Slowing Women's Labor Force Participation: The Role of Income Inequality

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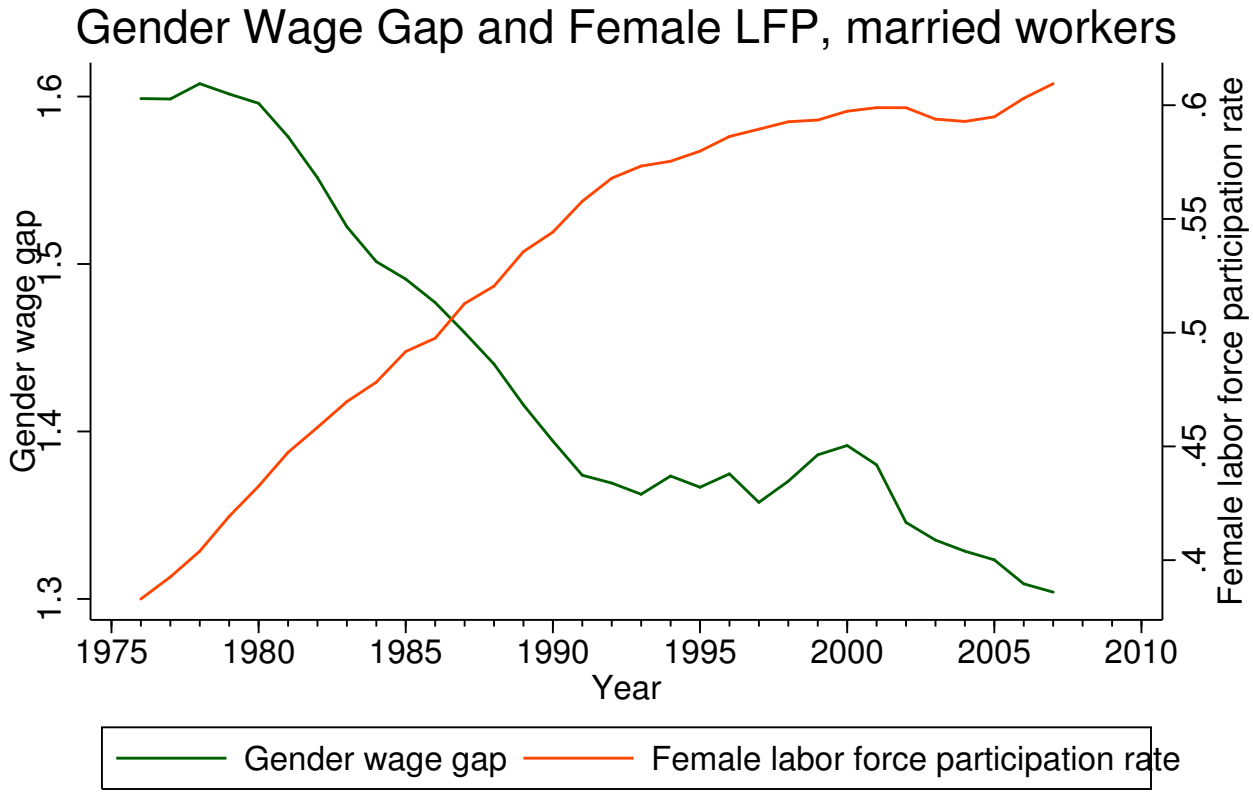
Trends in LFP and Wages

- Slowing female participation and convergence in wages since the mid-1990s in the US.

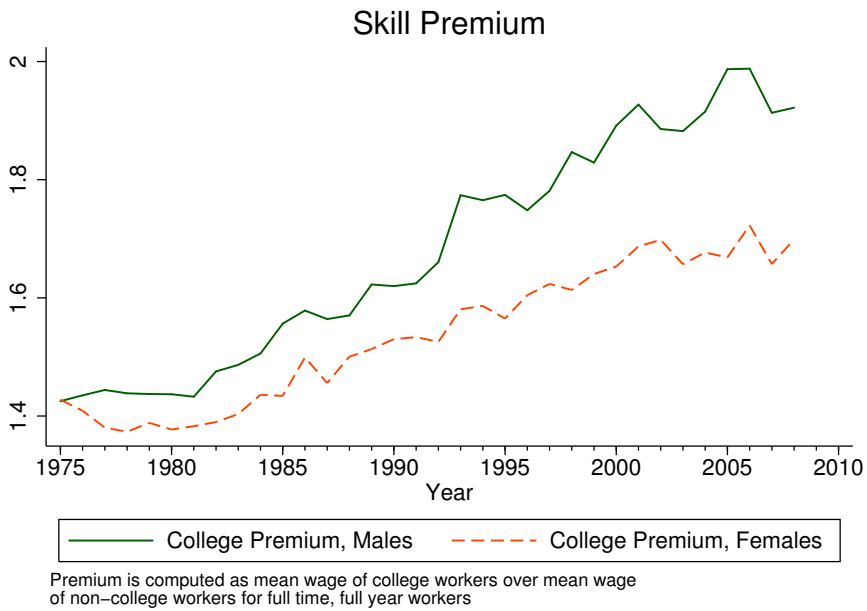


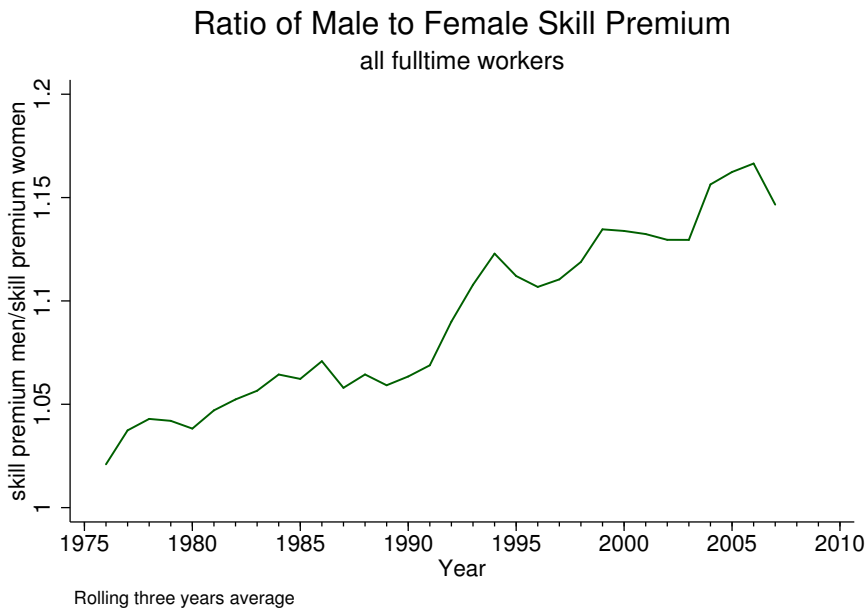
Source: March Supplement of CPS

Trends in LFP and Wages

Skill premium by sex

- Growth in the skill premium accelerated for men and slowed for women since the mid-1990s, resulting in growing divergence.
- 90/50 percentile ratio rose more for men than for women over same period Earning Dispersion





Ratio of mean hourly wages between workers with college degree and those without a college degree, for FT-FY workers, regardless of marital status. Three year centered moving averages.

Source: March Supplement of CPS

Hypothesis

- Rise in skill premium can explain the lack of convergence in participation and wages across genders since the early 1990s.
- Mechanism:
  - Rise in earnings for skilled men generates negative wealth effect on wives' participation and market hours.
  - Reduced attachment to the labor market reduces experience and earnings for skilled women relative to skilled men.
    - Positive assortative matching by education implies a large effect on skilled women, as well as unskilled women married to skilled men.
- Objectives:
  - Document empirical evidence on participation and hours by education of husbands and wives.
  - Explore mechanism quantitatively, how much can it explain?

Hypothesis

- Rise in skill premium can explain both the lack of convergence in participation and wages across genders since the early 1990s.
- Preview of findings:
  - Mechanism can account for sizable fraction of slowing growth in female participation in 1995-2005 for women married to college husbands.
  - Mechanism can only partially reproduce the slowing convergence in female wages to male wages in 1995-2005 and the lower growth in the skill premium for women.

Related Literature

- Theory: Fernandez (2013), Fogli and Veldkamp (2011)
  - Rise in female participation due to learning about costs for the household.
  - S-shape as learning slows with most women in the labor force.
- Empirical: Blau and Kahn (2013)
  - International comparison, lack of part time and access to daycare.
- Empirical: Fortin (2013)
  - Regression in attitudes towards gender role in the 1990s.

Outline

- Evidence
- Model
- Quantitative Analysis
- Ongoing work

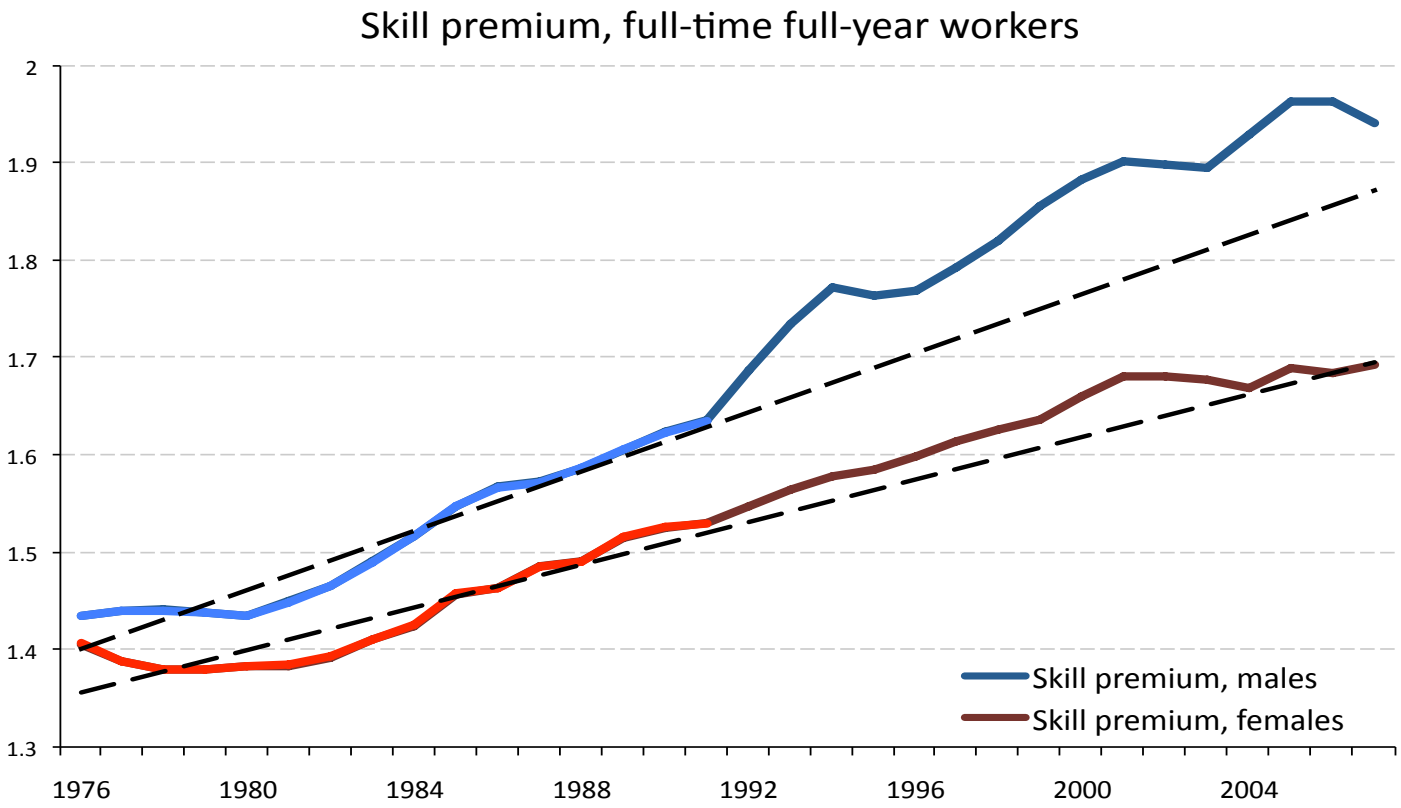
Evidence

Data and Sample

- CPS March Supplement, 1964-2009, and PSID, 1971-2011.
- Adults ages 25 to 64.
- Married (for most of the analysis).
- Labor force participation defined as: working or looking for work at least 40 weeks a year.
- Skilled (College) workers have completed four year college or post-graduate degree.
- Unskilled (High School) have completed high school and may have some college.

