

# Families' Career Investments and Firms' Promotion Decisions

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- ▶ **We study** how MM, families' joint labor supply choices, and firms' training and promotion policies interplay.
  - Gender gaps in career investments and firm's training reinforce each other.
  - The marriage market matters for policies targeted at reducing gender inequality.

# The Link between marriage and labor markets

**Marriage Market**

**Households**

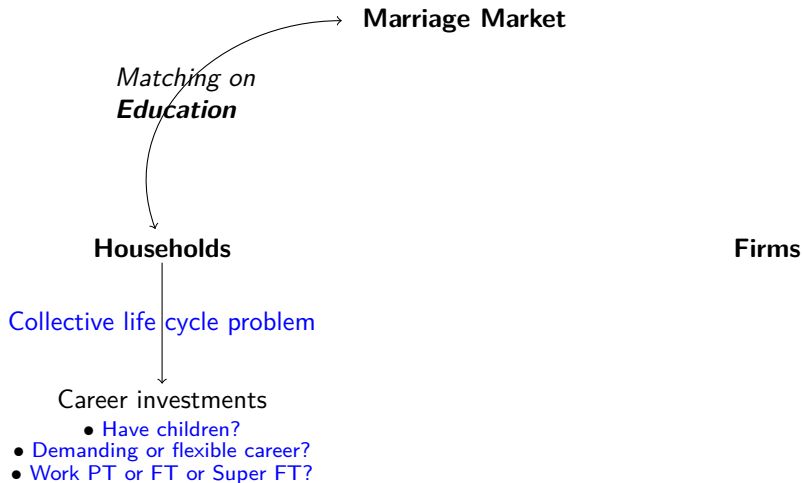
**Firms**



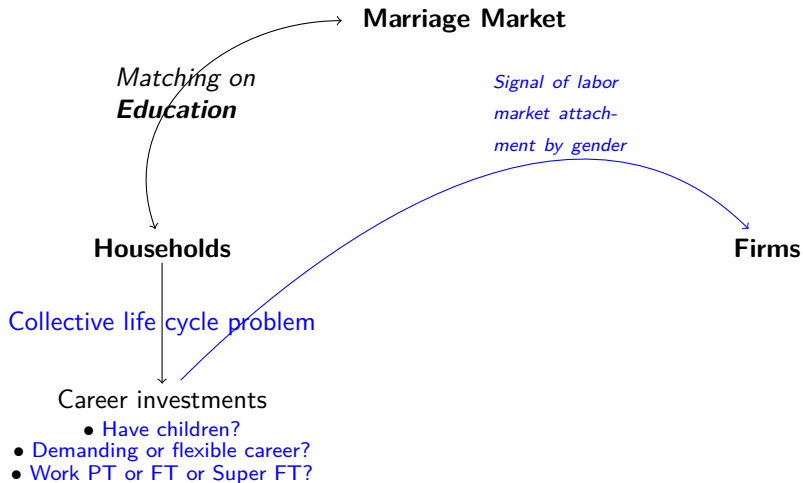
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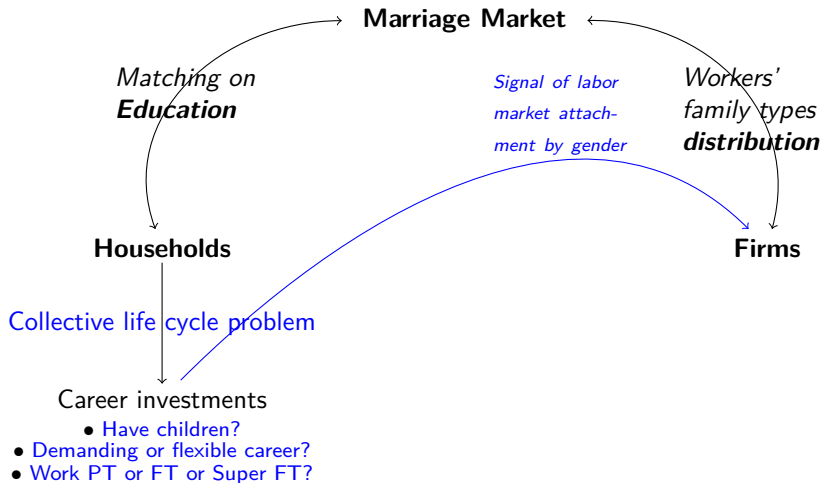
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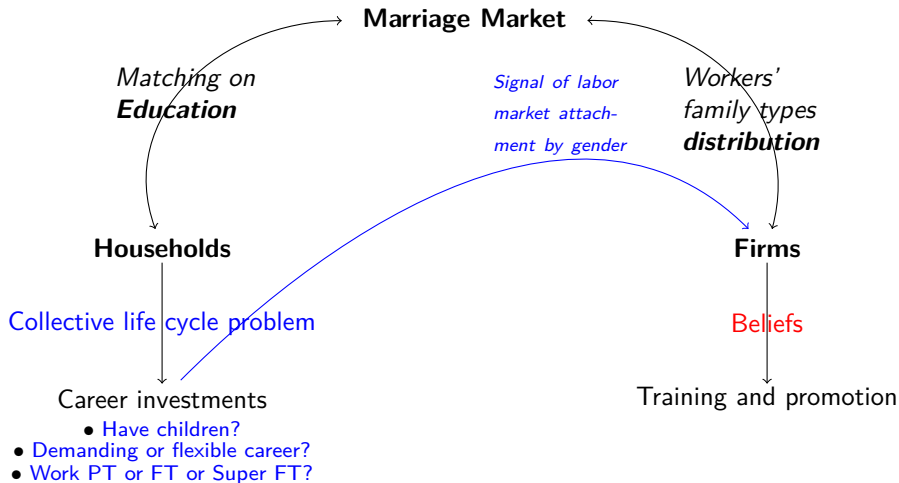
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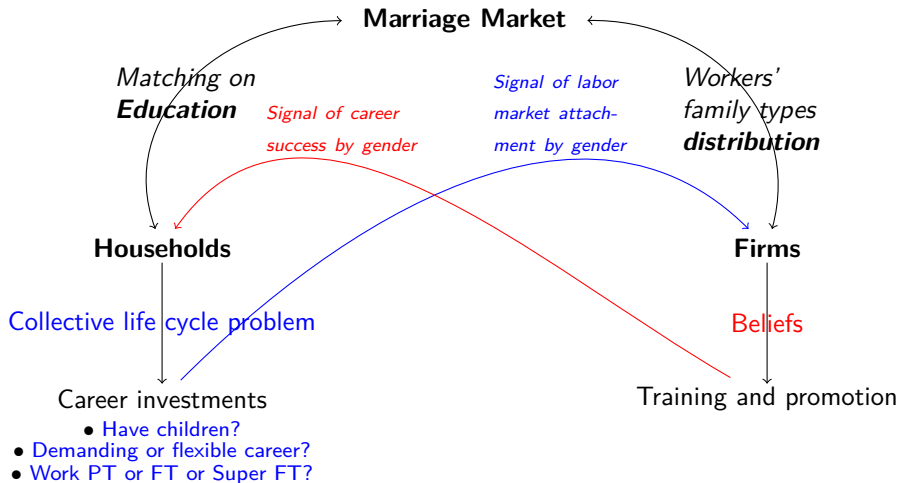
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- initial differences are amplified through the interaction of families and firms.
- 3. Evaluate policies to promote families' and firms' investments in women.
  - ▶ Focus on policies being discussed and implemented in different regions.
  - ▶ Quantify heterogeneous effects by gender, education, and type of couple.
  - ▶ Understand the role of the marriage market (who marries whom).

