Marriage and employment returns to female education

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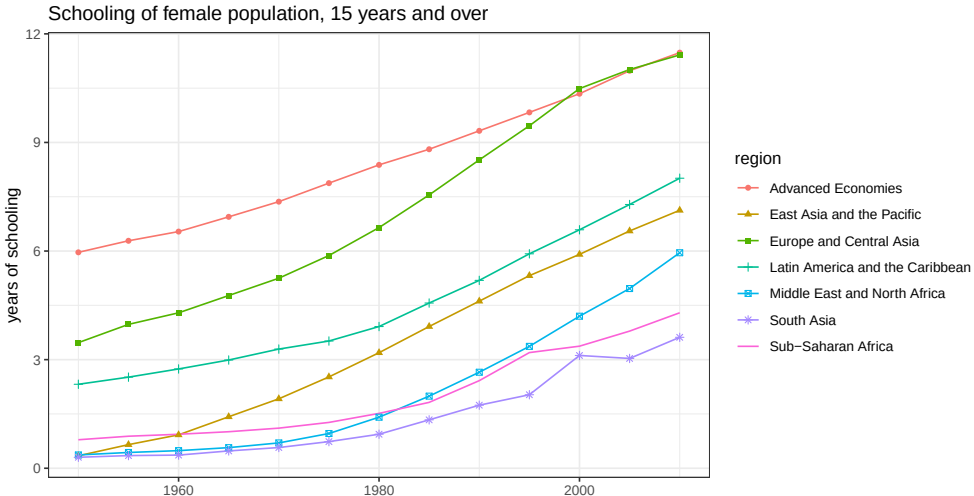
Motivation

The past century has witnessed a dramatic increase in women's education.



Source: Barro−Lee educational attainment dataset

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Education affects women's prospects in two markets:

- Labor market
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• Extensive margin:	working	marriage
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▶ match quality	job	spouse type
▶ transfer	wage & salary	surplus share
		unobservable

Measuring marriage return to education

Wage premium is usually used to measure labor market return to education

But in marriage markets, surplus and transfer are not observable

Estimation of surplus using matching patterns (who marries whom)

- Choo and Siow (2006): frictionless matching with transferable utility
- Recovering deterministic gains from marriage patterns

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- Recovering deterministic gains from marriage patterns

Chiappori et al. (2017) use deterministic utilities to measure marriage return to education level 2 compared to 1 as

$$\underbrace{U_2^{\text{married}} - U_2^{\text{single}}}_{\text{marriage gain from edu 2}} - \Big(\underbrace{U_1^{\text{married}} - U_1^{\text{single}}}_{\text{marriage gain from edu 1}} \Big)$$

This paper

Extends the framework of Choo and Siow (2006); Chiappori et al. (2017)

- Two bilateral matching markets: job market, marriage market
- Matching based on partner's quality (job & spouse types)
- Estimation using 3-way empirical distribution table of women's education $\times$ employment $\times$ marital status.
- Using transfer in labor market (earnings) as OID restrictions for estimation.

Yet, no joint estimation for the marriage and employment return to education and their difference.

Sign-based identification with no distributional assumption.

Documenting the U.S. trends for 1960-2019 (and many other countries).

Basic matching model: extending Choo-Siow

There are a large number of women, firms, and men belonging to a small number of observable categories.

- $I \in \{1, \ldots, N_I\}$ women's education
- $J \in \{0, 1, \ldots, N_J\}$ job classification ($0 =$ not working)
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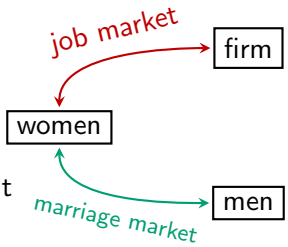
- In the job (marriage) market, the marriage (employment) category of the woman is important for firms (men).



