

# Technology and the Changing Family

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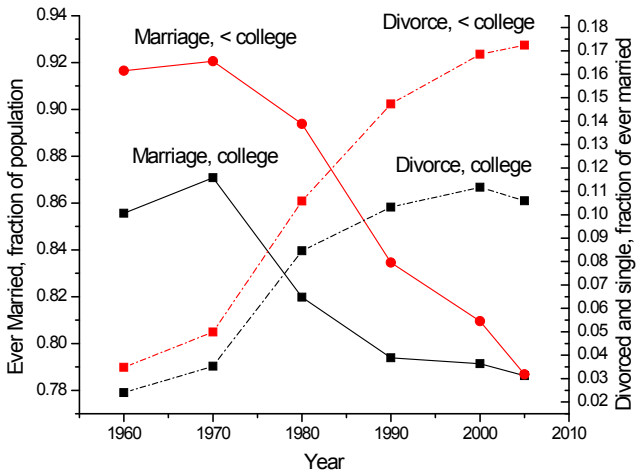
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# Introduction

Facts about American households in the last 50 years:

1. Decline in Marriage
  - Differences by education levels
2. Rise in Assortative Mating
3. Increase in Education and Labor-Force Participation (LFP) by Females

# The Decline in Marriage



# The Rise in Assortative Mating 1

Contingency Table

1960			2005		
Husband	Wife		Husband	Wife	
	< College	College		< College	College
< College	0.856	0.024	< College	0.565	0.109
College	0.080	0.040	College	0.103	0.223
	corr = 0.41	n=241,488		corr = 0.52	n=347,210

► Full Table

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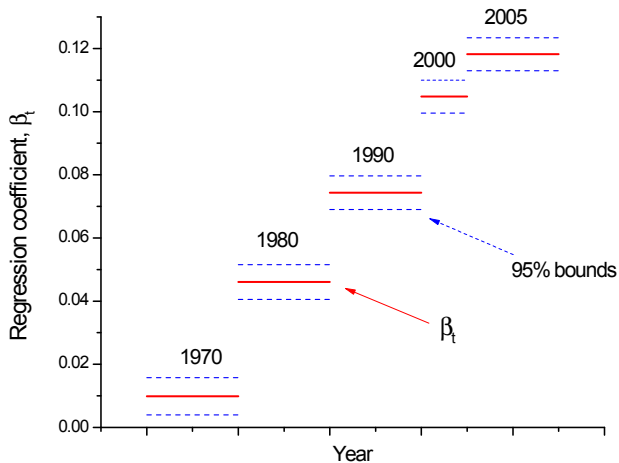
Consider the following regression:

$$\mathbf{e}_t^w = \alpha + \sum_{j \in \mathcal{J}} \beta_t \mathbf{e}_t^h d_{j,t} + \sum_{j \in \mathcal{J}} \gamma_t d_{j,t} + \varepsilon_t,$$

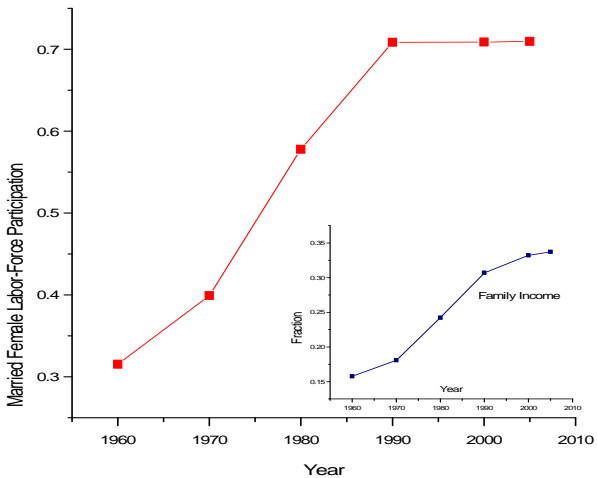
where:

- $\mathbf{e}_t^w \in \{0, 1\}$  : wife's education;
- $\mathbf{e}_t^h \in \{0, 1\}$  : husband's education;
- $d_{j,t}$  : year dummies (1970, 1980, 1990, 2000, 2005)

