Simple Model

Thomas H. Jørgensen

2024

# Plan for today

- Divorce law and intra-household bargaining
   Voena (2015): "Yours, Mine, and Ours: Do Divorce Laws Affect the Intertemporal Behavior of Married Couples?"
  - Limited commitment model as last time different notation  $\rightarrow$  good to see again but different!

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#### Reading guide:

- 1. What are the main research questions?
- 2. What is the (empirical) motivation?

3. What are the central mechanisms in the model?

4. What is the simplest model in which we could capture these?

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#### Reading guide:

- 1. What are the main research questions?
  - How does divorce laws affect saving and female labor supply in marriage?
  - What are the welfare consequences of unilateral divorce?
- 2. What is the (empirical) motivation?

3. What are the central mechanisms in the model?

4. What is the simplest model in which we could capture these?

# Empirical Motivation: I

Reduced Form evidence from the US
 Using time- and state variation in adoption in unilateral divorce

Years since introduction of unilateral divorce

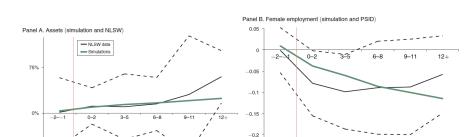
Introduction

-75%

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# • Reduced Form evidence from the US

Using time- and state variation in adoption in unilateral divorce



-0.25

— PSID data

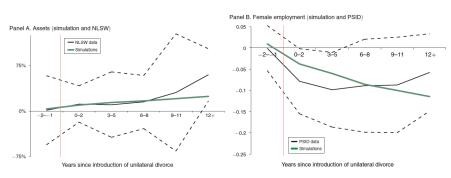
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# Empirical Motivation: I

Introduction

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Interpretation: women with low bargaining power pre-reform:
 unilateral → threat to leave → increase bargaining power → work less.

Introduction

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- 1. Unilateral vs. mutual consent divorce [One can decide vs. both has to agree]
- 2. Community vs. title-based division of property [50-50 vs. individual ownership]

Table: Mutual  $\rightarrow$  Unilateral (rows 1+2, Tab. 2).

	Savings	Employment	
Community Title-based	<u>†</u>	<u></u>	increased power of women (last slide) no sign. effect (everything is private)

# Outline

Model and Mechanisms

 $c_t^J$ : consumption of member  $j \in \{H, W\}$ 

# Model Overview

#### Choices:

```
P_t^W: labor market participation, wife (men always work)
  A_{t+1}^{j}: assets of member j \in \{H, W\}
   D_t: divorce
• States (\omega_t):
  A_t^j: assets of member i \in \{H, W\}
  z_t^J: income shock (perm)
  \mathcal{E}_t^J: match quality shock (love)
  h_t^W: human capital, wife only.
  \Omega_t: divorce laws.
  (\tilde{\theta}_{\star}^{W}, \tilde{\theta}_{\star}^{H}): bargaining weights (in unilateral/limited commitment).
   (Childbirth occurs at predetermined ages, perfect foresight)
```

Income is

$$\begin{split} \log(y_t^j) &= \ln(h_t^j) + z_t^j \\ z_t^j &= z_{t-1}^j + \zeta_t^j, \quad \zeta_t^j \sim \textit{iid} \mathcal{N}(0, \sigma_{7^j}^2) \end{split}$$

Human capital is

$$\log(h_t^j) = \log(h_{t-1}^j) - \delta(1 - P_{t-1}^j) + (\lambda_0^j + \lambda_1^j t) P_{t-1}^j$$

• Why only need to keep track of  $h_t^W$ ?

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• Why only need to keep track of  $h_t^W$ ? Because since men always work,  $P_t^H = 1$ , we have

$$\begin{split} \log(h_t^H) &= \log(h_{t-1}^H) + (\lambda_0^H + \lambda_1^H t) \\ &= \log(h_{t-2}^H) + (\lambda_0^H + \lambda_1^H (t-1)) + (\lambda_0^H + \lambda_1^H t) \\ &= \underbrace{\log(h_0^H)}_{\text{estimated as intercept}} + \sum_{s=1}^t (\lambda_0^H + \lambda_1^H s) \end{split}$$

If heterogeneity in initial condition, we would solve for a grid of  $h_0^H$ .