Skill Premium

Measuring the Phenomenon



Source: March Supplement of CPS

Dashed line corresponds to linear trend for 1976-1991, in and out of sample.

Skill Premium

Gender Wage Gap by Education

- The acceleration in the male skill premium post-1991 is also associated with a rise in the gender wage gap for skilled workers.

	Skill Premium		Male/Female Wages	
	Male	Female	HS	Coll
Average 1995-2005				
Actual	1.86	1.64	1.29	1.46
Projected	1.75	1.60	1.19	1.32
Actual-Projected	0.11	0.04	0.10	0.14
Actual-Projected%	6.29	2.5	8.4	10.61

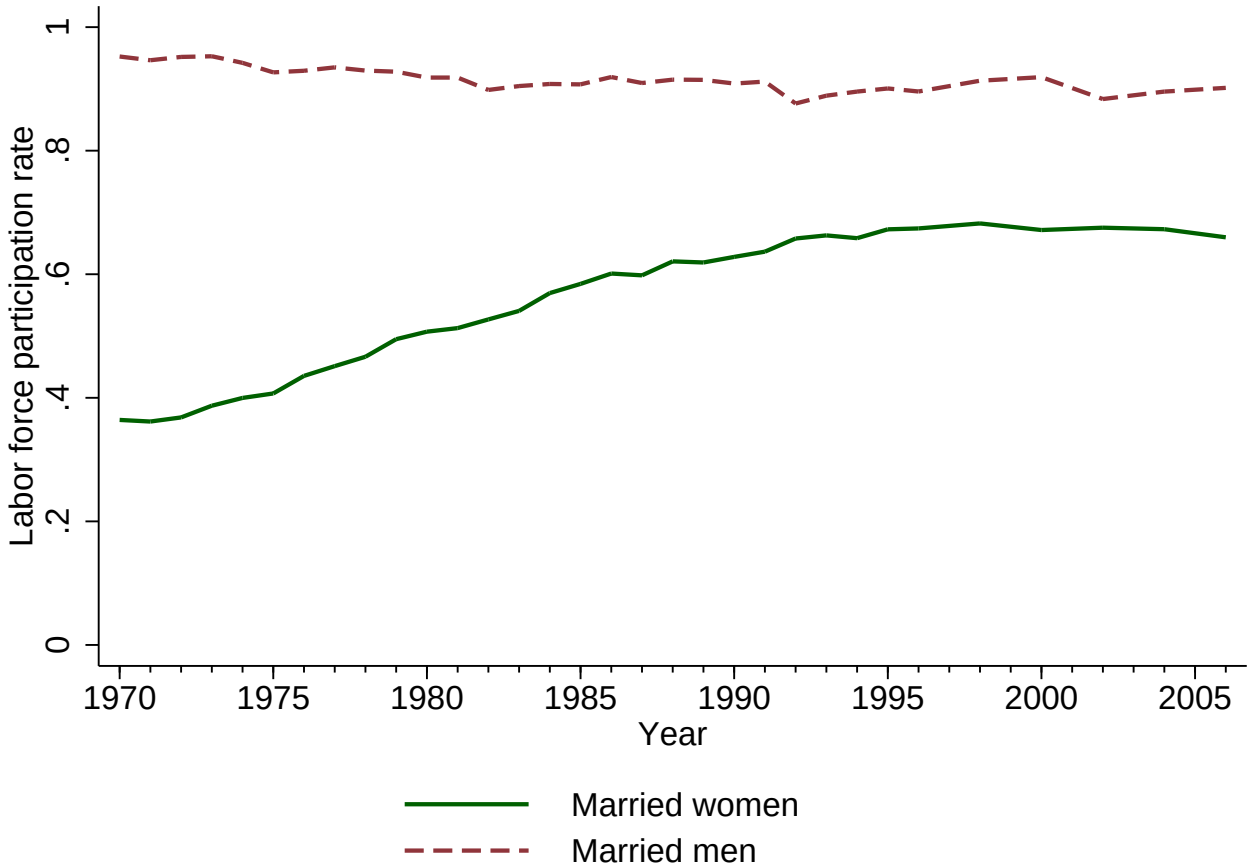
Source: Authors' calculations from CPS.

Labor Force Participation

Comparison with men

- Participation of married men has remained mostly stable.

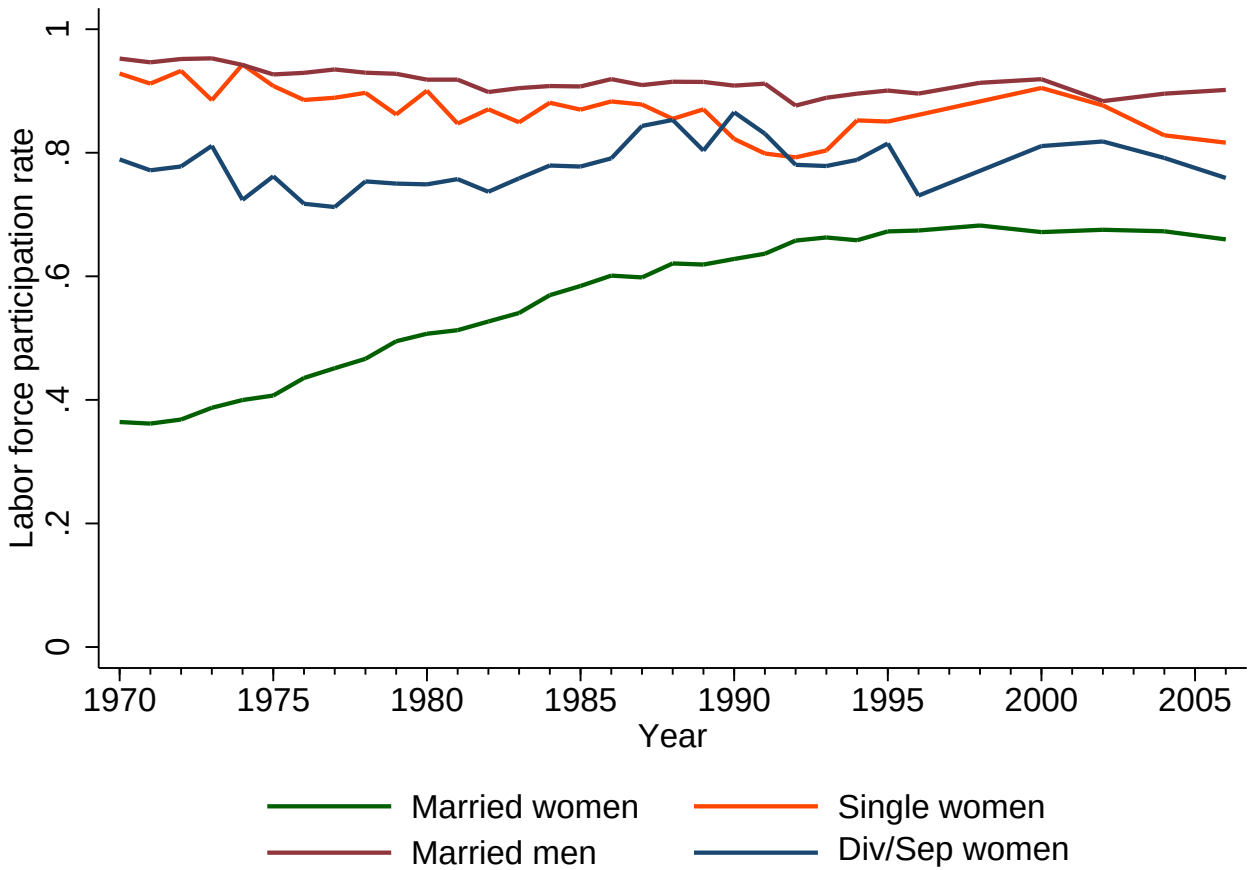
Male LFP



Source: PSID

Labor supply of women

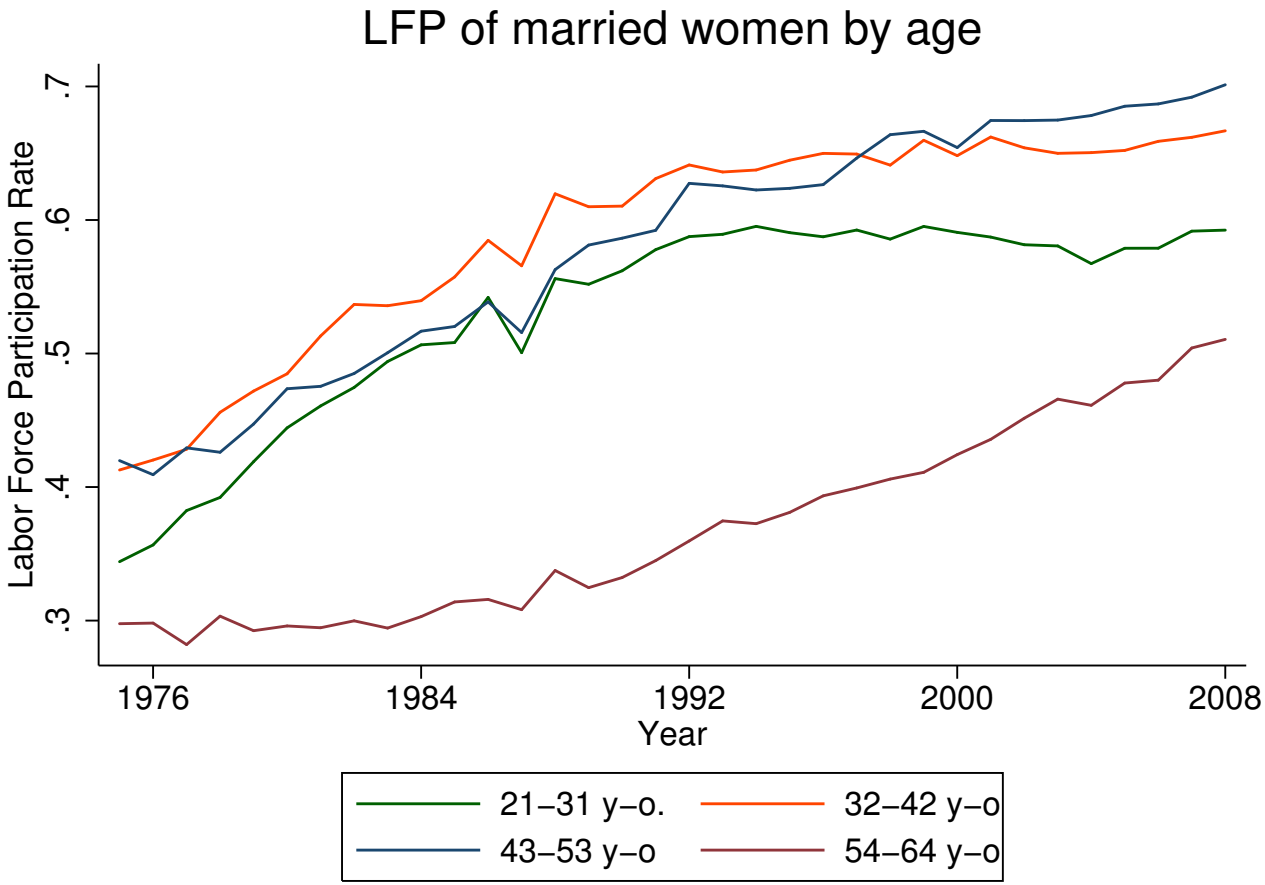
- Slowing of female participation driven by married women.
- Labor force participation of married women stopped catching up to other groups.