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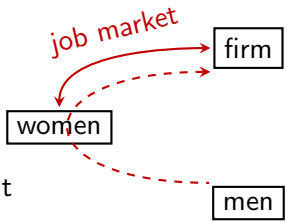

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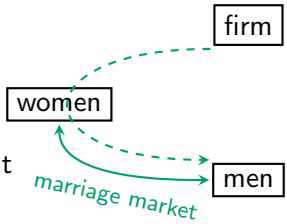

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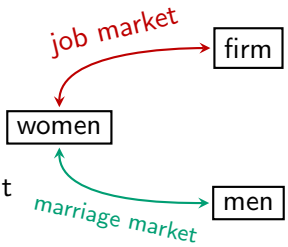


Extending Choo-Siow model

Woman's utility is quasi-linear in the payoffs from the two markets

$$u_i = \underbrace{x_i}_{\substack{\text{marriage}\\ \text{transfer}}} + \Phi(\underbrace{w_i}_{\text{earnings}}), \qquad \Phi \text{ is a strictly increasing}$$

By assuming **separability of unobservable factors in observable categories**,

$$U^{IJK} = \text{average utility of women with education } I, \text{ job } J, \text{ spouse } K$$

is estimated up to a constant for each I using a distributional assumption for those unobservable terms.

Conditional returns to education I_2 from I_1 – extensive margin

Marriage return of marrying husband K conditional on employment J:

$$r^m_{I_1 I_2 JK} = U^{I_2 JK} - U^{I_2 J0} - (U^{I_1 JK} - U^{I_1 J0}), \qquad K \geq 1$$

Employment return of getting job J conditional on marriage K:

$$r^e_{I_1 I_2 JK} = U^{I_2 JK} - U^{I_2 0K} - (U^{I_1 JK} - U^{I_1 0K}), \qquad J \geq 1$$

The conditional difference between marriage K and employment J returns

$$\delta^{me}_{I_1 I_2 JK} = \underbrace{U^{I_2 0K} - U^{I_1 0K}}_{\text{married to } K \text{ not-working}} - (\underbrace{U^{I_2 J0} - U^{I_1 J0}}_{\text{single working in } J}) \quad J, K \geq 1$$

Returns with logit distribution

Let $n(IJK)$ be the population corresponding to education I, occupation J, and spouse K.

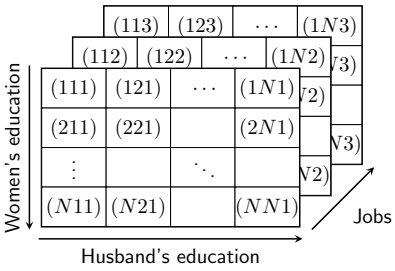
Proposition

If difference in unobservable terms has logit distribution

$$r^m_{I_1I_2JK} = \ln \frac{n(I_2JK) \times n(I_1J0)}{n(I_2J0) \times n(I_1JK)}, \quad K \geq 1$$

$$r^e_{I_1I_2JK} = \ln \frac{n(I_2JK) \times n(I_10K)}{n(I_20K) \times n(I_1JK)}, \quad J \geq 1$$

$$\delta^r_{I_1I_2JK} = \ln \frac{n(I_20K) \times n(I_1J0)}{n(I_10K) \times n(I_2J0)}, \quad J, K \geq 1$$



Aggregate returns

Aggregate returns at the extensive margin

$$\hat{r}^{m}_{I_1 I_2} = E[r^{m}_{I_1 I_2 JK} \mid I_1,\ I_2]$$
$$\hat{r}^{e}_{I_1 I_2} = E[r^{e}_{I_1 I_2 JK} \mid I_1,\ I_2]$$
$$\hat{\delta}^{me}_{I_1 I_2} = E[\delta^{me}_{I_1 I_2 JK} \mid I_1,\ I_2]$$

Empirical methodology

The basic model is just-identified and throws out earnings information.

Adding more moments from average earnings W^{IJK}:

$$U^{IJK} - U^{IJ'K} = \rho_{IK}\big(\Phi(W^{IJK}) - \Phi(W^{IJ'K})\big), \qquad J, J' > 0$$

ρ_{IK} is the sharing rule from just-identified model.

A heteroskedastic $\Phi(\cdot)$ as

$$\Phi(W) = \frac{1}{1-\phi_I} W^{1-\phi_I}$$

Finding U^{IJK} and ϕ_I using Minimum Distance Estimator.

