DEUTSCHE BUNDESBANK EUROSYSTEM

Love and money with inheritance: marital sorting by labor income and inherited wealth in the modern partnership

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Etienne Pasteau (Paris School of Economics)
Junyi Zhu (Deutsche Bundesbank)
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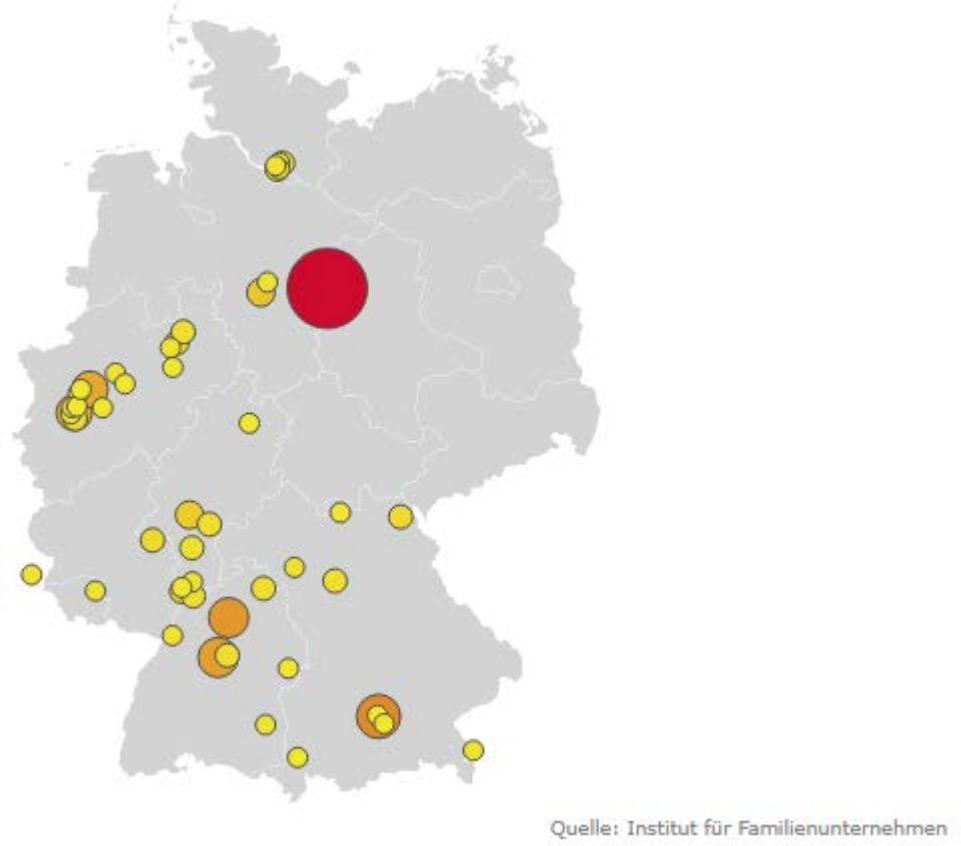
Not only love and money but also with inheritance

- "*Ich liebe sie, aber es macht mein Glück und meinen Stolz desto größer, dass ich, indem sie mein eigen wird, gleichzeitig unserer Firma einen bedeutenden Kapitalzufluss erobere.", Die Buddenbrooks,* Thomas Mann (1901)
- Eugène de Rastignac in *La Comédie humaine* by Honoré de Balzac (1799–1850).
- *Gianni Schicchi* by Giacomo Puccini (1917) – love without money but with "redistributed inheritance"
- *Dream of the Red Chamber* by Cao Xueqin *(1791)* – disparity wider in power than in resource for top class

Family business’s sorting in neigborhood



German top family businesses cluster geographically by industries:

- Hamburg with trading houses - Otto Group and Maxingvest AG (Tchibo and Beiersdorf)
- Rhein-Main area with chemical/ pharmaceutical companies - Fresenius, Boehringer Ingelheim, Merck, Heraeus…
- South with mechanical engineering sectors – (you all know..)

Link: http://www.spiegel.de/wirtschaft/unternehmen/deutsche-familienunternehmen-die-top-50-a-1041800.html

Marital sorting: two by two -> four by four

Assortative mating on income: “Love at first sight happens in the diagonal” (Bozon, Héran 1987)

	Bottom 50% labor income WIFE	Top 50% labor income WIFE
Bottom 50% labor income HUSBAND	11.26%	-11.10%
Top 50% labor income HUSBAND	-10.96%	10.80%