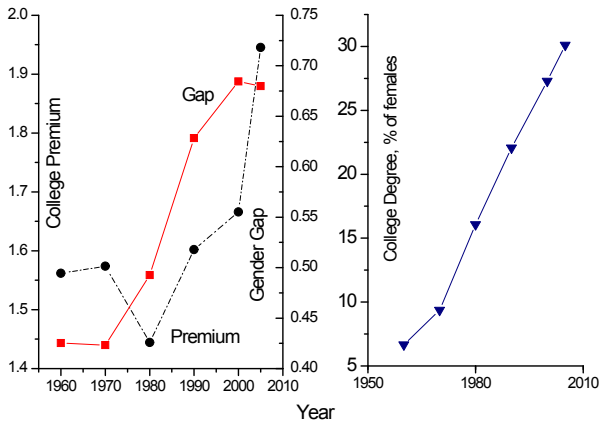
# The Rise in Assortative Mating 2



# Increase in LFP of Married Females



# Education and Wages





# What We Do

- We develop a model consistent with these facts
- Forces:
  - Economic and non-economic reasons for marriage
  - Technological progress in the household sector
  - Changing wage structure
    - Gender wage gap
    - College premium
    - Growth in wages
- We calibrate/estimate the model
  - Match steady state of model with data for 1960 and 2005
- Decompose the effects of different driving forces

# Preview of the Results

- Technological progress in the household:
  - increases married female LFP
  - decreases marriage and increases divorce (by education)
- Changes in the wage structure:
  - increase education
  - increase assortative mating.

## Relationship to the Literature

- **Decline in marriage:** Greenwood and Guner (2009), Regalia and Rios-Rull (2001), Choo and Siow (2006).
- **Increase in female LFP:** Galor and Weil (1996), Greenwood, Seshadri and Yorukoglu (2005), Albanesi and Olivetti (2009), Jones, Manuelli and McGrattan (2003), Fernandez, Fogli and Olivetti (2004)
- **Rise in single families:** Bethencourt and Rios-Rull (2009), Salcedo, Schoellman and Tertilt (2009).
- **Skill premium and mating:** Fernandez, Guner and Knowles (2005), Chiappori, Iyigun and Weiss (2009).

# Model Setup

- Female and male agents:
  - Married or single
  - Educated or not
- Probability of death  $\delta$
- Agents have ability level  $a$ 
  - Draw from distribution  $A(a)$  in the beginning of life
- One unit of time per person:
  - Housework
  - Market work  $\bar{h}$ 
    - wage  $w_e a$  to a male
    - wage  $\phi w_e a$  to a female (gender gap =  $\phi$ )
    - wages change over time

# Preferences

- Discount factor:  $\beta = \tilde{\beta}(1 - \delta)$
- Singles:

$$U_s(c, n) = \frac{1}{1 - \zeta} (c - c)^{1 - \zeta} + \frac{\alpha}{1 - \xi} n^{1 - \xi}$$

$c$  - fixed cost of maintaining a household

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- Couples:
  - Consumption:

$$U_m(c, n) = \frac{1}{1 - \zeta} \left( \frac{c - c}{1 + \chi} \right)^{1 - \zeta} + \frac{\alpha}{1 - \zeta} \left( \frac{n}{1 + \chi} \right)^{1 - \zeta}$$

- $c$  is a public good
  - Couple's compatibility:

$$M(e, e^*) = \mu_0(1 - e)(1 - e^*) + \mu_1 ee^*$$

- Match quality  $b$
  - Utility cost if wife works  $k$

# Shocks

- Match quality  $b$

- Singles:

$$b \sim N(\bar{b}_s, \sigma_{b,s}^2)$$

- Couples:

$$b' = (1 - \rho_{b,m})\bar{b}_m + \rho_{b,m}b + \sigma_{b,m}\sqrt{1 - \rho_{b,m}^2}\varepsilon, \text{ with } \varepsilon \sim N(0, 1)$$

- Cost if wife works  $k$ :

$$k \sim \Gamma(\kappa, \eta)$$

# Household Production

$$n = \left[ \theta d^\lambda + (1 - \theta)(z - h_T)^\lambda \right]^{1/\lambda}, \quad 0 < \lambda < 1.$$