# Roadmap

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# Data: Follow families and firms across cohort's life cycle

- ▶ Danish register data:
  - education, family history, and labor market history for the full population.
  - labor force survey: detailed work hours (weekly, overtime, evening, weekend).[▶ Details](#)
- ▶ Follow the cohort who graduates from highest degree between 1991 and 1995:
  - ▶ their main partner, and
  - ▶ their employers and occupations,
  - ▶ from household formation and labor market entry,
  - ▶ over their life cycle.
- ▶ Dataset of ~120K households and all of their employers observed for ~25 years.



# Measurement

- ▶ **Ambition** types (AFRSV, 2024),  $\theta_i$ 
  - ▶ For 1800+ **education programs**, compute average starting wages  $w_0$  and 10Y wage growth  $g$  of all program **graduates**.
  - ▶ Categorize programs into 4 groups ranging from low-level, low-growth to high-level, high-growth programs. [▶ Ambition Details](#)
- ▶ Career **ladders**, steep and flat
  - ▶ Compute 10-year wage growth by **firm-occupation pair**.
  - ▶ Group into **steep** and **flat** ladders using cutoff at 80th percentile [▶ Ladder Details](#)
- ▶ Promotion to **manager**
  - ▶ First time in occupational codes for "Management" (combines middle and top management jobs) [▶ Promotion Details](#)
- ▶ Firm's **managerial training** combines
  - ▶ participation in **managerial training programs**, and
  - ▶ **job assignments** that predict subsequent manager promotion. [▶ Training Details](#)
- ▶ **Super-full-time** work (SFT). Captures overtime and lack of work-life balance. [▶ SFT Details](#)

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# Facts: Families' and firms' investments interact

1. Large gender gaps in training and promotion. ▶ Fact 1
2. *Firm-side* investments heterogeneous across workers' family characteristics:
  - ▶ Gender gaps vary by family type; ▶ Fact 2a
  - ▶ are notoriously big when husbands ever become managers. ▶ Fact 2b
  - ▶ Likelihood of receiving investments positively associated with spouse's type, conditional on own type. Labor market controls diminish this effect. ▶ Fact 2c
3. Fertility & spousal time allocation within the household play a key role:
  - ▶ Within-couple gaps in human capital increase upon arrival of children; ▶ Fact 3a
  - ▶ and timing of fertility depends on wives' ambition types. ▶ Fact 3b

→ Facts motivate a model in which family-side and firm-side investments interact.

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**Model**

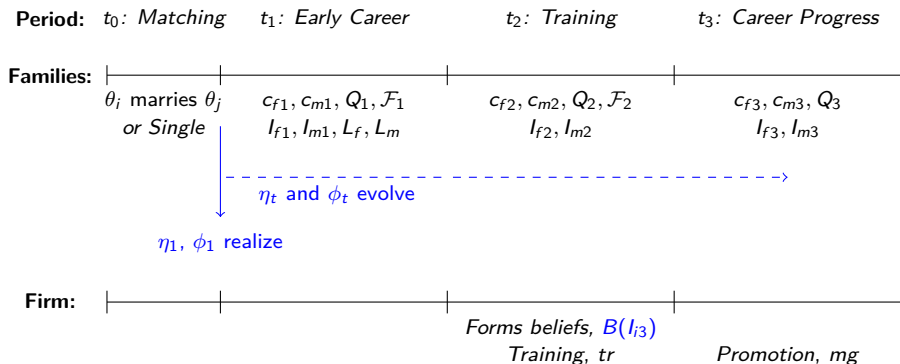
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# The life cycle of individual $\theta_i$ and the representative firm



- Periods in our model correspond to life cycle stages in the data ► in the data.

► Environment

► Market Human Capital

► Family Human Capital

► Worker and Family Types

► Firm's problem

► Marriage Market

# Equilibrium

A competitive equilibrium is a set of assignments, prices, and probabilities:

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- ▶ In the labor market:
  - ▶ wage rates,  $w(\eta, L, J)$  and beliefs,  $B(l_3 \mid \omega_2)$ ;
  - ▶ training policy  $tr(\omega_2) \in \{0, 1\}$ ;
  - ▶ promotion policy  $mg(\omega_2 \mid tr(\omega_2), l_3(\omega_2) = 1) \in \{0, 1\}$ ;



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such that:

- ▶ The marriage market is in equilibrium,
- ▶ individuals and households maximize life-time utility,
- ▶ the firm's beliefs are consistent with household behavior,
- ▶ and the firm maximizes expected profits.

# Summary

- ▶ The model gives rise to endogenous gender gaps in training and promotion.
- ▶ Key mechanisms include:
  - ▶ marriage market matching
  - ▶ women's initial advantage at home and
  - ▶ selective leadership training of firms.
- ▶ Families invest less in women  $\leftrightarrow$  firms invest less in women.
- ▶ Small initial differences can get amplified into large gender gaps.
- ▶ How do these forces and mechanisms interact with policies?
- ▶ Can policies that incentivize training eradicate the “bad” equilibrium?

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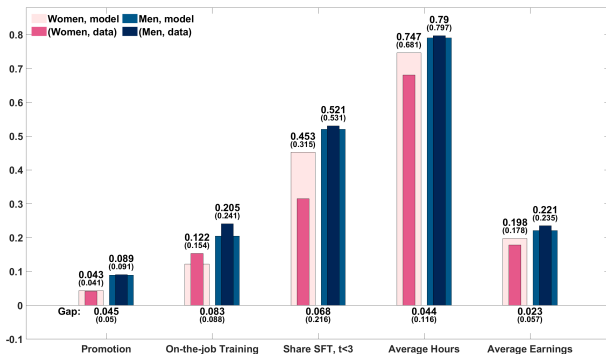
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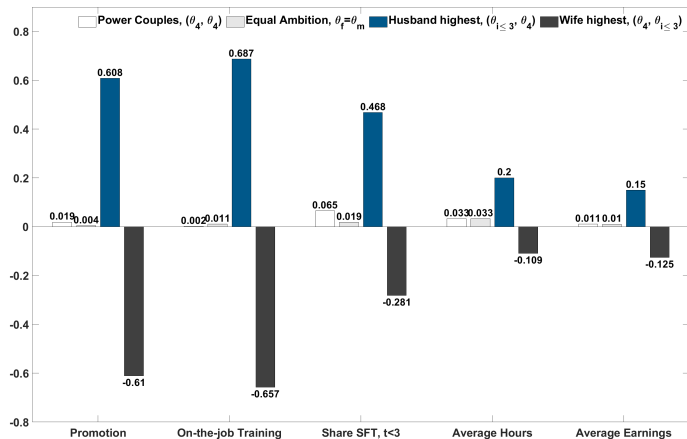
- ▶ We estimate the model using simulated method of moments.
- ▶ The full list of parameters is
  - ▶ production parameters  $a_{L,j}$  and  $b_{L,j}$
  - ▶ initial level of market human capital by ambition type  $\mu_{\eta,\theta}$  and dispersion  $\sigma_{\eta}$
  - ▶ market human capital accumulation  $\alpha_{L,\theta}$  and depreciation rates  $\delta_L^P$  and  $\delta_L^N$
  - ▶ training skill boost  $\tau$  and quadratic training cost parameter  $c$
  - ▶ initial level of family human capital  $\mu_{\phi}$  and dispersion  $\sigma_{\phi}$
  - ▶ initial advantage of women  $\kappa$  and persistence of family human capital  $\gamma$
  - ▶ utility boost  $\chi^u$  and household cost  $\chi^Q$  from having children
  - ▶ dispersion of marriage market shocks  $\sigma_{\beta}$
- ▶ 38 structural parameters
- ▶ disciplined by 56 moments relating to earnings, labor supply, marriage patterns, fertility, on-the-job training, promotions.