Dollar equivalent of spouse education

$$u_i = \underbrace{x_i}_{\substack{\text{marriage} \\ \text{transfer}}} + \Phi(\underbrace{w_i}_{\text{earnings}})$$

$\Phi^{-1}(\cdot)$ converts utility units to earnings units

$r = \Delta U_2 - \Delta U_1$ and from inverse function theorem

$$\Phi^{-1}(r) \approx \frac{r}{\Phi'(\Phi^{-1}(\bar{U}))} = \frac{r}{\Phi'(\bar{W})} = r\bar{W}^{\phi}$$

Data

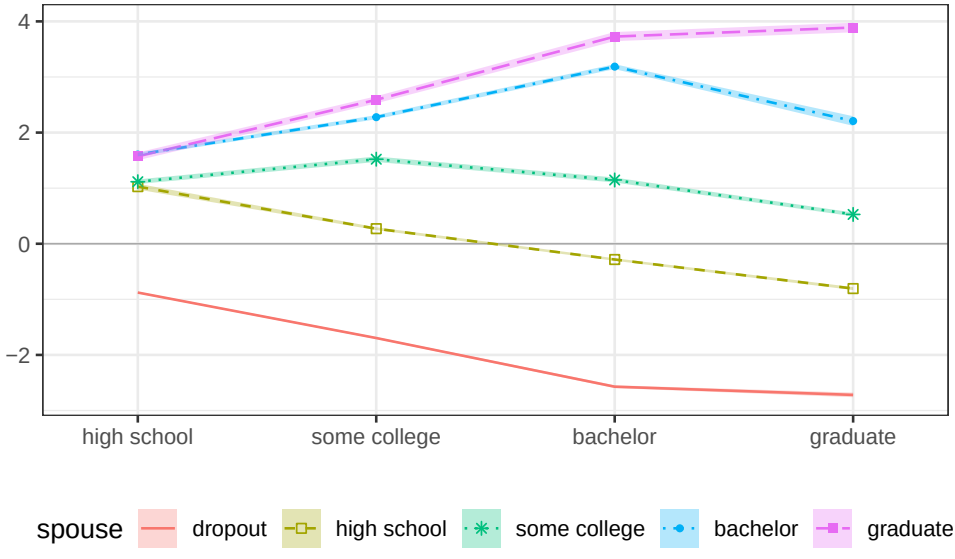
USA: IPUMS USA, Version 12.0

- Census 1960 (5%), 1970 (1%), 1980 (5%), 1990 (5%), 2000 (5%)
- American Community Surveys (ACS): 5-year averages (2007, 2012, 2017)
- 3-D discrete distribution for women between 35 and 50
- Average number of women per round: 1,270,000

Classifications

- Education
  1. *Dropouts*: have no high school qualification
  2. *High school*: finished high school
  3. *Some college*: attend 1 to 3 years of college
  4. *Bachelor*: bachelor's degree
  5. *Graduate*: higher education than bachelor's degree
- Occupation (ISCO code)
  1. *Unskilled*: elementary occupations (code 9)
  2. *Skilled*: skilled/semi-skilled workers (codes 0, 4 to 8)
  3. *High skilled*: technicians and associate professionals (code 3)
  4. *Professional*: managers, professionals (codes 1, 2)