$z$  = household's time endowment

$h_T$  = total market work

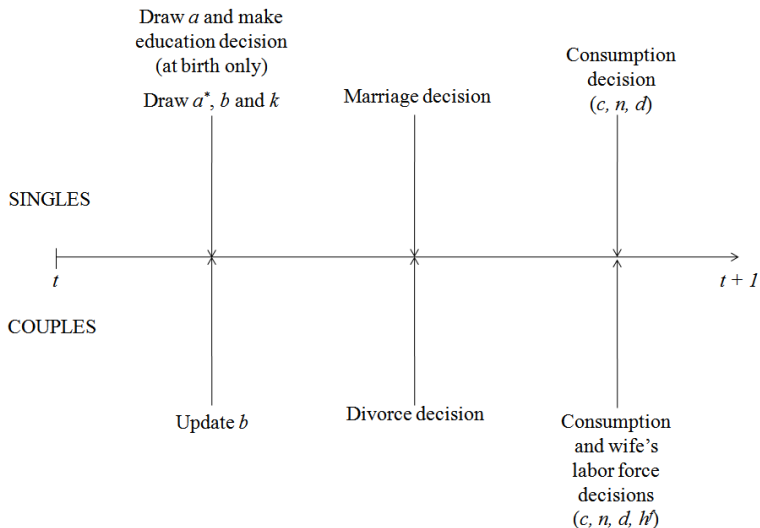
$d$  = purchased household inputs

$p$  = price of purchase household inputs

$p$  declines over time



# Timing



# Education Choice

- $V_s^g(a, e)$  - Value function, single agent
- $V_m^g(a, e, a^*, e^*, b, k)$  - Value function, married agent
  - Matched pair  $(a, e, a^*, e^*)$  draws shocks  $b$  and  $k$
- At birth:

$$\max_{e \in \{0,1\}} \{V_s^g(a, e) - eC(a)\}.$$

- Decision rule:  $e = E^g(a)$ .
- Cost:

$$C(a) = \varepsilon - \omega a$$

# Decision Making - Marriage and Divorce

- Marriage:

$$V_m^g(a, e, a^*, e^*, b, k) \geq V_s^g(a, e)$$

and

$$V_m^{\sim g}(a^*, e^*, a, e, b, k) \geq V_s^{\sim g}(a^*, e^*)$$

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- Divorce:

$$V_s^g(a, e) > V_m^g(a, e, a^*, e^*, b, k)$$

or

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or

$$V_s^{\sim g}(a^*, e^*) > V_m^{\sim g}(a^*, e^*, a, e, b, k)$$

- Matching rule:  $\mathbf{1}^g(a, e, a^*, e^*, b, k) = \begin{cases} 1, & \rightarrow \text{married} \\ 0, & \rightarrow \text{single} \end{cases}$

# Decision Making - Couples

Dynamic Programming Problem:

$$\begin{aligned}
 V_m^g(a, e, a^*, e^*, b, k) = & \max_{c, n, d, h^f \in \{0,1\}} U_m(c, n) - h^f k + b + M(e, e^*) \\
 & + \beta \int_B \underbrace{\{ \mathbf{1}^g(a, e, a^*, e^*, b', k) V_m^g(a, e, a^*, e^*, b', k) \}}_{\text{Stay married}} \\
 & + \underbrace{[1 - \mathbf{1}^g(a, e, a^*, e^*, b', k)] V_s^g(a, e)}_{\text{Get divorced}} dG(b' | b)
 \end{aligned}$$

subject to

$$c = \begin{cases} w_{e^*} a \bar{h} + w_e \phi a \bar{h} h^f - pd, & \text{if } g = f, \\ w_e a \bar{h} + w_{e^*} \phi a \bar{h} h^f - pd, & \text{if } g = m, \end{cases}$$

and

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# Decision Making - Singles

Dynamic Programming Problem:

$$V_S^g(\mathbf{a}, \mathbf{e}) = \max_{c,n,d} U_S(c, n)$$

$$\begin{aligned}
 & + \beta \int_{\mathcal{K}} \int_{\mathcal{B}} \int_{\mathcal{A}} \underbrace{\{ \mathbf{1}^g(\mathbf{a}, \mathbf{e}, \mathbf{a}^*, E^{\sim g}(\mathbf{a}^*), b, k) V_m^g(\mathbf{a}, \mathbf{e}, \mathbf{a}^*, E^{\sim g}(\mathbf{a}^*), b, k) \}}_{\text{Get married}} \\
 & + \underbrace{[1 - \mathbf{1}^g(\mathbf{a}, \mathbf{e}, \mathbf{a}^*, E^{\sim g}(\mathbf{a}^*), b, k)] V_S^g(\mathbf{a}, \mathbf{e})}_{\text{Stay single}} \} d\hat{\mathbf{S}}^{\sim g}(\mathbf{a}^*) dF(b) dK(k)
 \end{aligned}$$

subject to

$$c = \begin{cases} w_e \phi a \bar{h} - pd, & \text{if } g = f, \\ w_e a \bar{h} - pd, & \text{if } g = m, \end{cases}$$