# Implications for gender inequality (untargeted moments)



- ▶ At baseline, both firms and families invest relatively more in men than in women.
- ▶ Firms train 20.5% of men and only 12.2% of women on-the-job.
- ▶ Women 6.8 pp less likely to work SFT than men.
- ▶ Men devoting 4.4% more of their total lifetime to their careers.
- ▶ Implies women are half as likely as men to be promoted to managers.

# The role of the family



- ▶ As in the data, family-side & firm-side investments interact in interesting ways.
- ▶ Gaps in both highest among people in families in which type-4 men marry down.
- ▶ Still positive among equal-ambition and power couples—matching the data.

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# Policy Analysis: Overview

- ▶ We use the model as a laboratory to evaluate the *equilibrium* effects of policies.
- ▶ Stylized examples of two alternative sets of policies:
  1. Paid and mandatory parental leave for  $\sim 10$  to 12 months.
    - ▶ Part-time equivalent replacement rate for women only
    - ▶ Part-time equivalent replacement for both men and women
    - ▶ Note! A small fraction of a model period (10%).
  2. 50% Quota for female managers (with qualifications!)
    - ▶ Note: “non-patronizing” by design.



# Parental leave only for mothers increases all gaps

**Table:** Gender gaps in counterfactual policies and their % change relative to baseline

	Promotion		On-the-job Training		Fraction sft, $t < 3$		Average hours	
	Value	%Change	Value	%Change	Value	%Change	Value	%Change
<i>Panel A. Paid parental leave for mothers</i>								
<b>Men</b>	0.091	2.756	0.207	1.345	0.536	2.853	0.794	0.413
<b>Women</b>	0.041	-5.534	0.122	-0.221	0.446	-1.347	0.745	-0.204
<b>Gap</b>	0.050	10.671	0.086	3.655	0.089	30.702	0.049	10.947
<i>Panel B. Paid parental leave for mothers and fathers</i>								
<b>Men</b>	0.089	-0.412	0.203	-1.036	0.528	1.367	0.791	0.087
<b>Women</b>	0.044	0.860	0.125	2.575	0.472	4.313	0.752	0.704
<b>Gap</b>	0.045	-1.627	0.077	-6.359	0.056	-18.166	0.039	-10.437
<i>Panel C. Managerial quota</i>								
<b>Men</b>	0.067	-24.384	0.207	1.108	0.523	0.459	0.790	-0.049
<b>Women</b>	0.065	50.004	0.125	2.370	0.451	-0.264	0.746	-0.085
<b>Gap</b>	0.002	-95.419	0.082	-0.754	0.072	5.250	0.044	0.555

- ▶ Both families and firms increase investment in men
- ▶ and reduce investment in women.
- ▶ Results in a widening of promotion gap by over 10%.

# Parental leave for both mothers & fathers reduces all gaps

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- ▶ Families increase labor supply but more so for women.
- ▶ Firms train more women and less men.
- ▶ Higher investments in women relative to leave for mothers-only.
- ▶ Helps women in equal couples, harms women who marry-up

▶ By couple

# Managerial quotas induce more equal firm-side investments

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- ▶ Promotion gap almost disappears by design.
- ▶ Firms respond by training more workers, especially women.
- ▶ Families increase investments in men who face more competition.
- ▶ Helps especially women in power couples, and women who marry-up

▶ By couple

# Fixing marriage choices amplifies gender inequalities

Table: Policy impacts at *baseline marriage market equilibrium*

	Promotion		On-the-job Training		Share SFT, $t < 3$		Average Hours	
	Value	%Change	Value	%Change	Value	%Change	Value	%Change
<i>Panel A. Paid parental leave for mothers</i>								
<b>Men</b>	0.092	3.884	0.206	0.591	0.533	2.397	0.793	0.334
<b>Women</b>	0.040	-7.453	0.120	-1.843	0.441	-2.579	0.743	-0.520
<b>Gap</b>	0.052	14.710	0.086	4.179	0.092	35.388	0.050	14.894
<i>Panel B. Paid parental leave for mothers and fathers</i>								
<b>Men</b>	0.089	0.064	0.202	-1.406	0.515	-1.114	0.788	-0.341
<b>Women</b>	0.043	-0.077	0.125	2.460	0.451	-0.425	0.745	-0.161
<b>Gap</b>	0.046	0.198	0.077	-7.104	0.064	-5.688	0.042	-3.412
<i>Panel C. Managerial quota</i>								
<b>Men</b>	0.067	-24.812	0.207	0.954	0.523	0.483	0.790	-0.092
<b>Women</b>	0.065	50.403	0.126	2.939	0.449	-0.729	0.746	-0.140
<b>Gap</b>	0.002	-96.636	0.081	-1.971	0.074	8.518	0.044	0.729

- ▶ Fixing the marriage market amplifies family-side investment gaps,
- ▶ Increment in gender gaps bigger and declines smaller.
- ▶ Partner choice is an important mechanism for the impact of policies.

# The welfare effects of narrowing gender gaps

- ▶ Aggregate welfare decreases under the leave policies.
  - ▶ Additional income during leave does not compensate for the career costs of leave-induced skill depreciation.
  - ▶ Both men and women have lower average earnings under both leave scenarios.
  - ▶ The additional leave for mothers reduces average household utility by 1.052% and leave for both parents reduces welfare by 3.387%.
- ▶ Aggregate welfare increased marginally under managerial quota (0.011%).
  - ▶ Firms must increase their efforts to find suitable women for management and respond by training both women and men to a larger extent.
  - ▶ Substantial heterogeneity in welfare gains/losses across couple types.
  - ▶ Policy disincentivizes career investments of highly ambitious women who are protected by the quota.
  - ▶ Reduced welfare for households of highly ambitious men and less ambitious women.
- ▶ **Changes in the marital sorting** (long-run) can **mitigate** negative welfare effects because fewer negatively affected couples form under this policy.

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# Conclusion

- ▶ We document new facts on heterogeneity in firm-side investments by households types.
- ▶ Rich Danish data → follow households and their employers over life cycle.
- ▶ Build an equilibrium model in which who marries whom affects the link between workers' investments and firms' investments.
  - ▶ lifecycle collective household model with fertility and
  - ▶ career progression within the firm.
- ▶ The MM is important for the transmission of policies.
  - ▶ Overall, paid leave to both spouses can reduce gender gaps in promotions, but some groups may lose.
  - ▶ Management quota shifts the focus of households on career investments for ambitious women.
  - ▶ Blanket policies do not take into account important heterogeneity.
- ▶ Highlights importance of considering interactions with the MM.

