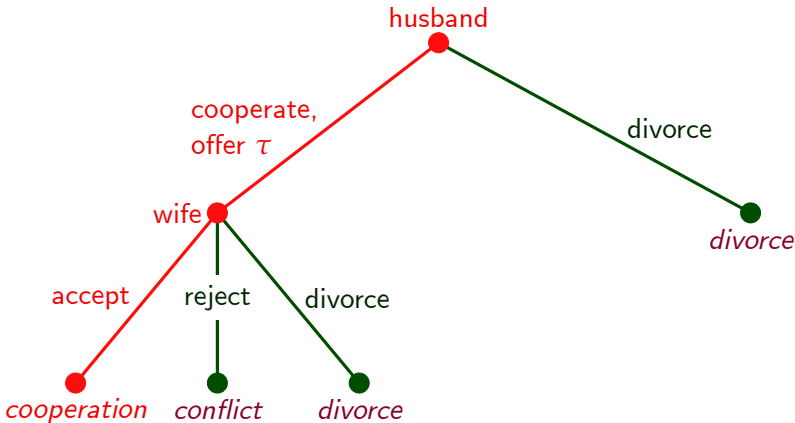
Notation:

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

Marital state probability:

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

Implementation of Estimation Strategy



Implementation of Estimation Strategy

Notation:

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

Marital state probability:

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

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 $E_{\theta,\eta} \mathbf{1}(\theta, \eta \in S) = \int_S f(\theta, \eta) d\theta d\eta$: 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 ($l = SP$):

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

Definitions:

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

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

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

Type Probabilities and Beliefs

Spousal Type	True Types		Beliefs
	Husband	Wife	Husband
<i>HO</i> (hard bargainer – optimist)	0.1064	0.0396	0.1695
<i>HP</i> (hard bargainer – pessimist)	0.1410	0.2490	0.0273
<i>SO</i> (soft bargainer – optimist)	0.0191	0.0478	0.1121
<i>SP</i> (soft bargainer – pessimist)	0.7335	0.6636	0.6911

Welfare Effect 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:

$$\begin{aligned} \widehat{LB} &= 1.45 \\ \widehat{UB} &= 3.84 \end{aligned}$$

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 avail. ratio	0.3214	(0.3337)	—	
female-specific avail. ratio	—		0.9463**	(0.4814)
separation, ≤ 1 year	-0.2294	(0.1635)	0.0813	(0.1500)
separation, > 1 year	-0.1777	(0.1321)	-0.2558	(0.1592)
collection rate	-0.1618	(0.2632)	1.9888**	(0.9009)
coll. rate \times high sch., husb.	-1.6447**	(0.7340)	—	
coll. rate \times college, husb.	-0.8884	(0.6516)	—	
coll. rate \times high sch., wife	—		-1.8196**	(0.8228)
coll. rate \times college, wife	—		-0.8287	(0.6694)
optimist's constant	3.7498**	(0.4108)	0.6682**	(0.1600)

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

Cooperation Payoff (No P.E. Vars)

Variable	Coeff.	Std. Err.
constant	4.4964**	(0.6894)
children, < 6 y.o.	—	
children, ≥ 6 y.o.	—	
children, wife's	-0.4508**	(0.1684)
duration	—	
home ownership	—	
age, husband's	1.2409**	(0.1950)
age, abs. diff.	-0.4254**	(0.1120)
black husband	0.4350	(0.3191)
catholic husband	0.2874	(0.2031)
religion, diff.	-0.0332	(0.1029)
high sch., husband	0.0670	(0.1473)
college, husband	0.1996	(0.2224)
education, diff.	-0.2308	(0.1666)

* 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	-2.5215**	(0.7528)	-1.1701**	(0.5919)
children, < 6 y.o.	-		-	
children, ≥ 6 y.o.	-		-	
children, wife's	0.3330**	(0.1625)	0.6426**	(0.1754)
duration	-		-	
home ownership	-		-	
age, husband's	1.4035**	(0.2663)	-0.4562**	(0.1172)
age, abs. diff.	-0.4323**	(0.1591)	0.2340**	(0.0935)
black husband	-0.9823*	(0.5839)	0.8211**	(0.2868)
catholic husband	0.6413*	(0.3442)	0.2184	(0.1602)
religion, diff.	-0.7994**	(0.3596)	0.2149	(0.1490)
high sch., husband	0.1443	(0.1932)	-0.4160**	(0.2070)
college, husband	0.2507	(0.2748)	-0.8183**	(0.2354)
education, diff.	-0.1641	(0.2042)	0.1625	(0.1408)
hard barg. constant	2.2738**	(0.6569)	3.5033**	(0.3963)