Combining inheritance and current labor income

		Non-heiress (inheritance section + exp+ HF)		Heiress (inheritance section + exp+ HF)	
		Bottom 50% labor income WIFE	Top 50% labor income WIFE	Bottom 50% current labour income WIFE	Top 50% labor income WIFE
Non-heir (inheritance section + exp+ HF)	Bottom 50% labor income HUSBAND	**23.74%**	**-0.61%**	**-19.66%**	**-36.34%**
	Top 50% labor income HUSBAND	**-7.48%**	**15.18%**	**-28.72%**	**8.74%**
Heir (inheritance section + exp+ HF)	Bottom 50% labor income HUSBAND	**-14.69%**	**-27.06%**	**75.11%**	**28.37%**
	Top 50% labor income HUSBAND	**-31.45%**	**-13.54%**	**60.15%**	**50.12%**

Nowadays strong sorting by inheiritance; the assortative mating on income does not seem to compensate the disassortative mating on inherited wealth

Our paper

Selection and investment in preferences as complementary in developing ***Spirit of Capitalism –*** Doepke and Zilibotti (2008)

*„**Capital is back**“ – Piketty, 2014*

Pioneered by Frémeaux (2014) in discussing France, we also study the distribution of sorting by inherited wealth as well as the substitutability of ***acquired and inherited traits***.

Using the ***individualized inheritance*** uniquely (partially) available in PHF (Panel on Household Finance).

Sequential love and money tradeoff as an extension of Fernández, Guner and Knowles (2005) - we develop a stylized multidimensional matching model which perfectly replicates the sorting pattern observed using marginal distributions of these two traits from either gender.

Our estimate suggests inheritance accounts for ***two and a half times more than*** labor income in marriage choice.

Aristocratic marriage is back- risk ratio

$$RR_{T,Wife} = \frac{P(\text{husband in top T\%} | \text{wife in top T\%})}{P(\text{husband in top T\%} | \text{wife in bottom } (100 - T)\%)}$$

Frémeaux (2014) with French Data-

T	Inheritance	Current Income	Permanent Income
10	3.29***	1.56***	2.14***
5	3.58***	2.00***	2.86***

Results from PHF: similar for Germany !

	Inheritance				
T	Case 0	Case 1	Case 2	Current Income	Permanent Income - Wage Rate
10	4.33***	2.99***	3.10***	1.66***	1.50*
5	7.19***	2.18***	2.02**	2.39***	2.11**

All the more striking is that German aristocratic wealth has been more negatively impacted by WWII, less social stratification and decades of communism for half of the country.

Old Germans are less likely to be heirs

Schinke (2014): inheritance in 2011 represented almost 11% of annual income in Germany and around 15% of annual income in France.

Share of households with inheritance (Westermeier, Tiefensee and Grabka, 2016)

	I. Core European countries			
	Austria	Belgium	France	West Germany
All households	35.7	31.7	39.9	38.1
Age classes				
21–35	22.9	16.1	24.8	22.3
35–44	34.8	25.3	32	36.1
45–54	38.6	29.2	38.3	46.8
55–64	44.4	43	51.7	46.2
65–74	37.1	40	51.9	39.9
75 and older	35.1	42.2	46.1	33.5
Income quintiles				
1st quintile	26.2	25.3	31.0	24.6
2nd quintile	29.7	32.5	33.8	32.2
3rd quintile	34.3	27.6	38.2	37.6
4th quintile	38.0	35.0	43.1	44.6
5th quintile	50.3	37.9	53.2	51.8
Sample size	2,337	2,307	14,929	2,826
Weighted in Mio.	3.71	4.66	27.51	28.64

Literature

Marital sorting by inheritance and labor income: Fremeaux (2014)

Marital sorting and inequality: Burtless (1999), Schwartz (2010), Fernandez, Güner and Knowles (2005)

Intergenerational inequality: Atkinson (1975)

Substitutability/complementarity between inherited and acquired traits: Becker (1973, 1974), Charles et al. (2013)

Bozon and Héran (1988) on selection due to segregation on socialization place

Inheritance and wealth distribution: Kohli et al. (2006), Bönke, Corne, and Westermeier (2016), Westermeier, Tiefensee and Grabka (2016)

Data and methodology

Using family matrix, housing and inheritance section

Full sample: 2,472 couples (4,944 individuals out of the 8,825 persons above 16 of PHF wave 2)

Two robustness check subsamples:

- 1,989 working age with wage rate (no spouse is 65+ or retired -> avoiding the under- ranking of pension income, survival bias, female labor supply, life cycle effect)
- 2,554 West German only (test whether results are driven by East-West inheritance difference)

Labor income (employment, self-employment and public pension)

Different sources of inheritance and assigning rules / imputation of source for HMR inherited

Imputing the source of HMR inherited/expected inheritance

Not asked in the first two waves (will do it next wave) for couples living in HMR inherited (13.04% of the couples) – **case 0** (not accounting for inhertied HMR or expected inheritance)

Two rules to assign it to either man or woman in relationship:

- Random – **case 1**
- Probit prediction (ie. multinomial probit) – **case 2**

Inherited wealth distribution before and after imputation

Taking into account inherited main residence expands the proportion of heirs and heiresses, and increases significantly the quantiles thresholds. Moreover, both assignment strategies yield similar distributions.