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# Ambition types (AFRSV, 2024), $\theta_i$

Educational level, all programs



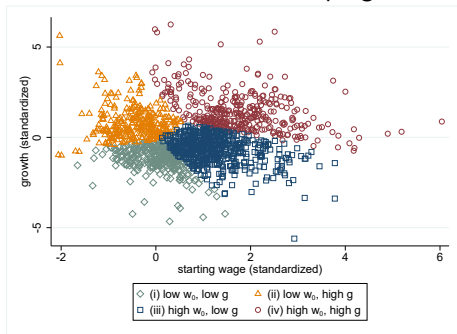
Educational ambition, all programs



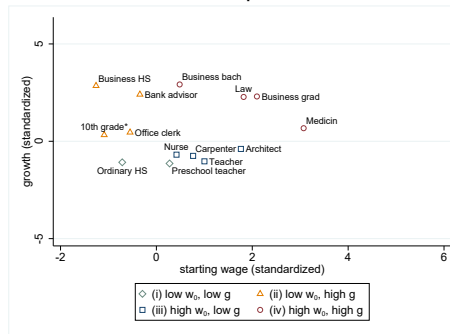
- Programs matter for marital sorting (Wiswal and Zafar, 2021),
- and differ in initial conditions and long-term outcomes (Altonji, Kahn, Speer, 2014, 2016; Kirkeboen, Leuven, Mogstad, 2016)

# Classification of most frequent programs (AFRSV, 2023)

Educational ambition, all programs

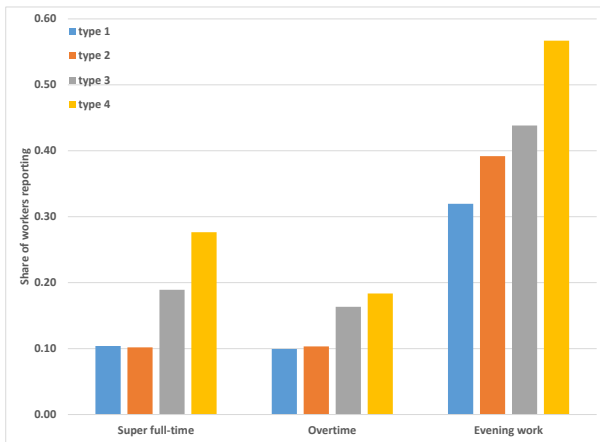


Examples



- Our method groups programs based on labor market starting conditions and progress.
- Successful measure to differentiate tertiary degrees
  - e.g.: Architecture  $\neq$  Business; Nurse  $\neq$  Doctor.

# Ambition types and hours worked



- Higher ambition types work longer and more irregular hours, often requiring working at home and in the evenings.

# Career ladders

- ▶ We aim to measure career path choices based on occupational choice and firm at labor market entry
- ▶ We distinguish *steep* and *flat* career ladder for tractability
  - ▶ Steep is defined as the top 20% occupation-firm pairs with highest hourly wage growth over first 10 years.
  - ▶ Calculate average growth based on coworkers.
  - ▶ Coarsen comparison group if necessary to avoid small-cells issues.
- ▶ Ambition type is about earnings potential ex ante, ladder choice is about the career path that individuals enter in the labor market.
  - Law graduate decides to work at a private law firm or in public sector administration.

# Promotion to manager

- ▶ Managers are workers with occupations coded "1: Management Work."
  - ▶ Categories include "Top management," "Management within administration," "Management within production," and "Management within services."
  - ▶ Examples: Manager in production company (132100), manager of internal IT (133020), top manager in public company (111200) etc.
- ▶ Promotion means transition to these occupation codes for the first time.
- ▶ Significant pay increase
  - ▶ Managers make 40% more than non managers, conditional on training.

# On-the-job training

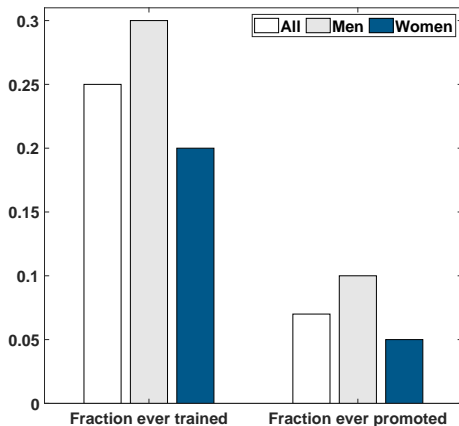
- ▶ Direct measure of firm investment: data on individuals' participation in **management training programs** (paid by firm while on the job).
  - 45% of program participants are subsequently promoted to managers.
  - 10% of all managers previously received this management training.
- ▶ Another type of firm investment: **lateral moves across occupations** within a firm
  - Returns to specialization vs preparing for management
- ▶ Predictive model to identify workers who receive training based on both sources:
  - classifies 85.75% of individuals correctly (managers with training and non-managers without training).
  - **12.92%** of trainees are subsequently promoted to managers.
  - **50.3%** of all managers previously received training.

# Super-full-time work

- ▶ We distinguish between four labor supply states at the yearly level: nonparticipation, part-time, full-time, and super-full-time.
- ▶ Nonparticipation refers to not being employed by the end of November in a given year.
- ▶ Those who are employed by the end of November in a given year are characterized as either part-time or full-time depending on the hours worked per week, e.g., less or more than 32 hours.
- ▶ The Danish standard full-time working week has 37 hours.
- ▶ The **super-full-time** status is constructed based on information from the Danish LFS. We classify a worker as working super-full-time in the following cases:
  1. reports working 38 hours or more per week
  2. reports working 37 hours and, additionally, irregular hours, e.g., in the evening, weekends, etc.



# Gender gaps in training and promotion

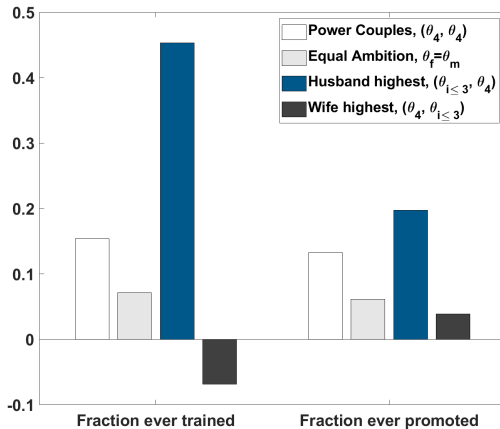


- ▶ Gender gap in training is 33%, increases to 50% at the promotion stage.
- ▶ Big and significant even with firm-occupation fixed effects.

▶ Regression

# Gender gaps in firm-side investments vary with worker's family type

Difference in men's and women's outcome



- ▶ Interestingly, gaps positive within power couples.
- ▶ Depend on own and spousal type.

## Firm-side investments vary with worker's family type

$$mg_{ijt} = \beta_0 + \beta_1 \cdot F_i + \beta_2 \cdot \theta_{i,\geq 3} + \beta_3 \cdot \theta_{i,\geq 3} \cdot F_i + \beta_3 \cdot \theta_{j,\geq 3} + \beta_4 \cdot \theta_{j,\geq 3} \cdot F_i + X' \gamma + \epsilon$$

	(1)	(2)	(3)	(4)
	Training		Manager Promotion	
female	-0.0322***		-0.0049***	
	(0.003)		(0.001)	
high-ambition	0.2392***		0.0295***	
	(0.003)		(0.001)	
high-ambition * female	-0.0469***		-0.0153***	
	(0.005)		(0.001)	
high-ambition spouse	0.0521***		0.0201***	
	(0.004)		(0.001)	
high-ambition spouse * female	-0.0305***		-0.0181***	
	(0.005)		(0.002)	
Control for LS Choices	No		No	
Observations	2,311,023		2,311,023	

Robust standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

- ▶ Gender gaps widen for ambitious women and for women with ambitious spouses.
- ▶ The role of the spouse declines conditional on labor market choices.

