math+econ+code
Collective models, marriage markets and matching

Simon Weber

University of York

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- Families, and not only individuals anymore, have become central in the economic literature
- They are a key unit of analysis for understanding earning dynamics, labour force participation, child development and skill formation, inequalities and ultimately economic development and growth

1. How do households form?

2. How do households make decisions?

- Who marries with Whom?
- Matching models are the obvious candidate to answer this question
- Why so obvious?
  - Becker, 1991, p.81: "the phrase marriage market is used metaphorically and signifies that the mating of human populations is highly systematic and structured"
  - Marriage is a particularly appealing example: bipartite, bilateral, one-to-one matching market with partial assignment.
- Why do we care?
  - Curiosity: assortativeness in education? age? potential wage? race?
  - (Between-households) inequality: Burtless (1999), Greenwood and al. (2015), Eika and al. (2019), Ciscato and Weber (2020).

- How do households make decisions?
- The "old" unitary models assumed that households maximize a unitary household utility function
- But households do not have utility functions, only individuals do $\Longrightarrow$ collective models

- Collective models (Chiappori 1988; Browning, Chiappori and Weiss 2014) assume instead that household members bargain and take Pareto-efficient decisions
- These models have become a standard toolbox for economic research on the family
- What's the appeal of collective models?
  - Power matters: the intra-household allocation of bargaining power shapes critical household decisions such as labour market participation, fertility, investment in public goods, etc.
  - (Within-households) inequality and indifference scales

- What do matching models have to do with this?
- In collective models, both the allocation of power ($\Rightarrow$ unknown function of prices, income and distribution factors) and household formation are taken as given
- Chiappori (2017): "The next step, obviously, would be an "upstream" theory that would *endogenize* both household composition ("who marries whom") and the resulting intrahousehold allocation of power"
- Can matching models be the answer?

- Seems appealing to bring together collective models and matching models
- Becker (1973): "I know of only highly impressionistic evidence on the effects of the sex ratio, or for that matter any other variable, on the division of output between mates. This division usually has not been assumed to be responsive to market forces, so that no effort has been put into collecting relevant evidence."
- A few notable attempts (Choo and Seitz, 2013; Chiappori, Costa-Dias and Meghir, 2017; Cherchye, Demuynck, De Rock, and Vermeulen, 2017 among others) but not entirely successful because
  1. we want imperfectly transferable utility (Galichon, Kominers and Weber (GKW), 2019)
  2. we want to keep things tractable

- There is a population of men indexed by $i \in \mathcal{I}$ and women indexed by $j \in \mathcal{J}$. Let x_i be the (observable) type of man i and y_j the (observable) type of woman j.

- Let $\mathcal{X}$ and $\mathcal{Y}$ be the sets of types of men and women, respectively. Denote $\mathcal{A} = \mathcal{X} \times \mathcal{Y}$ be the set of all possible pairs of types (i.e. "households")

- Let μ_{xy} denote the mass of couples of type xy, μ_{x0} the mass of single men of type x and μ_{0y} the mass of single women of type y

- If there is a mass n_x of men of type x and a mass m_y of women of type y, then a matching must satisfy the accounting constraints

$$\mu_{x0} + \sum_y \mu_{xy} = n_x$$

$$\mu_{0y} + \sum_x \mu_{xy} = m_y$$

- Denote c^a_{xy} and c^b_{xy} the amount (scalar) of private consumption that the man and the woman get, respectively, in household xy.
- Denote q^a_{xy} and q^b_{xy} the vectors of private goods that the man and the woman get, respectively, in household xy. Let Q_{xy} be the vector of public goods chosen in household xy. Let p and P be the vector of prices for the private goods and public goods, respectively. Let B_{xy} be the total income of pair xy.
- Let $U_{xy}(.)$ and $V_{xy}(.)$ be the utility functions of the man and the woman, respectively (when in household xy).
- Sometimes we drop the subscripts xy
- In applications, we often parametrize the utility functions by θ so that we work with $U^\theta_{xy}(.)$ and $V^\theta_{xy}(.)$ and we look to estimate θ.

