Marriage and Divorce under Labor Market Uncertainty

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Motivation

- Gender differences in labor market outcomes are related to choices made in the marriage market and at the household level.
- Two dimensions:
  1. Marriage Market: Who do I marry? Who do I divorce? $\rightarrow$ Marital sorting.
  2. Household: How do we organize our time to maximize utility flows? $\rightarrow$ Labor supply, household specialization.

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- There is a two-way interaction (or simultaneity) between the two types of decisions:
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  - Being married, and to whom, affects my labor market outcomes.
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  - My labor market outcomes affect, who I can marry.
  - Being married, and to whom, affects my labor market outcomes.
  - Changing labor market outcomes affect marital stability.
- Suppose gender equality in labor market outcomes was a political goal.
- Understanding this interaction would be absolutely critical to achieving this goal.

This paper: Theory

- We study this two-way interaction in a novel structural model.
- Core: TU, random search, ex-ante heterogeneity (Shimer & Smith, 2000).
- Match-specific “love shocks” (Jacquemet & Robin, 2012; Goussé et al.; 2017).

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- This mechanism affects marital stability, and marital sorting.

This paper: Empirics

- We take this model to German data:
  - Event studies provide evidence of the two-way interaction and support our modeling choices.
  - Structural estimation (work in progress)
    - No heterogeneity
    - One-dimensional heterogeneity (age or education)
    - Two-dimensional heterogeneity (age and education)
  - Counterfactuals (input welcome)

Literature

- Unemployment, especially male unemployment, is associated with an increase in the divorce rate (e.g. Jensen and Smith, 1990; Hansen, 2005; Amato and Beattie, 2011).
- Marriage/divorce rates negatively correlated with unemployment over the business cycle (e.g. Schaller, 2013; González-Val and Marcén, 2017a/b).
- Does female labor market participation decrease or increase marital stability? (Newman and Olivetti, 2017 vs. Folke and Rickne, 2020).
- Marriage market matching models (with and without frictions, TU/NTU): Becker (1973/74), Burdett & Coles (1997), Shimer & Smith (2000), Jacquemet & Robin (2012), Choo & Siow (2006), Choo (2015), Chiappori et al. (2015).
- Most closely related: Goussé et al. (2017).
- Also related: models of joint search: Guler et al. (2012), Pilossoph & Wee (2021).

Outline

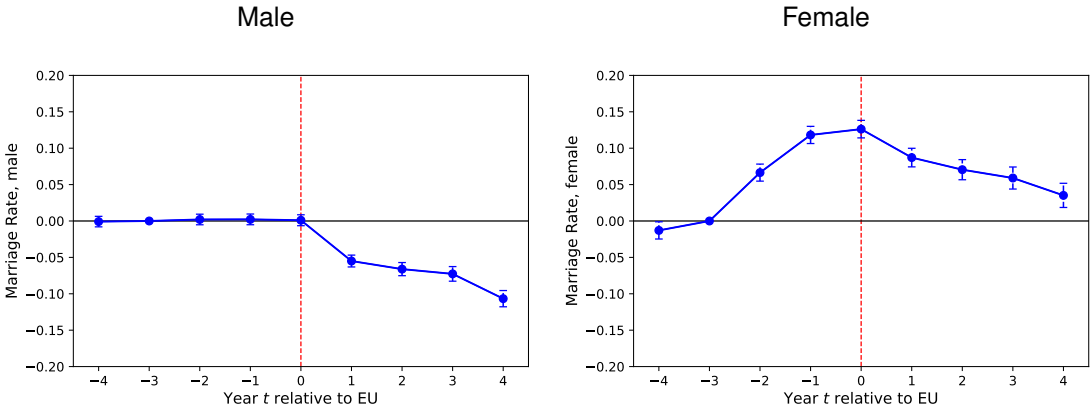
1. Data & Empirics
2. Model
3. Estimation
4. Counterfactuals (not today)

Data & Empirics

Data

- German data for the years 1983–2019.
- We combine data from two big surveys:
  (1) GSOEP, since 1983
  (2) IAB-PASS, since 2007.
- Key advantage: detailed information on domestic work hours and labor supply.

Event Study: Marriage Rate around EU Transition



- Relative to matched control group: no EU Transition, matched in $t-3$.