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and

$$n = \left[ \theta d^\lambda + (1 - \theta)(1 - \bar{h})^\lambda \right]^{1/\lambda}.$$

# Distributions

- Determined in equilibrium:

$$S'(a) = T_s S(a)$$

$$M'(a, a^*, b, k) = T_m M(a, a^*, b, k)$$

▶ Singles

▶ Married

# Equilibrium Definition

An equilibrium for this economy is a collection of functions  $V_s^g$ ,  $V_m^g$ ,  $E^g$ ,  $1^g$ ,  $S^g$ , and  $M^g$  for  $g = m, f$  such that:

1. The value functions  $V_s^g$  and  $V_m^g$  solve the corresponding household's problem;
2. The decision rule  $E^g$  solves the single's education problem;
3. The matching rule  $1^g$  is consistent with the value functions;
4.  $S^g$  and  $M^g$  are the corresponding stationary distributions.

# Calibration/Estimation

- **Two steady states:** 1960 and 2005
- **Model period:** 1 year
- **Life span:** 30 years
- **Probability of survival:**  $1 - 1/30 = 0.97$ .
- **Discount factor:**  $\beta = 0.96 \times 0.97$
- **Work time:**  $\bar{h} = 40/112 = 0.36$
- **Household production:**  $\theta = 0.206, \lambda = 0.189$ 
  - McGrattan, Rogerson and Wright (1997)

# Calibration/Estimation

- **Wages:**

- College premium in 1960:

$$(w_{1,1960} \bar{a}_{1,1960}^m) / (w_{0,1960} \bar{a}_{0,1960}^m) = 1.34$$

- $w_{0,1960} = 1$  (normalization)
- $w_{1,1960} = 1.34 \times \bar{a}_{0,1960}^m / \bar{a}_{1,1960}^m = 1.035$
- Increase in wages: 1.14x for non-college in 1960-2005
  - $w_{0,2005} = 1.437$
- College premium in 2005: 1.94
  - $w_{1,2005} = 2.009$

# Calibration/Estimation

- **Gender gap:**  $\phi_t$  in  $t = 1960, 2005$ 
  - Heckman correction procedure:

$$\ln w = \text{CONSTANT} + \alpha \times \text{EDUCATION} \\ + \beta \times \text{AGE} + \delta \times \text{AGE}^2 + \tilde{\phi} \times \text{GENDER} + \varepsilon.$$

- Selection equation: marital status and children.
  - $\phi_{1960} = \exp(\tilde{\phi}_{1960}) = 0.61.$
  - $\phi_{2005} = \exp(\tilde{\phi}_{2005}) = 0.72.$
- **The rest of the parameters:**
  - Chosen to match a set of stylized facts for 1960 and 2005



# Calibration/Estimation - Targets

- **Education:**

- Education of females and males (4)

- **Marriage:**

- Fraction of singles
- Marriage and divorce propensities by education (8)

- **Sorting:**

- Fraction of marriages by education of spouses (6)

- **Married females work:**

- Married females labor force participation (2)
- Fraction of household income from a working wife (2)

# Calibration/Estimation - Targets and Parameters

TARGETS AND PARAMETERS			
Group	# of targets	# of parameters	Parameters
Education	4	3	$\varepsilon, \omega, \sigma_a$
Marriage and Sorting	14	11	$\bar{b}_s, \sigma_{b,s}, \bar{b}_m, \sigma_{b,m}, \rho_{b,m}$ $\mu_0, \mu_1, p_{1960}, p_{2005}, c, \zeta$
Work, Marr Fem	4	4	$\alpha, \xi, \kappa, \eta$