Collective models

- Preferences may be given by $U(q^a, q^b, Q)$ and $V(q^a, q^b, Q)$
  - Egotistic: $U(q^a, Q)$ and $V(q^b, Q)$
  - Caring: $W^a(U(q^a, Q), V(q^b, Q))$ and $W^b(U(q^a, Q), V(q^b, Q))$

- In the classical unitary model, the household maximizes

$$\tilde{U}(q, Q) = W[U(q, Q), V(q, Q)]$$

where $q = q^a + q^b$ and $P'Q + p'q = B$ and where W is a fixed weighting function

- In the unitary framework, the maximization programs yields to standard demand function, that satisfy Slutsky conditions and income pooling.

- Collective models relies on the following two axioms.
- **Axiom 1.** Each household is characterized by a unique decision process
- **Axiom 2.** The outcome of the decision process is always efficient.

- Assuming a strictly concave representation of utility, we can model efficiency in the following way

$$\max_{Q,q^a,q^b} \tilde{\lambda}(P,p,B,z)U(q^a,q^b,Q) + V(q^a,q^b,Q)$$

$$\text{st } P'Q + p'q \leq B$$

where $\tilde{\lambda}(P,p,B,z)$ is the Pareto weight, a well defined function of prices, income and distribution factors.

- Pareto weights are a measure of bargaining power.

- The z's are distribution factors (variables that affect decision process but not preferences or budget constraints): divorce laws, ratio of wages, sex ratio $\rightarrow$ marriage market!

Table 4
Ratio of Children's to Men's Clothing Expenditures: Broad Income Measure

	Sample Time Period		
Variable	1973–76 1980–90	1973–76 1980–83	1980–83 1987–90
Children younger than 2	0.76 (1.2)	0.10 (0.1)	0.39 (0.3)
Children 2 to 4	−0.17 (0.4)	−0.47 (0.7)	−0.41 (0.6)
Two-child families	0.40 (2.0)	0.47 (2.0)	0.75 (3.1)
Three-child families	0.96 (4.2)	1.03 (3.7)	1.42 (5.4)
Late period X one-child (D_1)	0.11 (1.0)	0.11 (0.7)	0.12 (0.7)
Late period X two-child (D_2)	0.48 (4.8)	0.39 (3.0)	0.24 (1.7)
Late period X three-child (D_3)	0.55 (3.2)	0.52 (2.5)	0.44 (1.6)
Income/10	−0.12 (4.2)	−0.20 (3.3)	−0.17 (3.5)
Intercept	1.32 (4.8)	1.94 (4.0)	1.83 (3.8)
R^2	0.59	0.52	0.61
H_0	0.0005	0.0024	0.23
Observations	181	118	82

Notes: Figures in parentheses are *t* values. H_0 denotes the level at which the joint hypothesis $D_1 = D_2 = D_3 = 0$ is significant. "Observations" is the number of cell means used in the regression.

Lundberg, Pollak, Wales (1997)

Bridging the gap: a simple example

- Let's consider the simplest collective model we can think of
- Suppose that a man of type x and a woman of type y marrying together share total income B_{xy}
- They share this income into (private) consumption for the man c^a_{xy} and for the woman c^b_{xy}, so that

$$c^a_{xy} + c^b_{xy} = B_{xy}$$

- Suppose the husband and the wife receive utility

$$u = \alpha_{xy} + \tau \log c^a_{xy}$$
$$v = \gamma_{xy} + \tau \log c^b_{xy}$$

respectively, where α and γ capture non economic gains to marriage.

- Inverting the previous equations, we obtain

$$c^a_{xy} = \exp\left(\frac{u - \alpha_{xy}}{\tau}\right)$$
$$c^b_{xy} = \exp\left(\frac{v - \gamma_{xy}}{\tau}\right)$$

- The (frontier of the) bargaining set, that is, the set of the feasible (Pareto-efficient) utility allocations (u, v), is fully characterized by the equation

$$\exp\left(\frac{u - \alpha_{xy}}{\tau}\right) + \exp\left(\frac{v - \gamma_{xy}}{\tau}\right) = B_{xy}$$

- Recall that for a proper bargaining set $\mathcal{F}_{xy}$ and utility allocation (u, v), the distance-to-frontier function is defined as

$$D_{\mathcal{F}_{xy}}(u, v) = \min\{z \in \mathbb{R} : (u - z, v - z) \in \mathcal{F}_{xy}\}$$

- In our example, we are looking for z such that

$$\exp\left(\frac{u-z-\alpha_{xy}}{\tau}\right)+\exp\left(\frac{v-z-\gamma_{xy}}{\tau}\right)=B_{xy}$$

- We get the distance function

$$D_{xy}(u,v)=\tau\log\left(\frac{\exp\left(\frac{u-\alpha_{xy}}{\tau}\right)+\exp\left(\frac{v-\gamma_{xy}}{\tau}\right)}{B_{xy}}\right)$$

- Note that with $B_{xy}=2$, this is exactly the ETU model!