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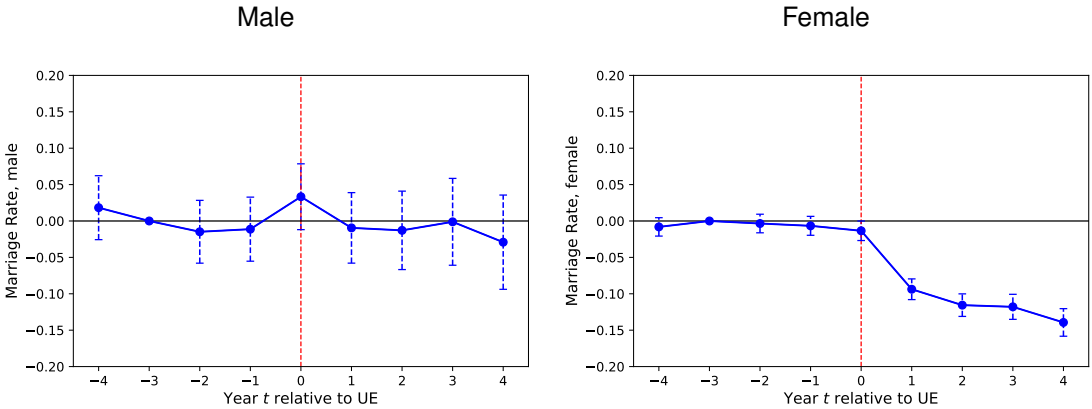

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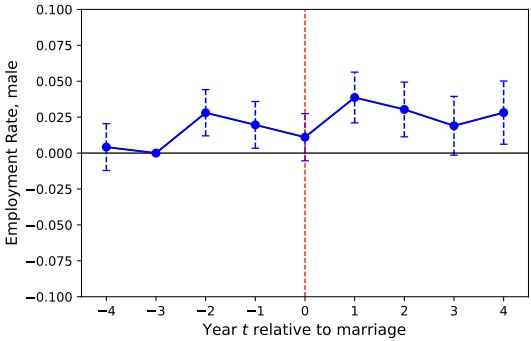
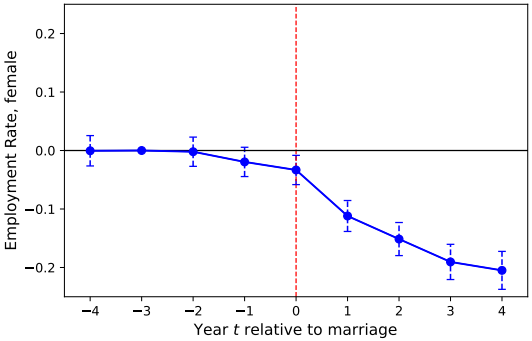
Event Study: Employment Rate around Marriage

Male

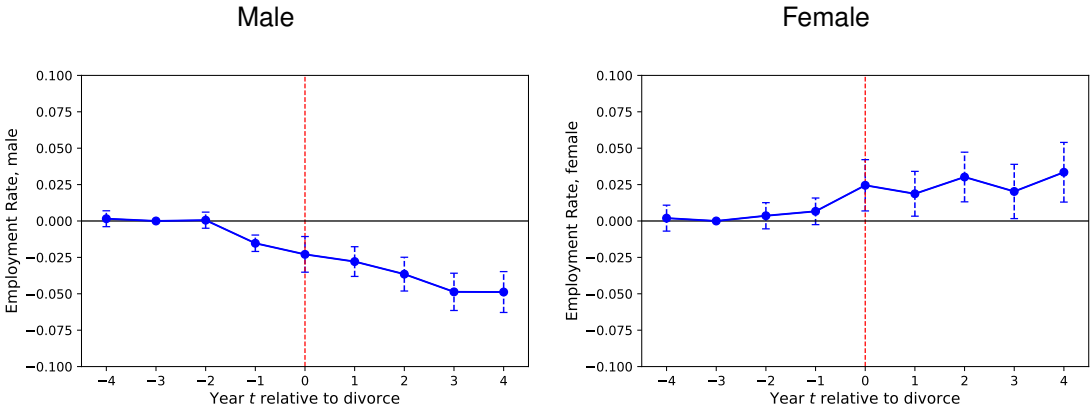


Female



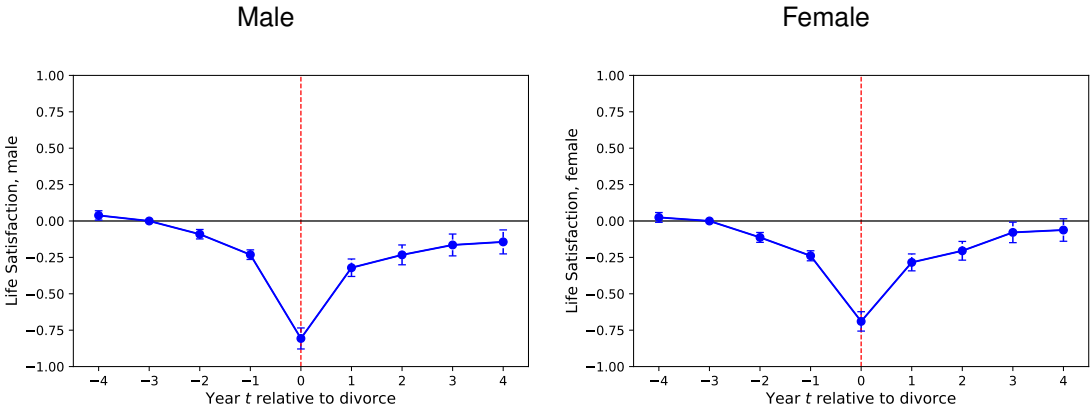
- Relative to matched control group: no marriage, matched in $t-3$.