Source: PSID

Labor Supply of Married Women

- Slowing in participation only for prime age married women.



Source: March Supplement of CPS

Labor supply of women

- Participation of married men has remained stable.
- Slowing in female participation is driven by married women.
  - Participation of never married women remained stable (87% pre-1995, 86.5% 1995-2005).
  - Participation of divorced or separated women remained stable (77.8% pre-1995, 77.3% 1995-2005).
  - Slowing in participation only for prime age married women.
- Labor force participation of married women stopped catching up to other groups.

Measuring the Phenomenon

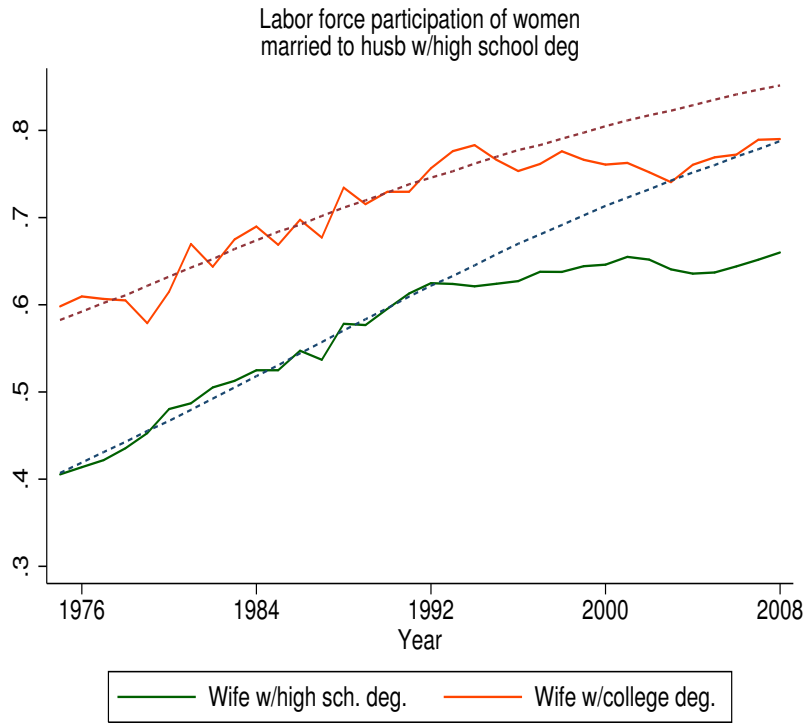
Labor force participation of married women

- Approach:
  - Estimate probit model for labor force participation of married women in 1964-1994 by own and husbands' education.
    - Controls for own and husband's age.
  - Use estimated parameters to project female labor force participation in 1995-2009.
  - Compare projected and actual series.

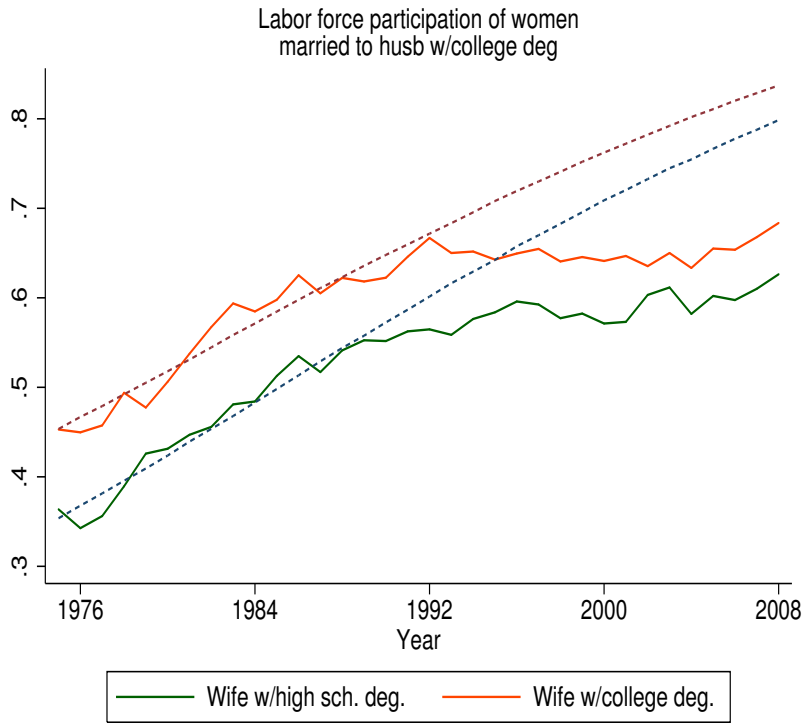
Labor supply of women

Participation by own and husband's education

High school husbands



College Husbands



Source: March Supplement of CPS

Dashed line corresponds to projection from 1976-1994 participation probit, in and out of sample.

Measuring the Phenomenon: Labor Supply

Participation by own and husband's education

- For 1995-2005, slowdown in participation was largest for wives with college husbands.

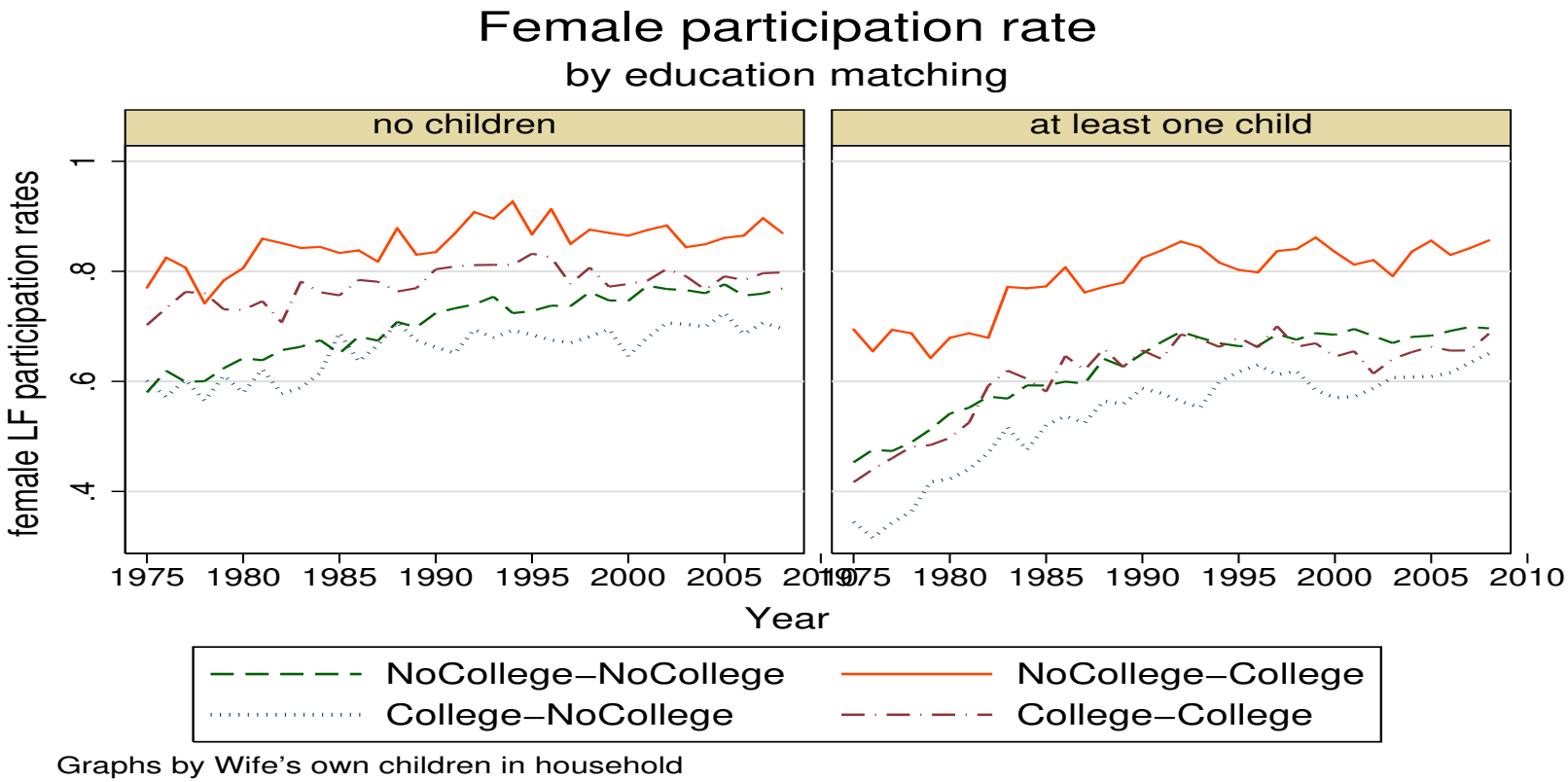
	Married Women's Participation			
Household Types (M-F)	HS-HS	C-HS	HS-C	C-C
Average 1995-2005				
Actual	0.6	0.56	0.73	0.63
Projected	0.66	0.67	0.79	0.75
Actual-Projected	-0.06	-0.11	-0.06	-0.12
Actual-Projected%	-9.8	-17	-8	-17

Source: Authors' calculations from CPS.

Labor supply of married women

Role of fertility

- Slowing of participation for both women with and without children. Suggests fertility demand not critical.



Wife-husband education pairs. Source: March Supplement of CPS

Labor supply of married women

Participation by husband's income

- Difference in projected and actual participation in 1995-2005 is increasing in husband's income.

Source: March Supplement of CPS

Difference between 1995-2005 projection and actual, based on 1976-1994 probit.

Charts

Labor supply of married women

Participation by husband's earnings

- Difference in projected and actual participation in 1995-2005 is increasing in husband's income.
- Suggests role of negative income effect.