- Now we are in business, and we can try to estimate θ, which in this particular example consists of τ and everything that's in α and γ.

- Let us add logit heterogeneities to this model, so that we are in the ITU-logit case (see GKW). In this case, equilibrium is fully characterized by the set of nonlinear equations

$$\mu_{x0} + \sum_y \exp(-D^\theta_{xy}(-\log \mu_{x0}, -\log \mu_{0y})) = n_x$$

$$\mu_{0y} + \sum_x \exp(-D^\theta_{xy}(-\log \mu_{x0}, -\log \mu_{0y})) = m_y$$

- To estimate θ, we can maximize an objective function (e.g. a likelihood)

$$\max_{\theta, \mu_{x0}, \mu_{0y}} F(\theta, \mu_{x0}, \mu_{0y})$$

subject to the equilibrium constraints above

- This is a mathematical program under equilibrium constraints (MPEC) approach

- The ETU model is a good starting point to understand the bridge that exists between collective models and matching models
- It is also very simple and gives us hints about the challenges when using more complicated models

Generalization and challenges

What challenges?

1. Given a collective model, is the resulting bargaining set proper?

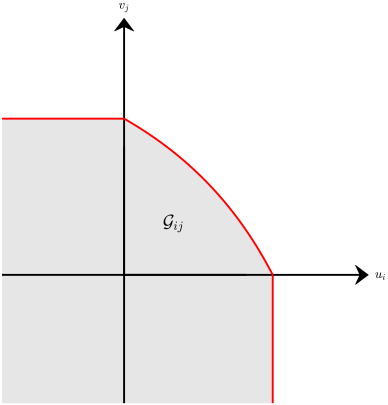
2. How can we keep things tractable?
   - ...when preferences are more general
   - ...when there are more private goods
   - ...when there are public goods
   - ...when there are many types on the market

- The bargaining sets are not given. They must be constructed from whatever (collective) model we have in mind
- Whenever man x meet woman y, they bargain and choose an allocation of goods ω from a feasible set Ω_{xy}
- A typical element of Ω_{xy} is an allocation $\omega = (q^a, q^b, Q)$
- Preferences are egotistic and represented by the utility functions $U_{xy}(q^a, Q)$ and $V_{xy}(q^b, Q)$, for men and women respectively.

- **Assumption 1**: The set of feasible good allocations, denoted Ω, is compact and convex.
- **Assumption 2**: Preferences are represented by utility functions U and V that are upper semi continuous and bounded above on Ω and strictly increasing.
- **Assumption 3**: Agents have free disposal of utility
- In that case, we can construct the utility possibility set is

$$\mathcal{G} = \{(u,v) : \exists (q^a, q^b, Q) \in \Omega : u \leq U(q^a, Q), v \leq V(q^b, Q)\}$$

$\Longrightarrow$ The bargaining set $\mathcal{G}$ associated with (Ω, U, V) is a proper bargaining set, and a boundary point of $\mathcal{G}$ is weakly Pareto-efficient.


v_j
$\mathcal{G}_{ij}$
u_i

- Let us discard the free disposal utility assumption, and introduce the usual utility possibility set

$$\mathcal{H} = \{(u, v) : \exists (q^a, q^b, Q) \in \Omega : u = U(q^a, Q), v = V(q^b, Q)\}$$

- We need to provide the following two results:
(i) if $\mathcal{H}$ is a proper bargaining set, then a boundary point is Pareto efficient
(ii) $\mathcal{H}$ is indeed a proper bargaining set.