Event Study: Employment Rate around Divorce



- Relative to matched control group: no divorce, matched in $t - 3$.

Event Study: Life Satisfaction around Divorce



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Household specialization - Time Inputs

- Labor market work hours per day

	single		married			
	U	E	UU	UE	EU	EE
male	0.57	9.68	0.25	0.66	10.23	10.32
female	0.67	8.50	0.21	8.02	0.67	7.64

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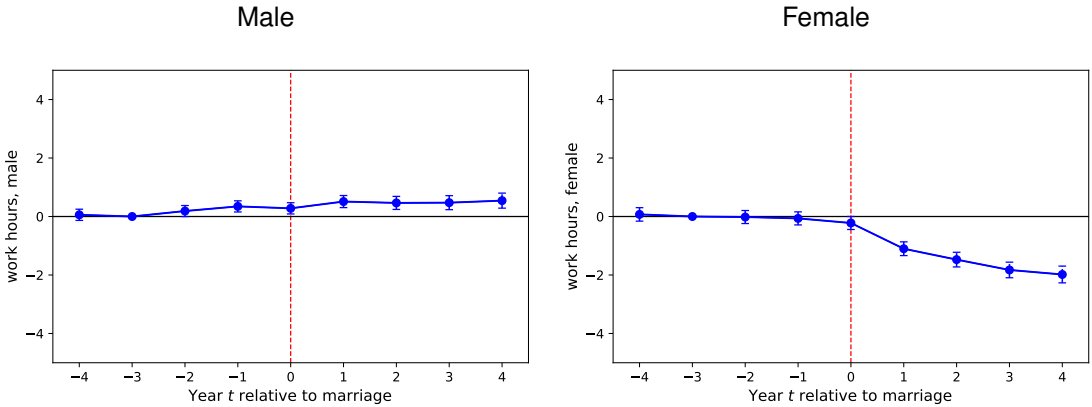
- Domestic work hours per day (childcare, errands, repairs, routine chores):

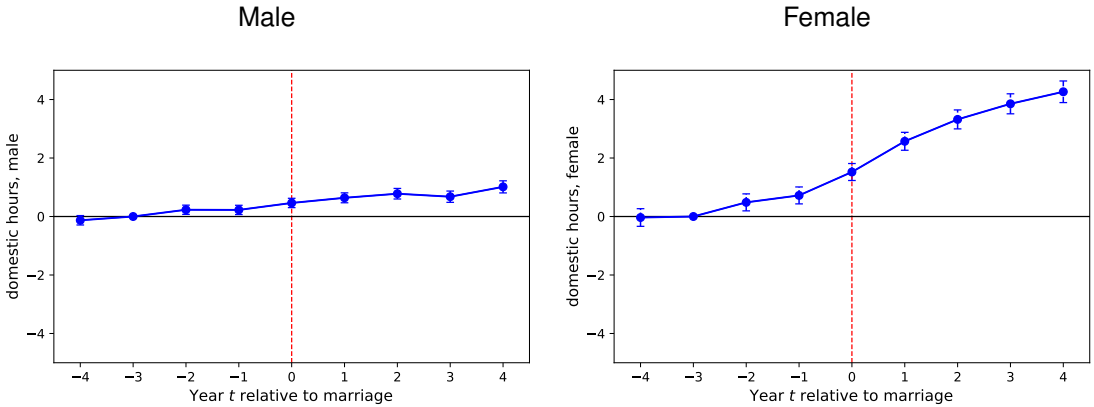
	single		married			
	U	E	UU	UE	EU	EE
male	3.21	2.62	4.99	5.42	3.08	3.13
female	6.00	3.97	7.39	4.57	9.89	5.90

Event Study: Work Hours around Marriage



- Relative to matched control group: no divorce, matched in $t-3$.