# Calibration/Estimation - Estimated Parameters

## PARAMETERS

<i>Category</i>	<i>Parameter Values</i>	<i>Criteria</i>
Preferences	$\beta = 0.96 \times (1 - \delta), \chi = 0.70$ $\alpha = 1.8, \xi = 2.5, \zeta = 1.6$ (goods) $c = 0.10$ (fixed costs) $\mu_0 = 0.42, \mu_1 = 0.82$ (compatibility)	A priori information Estimated Estimated Estimated
Household Technology	$\theta = 0.21, \lambda = 0.19$	McGrattan et al (1997)
Life span	$1/\delta = 30$	A priori information
Ability Shocks	$\bar{a} = 0$ (normalized), $\sigma_a = 0.02$	Estimated
Matching Shocks	$\bar{b}_s = -2.32, \sigma_{b,s} = 3.23$ (singles) $\bar{b}_m = -0.21, \sigma_{b,m} = 0.15, \rho_{b,m} = 0.8$ (couples)	Estimated Estimated
Home Shock	$\kappa = 20, \eta = 0.05$ (couples)	Estimated
Prices	$p_{1960} = 15$ $p_{2005} = p_{1960} \times e^{-0.065 \times (2005 - 1960)}$	Estimated Estimated
Wages	$w_{0,1960} = 1, w_{1,1960} = 1.035$ $w_{0,2005} = 1.437, w_{1,2005} = 2.009$ $\phi_{1960} = 0.61, \phi_{2005} = 0.72$ (gender gap)	Data Data Data
Hours	$\bar{h} = 0.36$	Data
Cost of Education	$\varepsilon = 130, \omega = 106$	Estimated

# Benchmark

## DATA AND MODEL

	1960				2005			
	<i>Data</i>		<i>Model</i>		<i>Data</i>		<i>Model</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males	Fem	Males
	0.067	0.116	0.105	0.105	0.301	0.284	0.315	0.281
<i>Marriage</i>								
Fraction	Sing	Marr	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.126	0.874	0.348	0.652	0.342	0.658
Rates	< Coll	Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
-Marriage	0.917	0.856	0.883	0.874	0.787	0.786	0.763	0.763
-Divorce	0.034	0.024	0.008	0.016	0.172	0.106	0.147	0.116
<i>Sorting</i>								
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.856	0.024	0.809	0.089	0.564	0.109	0.644	0.064
Coll	0.080	0.040	0.077	0.026	0.104	0.223	0.038	0.254
Corr, educ	0.410		0.114		0.519		0.761	
<i>Work, Marr Fem</i>								
Participation	0.315		0.319		0.710		0.779	
Income, frac	0.157		0.141		0.337		0.349	

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<i>Sorting Husband</i>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
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<i>Marriage</i>								
Fraction	Sing	Marr	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.126	0.874	0.348	0.652	0.342	0.658
<i>Rates</i>	< Coll	Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
-Marriage	0.917	0.856	0.883	0.874	0.787	0.786	0.763	0.763
-Divorce	0.034	0.024	0.008	0.016	0.172	0.106	0.147	0.116
<i>Sorting</i>								
<u>Husband</u>	< Coll	Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
< Coll	0.856	0.024	0.809	0.089	0.564	0.109	0.644	0.064
Coll	0.080	0.040	0.077	0.026	0.104	0.223	0.038	0.254
Corr, educ	0.410		0.114		0.519		0.761	
<i>Work, Marr Fem</i>								
Participation	0.315		0.319		0.710		0.779	
Income, frac	0.157		0.141		0.337		0.349	

# Benchmark

## DATA AND MODEL

	1960				2005			
	<i>Data</i>		<i>Model</i>		<i>Data</i>		<i>Model</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males	Fem	Males
	0.067	0.116	0.105	0.105	0.301	0.284	0.315	0.281
<i>Marriage</i>								
Fraction	Sing	Marr	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.126	0.874	0.348	0.652	0.342	0.658
Rates	< Coll	Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
-Marriage	0.917	0.856	0.883	0.874	0.787	0.786	0.763	0.763
-Divorce	0.034	0.024	0.008	0.016	0.172	0.106	0.147	0.116
<i>Sorting</i>								
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.856	0.024	0.809	0.089	0.564	0.109	0.644	0.064
Coll	0.080	0.040	0.077	0.026	0.104	0.223	0.038	0.254
Corr, educ	0.410		0.114		0.519		0.761	
<i>Work, Marr Fem</i>								
Participation	0.315		0.319		0.710		0.779	
Income, frac	0.157		0.141		0.337		0.349	