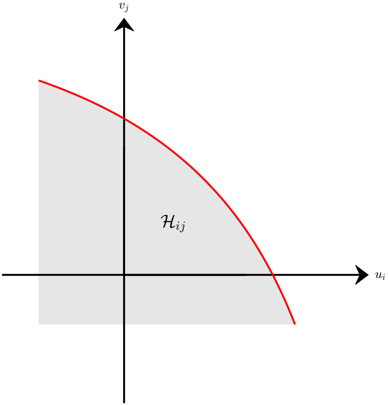
- **Assumption 4**: If $(q^a, q^b, Q) \in \Omega$ and $q^a_k > 0$ for some private good k, then for any $q^{a'}$ such that $q^{a'}_{-k} = q^a_{-k}$, $q^{a'}_k < q^a_k$ and $(q^{a'}, q^b, Q) \in \Omega$, there is a $q^{b\prime}$ and some private good l such that $q^{b\prime}_{-l} = q^b_{-l}$, $q^{b\prime}_l > q^b_l$ and $(q^{a'}, q^{b\prime}, Q) \in \Omega$.

- **Assumption 5**: U and V are strictly quasi-concave

$\Longrightarrow$ Whenever the set $\mathcal{H}$ is a proper bargaining set, a boundary point (u, v) of $\mathcal{H}$ is strongly Pareto efficient.

- **Assumption 6**: There exists two private goods, q_1^a and q_1^b such that
(i) $\lim_{q_1^a \to 0^+} U(q^a, Q) = -\infty$ and $\lim_{q_1^b \to 0^+} V(q^b, Q) = -\infty$
(ii) for any $(q^a, q^b, Q) \in \Omega$, $((q_1^{a'}, q_{-1}^a), (q_1^{b\prime}, q_{-1}^b), Q) \in \Omega$ whenever $q_1^{a'} \leq q_1^a$ and $q_1^{b\prime} \leq q_1^b$

$\Longrightarrow$ the set $\mathcal{H}$ associated with (Ω, U, V) is a proper bargaining set


v_j
$\mathcal{H}_{ij}$
u_i

To sum up: Under Assumption 1, 2, 4, 5 and 6, the bargaining set $\mathcal{H}$ is a proper bargaining set and any point on the boundary of $\mathcal{H}$ is strongly Pareto efficient. The underlying collective model is said to be *proper*.

- Let us go back to the ETU model, and consider the following variation:

$$u = \alpha_{xy} + \tau_a \log c^a_{xy}$$
$$v = \gamma_{xy} + \tau_b \log c^b_{xy}$$

- If $\tau_a \neq \tau_b$, then already we don't have a close form solution for the distance function!

- In general, adding more private goods to the model does not create too much difficulty thanks to a decentralization result from the collective model literature.

- Theorem. Assume that the allocation $(\hat{q}^a, \hat{q}^b)$ is pareto efficient, and define $\rho^a = p'\hat{q}^a$ and $\rho^b = B - \rho^a = p'\hat{q}^b$. We have

$$\begin{array}{l} \hat{q}^a \text{ solves } \max U(q^a) \; st \; p'q^a = \rho^a \\ \hat{q}^b \text{ solves } \max V(q^b) \; st \; p'q^b = \rho^b \end{array}$$

  Conversely, for any sharing rule (ρ^a, ρ^b), if $(\hat{q}^a, \hat{q}^b)$ solves respectively the two previous individual programs, then $(\hat{q}^a, \hat{q}^b)$ is Pareto efficient. **[See Browning, Chiappori, Weiss, 2014]**

- The sharing rule (usually rewritten as $\rho^b/(\rho^a+\rho^b)$) is frequently used as a measure of bargaining power, easier to interpret than the Pareto weight
- Let $\tilde{U}$ and $\tilde{V}$ be the indirect utility functions (functions of the sharing rules ρ^a and ρ^b respectively, ignoring prices). Then the set of utility allocations (u,v) located on the frontier is described by the equation

$$\tilde{U}^{-1}(u)+\tilde{V}^{-1}(v)=B$$

- To find the distance to the frontier, we solve for z such that

$$\tilde{U}^{-1}(u-z)+\tilde{V}^{-1}(v-z)=B$$

- With public goods, we could still try to make use of the following decentralization result, as the cost of introducing Lindhal prices.

- Theorem. Assume that $(\hat{Q}, \hat{q}^a, \hat{q}^b)$ is efficient. Then there exists a ρ and two personal prices vectors for the public goods P^a and P^b with $P^a + P^b = P$ such that

$$(\hat{Q}, \hat{q}^a) \text{ solves } \max U(q^a, Q) \; st \; p' q^a + P^a Q = \rho$$
$$(\hat{Q}, \hat{q}^b) \text{ solves } \max V(q^b, Q) \; st \; p' q^b + P^b Q = B - \rho$$

  [See Browning, Chiappori, Weiss, 2014]

- Of course, we have no idea what these Lindhal prices are, so we are back to square one.