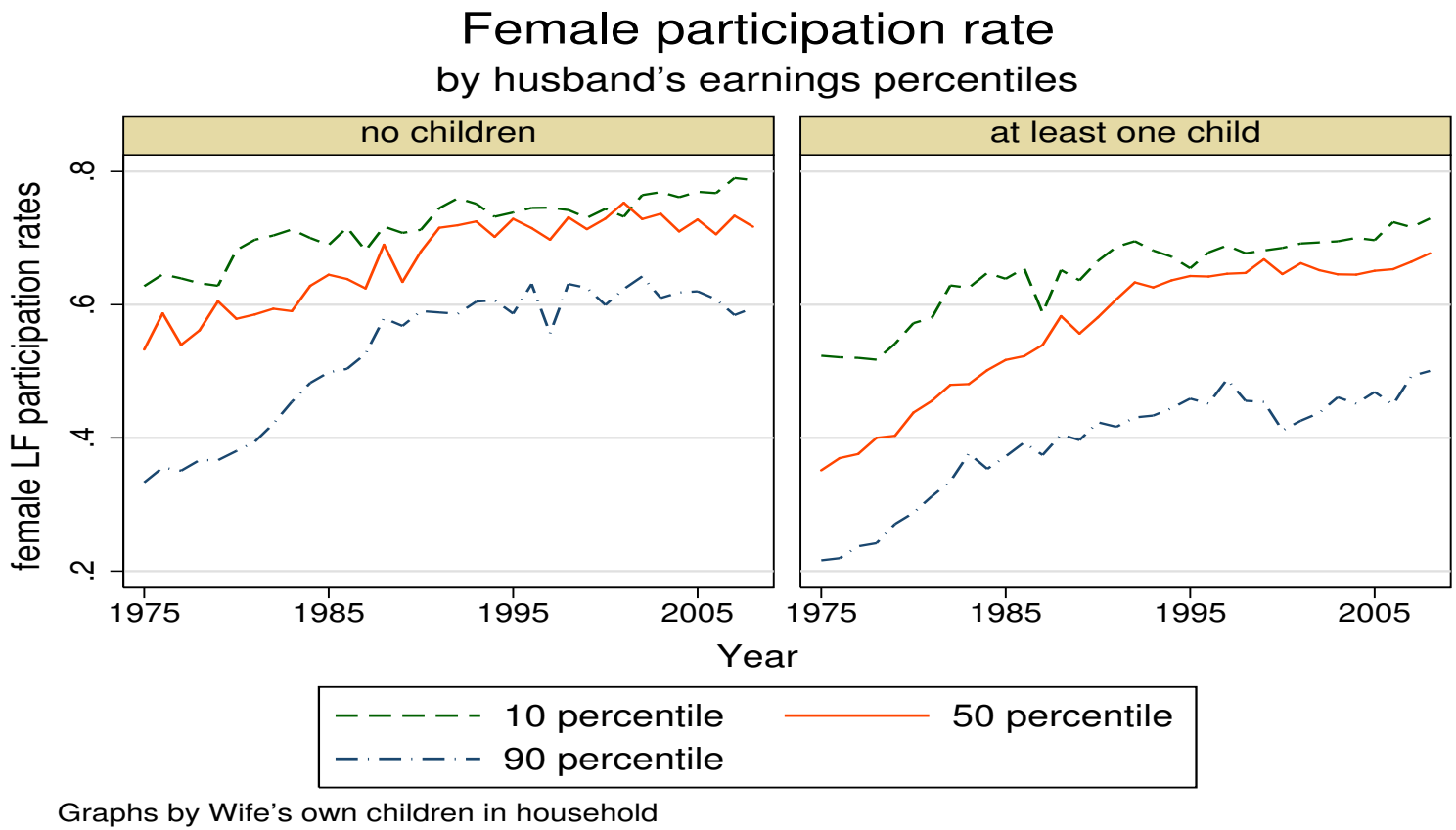
	Married Women's Participation			
	Aggregate	Husb <10%	Husb 50%	Husb> 90%
Average 1995-2005				
Actual	0.65	0.75	0.68	0.50
Projected	0.75	0.80	0.76	0.67
Actual-Projected	-0.10	-0.05	-0.09	-0.17
Actual-Projected%	-13	-6	-12	**-25**

Source: Authors' calculations from CPS.

Labor supply of married women

Role of fertility

- Slowing of participation for both women with and without children. Suggests fertility demand not critical.

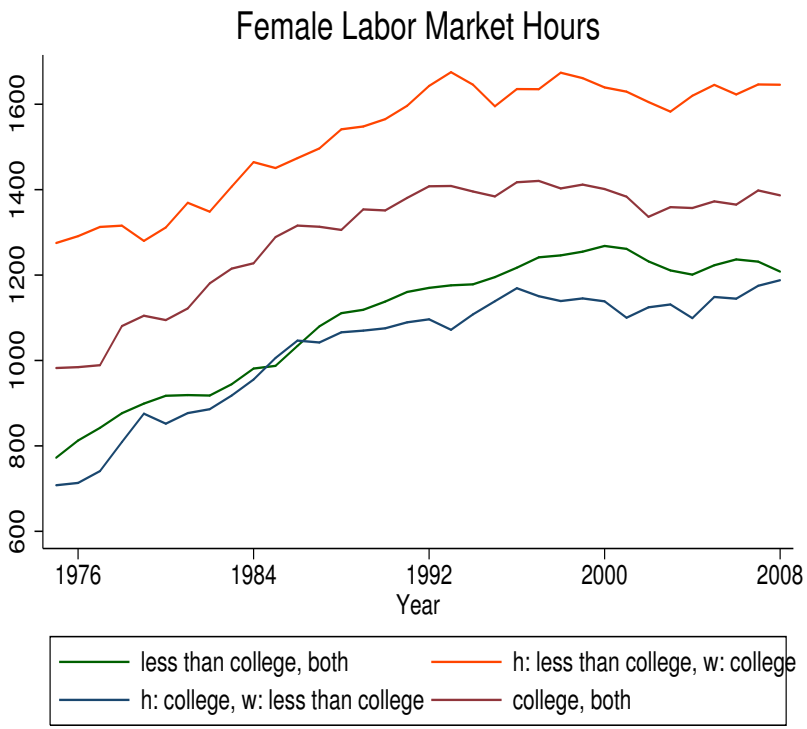


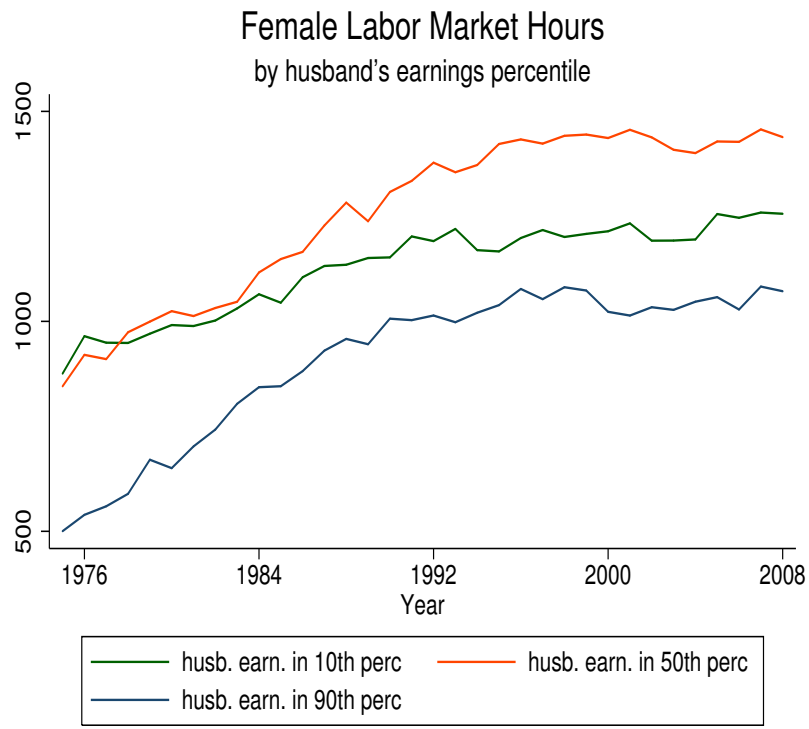
Source: March Supplement of CPS

Labor supply of married women

Hours by education/husband's income

- Pattern in hours reflects pattern in participation





Source: March Supplement of CPS

Negative Income Effect

Additional Supporting Evidence

- Average husbands' labor earnings significantly higher in one-earner households.
- Ratio of husbands' average wage in one-earner over two-earner households rose for college husbands after 1993, declined for high school husbands.
- Strong negative effect of husband's income and college degree on wives' participation.
- Rise in wife/husband wages for two earner households in early 1990s suggesting positive selection of women into participation.

Negative Income Effect

- Average husbands' labor earnings significantly higher in one-earner households.
- Ratio of husbands' average wage in one-earner over two-earner households rose for college husbands after 1993, declined for high school husbands.

Table 3: Average wage of husband, by household types

Period		One-earner households	Two-earner households	One-earner hh/ Two-earner hh
1976-1993	No College - No College	18.8	16.1	117%
	No Coll Husb - Coll Wife	22.1	17.1	129%
	College Husb - No Coll Wife	29.7	23.0	129%
	College - College	31.2	24.1	130%
1994-2008	No College - No College	19.4	18.0	108%
	No Coll Husb - Coll Wife	25.2	20.0	126%
	College Husb - No Coll Wife	38.5	29.0	133%
	College - College	44.7	33.1	135%

Source: Authors' calculations from CPS.

Negative Income Effect

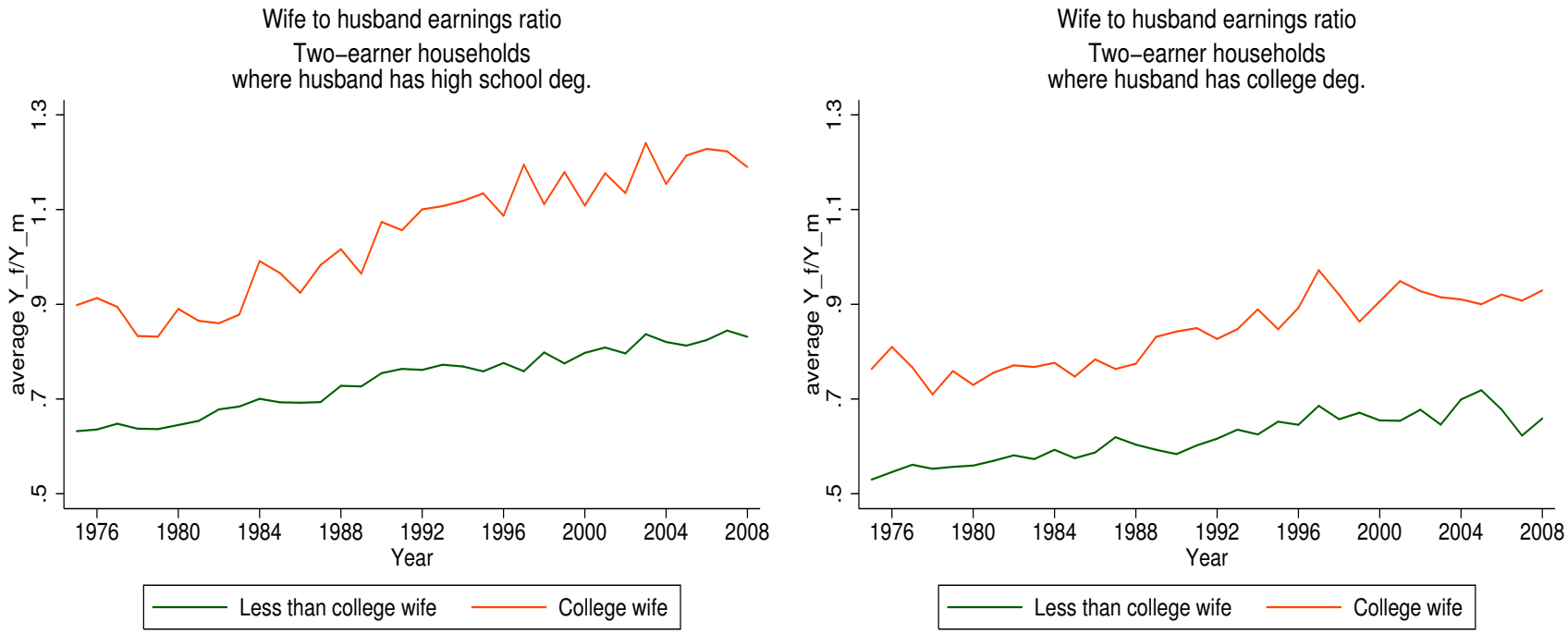
- Strong negative effect of husband's income and college degree.