# • Match quality (love) is an AR(1) process

$$\xi_t^j = \xi_{t-1}^j + \epsilon_t^j, \quad \epsilon_t^j \sim iid\mathcal{N}(0, \sigma^2)$$

- $e(k) \ge 1$  is equiv. scale as function of children, k.
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   Singles (share childcare costs):

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Couples  $(A_t = A_t^H + A_t^W)$ :

$$A_{t+1} = (1+r)A_t + y_t^H + (y_t^W - d_t^K)P_t^W - x_t$$

where expenditures are (couples have econ. of scale,  $\rho \geq 1$ )

$$x_t = [(c_t^H)^{\rho} + (c_t^W)^{\rho}]^{\frac{1}{\rho}} e(k)$$

(2)

### **Preferences**

• Individual preferences are [my notation]

$$u(c_t^i, P_t^i, D_t^i) = \frac{(c_t^i)^{1-\gamma}}{1-\gamma} - \psi P_t^i + \xi_t^i (1 - D_t^i)$$

where

 $\gamma$  is the CRRA coefficient

 $\psi$  is the dis-utility of working

 $\xi_t^i$  is a marital match shock ("love")

# Value of a Divorcee

• Re-marriage with prob.  $\pi_t^{j\Omega_t}$ Match with someone similar to j (I think).

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$$V_t^{jDR}(\omega_t) = \pi_t^{j\Omega_t} V_t^{jR}(\omega_t) + (1 - \pi_t^{j\Omega_t}) V_t^{jD}(\omega_t)$$

where  $V_t^{jR}$  is value of re-marriage (defined next) and

$$\begin{split} V_{t}^{jD}(\omega_{t}) &= \max_{c_{t}^{j}, P_{t}^{j}} u(c_{t}^{j}, P_{t}^{j}, 1) \\ &+ \beta \underbrace{\left\{ \pi_{t+1}^{j\Omega_{t}} \mathbb{E}_{t} [V_{t+1}^{jR}(\omega_{t+1})] + (1 - \pi_{t+1}^{j\Omega_{t}}) \mathbb{E}_{t} [V_{t+1}^{jD}(\omega_{t+1})] \right\}}_{\mathbb{E}_{t} [V_{t+1}^{jDR}(\omega_{t+1})]} \end{split}$$

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• Outside option is (my notation)

$$V_{i\,t}^{m\to s}(\omega_t;\kappa) = V_t^{jD}(\omega_t,(A_{t-1}-CD)/\kappa_i)$$

where *CD* is divorce costs (tab 3),  $\kappa_j=0.5$  in community property.  $_{_{11/27}}$ 

# Value of a Remarried

- **Re-marriage** is absorbing. See footnote 7.
- In turn,

$$V_t^{jR}(\omega_t) = u(c^{j*R}, P^{j*R}) + \beta \mathbb{E}_t[V_{t+1}^{jR}(\omega_{t+1})]$$

where

$$\begin{split} c^{W*R}, c^{H*R}, P^{W*R} &= \arg\max_{c^{W}, c^{H}, P^{W}} \theta u(c^{H}, 1, 0) + (1 - \theta) u(c^{W}, P^{W}, 0) \\ &+ \beta \mathbb{E}_{t} [\theta V_{t+1}^{HR}(\omega_{t+1}) + (1 - \theta) V_{t+1}^{WR}(\omega_{t+1})] \end{split}$$

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- This means that, in the model, divorce can only happen once.
- ullet Reason is computational: Assets brought into the marriage is private Keeping track of assets from all previous marriages would be unfeasible. No divorce ullet does not need to keep track of individual assets.

#### • Two cases:

- Mutual Consent: Both must prefer divorce for it to happen. Committed by law (there are exceptions).
- 2. *Unilateral divorce:* If one prefers divorce, they can divorce. Limited commitment.
  - See lecture note for my notation, I follow Voena (2015).