- We could try to work with the conditional sharing rule instead, and make use of the following result instead.
- Theorem. Suppose that $(\hat{Q}, \hat{q}^a, \hat{q}^b)$ is an efficient allocation, and denote $s^a = p'\hat{q}^a$ and $s^b = p'\hat{q}^b$, called the conditional sharing rules with $s^a + s^b = B - P'\hat{Q}$. Then $\hat{q}^a$ and $\hat{q}^b$ solve respectively

$$\max_q U(q, \hat{Q}) \; st \; p'q = s^a$$

$$\max_q V(q, \hat{Q}) \; st \; p'q = s^b$$

[See Browning, Chiappori, Weiss, 2014]

- How does that help us?
- Consider a simple example in which the public good is discrete (e.g. the number of children). Let $g \in \mathcal{G}$ denote public good consumption and let g be discrete.
- Consider the following variation of the ETU model

$$u = \alpha_{xy}(g) + \tau \log c_{xy}^{a}$$
$$v = \gamma_{xy}(g) + \tau \log c_{xy}^{b}$$

- Let the budget constraint be

$$c_{xy}^{a} + c_{xy}^{b} = B_{xy}(g)$$

- It follows from Lemma 2 in GKW that the distance-to-frontier function is given by

$$D_{xy}\left(u,v\right) = \min_{g \in \mathcal{G}} \left\{ \tau \log \left(\frac{\exp\left(\frac{u-\alpha_{xy}(g)}{\tau}\right) + \exp\left(\frac{v-\gamma_{xy}(g)}{\tau}\right)}{B_{xy}\left(g\right)} \right) \right\}.$$

see example in notebook

Suppose we are equipped with a proper collective model. For ease of exposition, let us assume that the constraints a household xy is facing can be written as

$$g_{xy}^{r}(q_{xy}^{a}, q_{xy}^{b}, Q_{xy}) \leq 0,\ r \in \{1, ..., R\}$$

where $\{g_{xy}^{r}\}_{r\in\{1,...,R\}}$ are convex functions.

To compute the distance from any given point (u, v), we can solve

$$\min_{z_{xy}, q_{xy}^{a}, q_{xy}^{b}, Q_{xy}} z_{xy} \tag{1}$$

$$\begin{aligned} s.t\ u - z_{xy} &= U_{xy}^{\theta}(q_{xy}^{a}, Q_{xy}) \\ v - z_{xy} &= V_{xy}^{\theta}(q_{xy}^{b}, Q_{xy}) \qquad (2) \\ g_{xy}^{r}(q_{xy}^{a}, q_{xy}^{b}, Q_{xy}) &\leq 0,\ r \in \{1, ..., R\} \end{aligned}$$

where θ is a vector of parameters (that what we usually want to estimate). We have $D_{xy}^{\theta}(u, v) = z_{xy}^{*}$, solution to the above program.

When all else fails, we can use this method. What are the advantages (asides from the fact that it always works)?

1. It is "stackable". Let $\mathcal{A}_1, ..., \mathcal{A}_K$ be a partition of $\mathcal{A}$. We can obtain the distance functions for all xy pairs in $\mathcal{A}_k$ at once by solving

$$\min_{\{z_{xy}, q^a_{xy}, q^b_{xy}, Q_{xy}\}_{xy \in \mathcal{A}_k}} \sum_{xy \in \mathcal{A}_k} z_{xy}$$

   subject to the constraints for all the xy pairs in $\mathcal{A}_k$.

2. It can be parallelized. We can ask worker k to solve for the distance functions for all xy in $\mathcal{A}_k$, as above.

3. It provides the gradient at very little cost. We can use the envelope theorem to get the derivative of the distance function with respect to (u, v, θ).

To hammer home the link with collective models, we have the following result.