Event Study: Domestic Hours around Marriage



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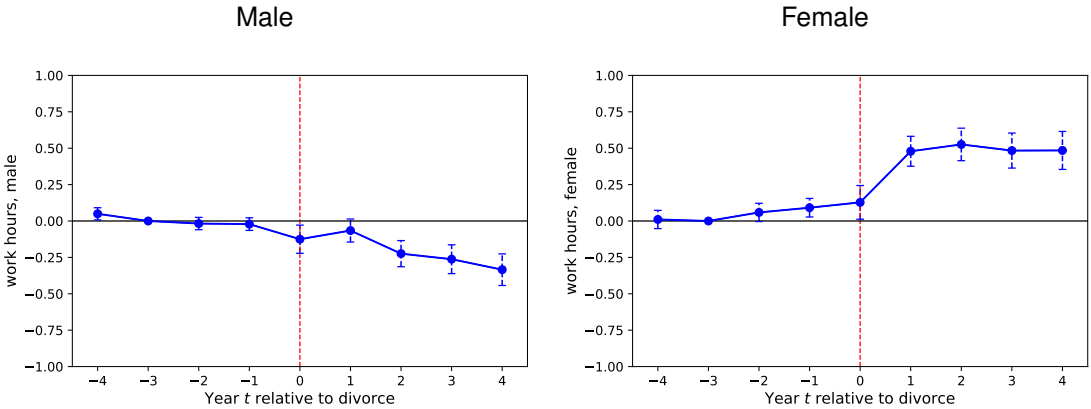

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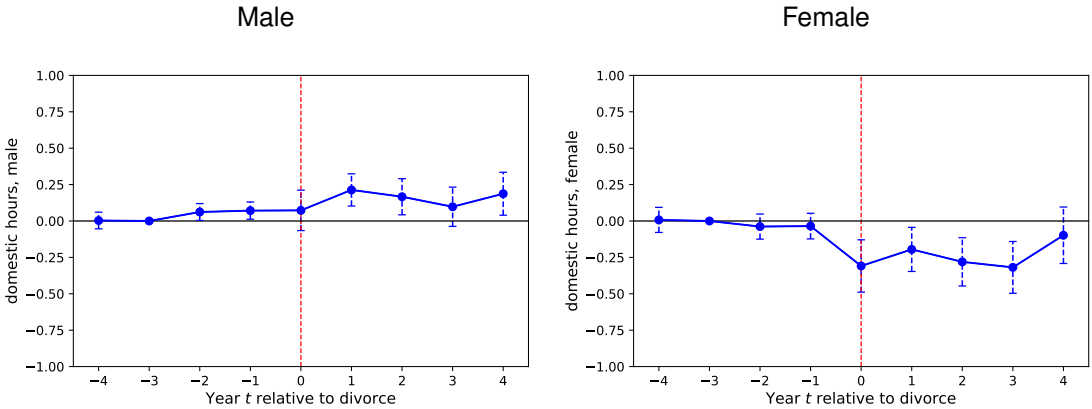

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Model

The Basics

- Marriage Market: Transferable utility, random search, and ex-ante heterogeneity (following Becker, 1973/74; Shimer & Smith, 2000; Goussé et al., 2017).
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- Labor Market: Endogenous labor search decisions on and off the job (as in Burdett & Mortensen, 1998, but no firms). Exogenous separations.
- Utility flow depends on their own income, leisure and household production.
  For married couples the household public good depends on:
  - time input into domestic work
  - match-specific “love” shock

Functional Forms

- We assume quasi-linear preferences in consumption c_f, leisure e_f and a household public good y.

$$u(c_f, e_f, y) = c_f + \zeta_x e_f + y$$

$$\text{with } y = \begin{cases} \left(X_j^l\right)^{1-\alpha_x} (h_f)^{\alpha_x} & \text{if single female} \\ \left(zX_{ij}^{-ll}\right)^{(1-\gamma_y-\gamma_x)} (h_m)^{\gamma_y} (h_f)^{\gamma_x} & \text{if married.} \end{cases}$$

$$c_f = I_j^l + t \text{ and } c_m = I_i^{-l} - t$$

$$\overline{h} = l_j^l + h_f + e_f \text{ and } \overline{h} = l_i^l + h_m + e_m$$

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- Linearity in consumption implies that income changes affects the couples' joint utility in the same way as single utilities.

  $\Rightarrow$ Marital surplus is independent of spouses' current income.

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- Specifically, taking up a job implies less hours for home production and leisure.
- Surplus is invariant to EE transitions (linear utility assumption). Marital Surplus
- No commitment, efficient divorce in case of negative surplus.

Endogenous Search Intensity and Reservation Wages

Endogenous search intensity and reservation wages depend on

- employed married/single: current wage.
- unemployed single: UI, home production, marriage market option value.
- unemployed married:
  - UI,
  - labor market status and type of spouse,
  - match-specific shock,
  - household public good.

Reservation Wages: Singles

- While employed, the reservation wage is equal to the current wage irrespective of marital status, i.e., $R_j^{l,-l}\left(z, I_i^{-l}, w_j\right) = R\left(w_j\right) = w_j$.