# Household Planning

#### • Two cases:

- 1. *Mutual Consent:* Both must prefer divorce for it to happen. Committed by law (there are exceptions).
- Unilateral divorce: If one prefers divorce, they can divorce. Limited commitment.
   See lecture note for my notation, I follow Voena (2015).
- **Timing-issue**: The bargaining weight is updated in current period. (See lecture note)

# Household Planning: Mutual Consent

• Couples  $(D_{t-1} = 0)$  in *mutual consent* regime solve

$$\begin{split} V_t(\omega_t) &= \max_{c_t^H, c_t^W P_t^W, A_{t+1}^H, A_{t+1}^W, D_t} \\ &(1 - D_t) \bigg( \theta u(c_t^H, 1, 0) + (1 - \theta) u(c_t^W, P_t^W, 0) + \beta \mathbb{E}_t[V_t(\omega_{t+1})] \bigg) \\ &+ D_t \bigg( \theta \big\{ u(c_t^H, 1, 1) + \beta \mathbb{E}_t[V_{t+1}^{HDR}(\omega_{t+1})] \big\} \\ &+ (1 - \theta) \big\{ u(c_t^W, P_t^W, 1) + \beta \mathbb{E}_t[V_{t+1}^{WDR}(\omega_{t+1})] \big\} \bigg) \end{split}$$

with constant bargaining weights  $\theta$  and  $1 - \theta$ .

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with constant bargaining weights  $\theta$  and  $1-\theta$ .

• **Subject to** non-participation constraints, when  $D_t = 1$ ,

$$V_{H,t}^{m \to s}(\omega_t; \kappa) = u(c_t^H, 1, 1) + \beta \mathbb{E}_t[V_{t+1}^{HDR}(\omega_{t+1})] > V_t^{HM}(\omega_t)$$
$$V_{W,t}^{m \to s}(\omega_t; \kappa) = u(c_t^H, P_t^W, 1) + \beta \mathbb{E}_t[V_{t+1}^{HDR}(\omega_{t+1})] > V_t^{WM}(\omega_t)$$

# Household Planning: Mutual Consent

Divorce only if both want a divorce.

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- If one is unhappy in the marriage, say the wife  $\theta$  remains unchanged asset-split in divorce,  $\kappa_m$ , is changed in her favor until she is indifferent  $\rightarrow$  changes intra-household allocations through  $\beta \mathbb{E}_t[V_{t+1}^{jDR}(\omega_{t+1})]$ .

• Couples  $(D_{t-1} = 0)$  in *unilateral* regime solve

$$V_{t}(\omega_{t}) = \max_{c_{t}^{H}, c_{t}^{W} P_{t}^{W}, A_{t+1}^{H}, A_{t+1}^{W}, D_{t}}$$

$$(1 - D_{t}) \left( \tilde{\theta}_{t+1}^{H} u(c_{t}^{H}, 1, 0) + \tilde{\theta}_{t+1}^{W} u(c_{t}^{W}, P_{t}^{W}, 0) + \beta \mathbb{E}_{t} [V_{t}(\omega_{t+1})] \right)$$

$$+ D_{t} \left( \tilde{\theta}_{t+1}^{H} \{ u(c_{t}^{H}, 1, 1) + \beta \mathbb{E}_{t} [V_{t+1}^{HDR}(\omega_{t+1})] \} \right)$$

$$+ \tilde{\theta}_{t+1}^{W} \{ u(c_{t}^{W}, P_{t}^{W}, 1) + \beta \mathbb{E}_{t} [V_{t+1}^{WDR}(\omega_{t+1})] \} \right)$$

where  $\tilde{\theta}_{t+1}^j = \tilde{\theta}_t^j + \mu_t^j$  and  $\mu_t^j$  are Lagrange multipliers on