Theorem. Suppose we are equipped with a proper collective model and associated (proper) bargaining set $\mathcal{H}_{xy}$. Suppose that Ω_{xy} is characterized by a set of feasibility constraints $g^r_{xy}(q^a_{xy}, q^b_{xy}, Q_{xy}) \leq 0,\ r \in \{1, ..., R\}$, where $\{g^r_{xy}\}$ are convex functions. Then

(i) given u, v and θ, the allocation $q^{a\star}_{xy}, q^{b\star}_{xy}, Q^{\star}_{xy}$ solution to the brute force method is Pareto efficient.

(ii) in addition, the Pareto weights associated to the boundary point $(u - z^\star, v - z^\star)$ (reached via the allocation of goods $q^{a\star}_{xy}, q^{b\star}_{xy}, Q^{\star}_{xy}$) for the man and the woman are, respectively, the Lagrange multipliers $\lambda^\star_1$ and $\lambda^\star_2$ associated to the first two constraints in (2). $\lambda^\star_1$ and $\lambda^\star_2$ also satisfy $\lambda^\star_1 + \lambda^\star_2 = 1$

- Finally, let us explore a bit more the connection between the distance-to-frontier function and the Pareto weight $\tilde{\lambda}$
- Recall that any allocation (u, v) on the frontier satisfies

$$D(u, v) = 0$$

- Implicitly, the above equation defines the mapping $u \mapsto \psi(u)$ with

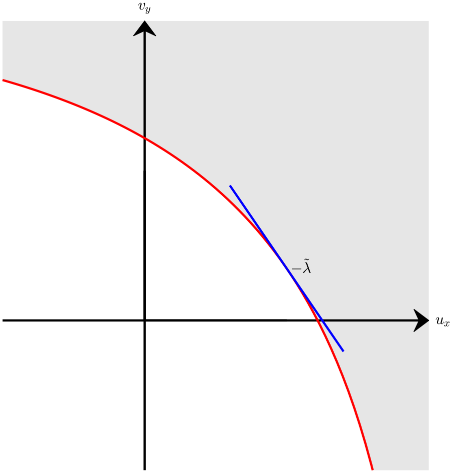
$$D(u, \psi(u)) = 0$$

- Differentiating along the frontier, we get

$$-\partial_u \psi = \frac{\partial_u D}{\partial_v D}$$

where $-\partial_u \psi$ is nothing else than the Pareto weight $\tilde{\lambda}$!

Figure: Bargaining set and Pareto weight



Application

- I construct a marriage market representative of the US population using PSID data from 1970 to 2017.
- Singles and couples derive utility from the consumption of a private composite good (c, whose price is normalized to 1), leisure (ℓ) and the public consumption of a home-produced good (Q).
- All agents can spend time on the labor market, in which case they earn a hourly wage denoted w. The total time endowment is T.
- Singles have the same preferences as married, but the production technology for the public good is different
- Preferences are allowed to vary by education level: Non-College and College

For singles, the public good is produced from time spent on housework, h, according to the production function

$$Q = \tilde{\zeta} h$$

Consequently, a single man of type $x \in \mathcal{X}$ faces the following maximization program

$$\begin{aligned} \max_{c_x^s, \ell_x^s, h_x^s} a_{e(x)} \log c_x^s + \alpha_{e(x)} \log \ell_x^s + A_{e(x)} \log \tilde{\zeta} h_x^s & \\ \text{s.t } c_x^s + (\ell_x^s + h_x^s) w_x &\leq T w_x \\ \ell_x^s + h_x^s &\leq T \end{aligned}$$

In similar fashion, a single woman of type $y \in \mathcal{Y}$ solves

$$\begin{aligned} \max_{c_y^s, \ell_y^s, h_y^s} b_{e(y)} \log c_y^s + \beta_{e(y)} \log \ell_y^s + A_{e(x)} \log \tilde{\zeta} h_y^s & \\ \text{s.t } c_y^s + (\ell_y^s + h_y^s) w_y &\leq T w_y \\ \ell_y^s + h_y^s &\leq T \end{aligned}$$