Wife's LFPR	Coef.	Robust Std. Err.	[95% Conf.	Interval]
age	0.005	0.0002	0.0047	0.0053
educ_years (wife)	0.108	0.0009	0.1059	0.1096
college (husband)	-0.171	0.0108	-0.1927	-0.1501
perc25	-0.208	0.0048	-0.2174	-0.1982
perc50	-0.408	0.0086	-0.4252	-0.3913
perc75	-0.427	0.0063	-0.4398	-0.4148
perc90	-0.773	0.0056	-0.7844	-0.762
collegeXper25	-0.024	0.0117	-0.0466	-0.0006
collegeXper~50	0.0147	0.0211	-0.0267	0.0562
collegeXper75	-0.085	0.0126	-0.1099	-0.0602
collegeXper90	-0.107	0.0124	-0.1320	-0.0834
constant	-1.028	0.0136	-1.0552	-1.001

Source: Authors' calculations from CPS.

Intra-household inequality

- Wife/husband earnings ratio rises for college wives in early 1990s, suggesting positive selection



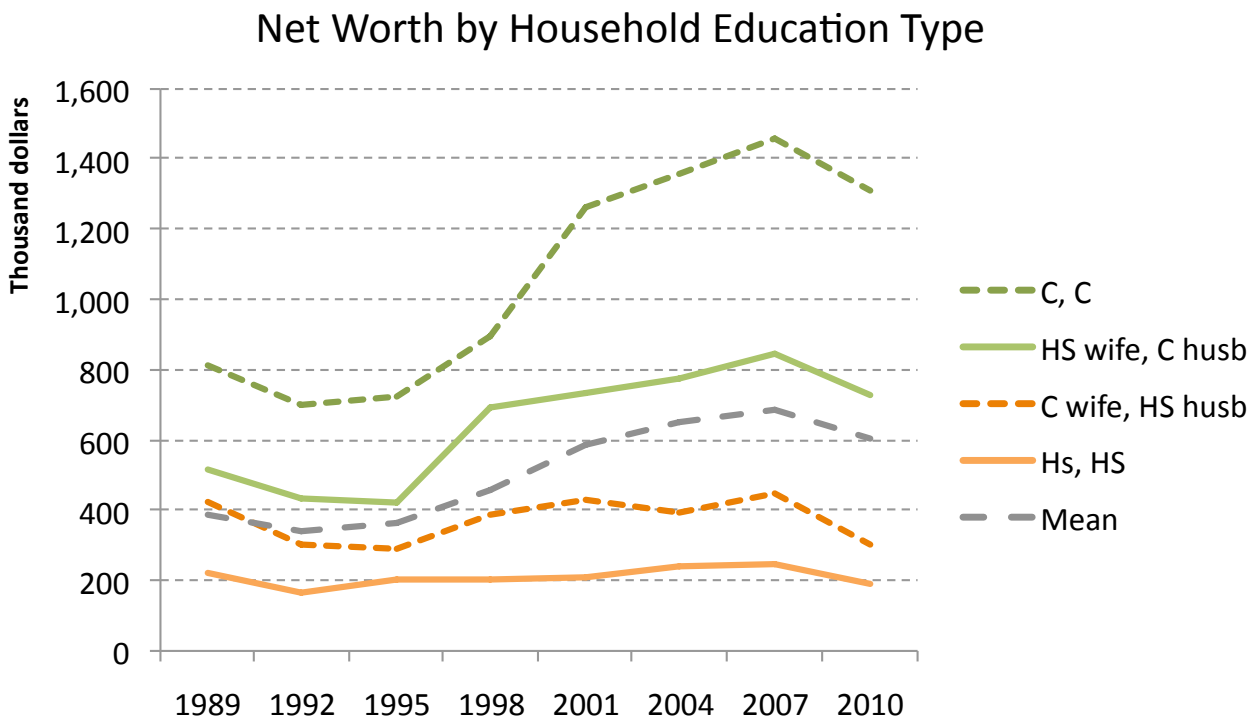
Source: March CPS

Ratio of wife to husband's earnings computed for households where both partners worked for at least 45 weeks that year, and each earned at least \$5,000 (in 2005 USD).

Negative Income Effect

Household Net Worth

- The corresponding rise in net worth for households with college husband since the mid-1990s also contributed to the negative income effect.



Source: Survey of Consumer Finances.

Labor Flows

- Participation to non-participation (EN) flow rates increased, while NE flow rates declined after 1995, especially for women with college husbands.

		Wife-Husband Education					Husband's Education	
		All	HS-HS	HS-C	C-HS	C-C	HS	Coll
EN	1984-1994	0.060	0.056	0.057	0.038	0.048	0.061	0.055
	1995-2005	0.073	0.063	0.075	0.045	0.074	0.072	0.065
NE	1984-1994	0.212	0.243	0.190	0.304	0.249	0.209	0.231
	1995-2005	0.209	0.220	0.195	0.345	0.220	0.215	0.207

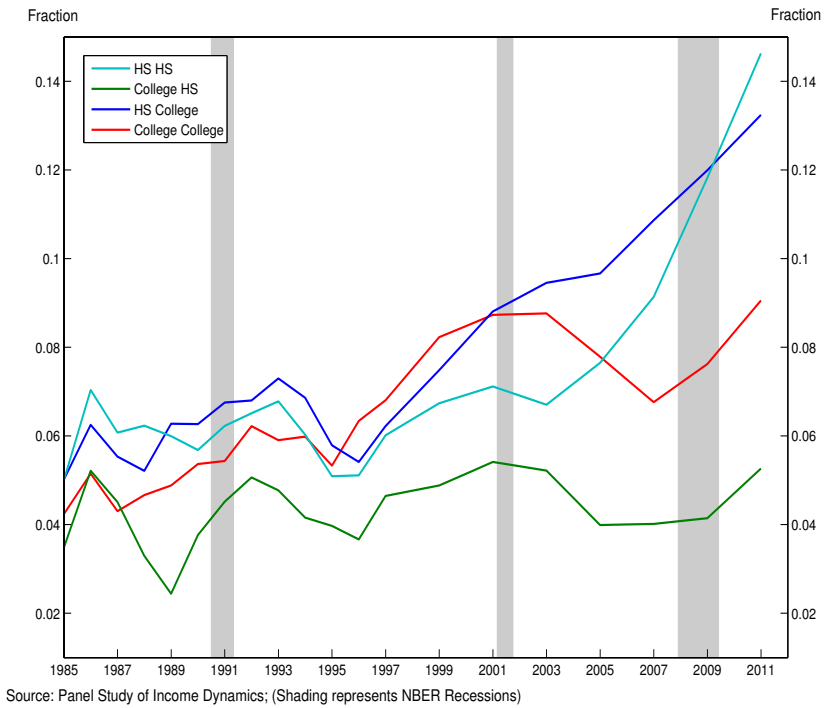
Yearly transition rates. Source: Authors' calculations from the PSID.

Labor Flows

By household type, prime age women

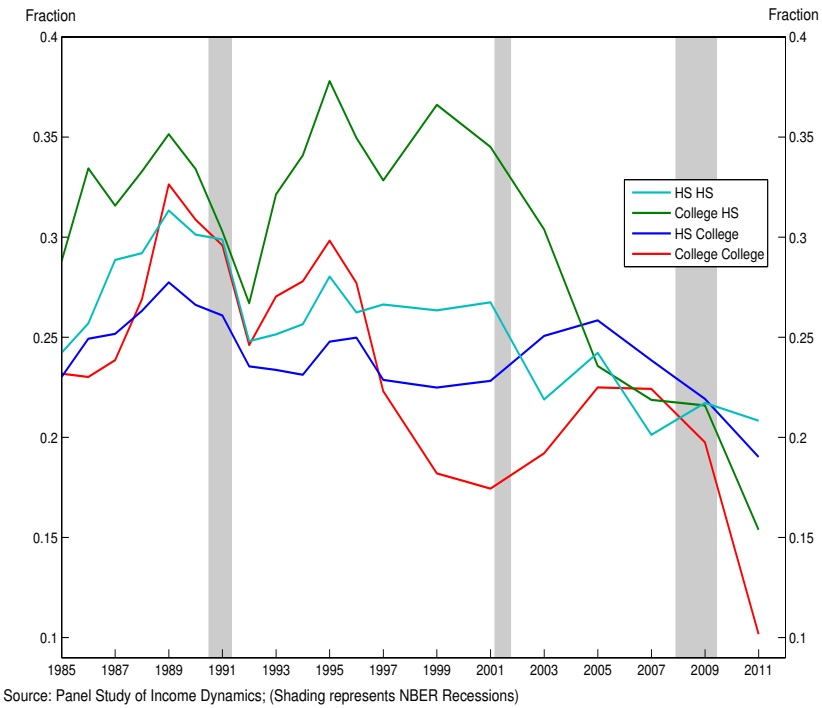
- The rise in EN is more pronounced for women with college husbands.

Core Prime E–to–N Flows by Household Type



Source: Panel Study of Income Dynamics; (Shading represents NBER Recessions)

Core Prime N–to–E Flows by Household Type



Source: Panel Study of Income Dynamics; (Shading represents NBER Recessions)

Yearly flows for Core Prime women (25-44 yo).

Source: Authors' calculations from the PSID.

Summary

- Skill premium for men rises by 6.3% in 1995-2005
  - Male/female wage ratio rises by 11% for college workers
- Labor force participation of married women in 1995-2005 relative to pre-1995 trend
  - 12% lower for college women
  - 17% lower for women with college husbands
  - 25% lower for women with husbands in top income decile
  - Similar behavior for hours
- Participation to Non-Participation flow rises, Non-Participation to Participation flow falls post 1995, especially for women with college husbands.