	Case 0[1)]		Case 1		Case 2	
	Heirs	Heiresses	Heirs	Heiresses	Heirs	Heiresses
	(19.2%)[2)]	(20.2%)	(24.4%)	(25.05%)	(23.8%)	(25.0%)
p10	6,933	6,032	8,514	7,856	8,352	7,874
p20	14,137	14,126	20,011	17,339	20,000	17,324
Median	53,488	56,620	80,331	74,188	81,852	73,270
p80	205,380	166,250	253,137	225,085	250,368	221,840
p90	411,840	242,916	497,773	368,549	492,164	411,222
p95	712,500	362,416	829,621	560,937	854,400	578,540
p98	1,302,488	622,280	1,446,382	1,056,856	1,386,500	1,000,000
Mean	186,344	152,245	230,086	203,381	231,696	207,553

Empirical evidences

- Contingency table
- Risk ratio
- Substitutability

Contingency table – case 0 assignment

elative difference in cell proportion between observed and random

		Non-heiress (inheritance section only)		Heiress (inheritance section only)	
		Bottom 50% labor income WIFE	Top 50% labor income WIFE	Bottom 50% current labour income WIFE	Top 50% labor income WIFE
Non-heir (inheritance section only)	Bottom 50% labor income HUSBAND	22.67%	-2.27%	-39.24%	-40.69%
	Top 50% labor income HUSBAND	-3.39%	17.20%	-43.46%	-12.29%
Heir (inheritance section only)	Bottom 50% labor income HUSBAND	-25.14%	-44.89%	182.57%	96.44%
	Top 50% labor income HUSBAND	-53.86%	-20.13%	167.67%	124.75%

Contingency table – case 1 assignment

Relative difference in cell proportion between observed and random distribution of couples, with the random assignment of inherited housing

		Non-heiress (inheritance section+ random assignment of inherited housing)		Heiress (inheritance section+ random assignment of inherited housing)	
		Bottom 50% labor income WIFE	Top 50% labor income WIFE	Bottom 50% current labour income WIFE	Top 50% labor income WIFE
Non-heir (inheritance section+ random assignment of inherited housing)	Bottom 50% labor income HUSBAND	24.78%	-0.25%	-33.80%	-38.94%
	Top 50% labor income HUSBAND	-5.11%	16.71%	-32.56%	-3.04%
Heir (inheritance section+ random assignment of inherited housing)	Bottom 50% labor income HUSBAND	-17.11%	-38.55%	113.43%	54.31%
	Top 50% labor income HUSBAND	-42.78%	-14.41%	94.87%	75.75%

Contingency table – case 2 assignment

Close to case 1 assignment!

Relative difference in cell proportion between observed and random distribution of couples, with the probit-based assignment of inherited housing

		Non-heiress (inheritance section+ probit-based assignment of inherited housing)		Heiress (inheritance section+ probit-based assignment of inherited housing)	
		Bottom 50% labor income WIFE	Top 50% labor income WIFE	Bottom 50% current labour income WIFE	Top 50% labor income WIFE
Non-heir (inheritance section + probit-based assignment of inherited housing)	Bottom 50% labor income HUSBAND	22.04%	-1.57%	-24.79%	-36.01%
	Top 50% labor income HUSBAND	-5.33%	17.47%	-37.84%	0.26%
Heir (inheritance section + probit-based assignment of inherited housing)	Bottom 50% labor income HUSBAND	-17.17%	-34.23%	111.09%	44.79%
	Top 50% labor income HUSBAND	-36.17%	-17.36%	91.24%	69.52%

Not enough… expected inheritance added

Relative difference in cell proportion between observed and random distribution of couples, with the random assignment of inherited housing

		Non-heiress (inheritance section + exp+ HF)		Heiress (inheritance section + exp+ HF)	
		Bottom 50% labor income WIFE	Top 50% labor income WIFE	Bottom 50% current labour income WIFE	Top 50% labor income WIFE
Non-heir (inheritance section + exp+ HF)	Bottom 50% labor income HUSBAND	26.75%	1.14%	-30.09%	-39.07%
	Top 50% labor income HUSBAND	-6.73%	15.36%	-24.71%	2.36%
Heir (inheritance section + exp+ HF)	Bottom 50% labor income HUSBAND	-11.54%	-31.23%	75.84%	32.04%
	Top 50% labor income HUSBAND	-39.32%	-12.67%	67.29%	62.30%

Risk ratio - factors jointly affecting sorting and inheritance

Residence region: inheritance rich West vs inheritance poor East (22.5%/25.2% heirs/heiresses are from West and 11.6%/15.6% counterparts are from East) <- mating with the neighborhood partner

Age: heirs/heiresses are older (median age: heirs vs non-heirs – 57 vs 50 and heiresses vs non-heiresses – 55 vs 48) <- mating is more likely to happen within the same generation.