# Benchmark

## DATA AND MODEL

	1960				2005			
	Data		Model		Data		Model	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males	Fem	Males
	0.067	0.116	0.105	0.105	0.301	0.284	0.315	0.281
<i>Marriage</i>								
Fraction	Sing	Marr	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.126	0.874	0.348	0.652	0.342	0.658
Rates	< Coll	Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
-Marriage	0.917	0.856	0.883	0.874	0.787	0.786	0.763	0.763
-Divorce	0.034	0.024	0.008	0.016	0.172	0.106	0.147	0.116
<i>Sorting</i>								
<u>Husband</u>	< Coll	Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
< Coll	0.856	0.024	0.809	0.089	0.564	0.109	0.644	0.064
Coll	0.080	0.040	0.077	0.026	0.104	0.223	0.038	0.254
Corr, educ	0.410		0.114		0.519		0.761	
<i>Work, Marr Fem</i>								
Participation	0.315		0.319		0.710		0.779	
Income, frac	0.157		0.141		0.337		0.349	

# Changing Wage Structure Only

**EXPERIMENT:** NO TECHNOLOGICAL PROGRESS IN THE HOME

	1960		2005			
	<i>Benchmark</i>		<i>Experiment</i>		<i>Benchmark</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males
	0.105	0.105	0.281	0.350	0.315	0.281
<i>Marriage</i>						
Fraction	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.185	0.815	0.342	0.658
Rates	< Coll	Coll	< Coll	Coll	< Coll	Coll
-Marriage	0.883	0.874	0.843	0.846	0.763	0.763
-Divorce	0.008	0.016	0.036	0.031	0.147	0.116
<i>Sorting</i>						
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.809	0.089	0.599	0.022	0.644	0.064
Coll	0.077	0.026	0.145	0.234	0.038	0.254
Corr, educ	0.114		0.648		0.761	
<i>Work, Marr Fem</i>						
Participation	0.319		0.104		0.779	
Income, frac	0.141		0.050		0.349	

# Changing Wage Structure Only

## BENCHMARK AND EXPERIMENT

	1960		2005			
	<i>Benchmark</i>		<i>Experiment</i>		<i>Benchmark</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males
	0.105	0.105	0.281	0.350	0.315	0.281
<i>Marriage</i>						
Fraction	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.185	0.815	0.342	0.658
Rates	< Coll	Coll	< Coll	Coll	< Coll	Coll
-Marriage	0.883	0.874	0.843	0.846	0.763	0.763
-Divorce	0.008	0.016	0.036	0.031	0.147	0.116
<i>Sorting</i>						
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.809	0.089	0.599	0.022	0.644	0.064
Coll	0.077	0.026	0.145	0.234	0.038	0.254
Corr, educ	0.114		0.648		0.761	
<i>Work, Marr Fem</i>						
Participation	0.319		0.104		0.779	
Income, frac	0.141		0.050		0.349	

# Changing Wage Structure Only

## BENCHMARK AND EXPERIMENT

	1960		2005			
	<i>Benchmark</i>		<i>Experiment</i>		<i>Benchmark</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males
	0.105	0.105	0.281	0.350	0.315	0.281
<i>Marriage</i>						
Fraction	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.185	0.815	0.342	0.658
<i>Rates</i>	< Coll	Coll	< Coll	Coll	< Coll	Coll
-Marriage	0.883	0.874	0.843	0.846	0.763	0.763
-Divorce	0.008	0.016	0.036	0.031	0.147	0.116
<i>Sorting</i>						
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.809	0.089	0.599	0.022	0.644	0.064
Coll	0.077	0.026	0.145	0.234	0.038	0.254
Corr, educ	0.114		0.648		0.761	
<i>Work, Marr Fem</i>						
Participation	0.319		0.104		0.779	
Income, frac	0.141		0.050		0.349	

# Changing Wage Structure Only

## BENCHMARK AND EXPERIMENT

	1960		2005			
	<i>Benchmark</i>		<i>Experiment</i>		<i>Benchmark</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males
	0.105	0.105	0.281	0.350	0.315	0.281
<i>Marriage</i>						
Fraction	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.185	0.815	0.342	0.658
Rates	< Coll	Coll	< Coll	Coll	< Coll	Coll
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-Divorce	0.008	0.016	0.036	0.031	0.147	0.116
<i>Sorting</i>						
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.809	0.089	0.599	0.022	0.644	0.064
Coll	0.077	0.026	0.145	0.234	0.038	0.254
Corr, educ	0.114		0.648		0.761	
<i>Work, Marr Fem</i>						
Participation	0.319		0.104		0.779	
Income, frac	0.141		0.050		0.349	