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- The reservation wage of an unemployed single (defined by $V_j^e\left(R_j^u\right) = V_j^u\left(b_j\right)$), is

$$R_j^u = b_j - \zeta_x\left(l_j^u - l_j^e\right) + \xi_y\left(X_j^u - X_j^e\right) + \beta_x \sum\nolimits_i \sum\nolimits_{-l} \left(\lambda^{-lu}\overline{S}_{z_{ij}^{-lu}}^{-lu} - \lambda^{-le}\overline{S}_{z_{ij}^{-le}}^{-le}\right) s_i^{-l}.$$

where $\bar{S}_{z_{ij}^{-ll}}^{-ll} \equiv \int_{z_{ij}^{-ll}}^{\infty} S_{ij}^{-ll}(z) dG(z)$.

Reservation Wages: Married

- Unemployed married female j with a partner of type i and emp. status $-l$.
- Definition:

$$R_{j,i}^{u,-l}(z) = R_j^u + r\left(S_{ij}^{-lu}(z) - \max\left[0, S_{ij}^{-le}(z)\right]\right)$$

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- A married individual faces on top of a single individual additional gains or losses associated with the effect of a changed labor market status on marital surplus.
- If after the shock the new z is high enough (above z_{ij}^{-le}) the individual will stay married and the marital surplus of a female of type j changes from $S_{ij}^{-lu}(z)$ to $S_{ij}^{-le}(z)$.
- If after the shock the new z is too small (below z_{ij}^{-le}) the labor market transition will lead to a divorce and hence to a loss of the marital surplus, i.e., $S_{ij}^{-le}(z) = 0$.

Reservation Wages: Married

- Note two things:
  1. The couple is currently married, so $S_{ij}^{-lu}(z) > 0$. Thus, reservation wage of unemployed married is (weakly) higher compared to unemployed single.
  2. But, the lower the love shock z, the lower is current marital surplus. Thus, the reservation wage is lower and search intensity higher ...

- Through this mechanism, a negative love shock will...
  - decrease the reservation wage (due to lower marital surplus) and
  - increase the labor market search intensity of the unemployed spouse.
  - make a transition into employment more likely.
  - make a divorce more likely.

Search Equilibrium

- The equilibrium is characterized by:
  - a set of surplus functions $S_{ij}^{ll}(z)$,
  - search intensities for unemployed married and single individuals, $\{\widehat{\sigma}_i^{u,l}(z), \widehat{\sigma}_j^{u,-l}(z)\}$ and $\{\widehat{\sigma}_i^{u}, \widehat{\sigma}_j^{u}\}$,
  - love shock threshold values z_{ij}^{ll},
  - the distributions of married couples m_{ij}^{ll} for each type ij and labor market status ll,
  - and single distributions s_i^l, s_j^l.
- Solution algorithm: alternating fixed-point iterations, three model blocks. Solution Algorithm
- We estimate four versions of the model:
  no heterogeneity, education heterogeneity, age heterogeneity, both (two-dimensional heterogeneity).

Estimation

Estimation with GMM

We target:

- yearly transition probabilities between: Example
  - married/single
  - employment/unemployment
  - EE-transition if employed
- domestic work hours of unemployed singles and couples, where both are unemployed.
- median wages for males and females.

We have more moments than parameters.

Target Moments and Fit

Table: Initial state: single female

Moment	Mean	Estimation	Percentage Deviation
T_sju_sje_none_1	0.239	0.218	-2.10%
T_sju_mju_none_1	0.022	0.050	2.80%
T_sju_mje_none_1	0.010	0.016	0.60%
T_sje_sje_f_none_1	0.094	0.145	5.10%
T_sje_sju_none_1	0.060	0.009	-5.10%
T_sje_mje_none_1	0.036	0.048	1.20%
T_sje_mje_f_none_1	0.004	0.009	0.50%
T_sje_mju_none_1	0.003	0.001	-0.20%

Table: Initial state: single male

Moment	Mean	Estimation	Percentage Deviation
T_siu_sie_none_1	0.301	0.205	-9.60%
T_siu_miu_none_1	0.010	0.053	4.30%
T_siu_mie_none_1	0.009	0.019	1.00%
T_sie_sie_m_none_1	0.096	0.180	8.40%
T_sie_siu_none_1	0.053	0.008	-4.50%
T_sie_mie_none_1	0.039	0.046	0.70%
T_sie_mie_m_none_1	0.005	0.011	0.60%
T_sie_miu_none_1	0.001	0.001	0.00%