Education: heirs/heiresses have higher school education than non-heirs/non-heiressess: eg., 27.41% of the heirs have been to the Gymnasium whereas this is the case of only 19.98% of non-heirs <- mating in school and the same education triggers the like

Risk ratio

$$RR_{T,Wife} = \frac{P(\text{husband in top T\%}|\text{wife in top T\%})}{P(\text{husband in top T\%}|\text{wife in bottom } (100-T)\%)}$$

Advantage: three joint factors controlled - age, education and residence region

Risk ratios for the whole couples population, wives' perspective

	Inherited wealth									Labour income		
	Case 0[1]			Case 1			Case 2					
	Estimate[2]	Significance[3]	S.E.	Estimate	Significance	S.E.	Estimate	Significance	S.E.	Estimate	Significance	S.E.
Heir/Heiress	3.31	***	0.096	2.28	***	0.089	2.17	***	0.093			
Top20				2.21	***	0.106	2.05	***	0.111	1.64	***	0.168
Top10	4.05	***	0.152	2.92	***	0.239	2.95	***	0.184	1.96	***	0.289
Top5	6.70	***	0.258	2.15	***	0.262	1.88	***	0.291	2.49	**	0.555
Top2	4.70	***	0.594	4.08	***	0.480	4.58	***	0.802	3.17	***	0.671

Substitutability across distribution - DE

$$TopSpouse_j = \alpha + r \times \beta_1 TopInheritor_i + \beta_2 TopIncome_i + \gamma X_{ij} + u$$

Change in chance to mate a partner at the top 10, 5 and 2% of the inherited wealth or labor income distributions gained by the wives or husbands belonging to the same top distribution

	Wives' perspective						Husbands' perspective					
	Inheritance			Labor income			Inheritance			Labor income		
	Estimate[1)]	Significance[2)]	S.E.	Estimate	Significance	S.E.	Estimate	Significance	S.E.	Estimate	Significance	S.E.
Top 10 inherited wealth[3)]	0.169	***	0.017	0.067	***	0.020	0.165	***	0.016	0.044	*	0.024
Top 10 labor income	0.061	***	0.023	0.130	***	0.019	0.043	**	0.019	0.127	***	0.019
Difference	**0.109**	***	0.029	**-0.063**	**	0.026	**0.122**	***	0.028	**-0.082**	**	0.034
Top 5 inherited wealth	0.117	***	0.017	0.052	***	0.015	0.112	***	0.017	0.019		0.016
Top 5 labor income	0.032	*	0.018	0.094	***	0.017	0.044	***	0.017	0.096	***	0.017
Difference	**0.078**	***	0.026	**-0.042**	*	0.023	**0.068**	***	0.026	**-0.078**	***	0.026
Top 2 inherited wealth	0.041	***	0.010	0.017		0.016	0.041	***	0.010	0.001		0.011
Top 2 labor income	-0.001		0.011	0.053	***	0.015	0.019		0.013	0.049	***	0.013
Difference	**0.043**	***	0.017	**-0.036**		0.023	**0.023**		0.017	**-0.048**	***	0.018

France vs Germany

Substitutability analysis in Frémeaux (2014)

	Panel A: Male partners		Panel B: Female partners	
	Inheritance	Permanent income	Inheritance	Permanent income
Top 10% inheritance [1]	0.200***	0.041***	0.203***	0.059***
	(0.000)	(0.000)	(0.000)	(0.000)
Top 10% permanent income [2]	0.067***	0.285***	0.052***	0.280***
	(0.000)	(0.000)	(0.000)	(0.000)
Difference [1-2]	0.133***	-0.244*	0.151***	-0.221*
	(0.000)	(0.000)	(0.000)	(0)

Risk ratios: French vs German results

			Wives' perspective		Husbands' perspective	
	Top T% distribution		10	5	10	5
French[1)]	Inheritance		3.68***[3)]	4.29***	3.29***	3.58***
	Current Income		2.97***	4.25***	1.56***	2.00***
	Permanent Income		5.27***	7.29***	2.14***	2.86***
German[2)]	Inheritance	Case 0	4.33***	7.19***	4.05***	6.7***
		Case 1	2.99***	2.18***	2.92***	2.15***
		Case 2	3.10**	2.02***	2.95***	1.88***
	Current Income		1.66***	2.39**	1.96***	2.49**
	Permanent Income		1.43	2.07**	1.31	1.94*

Empirical puzzel

Top decile mean(€) of inherited wealth (including probit assigned inherited HMR - case 2) and annual labor income for men and women

		Men	Women
French[1)]	Inherited wealth	353,310	299,300
	Labor income	71,080	36,630
German	Inherited wealth	486,887	458,686
	Labor income	117,379	65,046

Inheritors should be less attractive in the marriage market since their lifetime wealth seems to be lower than that of income earners?