# Changing Wage Structure Only

## BENCHMARK AND EXPERIMENT

	1960		2005			
	<i>Benchmark</i>		<i>Experiment</i>		<i>Benchmark</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males
	0.105	0.105	0.281	0.350	0.315	0.281
<i>Marriage</i>						
Fraction	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.185	0.815	0.342	0.658
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-Divorce	0.008	0.016	0.036	0.031	0.147	0.116
<i>Sorting</i>						
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.809	0.089	0.599	0.022	0.644	0.064
Coll	0.077	0.026	0.145	0.234	0.038	0.254
<i>Corr, educ</i>	0.114		0.648		0.761	
<i>Work, Marr Fem</i>						
Participation	0.319		0.104		0.779	
Income, frac	0.141		0.050		0.349	

# Technological Progress in the Home Only

EXPERIMENT: NO CHANGE IN WAGES

	1960		2005			
	<i>Benchmark</i>		<i>Experiment</i>		<i>Benchmark</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males
	0.105	0.105	0.105	0.074	0.315	0.281
<i>Marriage</i>						
Fraction	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.285	0.715	0.342	0.658
Rates	< Coll	Coll	< Coll	Coll	< Coll	Coll
-Marriage	0.883	0.874	0.797	0.820	0.763	0.763
-Divorce	0.008	0.016	0.107	0.096	0.147	0.116
<i>Sorting</i>						
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.809	0.089	0.827	0.112	0.644	0.064
Coll	0.077	0.026	0.041	0.020	0.038	0.254
Corr, educ	0.114		0.145		0.761	
<i>Work, Marr Fem</i>						
Participation	0.319		0.891		0.779	
Income, frac	0.141		0.355		0.349	

# Technological Progress in the Home Only

## BENCHMARK AND EXPERIMENT

	1960		2005			
	<i>Benchmark</i>		<i>Experiment</i>		<i>Benchmark</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males
	0.105	0.105	0.105	0.074	0.315	0.281
<i>Marriage</i>						
Fraction	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.285	0.715	0.342	0.658
Rates	< Coll	Coll	< Coll	Coll	< Coll	Coll
-Marriage	0.883	0.874	0.797	0.820	0.763	0.763
-Divorce	0.008	0.016	0.107	0.096	0.147	0.116
<i>Sorting</i>						
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.809	0.089	0.827	0.112	0.644	0.064
Coll	0.077	0.026	0.041	0.020	0.038	0.254
Corr, educ	0.114		0.145		0.761	
<i>Work, Marr Fem</i>						
Participation	0.319		0.891		0.779	
Income, frac	0.141		0.355		0.349	



# Technological Progress in the Home Only

## BENCHMARK AND EXPERIMENT

	1960		2005			
	<i>Benchmark</i>		<i>Experiment</i>		<i>Benchmark</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males
	0.105	0.105	0.105	0.074	0.315	0.281
<i>Marriage</i>						
Fraction	Sing	Marr	Sing	Marr	Sing	Marr
	0.126	0.874	0.285	0.715	0.342	0.658
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-Divorce	0.008	0.016	0.107	0.096	0.147	0.116
<i>Sorting</i>						
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.809	0.089	0.827	0.112	0.644	0.064
Coll	0.077	0.026	0.041	0.020	0.038	0.254
Corr, educ	0.114		0.145		0.761	
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Participation	0.319		0.891		0.779	
Income, frac	0.141		0.355		0.349	

# Technological Progress in the Home Only

## BENCHMARK AND EXPERIMENT

	1960		2005			
	<i>Benchmark</i>		<i>Experiment</i>		<i>Benchmark</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males
	0.105	0.105	0.105	0.074	0.315	0.281
<i>Marriage</i>						
Fraction	Sing	Marr	Sing	Marr	Sing	Marr
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<i>Sorting</i>						
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.809	0.089	0.827	0.112	0.644	0.064
Coll	0.077	0.026	0.041	0.020	0.038	0.254
Corr, educ	0.114		0.145		0.761	
<i>Work, Marr Fem</i>						
Participation	0.319		0.891		0.779	
Income, frac	0.141		0.355		0.349	