The preferences of married individuals are given as follows

$$\mathcal{U}_{xy}(c^a_{xy}, \ell^a_{xy}, Q_{xy}) = \delta^a_{xy} + a_{e(x)} \log c^a_{xy} + \alpha_{e(x)} \log \ell^a_{xy} + A_{e(x)} \log Q_{xy} \tag{3}$$
$$\mathcal{V}_{xy}(c^b_{xy}, \ell^b_{xy}, Q_{xy}) = \delta^b_{xy} + b_{e(y)} \log c^b_{xy} + \beta_{e(y)} \log \ell^b_{xy} + B_{e(y)} \log Q_{xy} \tag{4}$$

where

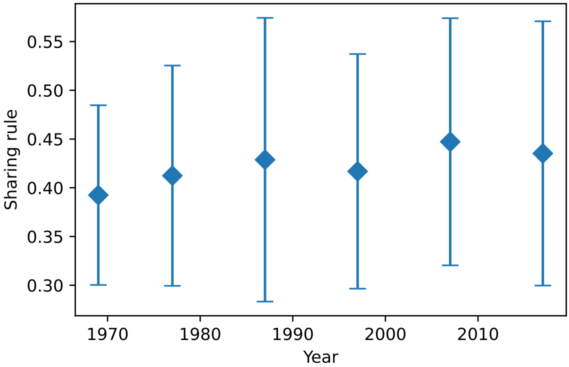
$$Q_{xy} = \zeta (h^a_{xy})^{\eta} (h^b_{xy})^{(1-\eta)}$$

They face the constraints

$$c^a_{xy} + c^b_{xy} + (\ell^a_{xy} + h^a_{xy}) w_x + (\ell^b_{xy} + h^b_{xy}) w_y \leq T(w_x + w_y) \tag{5}$$
$$\ell^a_{xy} + h^a_{xy} \leq T \tag{6}$$
$$\ell^b_{xy} + h^b_{xy} \leq T \tag{7}$$

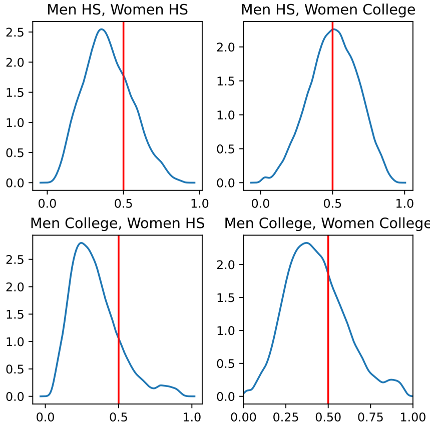
- We add logit heterogeneities to the utilities specified on the previous slides, so that we end up with our familiar ITU-logit framework
- Estimation proceeds as usual (see slide on estimation in the ETU example)
- In addition to marriage patterns, we fit housework and leisure time in the objective function

Figure: Sharing Rule



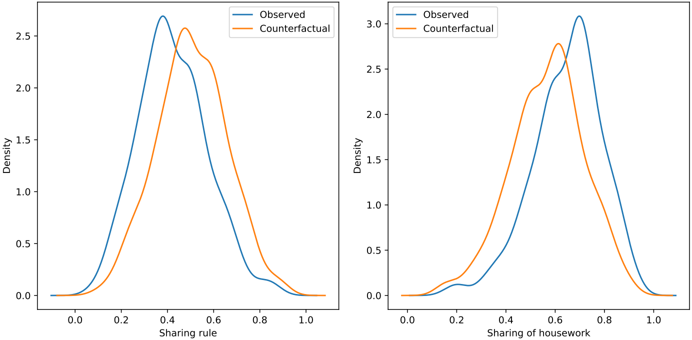
This figure shows the distribution of the sharing rule (the share of women's consumption in total consumption) over all observed couples for each marriage market. The diamond marker indicates the mean unconditional sharing rule while the bottom and top caps indicate the first and third quartile of the distribution of the unconditional sharing rule, respectively.

Figure: Sharing Rule



This figure shows the distribution of the sharing rule in 2017 over all (i, j) pairs, conditioning on the education levels of the husband and the wife. The husband education level is displayed in rows, the one of the wife in columns.

Figure: Counterfactual (closing gender wage gap) sharing rule and housework sharing



This figure shows the distribution of the sharing rule and the sharing of housework time in the 2017 marriage market and in the counterfactual marriage market. The counterfactual corresponds to a closing of the gender wage gap.

If you are interested in doing a PhD at the University of York (a top-10 UK university) on any topic related to family economics and/or matching, please check out

`https://www.york.ac.uk/economics/postgrad/research-degrees`

You can apply at any time of the year, and there many funding opportunities available

If you have any questions, please feel free to contact me

simon.weber@york.ac.uk