Table: Initial state: married, UU

Moment	Mean	Estimation	Percentage Deviation
T_miuju_miuje_none_1_1	0.045	0.104	5.90%
T_miuju_mieju_none_1_1	0.118	0.113	-0.50%
T_miuju_mieje_none_1_1	0.107	0.038	-6.90%
T_miuju_siu_sju_none_1_1	0.084	0.038	-4.60%
T_miuju_siu_sje_none_1_1	0.007	0.007	0.00%
T_miuju_sie_sju_none_1_1	0.003	0.007	0.40%
T_miuju_sie_sje_none_1_1	0.008	-0.012	-2.00%

Table: Initial state: married, UE

Moment	Mean	Estimation	Percentage Deviation
T_miuje_miuje_f_none_1_1	0.021	0.119	9.80%
T_miuje_miuju_none_1_1	0.082	0.008	-7.40%
T_miuje_mieje_none_1_1	0.171	0.142	-2.90%
T_miuje_mieje_f_none_1_1	0.008	0.026	1.80%
T_miuje_mieju_none_1_1	0.031	0.001	-3.00%
T_miuje_siu_sje_none_1_1	0.062	0.026	-3.60%
T_miuje_siu_sje_f_none_1_1	0.001	0.005	0.40%
T_miuje_siu_sju_none_1_1	0.010	0.002	-0.80%
T_miuje_sie_sje_none_1_1	0.018	0.030	1.20%
T_miuje_sie_sje_f_none_1_1	0.002	0.006	0.40%
T_miuje_sie_sju_none_1_1	0.001	-0.007	-0.80%

Table: Initial state: married, EU

Moment	Mean	Estimation	Percentage Deviation
T_mieju_mieju_m_none_1_1	0.027	0.150	12.30%
T_mieju_miuju_none_1_1	0.033	0.007	-2.60%
T_mieju_mieje_none_1_1	0.142	0.127	-1.50%
T_mieju_mieje_m_none_1_1	0.006	0.030	2.40%
T_mieju_miuje_none_1_1	0.004	0.001	-0.30%
T_mieju_sie_sju_none_1_1	0.046	0.029	-1.70%
T_mieju_sie_sju_m_none_1_1	0.004	0.007	0.30%
T_mieju_siu_sju_none_1_1	0.003	0.001	-0.20%
T_mieju_sie_sje_none_1_1	0.021	0.021	0.00%
T_mieju_sie_sje_m_none_1_1	0.001	0.005	0.40%
T_mieju_siu_sje_none_1_1	0.000	-0.003	-0.30%

Table: Initial state: married, EE

Moment	Mean	Estimation	Percentage Deviation
T_mieje_mieje_m_none_1_1	0.021	0.152	13.10%
T_mieje_mieje_f_none_1_1	0.025	0.117	9.20%
T_mieje_mieju_none_1_1	0.083	0.007	-7.60%
T_mieje_mieju_m_none_1_1	0.004	0.002	-0.20%
T_mieje_miuje_none_1_1	0.022	0.007	-1.50%
T_mieje_miuje_f_none_1_1	0.001	0.001	0.00%
T_mieje_miuju_none_1_1	0.004	0.000	-0.40%
T_mieje_sie_sje_none_1_1	0.059	0.036	-2.30%
T_mieje_sie_sje_m_none_1_1	0.002	0.009	0.70%
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Table: Hours and wages

Moment	Mean	Estimation	Percentage Deviation
hh_f_su_none_1	5.462	5.444	-0.33%
hh_m_su_none_1	3.084	3.163	2.56%
hh_muu_f_none_1_1	7.095	7.139	0.62%
hh_muu_m_none_1_1	4.648	4.664	0.34%
w_p50_f_none_1	13.224	12.918	-2.31%
w_p50_m_none_1	16.177	15.664	-3.17%

Estimated Parameter Values

Parameter	Symbol	Value
Output elasticity male hours married	γ_y	0.270608
Output elasticity female hours married	γ_x	0.351117
HH public good EE	X_{ij}^{ee}	3.774162
HH public good EU	X_{ij}^{eu}	1.879224
HH public good UE	X_{ij}^{ue}	1.477419
HH public good UU	X_{ij}^{uu}	1.023982
Wage offer dist shape female	ϑ_i	0.166149
Wage offer dist shape male	ϑ_j	0.119967

Estimated Parameters Values

Parameter	Symbol	Value
HH public good single male E	X_i^e	4.671016
HH public good single male U	X_i^u	4.751025
Output elasticity male hours single	α_y	0.852360
Leisure coefficient male	ζ_y	0.910708
HH public good single female E	X_j^e	2.314547
HH public good single female U	X_j^u	3.150551
Output elasticity female hours single	α_x	0.838973
Leisure coefficient female	ζ_x	0.767394

Estimated Parameters Values

Parameter	Symbol	Value
Quit rate female	q_j	0.010003
Quit rate male	q_i	0.010043
Love shock arrival rate	δ	0.229844
Marriage market matching efficiency	ϕ	0.309137
Male bargaining power	β_y	0.680531
Labor market matching efficiency female	μ_j	0.479011
Labor market matching efficiency male	μ_i	0.312576
Love shock standard deviation	σ_z	1.495653

Thank you for your attention.