# Technological Progress in the Home Only

## BENCHMARK AND EXPERIMENT

	1960		2005			
	<i>Benchmark</i>		<i>Experiment</i>		<i>Benchmark</i>	
<i>Education</i>	Fem	Males	Fem	Males	Fem	Males
	0.105	0.105	0.105	0.074	0.315	0.281
<i>Marriage</i>						
Fraction	Sing	Marr	Sing	Marr	Sing	Marr
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<i>Sorting</i>						
<u>Husband</u>	<u>Wife</u>		<u>Wife</u>		<u>Wife</u>	
< Coll	< Coll	Coll	< Coll	Coll	< Coll	Coll
	0.809	0.089	0.827	0.112	0.644	0.064
Coll	0.077	0.026	0.041	0.020	0.038	0.254
<i>Corr, educ</i>	0.114		0.145		0.761	
<i>Work, Marr Fem</i>						
Participation	0.319		0.891		0.779	
Income, frac	0.141		0.355		0.349	

# Conclusions

- We develop an equilibrium model consistent with:
  - a decline in marriage and a rise in divorce
  - increasing assortative mating
  - increasing education and female LFP
- Results:
  - Technological progress in the household:
    - increases married female LFP
    - decline of marriage and rise of divorce (by education)
  - Changes in the wage structure:
    - increase education
    - increase assortative mating.

# Appendix: Steady-state Distribution for Singles

- Singles:  $\mathbf{S}^g(\mathbf{a}') =$

$$(1 - \delta) \int_{\mathcal{K}} \int_{\mathcal{B}} \int_{\mathcal{A}}^{\mathbf{a}'} \int_{\mathcal{A}} [1 - \mathbf{1}^g(\mathbf{a}, E^g(\mathbf{a}), \mathbf{a}^*, E^{\sim g}(\mathbf{a}^*), b, k)] d\mathbf{S}^g(\mathbf{a}) d\widehat{\mathbf{S}}^{\sim g}(\mathbf{a}^*) dF(b) dK(k)$$

Singles who failed to match

$$+ (1 - \delta) \int_{\mathcal{K}} \int_{\mathcal{B}} \int_{\mathcal{A}}^{\mathbf{a}'} \int_{\mathcal{A}} [1 - \mathbf{1}^g(\mathbf{a}, E^g(\mathbf{a}), \mathbf{a}^*, E^{\sim g}(\mathbf{a}^*), b, k)] d\mathbf{M}^g(\mathbf{a}, \mathbf{a}^*, b_{-1}, k) dG(b|b_{-1})$$

Married who decided to divorce

$$+ \underbrace{\delta A(\mathbf{a})}_{\text{New adults}}, \text{ for } g = f, m.$$

New adults

- Married people:  $\mathbf{M}^g(\mathbf{a}, \mathbf{a}^*, b, k)$ .
- Normalized distribution for singles of the opposite gender:

$$\widehat{\mathbf{S}}^{\sim g}(\mathbf{a}^*) \equiv \frac{\mathbf{S}^{\sim g}(\mathbf{a}^*)}{\int d\mathbf{S}^{\sim g}(\mathbf{a}^*)}$$

# Appendix: Steady-state Distribution for Married

$$\mathbf{M}^g(a', a^{*'}, b', k') =$$

$$(1 - \delta) \int_{\mathcal{K}} \int_B \int_A \int_A \mathbf{1}^g(a, E^g(a), a^*, E^{\sim g}(a^*), b, k) \times d\widehat{\mathbf{S}}_{e^*}^{\sim g}(a^*) d\mathbf{S}^g(a) dF(b) dK(k)$$

Newlywed

$$+ (1 - \delta) \int_{\mathcal{K}} \int_B \int_B \int_A \int_A \mathbf{1}^g(a, E^g(a), a^*, E^{\sim g}(a^*), b, k) \times d\mathbf{M}^g(a, a^*, b_{-1}, k) dG(b|b_{-1}).$$

Married who decided to stay married

◀ Return

# Appendix: Contingency Table

Contingency Table

1960			2005		
Husband	Wife		Husband	Wife	
	< College	College		< College	College
< College	0.856 (0.823)	0.024 (0.056)	< College	0.565 (0.450)	0.109 (0.223)
College	0.080 (0.113)	0.040 (0.008)	College	0.103 (0.218)	0.0223 (0.108)
chi sq=40,567	corr = 0.41	n=241,488	chi sq = 93,446	corr = 0.52	n=347,210

◀ Return