Quantitative Analysis

Model

Household Labor Supply

- Households:
  - Composed by two married partners of different gender.
  - Partners have independent utility functions.
- Marriage and educational attainment exogenous. No divorce.
- Heterogeneity in individual productivity.
  - Assortative matching by education based on empirical distribution of household types.
- Intensive and extensive labor supply decisions.
- Efficient market and home hours allocation.
- Wages endogenous due to on the job acquisition of human capital.

Model

Household Problem

$$max_{c_j^{is}, h_j^{is} \geq 0, l_j^{is} \in \{0, [\underline{l}, \bar{l}]\}, b_{j+1}, k_{j+1}^s \geq 0} \sum_{j=1}^{J} \beta^j \sum_{s=f,m} \lambda^s u\left(c_j^{is}, l_j^{is} + h_j^{is}\right)$$

s.t.

$$H_j = G(h_j^f, h_j^m)$$

$$\sum_{s=f,m} c_j^{is} + q b_{j+1}^i \leq \sum_{s=f.m} W_j^{is} l_j^{is} + b_j^i \text{ for } j = 1, 2, ...J$$

$$\sum_{s=f,m} c_J^{is} \leq b_J$$

$$k_{j+1}^{is} = F(l_j^{is}, k_j^{is})$$

$$k_0^s = \overline{k^s}$$

$$H_j \text{ given for } j = 1, .., J$$

Model

Wages and Human Capital

- Wages:

$$W_j^{is} = \theta^s w^s (1 + \xi_j^s e^{is}) k_j^{is}$$

for $s = f, m$, $i = c, hs$, for all $j = 1, 2, ...J - 1$

  - fixed individual productivity θ^s, with gender specific distribution
  - gender specific baseline wage $w^f \leq w^m$
  - skill premium, ξ_j^s, indicator for college e^{is}
  - human capital law of motion follows Imai and Keane (2004), $k_j^i = f(k_{j-1}^i, l_{j-1}^i)$

- Endogenous gender wage gap and skill premium due to on the job acquisition of human capital.

Model

Market and Home Hours

- Indivisible labor:

$$l_j^{is} = \begin{cases} 0 & \text{if } p_j^{is} = 0 \\ \geq \underline{l} & \text{if } p_j^{is} = 1 \end{cases}$$

- Home hours requirement:

$$H_j = G(h_j^f, h_j^m)$$

  - H_j exogenous, varies with age $j = 1, 2, ...J$

Optimal Household Allocation

- Income effects:
  - Participation is zero if own productivity is sufficiently low and non-labor income (partner's income+wealth) is sufficiently high.
  - Rise in partner's wage causes market hours to drop and eventually participation to go to zero.
- Gender wage gap causes wives' participation and market hours to be lower than husbands on average, triggering a decline in both, if the skill premium rises.

Calibration

- Household types (wife-husband):
  $hs - hs, hs - coll, coll - hs, coll - coll$
- Four stages: 25-39, 40-54, 55-69, 70+ yo
- Productivity distribution:
  - $\theta^s \sim logN(\bar{\theta}, \sigma^s)$ for $s = f, m$,
- Strategy:
  - Set most parameters based on independent evidence.
  - Set remaining parameters to match 1980 aggregate participation, labor earnings dispersion by gender, home/market hours ratio.

Calibration

Functional Forms

- Utility:

$$u\left(c_j^{is}, l_j^{is} + h_j^{is}\right) = \frac{\left(c_j^{is}\right)^{1-\sigma}}{1-\sigma} - \phi^s \frac{\left(l_j^{is} + h_j^{is}\right)^{1+\frac{1}{\gamma^s}}}{1+\frac{1}{\gamma^s}}$$

  - $\sigma,\ \phi^s, \gamma^s > 0$ for $s = f, m$

- Home production:

$$G(h^f,\ h^m) = \left[\psi^f \left(h^f\right)^{\rho} + \psi^m \left(h^m\right)^{\rho}\right]^{1/\rho}$$

  - $\rho,\ \psi^s \in (0,1)$ for $s = f, m$, $\sum_s \psi^s = 1$

Calibration

Table: Parameters calibrated based on independent evidence

Preferences	
	$\sigma = 1.1$
	$\beta = 0.978^{15}$
	$\lambda^f = 0.5$
Home production	
	$\psi^f = 0.5$
	$\rho = 0.65$
	$\{H_2, H_3\} = \{1.018, 1.031\} H_1$
Human capital	
	Imai and Keane(2004)
Labor market	
	$w^f / w^m = 0.9,\ w^m = 1$

Level of ξ^s backed out of data on wages and hours by age.
Distribution of household types: from data.

Calibration

Table: Parameters calibrated for 1980 to match population moments

Utility		Home Production	θ distribution	
ϕ_t^f	ϕ_t^m	H_1	σ^m	σ^f
0.169	0.142	2.74	0.48	0.35

Table: Data/Model Comparison

1980	Data		Model	
	Women	Men	Women	Men
Participation	0.44	0.86	0.44	0.86
Coeff. var. earnings distribution	1.34	0.84	1.34	0.84
Market/home hours	0.922		1.23	

Exercise 1: Steady state rise in the skill premium

- Exercise:
  - Back out ξ_j^s to match actual 1995-2005 average skill premium by gender using data on wages and hours by age.
  - Compare 1980 to 1995-2005, as if steady states.
- Labor supply response:
  - large drop in participation of women with college husbands, 60% of data;
  - large drop in participation of women in college women with college husbands, 40% of data;
  - participation of college women with high school husbands rises, contrary to data
  - no response in participation of high school women, by design
- Qualitatively captures larger increase in skill premium for men, and higher rise in male/female wage ratio for college than high school.

Exercise 1

Response of women's labor supply

- Decline in participation in the model greatest for women with college husbands, as in data.
- Participation of college women with high school husbands rises, contrary to data.

	Married Women's Participation			
Household Types	HS-HS	HS-C	C-HS	C-C
Model	1980 calibration: 1995-2005 skill premium-actual			
percent change	0	−16.8	8.1	−7.3
Data	Average 1995-2005: actual- pre1995 projection			
percent change	−10	−17	−8	−17

Wages

Exercise 2: Cohort simulations

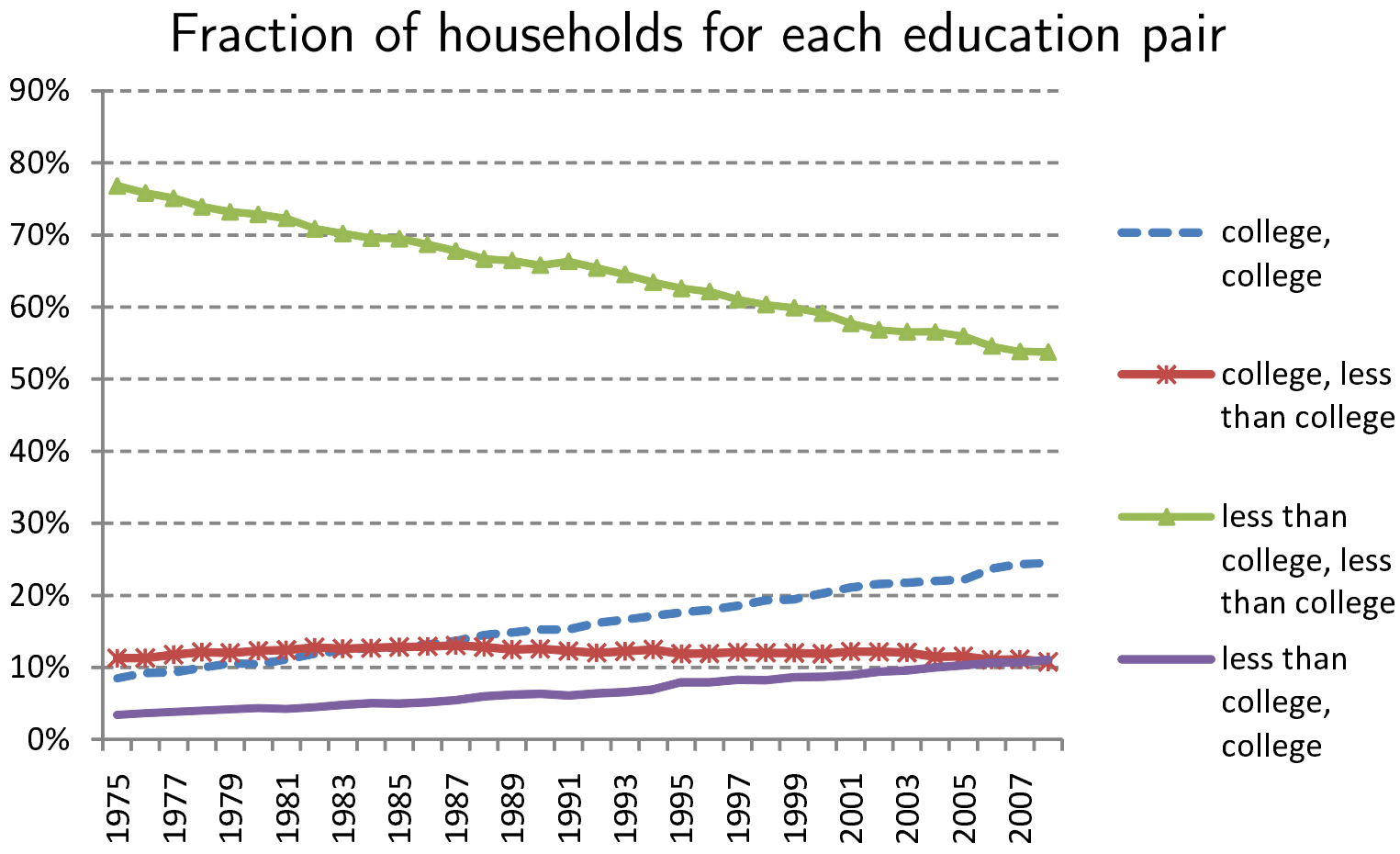
- Simulate model every 5 years between 1965 and 2005, examine behavior of cohorts who are 25-39 in each year throughout their lifetime.
  - Calibrate constant rate of decline in ϕ^f to match participation growth between 1965-1995, projected forward post 1995. Captures forces increasing women's labor supply.
    - Examples: Home appliances (Greenwood, Sheshadri and Yorugoklu 2005), cultural factors (Fogli and Veldkamp 2011, Fernandez 2013), improvement in maternal health (Albanesi and Olivetti 2016).
  - Trends for w^f/w^m and w^m as in data.
- Skill premium:
  - 1965-1990: Stable process backed out from data.
  - 1995-2005: New process backed out from data, with higher level and higher growth rate.
  - Unanticipated change in skill premium process in 1995. Active households re-optimize in 1995 based on new process.

Exercise 2

Estimated process for the skill premium

Skill Premium					
1980	Level	ξ_1^f	0.572	ξ_1^m	0.662
pre – 1995	Trend (5 year growth factor)	F	1.036	M	1.054
1995	Level	ξ_1^f	0.74	ξ_1^m	0.80
post – 1995	Trend (5 year growth factor)	F	1.037	M	1.06

Distribution of Households by Education



Source: March Supplement of CPS

Calibration

Exercise 2

Participation

- Participation drops most for women with college husbands, especially those with high school.
- Participation rises for college women with high school husbands, contrary to data.