## Firm-side investments vary with worker's family type

$$mg_{ijt} = \beta_0 + \beta_1 \cdot F_i + \beta_2 \cdot \theta_{i,\geq 3} + \beta_3 \cdot \theta_{i,\geq 3} \cdot F_i + \beta_3 \cdot \theta_{j,\geq 3} + \beta_4 \cdot \theta_{j,\geq 3} \cdot F_i + X' \gamma + \epsilon$$

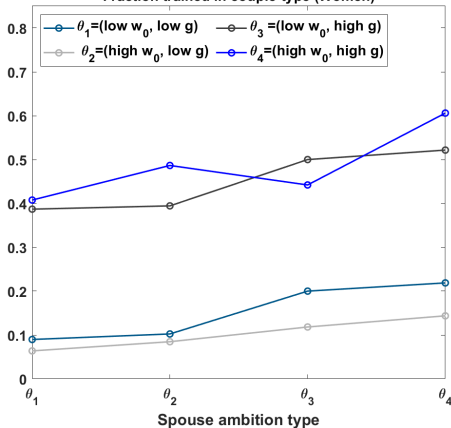
	(1)	(2)	(3)	(4)
	Training		Manager Promotion	
female	-0.0322*** (0.003)	-0.0266*** (0.003)	-0.0049*** (0.001)	-0.0035*** (0.001)
high-ambition	0.2392*** (0.003)	0.1897*** (0.004)	0.0295*** (0.001)	0.0285*** (0.001)
high-ambition * female	-0.0469*** (0.005)	-0.0426*** (0.004)	-0.0153*** (0.001)	-0.0140*** (0.001)
high-ambition spouse	0.0521*** (0.004)	0.0261*** (0.004)	0.0201*** (0.001)	0.0152*** (0.001)
high-ambition spouse * female	-0.0305*** (0.005)	-0.0114** (0.005)	-0.0181*** (0.002)	-0.0094*** (0.002)
Control for LS Choices	No	Yes	No	Yes
Observations	2,340,453	2,304,425	2,340,453	2,304,425

Robust standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

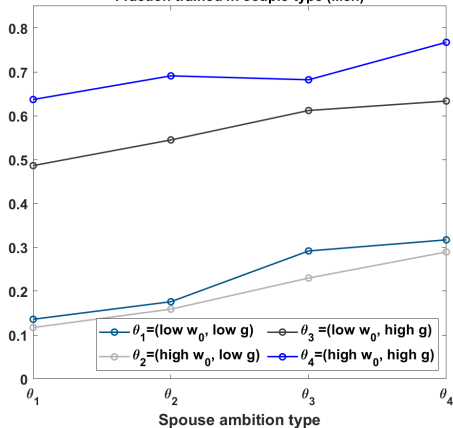
- ▶ Gender gaps widen for ambitious women and for women with ambitious spouses.
- ▶ The role of the spouse declines conditional on labor market choices.

# Firm-side investments vary with worker's family type

Fraction trained in couple-type (Women)



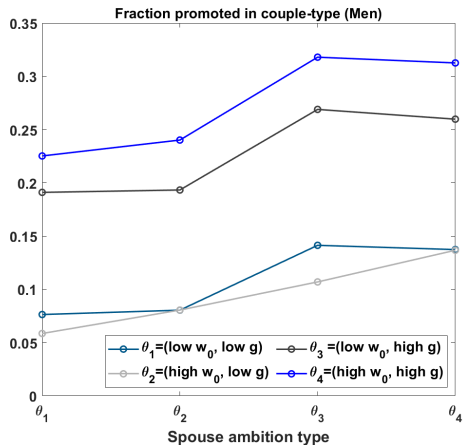
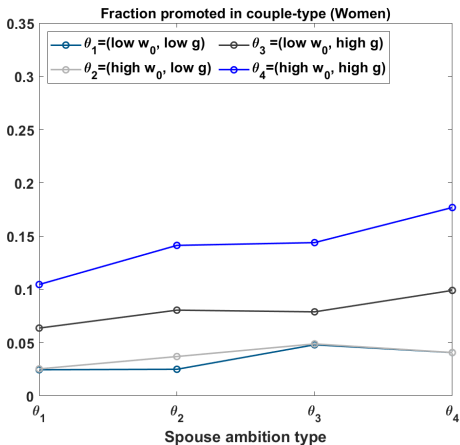
Fraction trained in couple-type (Men)



► Probability of receiving training  $\uparrow$  with own and spouse's ambition

► but more so for men. [► Back](#)

# Firm-side investments vary with worker's family type



► Probability of reaching managerial position  $\uparrow$  with spouse's ambition

► but more so for men. [► Back](#)

# Gender gaps in training and promotion

$$mgift = \beta_0 + \beta_1 \cdot F_i + \delta_{f,L} + \theta_i + \delta_{\{I_i\}_t} + \epsilon$$

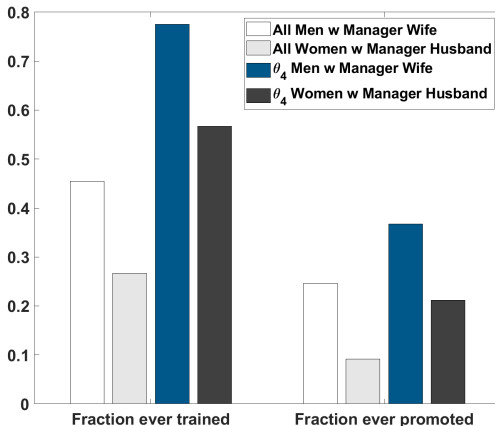
	(1)	(2)	(3)	(4)	(5)	(6)
		Training			Manager Promotion	
female	-0.0819*** (0.002)	-0.0579*** (0.003)	-0.0285*** (0.003)	-0.0192*** (0.001)	-0.0190*** (0.001)	-0.0096*** (0.001)
Firm-Ladder FE	No	Yes	Yes	No	Yes	Yes
Worker Ambition FE	No	No	Yes	No	No	Yes
Worker Exp FE	No	No	Yes	No	No	Yes
Observations	2,340,453	2,340,453	2,304,425	2,340,453	2,340,453	2,304,425
R-squared	0.010	0.347	0.412	0.003	0.199	0.231

Robust standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

- ▶ Gender gaps big and significant even with firms and ladders.
- ▶ Decline conditional on labor market choices.

# When the husband is a manager

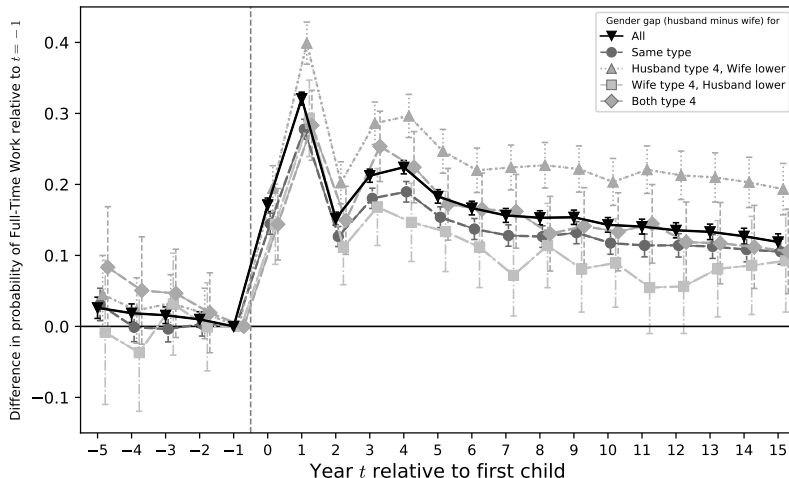
Difference in men's and women's outcome



- ▶ Most ambitious women who marry a manager 42.51% less likely to become managers than men married to managers.
  - ▶ Might be behind the higher gaps among power couples.