Model - Extension of love and money tradeoff

Whether love quality is high enough to compensate a skilled worker in settling with an unskilled partner instead of waiting for the new match in a hope for mating with a skilled partner - Fernandez, Güner and Knowles (2005)

Sorting by multidimensional attributes – Lindenlaub and Postel-Vinay (2016)

The inputs for the model are the marginal distributions of four labor income – inheritance types (2*2) for each gender of married population. The main outputs are simply the joint matching distribution of these types from either gender (16 cell proportions).

Model - assumptions

Information structure:

- In the first stage, each individual knows
  - his own income-inheritance type,
  - the inheritance type of others (eg. reading Piketty or James Patterson – R. Lieber, NYT 2014),
  - but not their income type (ie. income is more uncertain in the early life).
- In the second stage, the income type is revealed to everyone.
- The marginal distribution of income-inheritance type from both genders are public information (eg. proportions living in Kreuzberg-Charlottenburg vs Zehlendorf-Charlottenburg and school district quality).

Intrinsic quality of marriage (eg. love) is a public good.

Joint maximization of household utility (ie. unitary model).

Model- set up

Sequential sorting in two sage (**segregated marriage market**) – each with two rounds of random matching on inheritance (first stage; fixed afterwards) then money (second stage).

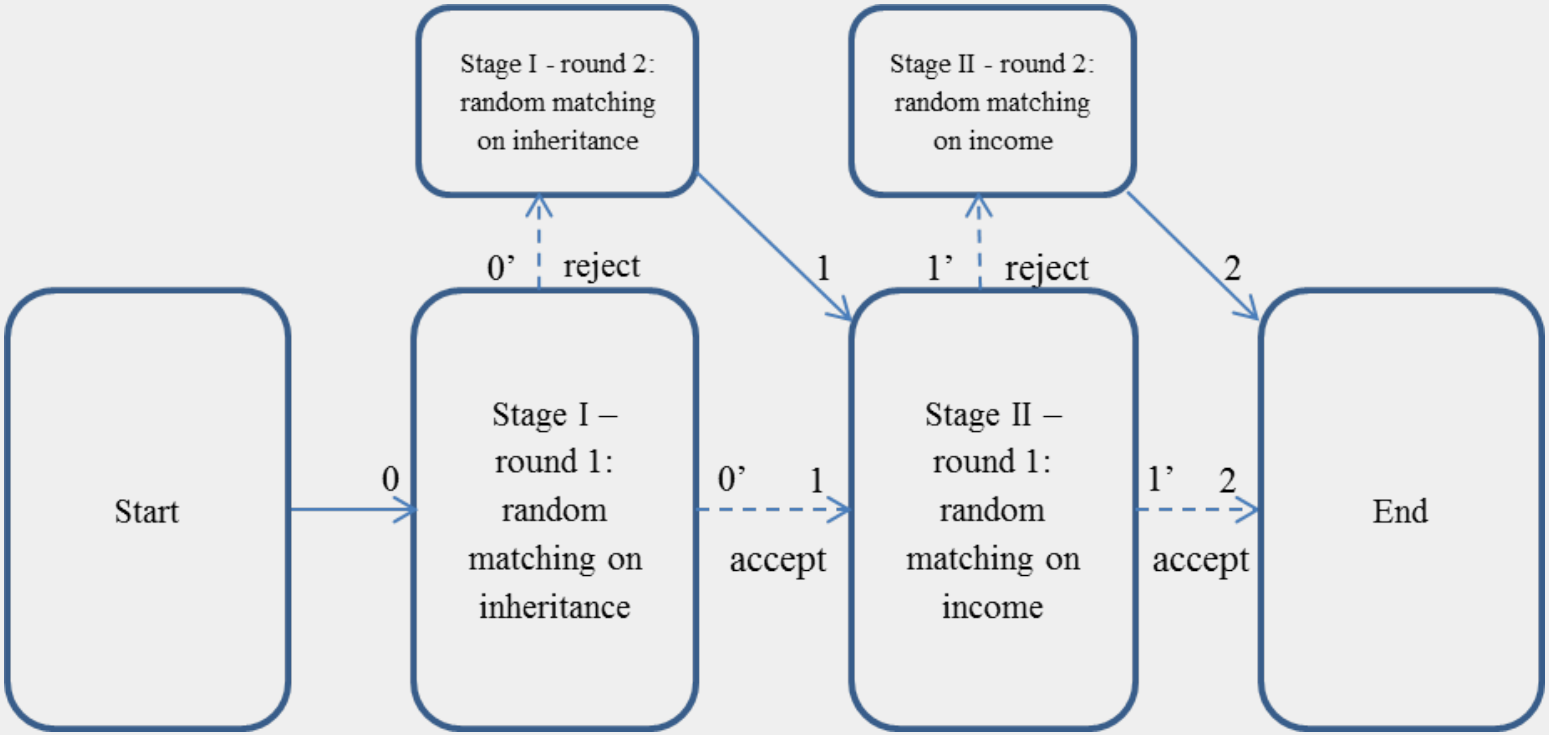
At birth, each person has a particular earning ability $\boldsymbol{\theta^g} \in \{0, 1\}$ and an inheritance to receive (or not) in the future, $\boldsymbol{\alpha^g} \in \{0, 1\}$, where $g \in \{f, m\}$ is a gender index.