Christian Holzner

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Bargaining - No Commitment

- Bargaining powers are (β_i, β_j), with $\beta_i + \beta_j = 1$.
- Search intensities and transfers are chosen such that the Nash-Product,

$$\left[V_{j,i}^{l,-l} - V_j^l\right]^{\beta_j} \left[V_{i,j}^{-l,l} - V_i^{-l}\right]^{\beta_i},$$

  is maximized subject to participation and feasibility constraints.

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- If a labor market transition or a love shock occurs, search intensities $(\sigma_{i,j}^{-l,l}(.), \sigma_{j,i}^{l,-l}(.))$ and transfers (t_i, t_j) are (re)negotiated.
- Marital Surplus is defined as the gain from marriage for both spouses:

$$S_{ij}^{-ll} \equiv \left[V_{j,i}^{l,-l} - V_j^l\right] + \left[V_{i,j}^{-l,l} - V_i^{-l}\right]$$

Go back

The present value of being single

$$
\begin{aligned}
rV_j^l = & \underbrace{\max_{h_f, e_f} u\left(c_f, e_f, y\right)}_{\text{Flow utility}} + \underbrace{q_j \left[V_j^u\left(b_j\right) - V_j^l\left(I_j^l\right)\right] \mathbb{1}\left[l = e\right]}_{\text{Job separation if employed}} \\
& + \underbrace{\max_{\sigma_j} \left[\sigma_j \mu_j \int \max\left[V_j^e\left(w_j'\right) - V_j^l\left(I_j^l\right), 0\right] dF_j\left(w_j'\right) - c\left(\sigma_j\right)\right]}_{\text{Labor market search intensity choice}} \\
& + \underbrace{\sum\nolimits_i \lambda s_i^u \int \max\left[V_{j,i}^{l,u}\left(z'\right) - V_j^l, 0\right] dG\left(z'\right)}_{\text{Option value of finding a unemployed (male) partner}} \\
& + \underbrace{\sum\nolimits_i \lambda s_i^e \iint \max\left[V_{j,i}^{l,e}\left(z', w_i\right) - V_j^l, 0\right] dG\left(z'\right) dH_i\left(w_i\right)}_{\text{Option value of finding an employed (male) partner}}
\end{aligned}
$$

Go back

The present value of being married

$$
\begin{aligned}
rV_{j,i}^{l,-l} = & \max_{h_f, e_f} u\left(c_f, e_f, y\right) \\
& + \max_{\sigma_f} \left[\sigma_f \mu_j \int \left[\max \left[V_j^e \left(w_j' \right), V_{j,i}^{e,-l} \left(w_j' \right) \right] - V_{j,i}^{l,-l} \right] dF_j \left(w_j' \right) - c\left(\sigma_f\right) \right] \\
& + q_j \left[\max \left[V_j^u, V_{j,i}^{u,-l} \right] - V_{j,i}^{l,-l} \right] \\
& + \sigma_m \mu_i \int \left[\max \left[V_j^l, V_{j,i}^{l,e} \right] - V_{j,i}^{l,-l} \right] dF_i \left(w_i' \right) \\
& + q_i \left[\max \left[V_j^l, V_{j,i}^{l,u} \right] - V_{j,i}^{l,-l} \right] \\
& + \delta \int \left[\max \left[V_j^l, V_{j,i}^{l,-l} \left(z' \right) \right] - V_{j,i}^{l,-l} \right] dG\left(z' \right),
\end{aligned}
$$

Go back

The Surplus of Marriage

- is independent of income due to quasi-linearity of the utility function.
- is strictly increasing in z.