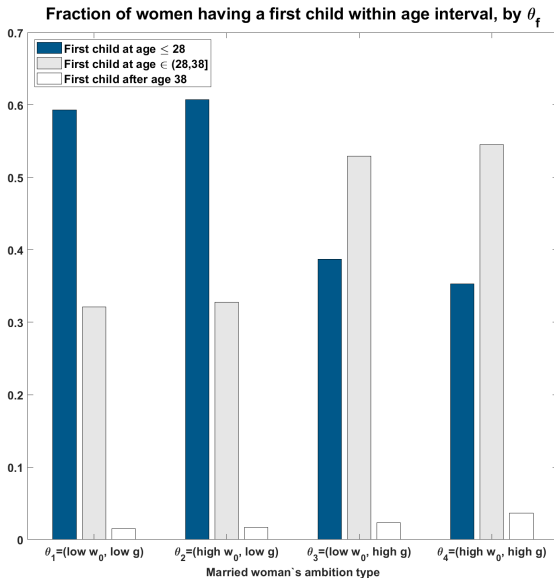


# Time allocation after arrival of children

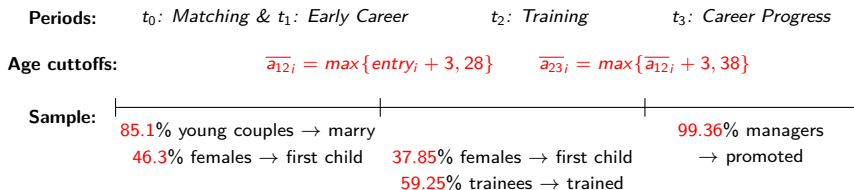


- ▶ Large and persistent child penalty even for women with highest ambition.
- ▶ Women married to more ambitious spouse show a more persistent penalty.

# More ambitious women delay fertility significantly more



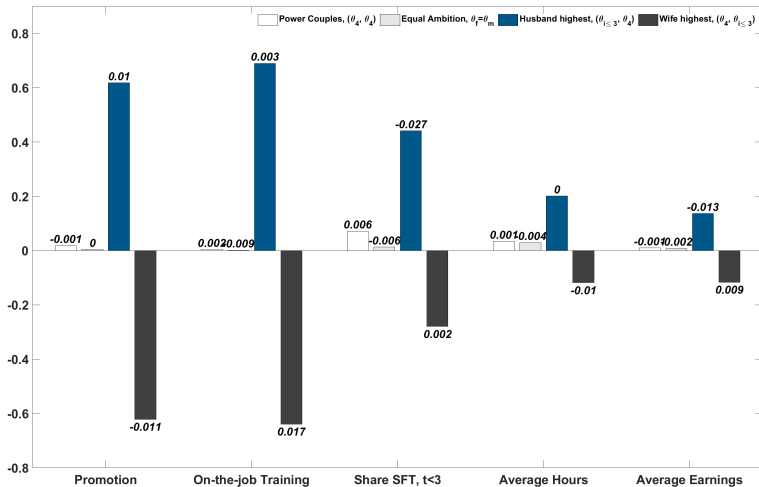
# Model Periods and the life cycle of individuals in the data



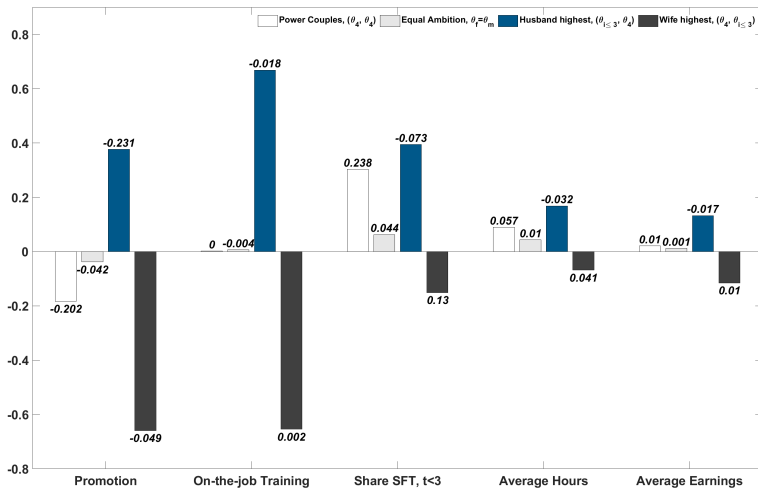
# Endogenous gender gaps in promotion

- ▶ Initial women's advantage at home imply women tend to stay at home more.
- ▶ Firms tend to see women as workers with lower market human capital,  $\eta$ .
- ▶ Firms tend to expect women to work less in  $t = 3$ .
- ▶ Training is offered relatively more to men.
- ▶ Expecting this bias, families tend to invest even more in husbands.
- ▶ In equilibrium, gender gaps in training and promotion arise.
- ▶ How do these forces and mechanisms interact with policies?

# Parental leave for both mothers & fathers by type of couple



# Managerial quotas by type of couple



# Hours Worked

- ▶ Detailed responses on hours worked from labor force survey (9.4% of individuals)
- ▶ "Ever managers" have much higher and irregular working hours:
  - ▶ Higher share working "super full-time" (more than 37 hours per week) and reporting overtime work, especially in the mid-career phase.
  - ▶ Higher share working usually or sometimes in the evening (excl. shift work) and on the weekend in mid and late career.
- ▶ Higher and more irregular hours worked on the steep than the flat ladder:
  - ▶ 1.5 hours more per week on average, 19% report working "super full-time" (vs 11% on flat ladder).
  - ▶ 5pp higher shares of overtime work and evening work, respectively.

# Moments I: Earnings Process (EP)

Label	Description	Model	Data
EP1	Mean earnings of $\theta_i = 1$ in $L_1$ and $t = 1$	0.15	0.16
EP2	Mean earnings of $\theta_i = 2$ in $L_1$ and $t = 1$	0.16	0.18
EP3	Mean earnings of $\theta_i = 3$ in $L_1$ and $t = 1$	0.15	0.16
EP4	Mean earnings of $\theta_i = 4$ in $L_1$ and $t = 1$	0.18	0.19
EP5	Mean earnings of $\theta_i = 1$ in $L_2$ and $t = 1$	0.23	0.16
EP6	Mean earnings of $\theta_i = 2$ in $L_2$ and $t = 1$	0.25	0.18
EP7	Mean earnings of $\theta_i = 3$ in $L_2$ and $t = 1$	0.16	0.18
EP8	Mean earnings of $\theta_i = 4$ in $L_2$ and $t = 1$	0.21	0.20
EP9	Earnings growth of FT workers in $L_1$	0.05	0.06
EP10	Earnings growth of FT workers in $L_2$	0.07	0.13
EP11	Earnings growth of $\theta_i = 1$ FT workers in $L_1$	0.02	0.05
EP12	Earnings growth of $\theta_i = 2$ FT workers in $L_1$	0.04	0.05
EP13	Earnings growth of $\theta_i = 3$ FT workers in $L_1$	0.09	0.09
EP14	Earnings growth of $\theta_i = 4$ FT workers in $L_1$	0.12	0.13
EP15	Earnings growth of $\theta_i = 1$ FT workers in $L_2$	0.03	0.07
EP16	Earnings growth of $\theta_i = 2$ FT workers in $L_2$	0.06	0.08
EP17	Earnings growth of $\theta_i = 3$ FT workers in $L_2$	0.13	0.13
EP18	Earnings growth of $\theta_i = 4$ FT workers in $L_2$	0.12	0.17
EP19	Earnings difference FT vs NT at $t = 2$ in $L_1$	0.06	0.08
EP20	Earnings difference FT vs NT at $t = 2$ in $L_1$	0.10	0.11
EP21	Earnings growth without training	0.07	0.05
EP22	Earnings growth with training	0.16	0.09
EP23	Mean earnings of $\theta_i = 3$ managers in $L_1$	0.54	0.42
EP24	Mean earnings of $\theta_i = 4$ managers in $L_1$	0.57	0.56
EP25	Mean earnings of $\theta_i = 3$ managers in $L_2$	0.59	0.62
EP26	Mean earnings of $\theta_i = 4$ managers in $L_2$	0.64	0.74
EP27	Earnings difference SFT vs FT at $t = 2$ in $L_1$	0.07	0.04
EP28	Earnings difference SFT vs FT at $t = 2$ in $L_2$	0.09	0.06