Couple‘s payoff:

$$V(\gamma^g;\theta^f, \alpha^f, \theta^m, \alpha^m) = \beta[w(\theta^f) + w(\theta^m)]+(1- \beta)[e(\alpha^f)+ e(\alpha^m)]+ \gamma^g,$$

where w() is the gender-specific wage function and e() is the gender-specific inheritance function, intrinsic quality level (think of love) γ^g (drawn in the beginning of each stage), and $\boldsymbol{\beta}$ **measures the degree of substitutability** between labor income and inheritance.

Model – matching process



Model – matching process (con't)

Stage I: **two rounds** of random matching on the dimension of inheritance

1. Accecepted by both or reject by one
2. Rejected population match again

Stage II. after θ^g from potential mate delivered in last stage is revealed, again two rounds of random matching on the other dimension- labor income - with the same **two rounds** matching

Each stage can be fitted using the sorting with gender model in Fernandez, Güner and Knowles (2005) with the observed marginal distribution in either dimension: **solving reserved love quality to determine accepting the first round of match or not**.

We can backward solve the model and, in the first stage, form the expected second stage payoff conditional on joint inheritance type.

The marginal distribution $\lambda_{g,1}^{i|jk}$ used in the second stage is simply a function of $\phi_{g,1}^{ij\cdot k}$ solved in the first stage -> iteration to repeatedly solve these two stages.

Sequential sorting – second stage

On labor income, conditional on inheritance sorting is settled, ie. knowing marginal distribution (blue) of income type $\boldsymbol{\lambda_{g,1}^{x|ij}}$, we solve joint distribution (yellow) of income type $\boldsymbol{\phi_2^{xy|ij}}$

	$\lambda_{f,1}^{u\|nn}=0.51$ $w_f^{u\|nn}=3{,}435$	$\lambda_{f,1}^{s\|nn}=0.49$ $w_f^{s\|nn}=27{,}436$		$\lambda_{f,1}^{u\|hn}=0.46$ $w_f^{u\|hn}=2{,}789$	$\lambda_{f,1}^{s\|hn}=0.54$ $w_f^{s\|hn}=29{,}363$
$\lambda_{m,1}^{u\|nn}=0.54$ $w_m^{u\|nn}=13{,}397$	$\phi_2^{uu\|nn}$	$\phi_2^{us\|nn}$	$\lambda_{m,1}^{u\|nh}=0.47$ $w_m^{u\|nh}=14{,}578$	$\phi_2^{uu\|nh}$	$\phi_2^{us\|nh}$
$\lambda_{m,1}^{s\|nn}=0.46$ $w_m^{s\|nn}=50{,}971$	$\phi_2^{su\|nn}$	$\phi_2^{ss\|nn}$	$\lambda_{m,1}^{s\|nh}=0.53$ $w_m^{s\|nh}=59{,}155$	$\phi_2^{su\|nh}$	$\phi_2^{ss\|nh}$
	$\lambda_{f,1}^{u\|nh}=0.48$ $w_f^{u\|nh}=3{,}680$	$\lambda_{f,1}^{s\|nh}=0.52$ $w_f^{s\|nh}=28{,}994$		$\lambda_{f,1}^{u\|hh}=0.52$ $w_f^{u\|hh}=3{,}924$	$\lambda_{f,1}^{s\|hh}=0.48$ $w_f^{s\|hh}=29{,}776$
$\lambda_{m,1}^{u\|hn}=0.41$ $w_m^{u\|hn}=17{,}182$	$\phi_2^{uu\|hn}$	$\phi_2^{us\|hn}$	$\lambda_{m,1}^{u\|hh}=0.40$ $w_m^{u\|hh}=12{,}267$	$\phi_2^{uu\|hh}$	$\phi_2^{us\|hh}$
$\lambda_{m,1}^{s\|hn}=0.59$ $w_m^{s\|hn}=60{,}336$	$\phi_2^{su\|hn}$	$\phi_2^{ss\|hn}$	**$\lambda_{m,1}^{s\|hh}=0.60$** **$w_m^{s\|hh}=56{,}038$**	$\phi_2^{su\|hh}$	$\phi_2^{ss\|hh}$

For example, a skilled heir already sorted to marry with a heiress (i.e. one man in the second row of right bottom block with average income 56,038 euro) has to decide to mate finally with skilled (with avg income 29,776) or unskilled heiress (with avg income 3,924)).