$$
\begin{aligned}
\left[r+\delta+q_i+q_j\right] S_{ij}^{-ll}\left(z\right) &= \left(\xi_{y,x}+\xi_{x,y}\right) z X_{ij}^{-ll} - \xi_y X_i^{-l} - \xi_x X_j^{l} \\
\textit{Gains from search for } i \quad & +\sigma_{i,j}^{-l,l} c'\left(\sigma_{i,j}^{-l,l}\right) - c\left(\sigma_{i,j}^{-l,l}\right) - \sigma_i^{-l} c'\left(\sigma_i^{-l}\right) + c\left(\sigma_i^{-l}\right) \\
\textit{Gains from search for } j \quad & +\sigma_{j,i}^{l,-l} c'\left(\sigma_{j,i}^{l,-l}\right) - c\left(\sigma_{j,i}^{l,-l}\right) - \sigma_j^{l} c'\left(\sigma_j^{l}\right) + c\left(\sigma_j^{l}\right) \\
& +q_i \max\left[0, S_{ij}^{ul}\left(z\right)\right] + q_j \max\left[0, S_{ij}^{-lu}\left(z\right)\right] \\
& -\beta_y \sum\nolimits_j \sum\nolimits_l \lambda^{-ll} s_j^{l} \int \max\left[S_{ij}^{-ll}\left(z'\right), 0\right] dG\left(z'\right) \\
& -\beta_x \sum\nolimits_i \sum\nolimits_{-l} \lambda^{-ll} s_i^{-l} \int \max\left[S_{ij}^{-ll}\left(z'\right), 0\right] dG\left(z'\right) \\
& +\delta \int \max\left[S_{ij}^{-ll}\left(z'\right), 0\right] dG\left(z'\right),
\end{aligned}
$$

Solution Method

- Linear grids with, 1×1, 4×4, 5×5, 20×20 nodes.
- Three fixed point systems, alternating solution algorithm.
  1. Initialize the model.
  2. Find fixed point of first system of equations:
     - 16 integrated surplus equations.
  3. Find fixed point of second system of equations:
     - Compute reservation wages and search intensities.
     - Find the z_{ij}^{ll} thresholds at the point where the surplus is zero.
  4. z_{ij}^{ll} determine $\alpha_{ij}^{ll} \equiv \left(1 - G\left(z_{ij}^{ll}\right)\right)$, which determine m_{ij}^{ll}.
  5. Use flow equations and exog. distributions of i, j to find s_i^l, s_j^l.
  6. Go back to step 2. Repeat until convergence.

Go back

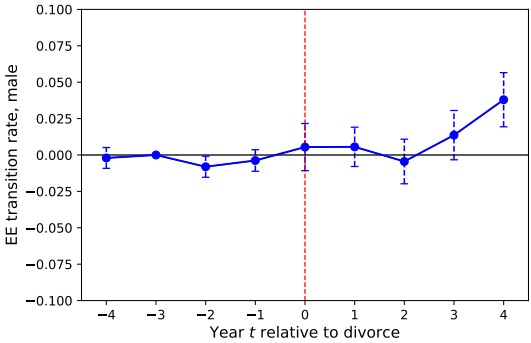
Yearly transition probability - Example

$$
\begin{aligned}
\Pr\left[s_j^u \to \sum\nolimits_i \sum\nolimits_{-l} m_{ij}^{-le}\right] &= \int_0^1 \lambda_j^u e^{-\lambda_j^u t} dt \int_0^1 \tau_j^u e^{-\tau_j^u t} dt \\
&\quad + \int_0^1 \tau_j^u e^{-\tau_j^u t} \left(\int_t^1 \lambda_j^e e^{-\lambda_j^e x} dx - \int_t^1 \lambda_j^u e^{-\lambda_j^u x} dx \right) dt \\
&\quad + \int_0^1 \lambda_j^u e^{-\lambda_j^u t} \left(\int_t^1 \widehat{\tau}_{j,i}^{u,-l} e^{-\widehat{\tau}_{j,i}^{u,-l} x} dx - \int_t^1 \tau_j^u e^{-\tau_j^u x} dx \right) dt, \\
&= \frac{\tau_j^u}{\lambda_j^e + \tau_j^u} \left(1 - e^{-\left(\lambda_j^e + \tau_j^u\right)}\right) - \left(1 - e^{-\tau_j^u}\right) e^{-\lambda_j^e} \\
&\quad + \frac{\lambda_j^u}{\lambda_j^u + \widehat{\tau}_{j,i}^{u,-l}} \left(1 - e^{-\left(\lambda_j^u + \widehat{\tau}_{j,i}^{u,-l}\right)}\right) - \left(1 - e^{-\lambda_j^u}\right) e^{-\widehat{\tau}_{j,i}^{u,-l}}.
\end{aligned}
$$

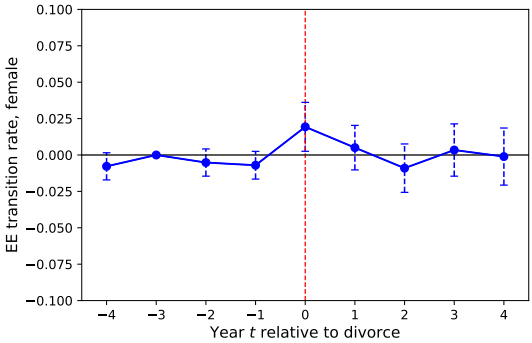
Go back

Event Study: EE Rate around Divorce

Male



Female



- Relative to matched control group: no divorce, matched in $t-3$.