## Moments II: Marriage Patterns (MM)

Label	Description	Model	Data
MM1	Fraction $\theta_f = \theta_m$	0.39	0.42
MM2	Fraction ( $\theta_f = 4, \theta_m = 4$ )	0.08	0.04
MM3	Fraction ( $\theta_f \leq 3, \theta_m = 4$ )	0.10	0.12
MM4	Fraction ( $\theta_f = 4, \theta_m \leq 3$ )	0.03	0.03
MM5	Fraction single men $\theta_m = 1$	0.37	0.41
MM6	Fraction single men $\theta_m = 2$	0.37	0.27
MM7	Fraction single men $\theta_m = 3$	0.40	0.36
MM8	Fraction single men $\theta_m = 4$	0.26	0.27

► Go back

## Moments III: Fertility Patterns (FP)

Label	Description	Model	Data
FP1	Fraction $\theta_f = 1$ having first child in $t = 1$	0.38	0.57
FP2	Fraction $\theta_f = 4$ having first child in $t = 1$	0.36	0.31
FP3	Fraction $\theta_f = 1$ having first child in $t = 2$	0.31	0.37
FP4	Fraction $\theta_f = 4$ having first child in $t = 2$	0.64	0.60

► Go back

## Moments IV: Labor Supply (LS)

Label	Description	Model	Data
LS1	Participation rate of men $\theta_m = 1$	0.74	0.85
LS2	Participation rate of men $\theta_m = 2$	0.81	0.91
LS3	Participation rate of men $\theta_m = 3$	0.76	0.91
LS4	Participation rate of men $\theta_m = 4$	0.96	0.98
LS5	Variance of men's labor supply	0.15	0.10
LS6	Participation gap in homogamous couples	0.05	0.04
LS7	Women's probability of re-entry ( $t = 1$ to $t = 2$ )	0.61	0.49
LS8	Women's probability of re-entry ( $t = 2$ to $t = 3$ )	0.38	0.37
LS9	Share working PT in $t = 1$ and $t = 2$ in $L_1$	0.09	0.04
LS10	Share working PT in $t = 1$ and $t = 2$ in $L_2$	0.11	0.02

► Go back

## Moments V: Firm's Investments (FI)

Label	Description	Model	Data
FI1	Share of men trained in $L_1$	0.16	0.19
FI2	Share of women trained in $L_1$	0.09	0.11
FI3	Share of men trained in $L_2$	0.32	0.47
FI4	Share of women trained in $L_2$	0.21	0.35
FI5	Promotion gender gap in $L_1$	0.03	0.03
FI6	Promotion gender gap in $L_2$	0.07	0.09

► Go back

# We combine three strands in a unified framework

- ▶ Build on literature on the career cost of workers' choices.
  - ▶ Adda, Dustmann, Stevens (2017); Kleven, Landais, Sørensen (2019); Angelov, Johansson, Lindahl (2016); Goldin (2014); Cortes & Pan (2019);
- ▶ We incorporate **Marriage Market (MM)** and **Firm-side investments**.

▶ Go back

# We combine three strands in a unified framework

- ▶ MM: education-based marriage market sorting, workers' post-marriage human capital investments depend on the partner type.
  - ▶ Chiappori, Costa-Dias, Meghir (2018); Gayle & Shephard (2019); Calvo (2022); Reynoso (2024), Almar, Friedrich, Reynoso, Schulz & Vejlin (AFRSV, 2024).
- ▶ Firms have limited manager slots and invest in more attractive workers.
  - ▶ Training matters: Blundell, Costa-Dias, Goll, Meghir (2021)
  - ▶ job assignment/ promotions: Friedrich (2020), Gibbons and Waldman (1999).
  - ▶ firms expectations about workers' performance: Gayle & Golan (2012).
- ▶ We extend the literature on marriage and labor market interactions, household specialization, and joint labour supply decisions of couples
  - ▶ Philosoph & Wee (2021), Holzner & Schulz (2023), Calvo, Lindenlaub, Reynoso (2024); Foerster, Obermeier & Schulz (2024).
  - ▶ First dynamic framework with marriage formation, sorting, fertility, on-the-job training, and managerial promotions (we make the firm side explicit).
  - ▶ We abstract from savings, search frictions, divorce, job-to-job mobility, firm heterogeneity (representative firm).

# Our framework offers a fresh approach to policy evaluation

- ▶ Gender gaps in reaching managerial positions are important and persistent.
  - ▶ Bronson & Skogman Thoursie (2021); Hampole, Truffa, & Wong (2023); Gayle, Golan & Miller (2012).
- ▶ We add to the literature on how different policies affect women's careers,
  - ▶ Parental leave policies
    - Das and Polachek (2015); Thomas (2021); Xiao (2021); Bailey, Byker, Patel, Ramnath (2024), Corekcioglu, Francesconi, Kunze (2024).
  - ▶ Diversity, Equity, and Inclusion efforts by firms
    - Bertrand, Black, Jensen, Lleras-Muney (2019).

by accounting for *equilibrium* policy impacts

- ▶ families' and firms' endogenously react to the policy environment, and
- ▶ effects may vary with degree of marriage market sorting.

# Environment I: General

- ▶ Three periods,  $t$ .
- ▶ Two markets: The marriage market and the labor market.
- ▶ A representative **firm** with:
  - ▶ Two ladders (or career paths),  $L = \{L_1, L_2\}$
  - ▶ Two production technologies, producer or manager,  $J = \{p, mg\}$
- ▶ Equal mass of **women and men**,  $i = \{m, f\}$ , of gender  $\mathcal{G} = \{\mathcal{X}, \mathcal{Y}\}$
- ▶ Distinguished by their *initial* human capital,  $\theta_i$ 
  - ▶ relevant for matching in the marriage market, and
  - ▶ sorting into *career paths*.



## Environment II: The Family

- ▶ Flow individual utility:  $u_{it} = c_{it} Q_t \chi_{(children)}^u$
- ▶ Labor supply choices:  $I_i = \{N, P, F, S\} = \{0, \frac{1}{3}, \frac{2}{3}, 1\}$ , no leisure.
- ▶ Ladder choices:  $L_i = \{L_1, L_2\}$ .
- ▶ The public good produced with private goods and time:
$$Q_t = c_{Qt} + \phi_{ft}(1 - I_{ft}) + \phi_{mt}(1 - I_{mt}) - \chi_{(children)}^Q$$
- ▶ Complementarity between time and goods: Welfare cost if both spouses choose super-full-time.
- ▶  $\phi_i$ : spouse  $i$ 's *family* human capital.
  - ▶ Depreciates over time.

# Environment III: The Representative Firm

- ▶ Two jobs  $J$  on each ladder  $L$ , producer and manager.
- ▶ *Output per unit of time* in job  $J$  and ladder  $L$  is parameterized as follows:

$$y_{L,J}(\eta_{it}) = a_{L,J} + b_{L,J}\eta_{it}.$$

- ▶ *Manager promotion* requires *leadership training* and *super-full-time work*.
  - ▶ Time use trade-off for families.
  - ▶ Firms are selective due to *capacity constraints*: Convex cost of training and fixed slots for managers.