Sequential sorting – first stage

On inheritance, knowing $F(\theta^g, \alpha^g) = \boldsymbol{\lambda}_{g,1}^{ij}$, we solve (or divide) $\boldsymbol{\lambda}_{g,1}^{ij}$ between non-heir(ess) or heir(ess) partners.

		f	
		e_f=178,770	
		n	h
m	$\lambda_{m,1}^{un\cdot\cdot}$=0.39	$\phi_{m,1}^{un\cdot n}$	0.39-$\phi_{m,1}^{un\cdot n}$
	$\lambda_{m,1}^{sn\cdot\cdot}$=0.35	$\phi_{m,1}^{sn\cdot n}$	0.35-$\phi_{m,1}^{sn\cdot n}$
	$\lambda_{m,1}^{uh\cdot\cdot}$=0.11	$\phi_{m,1}^{uh\cdot n}$	0.11-$\phi_{m,1}^{un\cdot n}$
	$\lambda_{m,1}^{sh\cdot\cdot}$=0.16	$\phi_{m,1}^{uh\cdot n}$	0.16-$\phi_{m,1}^{un\cdot n}$

		f			
		$\lambda_{f,1}^{un\cdot\cdot}$=0.35	$\lambda_{f,1}^{sn\cdot\cdot}$=0.35	$\lambda_{f,1}^{uh\cdot\cdot}$=0.14	$\lambda_{f,1}^{sh\cdot\cdot}$=0.15
m	n	$\phi_{f,1}^{un\cdot n}$	$\phi_{f,1}^{sn\cdot n}$	$\phi_{f,1}^{uh\cdot n}$	$\phi_{f,1}^{uh\cdot n}$
e_m=207,557	h	0.35-$\phi_{f,1}^{un\cdot n}$	0.35-$\phi_{f,1}^{sn\cdot n}$	0.14-$\phi_{f,1}^{un\cdot n}$	0.15-$\phi_{f,1}^{un\cdot n}$

For example, that skilled heir (one of the 16% male population) decides to potentially marry a nonheiress (with zero average inheritance) or a heiress (with 178,770 euro avg inheritance).

Computation

Solving system of equations being (piecewise) cubic

Multiple equilibrium – global optimization (uniformly distributed 30 random starting points between zero and one)

Estimation

Targets: standard deviation *t* of love distribution *Q(.)* and the substitutability measure *β.*

Estimator: least square to fit the equilibirum distribution solved with the observed ones.

Outcome (yellow) - stage II:

		$\lambda_{f,1}^{u\|nn}=0.51$	$\lambda_{f,1}^{s\|nn}=0.49$			$\lambda_{f,1}^{u\|hn}=0.46$	$\lambda_{f,1}^{s\|hn}=0.54$
$\lambda_{m,1}^{u\|nn}=0.54$	obs	0.30	0.24	$\lambda_{m,1}^{u\|nh}=0.47$	obs	0.25	0.21
	est	*0.30*	*0.25*		*est*	*0.24*	*0.22*
$\lambda_{m,1}^{s\|nn}=0.46$	obs	0.20	0.25	$\lambda_{m,1}^{s\|nh}=0.53$	obs	0.20	0.33
	est	*0.21*	*0.25*		*est*	*0.21*	*0.32*
		$\lambda_{f,1}^{u\|nh}=0.48$	$\lambda_{f,1}^{s\|nh}=0.52$			$\lambda_{f,1}^{u\|hh}=0.52$	$\lambda_{f,1}^{s\|hh}=0.48$
$\lambda_{m,1}^{u\|hn}=0.41$	obs	0.22	0.19	$\lambda_{m,1}^{u\|hh}=0.40$	obs	0.22	0.17
	est	*0.22*	*0.18*		*est*	*0.23*	*0.16*
$\lambda_{m,1}^{s\|hn}=0.59$	obs	0.26	0.33	$\lambda_{m,1}^{s\|hh}=0.60$	obs	0.30	0.30
	est	*0.26*	*0.33*		*est*	*0.29*	*0.31*

Estimation (con't)