* 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)	0.0970	0.0382	0.1484
<i>HP</i> (hard bargainer – pessimist)	0.1484	0.2220	0.0372
<i>SO</i> (soft bargainer – optimist)	0.0191	0.0534	0.1186
<i>SP</i> (soft bargainer – pessimist)	0.7354	0.6864	0.6958

Reduced Form Trinomial Model

Variable	<i>Conflict</i>		<i>Divorce</i>	
	Coeff.	Std. Err.	Coeff.	Std. Err.
constant	-2.3122**	(0.5583)	-2.6684**	(0.5743)
children, < 6 y.o.	0.0384	(0.0614)	-0.0610	(0.0606)
children, ≥ 6 y.o.	0.1152**	(0.0484)	0.0846	(0.0520)
children, wife's	0.1333	(0.0828)	0.1521**	(0.0771)
duration	-0.0835	(0.0860)	-0.4675**	(0.0936)
home ownership	-0.2201**	(0.0905)	-0.2722**	(0.0858)
age, husband's	-0.3468**	(0.1022)	-0.3684**	(0.0977)
age, abs. diff.	0.1097**	(0.0457)	0.1822**	(0.0444)
black husband	0.4037**	(0.1347)	0.4253**	(0.1402)
catholic husband	0.1692*	(0.0896)	-0.1207	(0.0931)
religion, diff.	0.1272	(0.0824)	0.1593**	(0.0797)
high sch., husband	-0.2981*	(0.1668)	-0.0909	(0.1865)
college, husband	-0.3530*	(0.1864)	-0.4089**	(0.2014)
education, diff.	0.1297	(0.0812)	0.1700**	(0.0809)
male-specific avail. ratio	0.8618**	(0.2806)	0.5375*	(0.3019)
female-specific avail. ratio	-0.3147	(0.3827)	0.7100*	(0.3716)
separation, ≤ 1 year	-0.1811*	(0.1095)	-0.1012	(0.1048)
separation, > 1 year	0.0210	(0.0855)	-0.2113**	(0.0870)
collection rate	2.2152*	(1.2347)	2.5051**	(1.2639)
coll. rate × high sch., husband	-0.4421	(1.1532)	-1.2152	(1.2114)
coll. rate × college, husband	-0.4525	(1.2973)	-0.5329	(1.3417)
coll. rate × high sch., wife	-0.9725	(0.8534)	-1.3771*	(0.8271)
coll. rate × college, wife	-1.6117*	(0.9696)	-1.6516*	(0.9352)

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

Reduced Form Trinomial Model (No P.E. Vars)

Variable	<i>Conflict</i>		<i>Divorce</i>	
	Coeff.	Std. Err.	Coeff.	Std. Err.
constant	-2.3689**	(0.5425)	-3.0134**	(0.5544)
children, < 6 y.o.	—	—	—	—
children, ≥ 6 y.o.	—	—	—	—
children, wife's duration	0.1041	(0.0775)	0.2349**	(0.0713)
home ownership	—	—	—	—
age, husband's	-0.4393**	(0.0709)	-0.7077**	(0.0724)
age, abs. diff.	0.1324**	(0.0399)	0.2826**	(0.0393)
black husband	0.4506**	(0.1330)	0.4600**	(0.1372)
catholic husband	0.1748**	(0.0892)	-0.1082	(0.0922)
religion, diff.	0.1177	(0.0813)	0.1947**	(0.0784)
high sch., husband	-0.2716*	(0.1644)	0.0050	(0.1804)
college, husband	-0.3479*	(0.1837)	-0.2926	(0.1956)
education, diff.	0.1195	(0.0808)	0.1713**	(0.0801)
male-specific avail. ratio	0.8183**	(0.2758)	0.5653*	(0.2936)
female-specific avail. ratio	-0.3449	(0.3796)	0.8134**	(0.3649)
separation, ≤ 1 year	-0.2003*	(0.1087)	-0.1083	(0.1034)
separation, > 1 year	0.0192	(0.0852)	-0.2011**	(0.0861)
collection rate	3.2900**	(1.1589)	3.0828**	(1.1895)
coll. rate × high sch., husband	-0.8204	(1.1391)	-1.8573	(1.1833)
coll. rate × college, husband	-0.7136	(1.2856)	-1.1774	(1.3182)
coll. rate × high sch., wife	-1.2623	(0.8420)	-1.6327**	(0.8176)
coll. rate × college, wife	-2.0493**	(0.9489)	-1.8783**	(0.9183)

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