Conditional marriage returns to female education in the US



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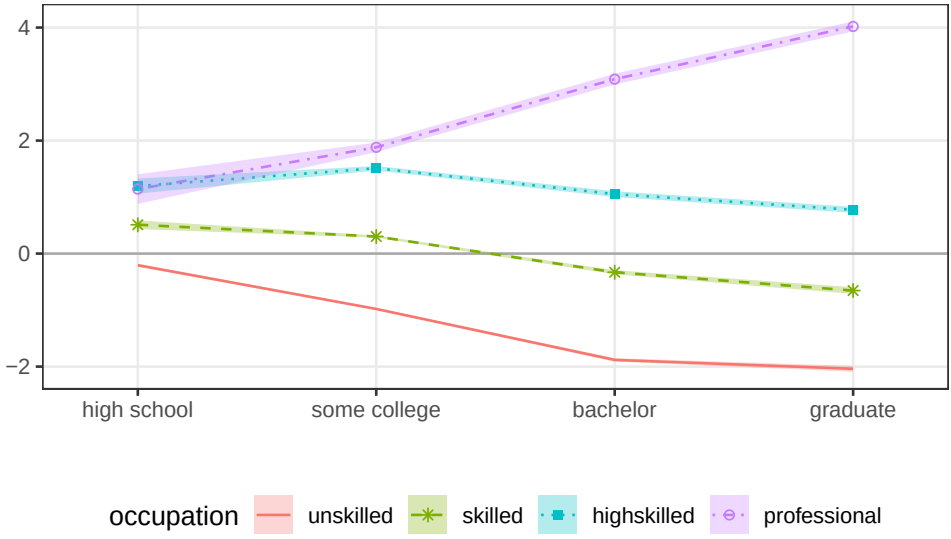
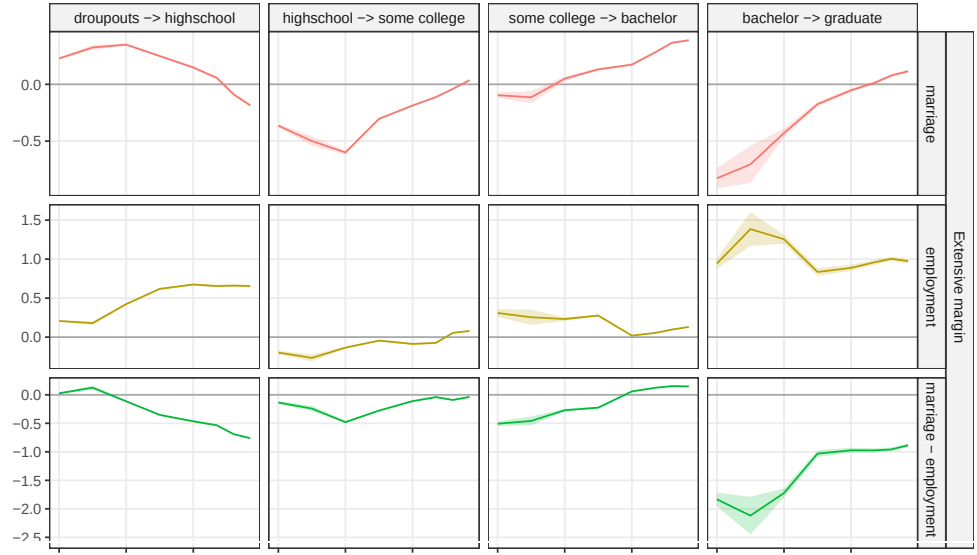


Equivalent remuneration of marrying different men in 2017

		equivalent annual worth (in 2023 dollars)				% of women's yearly earnings			
		women's education				women's education			
		high school	some college	bachelor	graduate	high school	some college	bachelor	graduate
men's education	dropout	-1607	-4630	-8215	-7510	-4.91	-11.52	-13.76	-9.05
	high school	1014	858	3	-1230	3.10	2.13	0.00	-1.48
	some college	965	3421	4445	3157	2.95	8.51	7.45	3.81
	bachelor	1119	3767	10357	9580	3.42	9.37	17.35	11.55
	graduate	883	3500	10949	15056	2.70	8.71	18.34	18.15

Aggregate extensive margin return indices in the US



Conclusion

Building a method for the joint estimation of marriage and employment returns to female education.

- Enabling comparison between the two returns
- Feasible in widely available cross-sectional household surveys
- Sign-based identification with no distributional assumption
- Separate estimations for extensive and intensive margins of the returns

Thank you!

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Chiappori, P.-A., Salanié, B., and Weiss, Y. (2017). Partner Choice, Investment in Children, and the Marital College Premium. *American Economic Review*, 107(8):2109–2167.

Choo, E. and Siow, A. (2006). Who Marries Whom and Why. *Journal of Political Economy*, 114(1):175–201.