Outcome (yellow) - stage I:

		$\phi_{m,1}^{ij\cdot h}$ obs	$\phi_{m,1}^{ij\cdot h}$ *est*			f			
						$\lambda_{f,1}^{un\cdot\cdot}$=0.35	$\lambda_{f,1}^{sn\cdot\cdot}$=0.35	$\lambda_{f,1}^{uh\cdot\cdot}$=0.14	$\lambda_{f,1}^{sh\cdot\cdot}$=0.15
	$\lambda_{m,1}^{un\cdot\cdot}$=0.39	0.08	*0.10*						
m	$\lambda_{m,1}^{sn\cdot\cdot}$=0.35	0.09	*0.09*	$\phi_{f,1}^{ij\cdot h}$	obs	0.07	0.08	0.06	0.06
	$\lambda_{m,1}^{uh\cdot\cdot}$=0.11	0.05	*0.05*		*est*	*0.07*	*0.07*	*0.06*	*0.06*
	$\lambda_{m,1}^{sh\cdot\cdot}$=0.16	0.07	*0.07*						

The least square function regarding the substitutability measure *β* has a U shape on the support between zero and one with the bottom reaching 0.70.

The estimated *t* standard deviation of *Q()* is 17,544 (ie. the length of the support is 60,775).

Sensitivity analysis

1. Replacing average income and inheritance by zero and one (“status gain” hypothesis) :

- Least square is 0.0012 for t estimation in stage II vs 0.0014 in the benchmark model
- Least square is 0.0030 for β estimation in stage I vs 0.0005 in the benchmark model
- β estimate is 1 vs 0.70 in the benchmark model - inconsistency of identification - income sorting does not matter **vs.** stage II fitness is superior

2. Reverse the sorting sequence of income and inheritance (“segregated by income” hypothesis):

- least squares function in estimating *t* is always flat and then shoots up
- β estimate by using some *t* in the initial flat range is rather unstable

Rationalization of β estimation

- Revisiting empirical puzzel in dominance of sorting by inheritance.
- Life-time wealth perspective:
  - We annualize b_t flows as b for the years before marriage and kb for the years after marriage where k is the scaling factor between the inheritance received before and after marriage. Couple‘s end-of-life wealth –

$$kb\int_m^n e^{r(t-m)}dt + y_m\int_m^n e^{(r+g)(t-m)}dt$$

  - At q years after marriage, we observe B_{m+q} the stock of b_t accumulated from year 0 and y_{m+q} the income at that year. Substitution and factoring –

$$A[\frac{ke^{-rq}\int_m^n e^{r(t-m)}dt}{A\int_0^m e^{rt}dt}B_{m+q} + \frac{e^{-gq}\int_m^n e^{(r+g)(t-m)}dt}{A}y_{m+q}]$$

  - Our estimate of β is equivalent to $\frac{ke^{-rq}\int_m^n e^{r(t-m)}\mathrm{dt}}{A\int_0^m e^{rt}\mathrm{dt}}$

Rationalization of β estimate (con't)

Comparing the calibrated scale *k* and the observed (or estimated) one from the literature:

- *r* and *g* are chosen to be 1.1% and 3.8% (Piketty and Zucman, 2014)
- First marriage age *m* is 27 and the age at death *n* be 69
- Using the identity above and estimated β being 0.7, solve for *k* at five age cohorts – i.e. letting *q* being 10, 20, 30, 40, 50

The solutions are 146, 111, 85, 65 and 50.

Aggregate flows of inheritance and gifts in Germany for 1961 - 2009 (Schinke, 2012).

	1961	1973	1978	2002	2007	2009
Annual bequest flow	2.544	13.46	20.564	130.337	201.868	220.308

The largest ratios between any two years are those with respect to 1961 and this ratio corresponds to our concept of *k* which range from 5 to 87 -> **agents are reasonably proficient in forecasting the future inheritance flows**.

Conclusion

Empirically similar to French (Fremeaux, 2016) -

- a stronger sorting by inheritance than by income
- Concentration: risk ratios increase in the sorting of top distribrution
- Labor income and inherited wealth cannot perfectly substitute with each other

Model

- Almost exactly replicates the equilibrium matching distribution over two dimensions - “Patrimonial capitalism” as portrayed in Milanovic (2014)
- The estimated contribution from inherited wealth to the pecuniary payoff of the marital choice is two and a half times more than that from labor income

To do in the future:

- China and US story – stage of Capitalism
- Policy application (eg family tax vs inheritance tax – „Schicchi experiment”)…
- Model may be used in any “unfolding bracket” sorting structure

General questions:

- sociology knowledge on the nature of the “superstructure”
- causes and consequences of rational expectations – predicting power on the rising flows of inheritance and wealth inequality induced by marital sorting