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$$+ D_{t} \left( \tilde{\theta}_{t+1}^{H} \{ u(c_{t}^{H}, 1, 1) + \beta \mathbb{E}_{t} [V_{t+1}^{HDR}(\omega_{t+1})] \}$$

$$(3)$$

 $V_{W,t}^{m \to s}(\omega_t; \frac{1}{2}) \leq V_t^{WM}(\omega_t)$ 

$$+ \, \tilde{\theta}^W_{t+1} \big\{ u(c^W_t, P^W_t, 1) + \beta \mathbb{E}_t \big[ V^{WDR}_{t+1}(\omega_{t+1}) \big] \big\} \bigg)$$
 where  $\tilde{\theta}^j_{t+1} = \tilde{\theta}^j_t + \mu^j_t$  and  $\mu^j_t$  are Lagrange multipliers on

participation constraints, when  $D_t = 0$ ,  $V_{H,t}^{m \to s}(\omega_t; \frac{1}{2}) \leq V_t^{HM}(\omega_t)$ 

Individual value of remaining in marriage (RHS of constraint) is

$$V_t^{jM}(\omega_t) = u(c_t^{j*}, P_t^{j*}, 0) + \beta \mathbb{E}_t[V_{t+1}^j(\omega_{t+1})]$$

where  $c_t^{j*}$ ,  $P_t^{j*}$ ,  $A_{t+1}^{j*}$  are optimal choices from eq. (3) and

$$V_{t+1}^{j}(\omega_{t+1}) = (1 - D_{t+1}^{*})V_{t+1}^{jM} + D_{t+1}^{*}V_{t+1}^{jD}$$

is individual value of entering as married in t+1.

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is individual value of entering as married in t+1.

• Choices are made as a household (with weights on individual utility) individual values are only based on own utility (and future).

- Beginning of period bargaining weights,  $\tilde{ heta}_t^j$ , are in  $\omega_t$ .
- If both participation constraints are not violated at  $\tilde{\theta}_t^H$  and  $\tilde{\theta}_t^W$ , the Lagrange multipliers are zero and  $\tilde{\theta}_{t+1}^j = \tilde{\theta}_t^j$  is not updated.

- **Beginning of period** bargaining weights,  $\tilde{\theta}_t^j$ , are in  $\omega_t$ .
- If both participation constraints are not violated at  $\tilde{\theta}_t^H$  and  $\tilde{\theta}_t^W$ , the Lagrange multipliers are zero and  $\tilde{\theta}^j_{t+1} = \tilde{\theta}^j_t$  is not updated.
- **To solve** this model (last time + note)
  - 1. solve the model for couples assuming they remain together, for a grid of bargaining weights.
  - 2. If, for a given weight, one spouse is not satisfied ( $V_t^{jD} > V_t^{jM}$ ), update the weight on that spouse until indifferent ( $V_{t}^{jD} = V_{t}^{jM}$ ). If the other spouse wants to remain in marriage at this new weight, then update weight and carry on! Otherwise, divorce.

Simple Model

# Outline

Estimation and Counterfactuals

#### **Estimation**

#### • 2-step estimation:

- 1. calibrate (preset) parameters in Table 3+4
- 2. estimate by SMM 3 parameters in Table 5 using policy variation from mutual to unilateral

TABLE 5—ESTIMATED STRUCTURAL PARAMETERS AND MATCH OF THE AUXILIARY MODEL

Parameter	Symbol	Estimate	Standard error
Standard deviation of preference shocks	$\sigma$	0.0008	0.0004
Disutility from labor market participation	$\psi$	0.0107	0.0025
Husbands' Pareto weight	$\theta$	0.7	0.0155
Auxiliary model parameter	Symbol	Target	Simulated
Effect of uni. divorce on savings in CP	$\phi_1$	13.54 percent	13.43 percen
Effect of uni. divorce on participation in CP	$\phi_2$	-6.93 pcpt	-6.86 pcpt
Baseline participation rate in CP	$\phi_3$	55.97 percent	56.03 percen
Baseline divorce probability in CP	$\phi_4$	19.44 percent	19.44 percen