Married Women's Participation, 1995-2005 Average				
Wife-Husband Education	HS-HS	HS-C	C-HS	C-C
Model	actual − pre-1995 projected			
percent change	0	−12	7	−4
Data	actual − pre-1995 projected			
percent change	−10	−17	−8	−17

Constant ϕ_f results

Exercise 2

Wages

- Simulation captures small fraction of slowing convergence in wages across gender, consistent with differential by skill.
- Due to rise in participation of college wives with high school husbands in the model, skill premium rises slightly more for women than for men.

	Skill Premium		Male/Female Wages	
1995-2005 Average	Male	Female	HSchool	Coll
Model	actual - projected pre-1995			
percent change	14.6	16	1.0	2.6
Data	actual - projected pre-1995 growth			
percent change	11.4	9.2	8.4	10.61

Constant ϕ_f results

Summary

- Empirical evidence:
  - Slowing labor force participation of married women, particularly for those with college husbands and high income husbands, suggesting role for income effects.
- Quantitative analysis:
  - Income effects can account for approx. 60% of the decline in participation of women with college husbands for 1995-2005, relative to pre-1995 trend.
  - Missing force:
    - Participation of college women with high school husbands rises in model.
    - Participation of high school women with high school husbands constant by design.
  - Model captures small fraction of rise in male/female wage ratio for college workers, overpredicts rise in female skill premium.

International Evidence

- Most OECD countries display a negative correlation between the growth in inequality and women's participation.

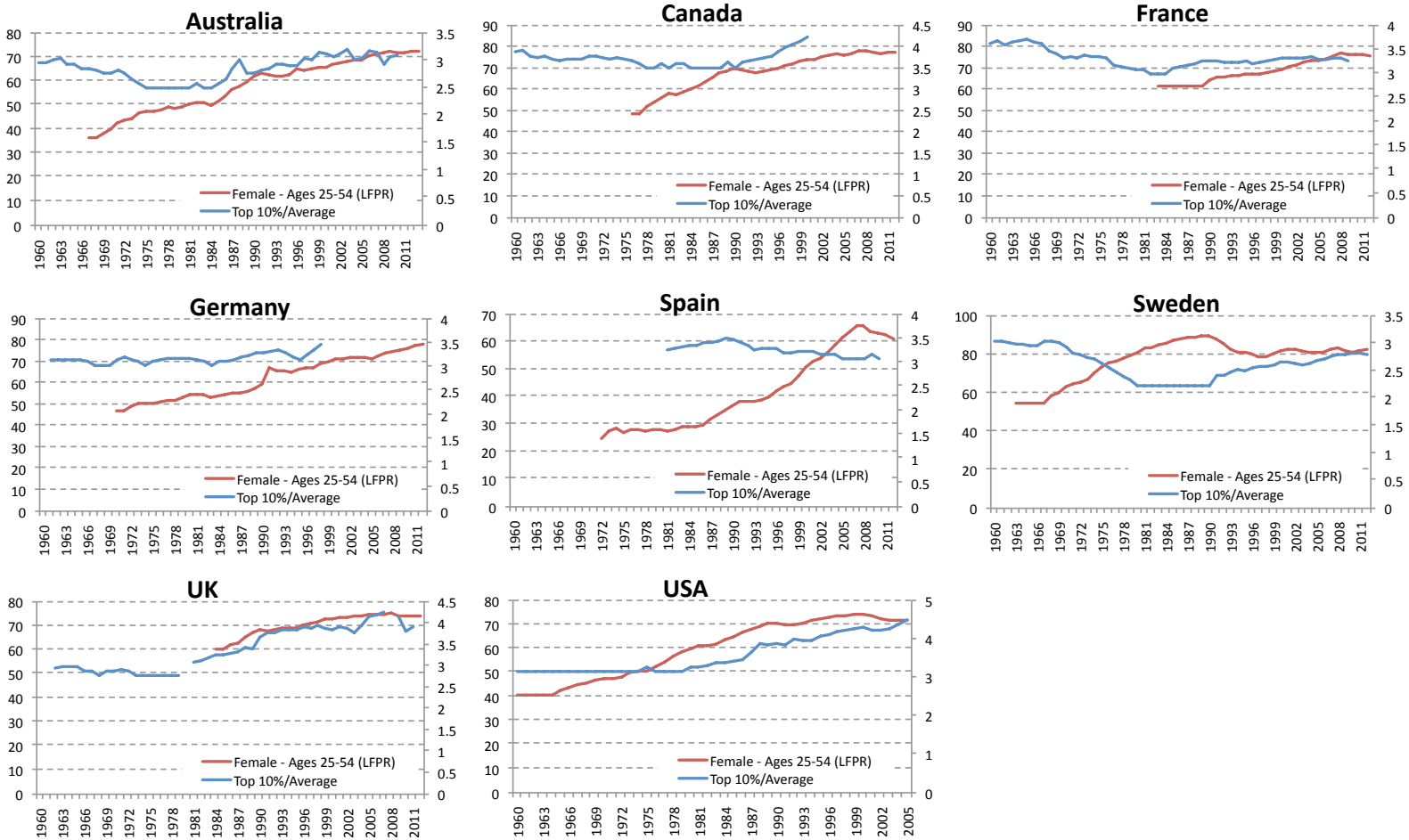


Figure: Participation and top 10%/average income ratio. Source: OECD

Ongoing work

- Income tax: incorporate 1993 tax reform.
- Household production: endogenize home production requirement allowing to substitute time with market goods.
- Incorporate fertility choice.

Back Up Slides

Back up slides

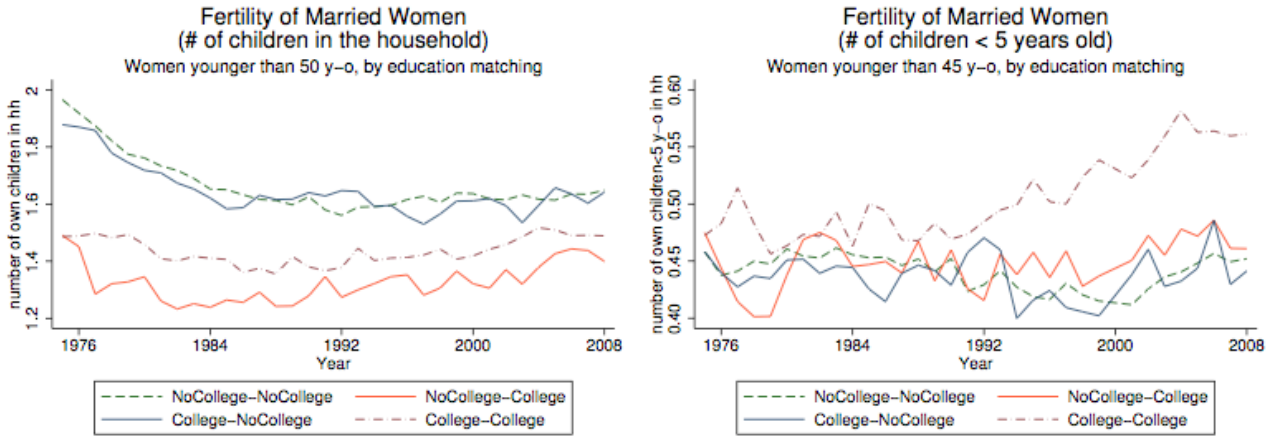
- Additional channels: Fertility choice
- Earnings dispersion by gender
- Intra-household inequality
- Labor supply of men
- Exercise 1: Wages
- Exercise 2: Constant ϕ^f

Additional Channels

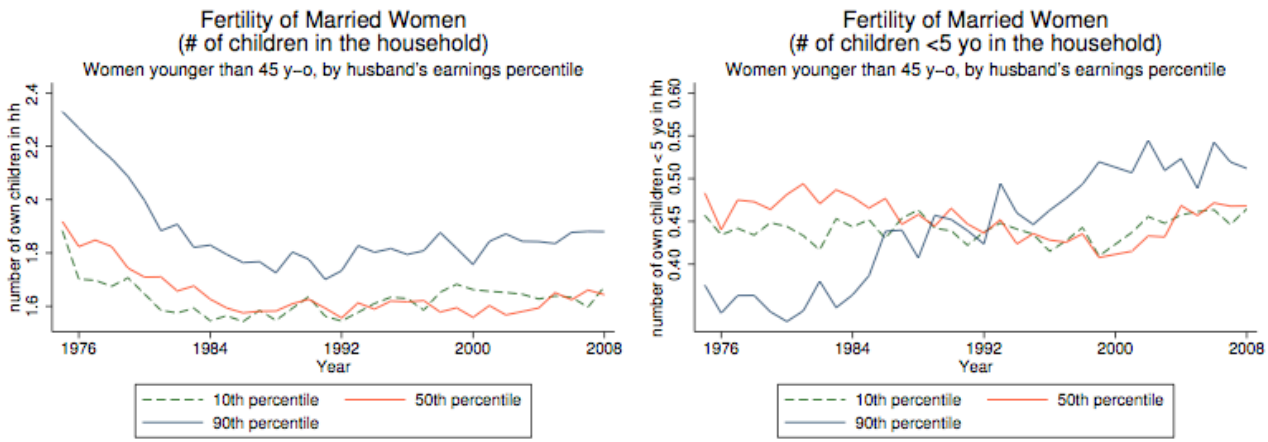
Fertility choice with quality/quantity trade-off

- Slowing in participation occurs for married women with and without children.
- Low opportunity cost of additional children in high income one earner households $\Longrightarrow$ quantity of children may rise in addition to quality.
- Hypothesis is consistent with rise in fertility for college-college households and high income husband households in the mid-1990s.