# Simulation: A

 Effects from mutual to unilateral in community (50-50) regime

# Simulation: A

- Effects from mutual to unilateral in *community* (50-50) regime
- Mutual:

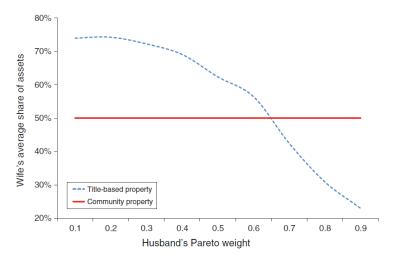
heta=0.7 consumption share of women: 39%

• Unilateral:

19% re-bargained their power consumption share of women: 41% labor supply:  $\downarrow$  6.86pp.

### Simulation: B

## Effects of property division regimes



#### Divorce laws and consumption insurance

TABLE 6—DIVORCE LAWS AND CONSUMPTION INSURANCE AGAINST INCOME SHOCKS

	Married couples					
	N	Women				
Regimes	Mutual consent	Unilateral divorce	Mutual	Unilateral divorce		
Title-based	0.372	0.410	0.233	0.207		
Community property	0.371	0.390	0.235	0.192		
Equitable distribution	0.375	0.384	0.238	0.197		

Notes: The table reports the estimates of coefficients  $\mu^{j}$  obtained from the regressions

$$\Delta \log(c_{ii}^{H}) = \kappa^{H} + \mu^{H} \Delta \log(y_{ii}^{H}) + \nu'^{H} \mathbf{X}_{ii}^{I} + e_{ii}^{H}$$
 and  $\Delta \log(c_{ii}^{W}) = \kappa^{W} + \mu^{W} \Delta \log(y_{ii}^{W}) + \nu'^{W} \mathbf{X}_{ii}^{I} + e_{ii}^{W}$ 

in each legal regime, where  $X_k^i$  are spouse f's age and age squared. The coefficients are estimated on data obtained from simulating the model using the preset parameters and the estimated parameters for a sample of simulated households. I account for the differential selection of couples out of marriage because of divorce laws by simulating income and consumption profiles using only the policy functions of married couples.

- 1. Men have more consumption insurance under mutual (lower pass-through of income shocks)
- 2. Property division does not matter in mutual (col 1 + 3 constant across rows)

# Outline

Simple Model

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# Our simple model

- Same model as last time (see notebook)
- We cannot model the same counterfactuals as Alessandra Voena in our simple model.
  - But we can **change wealth distribution upon divorce**.

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- We cannot model the same counterfactuals as Alessandra Voena in our simple model.

But we can **change wealth distribution upon divorce**.

• Now,  $\kappa_i$  denotes the share of wealth to member i,  $\kappa_1 + \kappa_2 = 1$ .

$$\begin{split} V_{j,t}^{m}(a_{t-1}, \psi_{t}, \mu_{t-1}) &= D_{t}^{\star} V_{j,t}^{m \to s}(\kappa_{j} a_{t-1}, \psi_{t}, \mu_{t-1}) \\ &+ (1 - D_{t}^{\star}) V_{j,t}^{m \to m}(a_{t-1}, \psi_{t}, \mu_{t-1}) \end{split}$$

## Next Time

#### Next time:

Marriage and Divorce (in Denmark).

#### Literature:

Bruze, Svarer and Weiss (2015): "The Dynamics of Marriage and Divorce" [full commitment]

- Read before lecture
- Reading guide:
  - Section 1: Introduction + overview. Read.
  - Section 2: Data. Skim.
  - Section 3: Marriage patterns. Read (many figures).
  - Section 4: Model. Key, get the idea.
  - Section 5: Estimation. Skim.
  - Section 6: Results. Read.

## References I

- Bruze, G., M. Svarer and Y. Weiss (2015): "The Dynamics of Marriage and Divorce," Journal of Labor Economics, 33(1), 123-170.
- VOENA, A. (2015): "Yours, Mine, and Ours: Do Divorce Laws Affect the Intertemporal Behavior of Married Couples?," American Economic Review, 105(8), 2295–2332.