Fertility by household type



(a) Fertility by household type

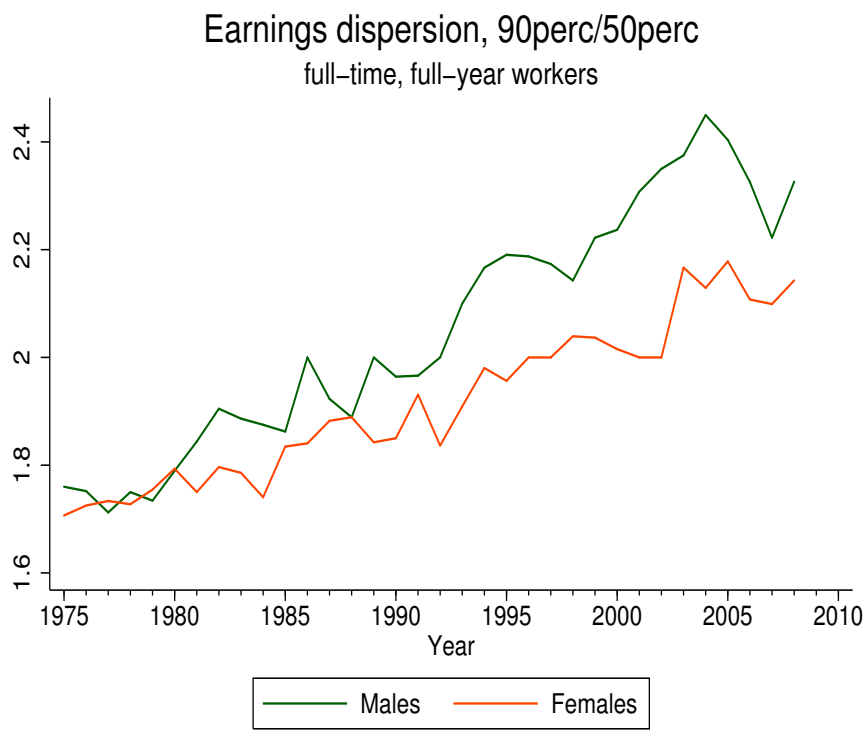


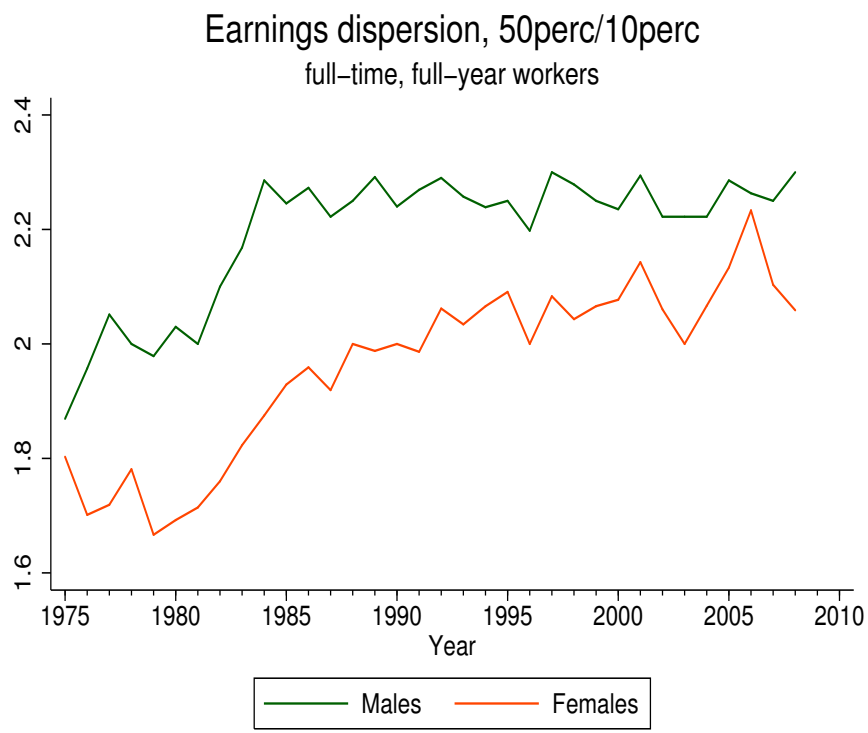
(b) Fertility by husband's earnings

List

Earnings dispersion by gender

- 90/50 percentile ratio rose more for men than for women over same period



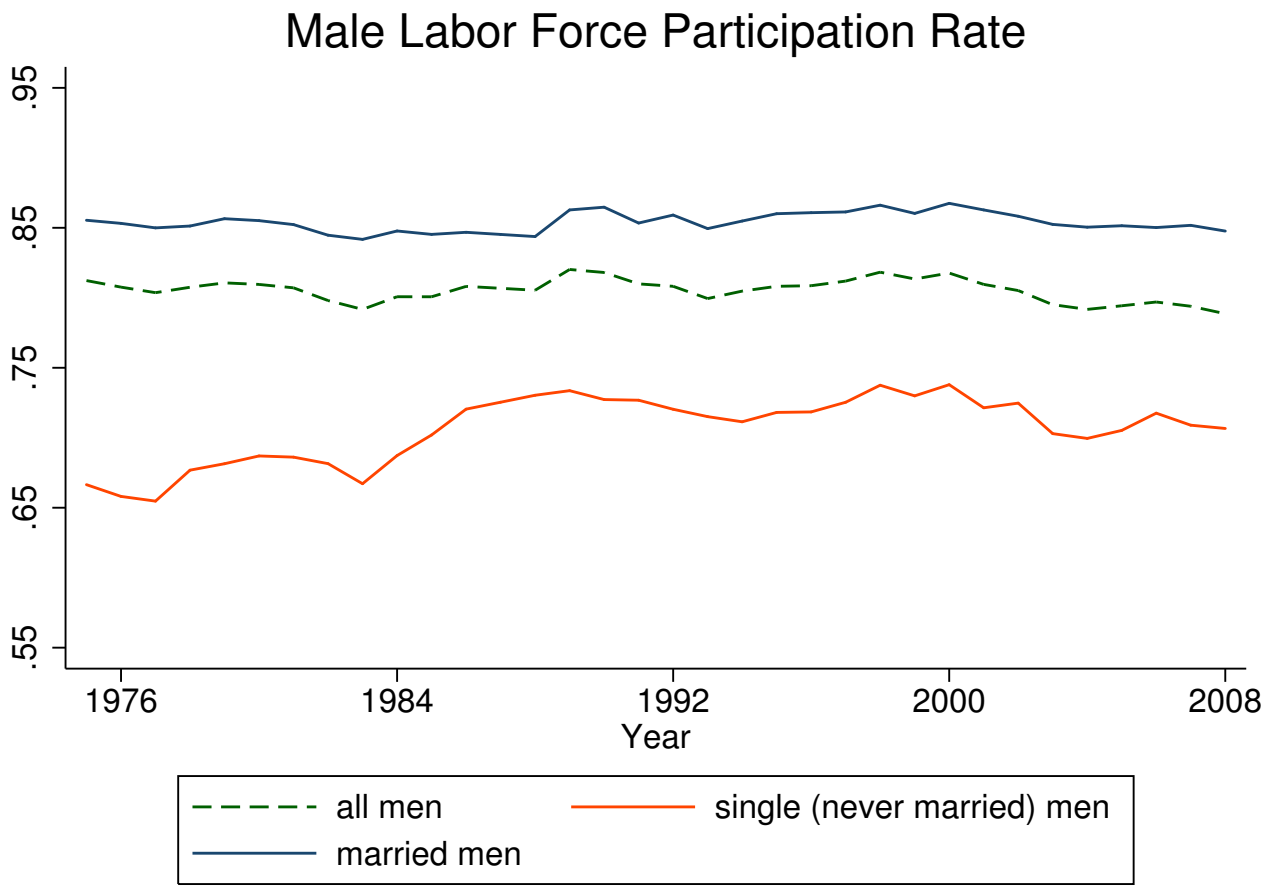


Source: March Supplement of CPS

Skill Premium by Gender

Labor supply of men

- Participation of married men has remained stable.

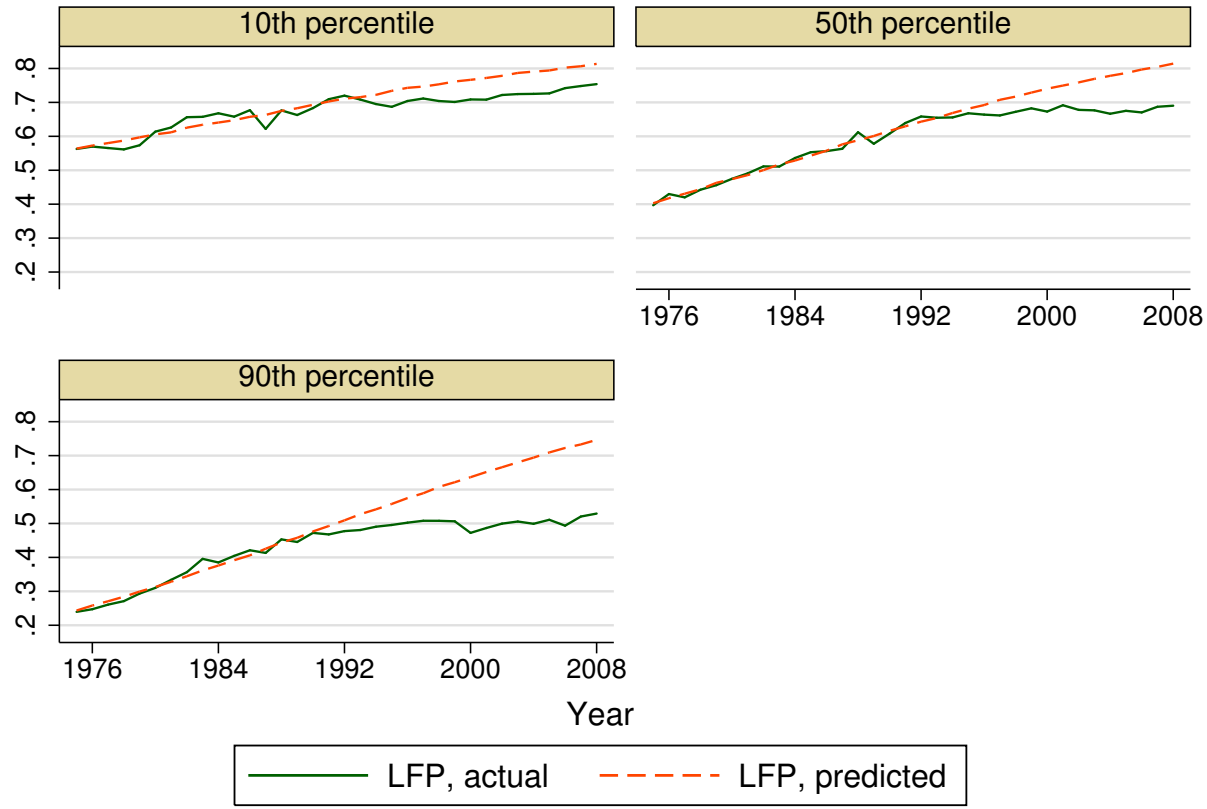


Source: March Supplement of CPS

Labor Supply of Married Men

Labor supply of married women

Participation by husband's earnings



Source: March Supplement of CPS

Dashed line corresponds to 1976-1994 participation probit, in and out of sample.

Actual vs Projected

Exercise 1

Response of wages by gender

- Skill premium rises more for men in the model, as in the data. Model magnitude much higher than data.
- Male/female wage ratio rises more for college than high school workers, as in the data, model magnitude of difference larger than data.

	Skill Premium		Male/Female Wages	
	Male	Female	HS	Coll
Model	1980 calibration: 1995-2005 skill premium-actual			
% change	25	11	-1.3	5.9
Data	Average 1995-2005: actual- pre1995 projection			
% change	6.3	2.5	8.4	10.61

Participation

Exercise 2

Constant ϕ_f results

Baseline Results

- Participation drops most for women married to college husbands, especially those with high school. But participation rises for college women with high school husbands, contrary to data.

	Married Women's Participation, 1995-2005 Average			
Hh Types	HS-HS	HS-C	C-HS	C-C
Model	actual skill premium − pre-1995 projected skill premium			
% change	0	−23.3	7.3	−4
Data	actual − projected using pre-1995 growth			
% change	−9.8	−17	−8	−17

Exercise 2

Constant ϕ_f results

- Simulation captures the gender divergence in the skill premium. It does not capture the slowing convergence in wages across gender for skilled workers, due to the strong rise in participation and hours of college women with high school husbands.

	Skill Premium		Male/Female Wages	
1995-2005 Average	Male	Female	HS	Coll
Model	actual skill premium − pre-1995 projected skill premium			
percent change	14.5	15.9	−0.4	1
Data	actual-projected using pre-1995 growth			
percent change	11.4	9.2	8.4	10.6

Baseline Results
List