# Market Human Capital Evolves over Time

- ▶ Initial human capital depends on ambition type:

$$\eta_1(\theta) \sim F(\mu_\theta, \sigma) \quad \forall \theta \in \Theta$$

- ▶ *Beginning-of- $t$*   $\eta_t$  depends on past LS, ambition type, and ladder:

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$$\eta_{it} = [\eta_{t-1} + \alpha_{L,\theta}]$$

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$$\eta_{it} = [\eta_{t-1} + \alpha_{L,\theta} + \delta_{L,\theta}^S \mathbb{1}_{\{I_{t-1}=S\}}]$$

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$$\eta_{it} = [\eta_{t-1} + \alpha_{L,\theta} + \delta_{L,\theta}^S \mathbb{1}_{\{I_{t-1}=S\}} - \delta_{L,\theta}^P \mathbb{1}_{\{I_{t-1}=PT\}}]$$

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$$\eta_{it} = [\eta_{t-1} + \alpha_{L,\theta} + \delta_{L,\theta}^S \mathbb{1}_{\{I_{t-1}=S\}} - \delta_{L,\theta}^P \mathbb{1}_{\{I_{t-1}=PT\}} - \delta_{L,\theta}^N \mathbb{1}_{\{I_{t-1}=NP\}}] \tau$$

- ▶  $\tau$ : Training boost in human capital reaped at the beginning of  $t = 3$ :

$$\tau \begin{cases} = 1 & \text{if } t = \{0, 1, 2\} \\ > 1 & \text{if } t = 3 \text{ \& } tr = 1 \end{cases}$$



# Market Human Capital Evolves over Time

- ▶ Initial human capital depends on ambition type:

$$\eta_1(\theta) \sim F(\mu_\theta, \sigma) \quad \forall \theta \in \Theta$$

- ▶ *Beginning-of- $t$*   $\eta_t$  depends on past LS, ambition type, and ladder:

$$\eta_{it} = [\eta_{t-1} + \alpha_{L,\theta} + \delta_{L,\theta}^S \mathbb{1}_{\{l_{t-1}=S\}} - \delta_{L,\theta}^P \mathbb{1}_{\{l_{t-1}=PT\}} - \delta_{L,\theta}^N \mathbb{1}_{\{l_{t-1}=NP\}}] \tau$$

- ▶  $\tau$ : Training boost in human capital reaped at the beginning of  $t = 3$ :

$$\tau \begin{cases} = 1 & \text{if } t = \{0, 1, 2\} \\ > 1 & \text{if } t = 3 \text{ \& } tr = 1 \end{cases}$$

- ▶ Evolves due to family's and firm's investments:

- ▶ Returns to experience; skill-depreciation when out-of-work.
- ▶ L choice matters:  $L_1$  rewards experience less but penalizes time-out-of-work less.
- ▶ Training boosts human capital evolution.

# Family Human Capital Evolves over Time

- ▶ Initial random family shock common to both spouses.

- ▶ Women may have an initial advantage:

$$\phi_{i1} = \begin{cases} \bar{\phi}^{\kappa} & \text{if } i = f \\ \bar{\phi} & \text{if } i = m \end{cases}$$

- ▶ Skills at home depreciate (relative to private goods):

$$\phi_{it} = \phi_{it-1}^{\gamma}$$

where  $\gamma > 0$ .

- ▶ The potential initial advantage of women persists over time.
- ▶ Absolute difference between men and women gets smaller due to depreciation.

# Worker Type vs. Family Type at a given time $t$

- ▶ A *worker type* consists of their gender, *ambition type*, *initial hk*, *ladder*, *LS history*, and *training*:

$$\omega_{it} = (\mathcal{G}_i, \theta_i, \eta_{1i}, L_i, \{l_{ir}\}_{r=1}^t, tr_i) \in \Omega_t$$

- ▶ A *family type* consists of *own worker type*, *own family hk*, *spouse's worker type*, and *spouse's family hk*:

$$\varphi_{it} = (\underbrace{\mathcal{G}_i, \theta_i, \eta_{1i}, L_i, \{l_{ir}\}_{r=1}^t, tr_i}_{\omega_{it}}, \underbrace{\mathcal{G}_j, \theta_j, \eta_{1j}, L_j, \{l_{jr}\}_{r=1}^t, tr_j}_{\omega_{jt}}, \phi_{it}, \phi_{jt})$$

# Firms

- ▶ At  $t = 2$ , the firm takes as given:
  - ▶ Matching in the MM,  $\mu(\theta)$ ;
  - ▶ Distribution of worker types decided by families,  $\{\omega_{i2}\}$ ;
- ▶ Forms beliefs about  $I_{i3} \mid \omega_{i2}$  and profits with and without training
  - ▶ Over unknown *family type* and *family shock*.
- ▶ Chooses fraction of  $N(\omega)$  trained,  $tr(\omega)$ , and promoted,  $mg(\omega)$ ;
- ▶ to maximize expected profits from training.

▶ Go back

# Firm's training and promotion policies I

- ▶ The firm maximizes profits by choosing optimal training and promotion policies on each ladder.
- ▶ The firm takes as given any equilibrium distribution of households from the marriage market,  $\Gamma(\theta_f, \theta_m) : \Theta_0 \times \Theta_0 \setminus (\emptyset, \emptyset) \rightarrow (0, 1)$ .

$$\max_{\{tr(\omega), mg(\omega)\}} \Pi_{tr} = \sum_{\omega \in \Omega_2} tr(\omega) [mg(\omega)E[\pi_{mg}(\omega)] + (1 - mg(\omega))E[\pi_p(\omega)]] \cdot N(\omega) - C(N_{tr})$$

subject to the size of the training program, and the capacity constraint for managers,

$$N_{tr} = \sum_{\omega \in \Omega_2} tr(\omega) \cdot N(\omega)$$
$$N_{mg} \geq \sum_{\omega \in \Omega_2} tr(\omega) \cdot mg(\omega) \cdot B_3(SFT \mid tr, \omega) \cdot N(\omega)$$

## Firm's training and promotion policies II

- ▶ where  $E[\pi_J(\omega)]$  denote expected profits in future assignment  $J$ .
- ▶  $B_3(SFT|tr, \omega)$  denotes firm beliefs about period-3 labor supply.
- ▶ The firm forms these beliefs by anticipating optimal future choices of different family types that are consistent with an individual's observed worker type  $\omega_{i2}$ .

$$B_3(\tilde{l} \mid \omega_{i2}) \equiv B(l_{i3}(\omega_{i2}) = \tilde{l} \mid tr_i, \omega_{i2}) = \sum_{h \text{ s.t. } \omega_{i2} \in \arg \max(HP_h)} \frac{\Gamma(\theta_f, \theta_m)}{\Gamma_{\omega_{i2}}} E_{\varphi(f, m)} \left[ \tilde{l} \in \arg \max(HP_i) \mid tr_i \right].$$

- ▶ and  $\Gamma_{\omega_{i2}} = \sum_h \Gamma(\theta_f, \theta_m) \mathbb{1}\{\omega_{i2} \in \arg \max(HP_h)\}$  is the total share of households consistent with the worker's observed type  $\omega_{i2}$ .

# Families' problem

- ▶ Households  $(\theta_f, \theta_m)$  that formed in the MM take as given:
  - ▶ Matching in the MM,  $\mu(\theta)$ , and women's utility prices,  $\overline{U}_x^{\theta_f \theta_m}$ ;
  - ▶ wage rates,  $w(\omega_i)$ ;
  - ▶ firm's training and promotion policies,  $tr(\omega_2) \in \{0, 1\}$  and  $mg(\omega_3/tr) \in \{0, 1\}$
- ▶ choose a contingent contract of career trajectories, fertility, and consumption,

$$x(\varphi) = \underbrace{\left\{ L_f(\varphi_t), L_m(\varphi_t), \mathcal{F}_t(\varphi_t), I_{ft}(\varphi_t), I_{mt}(\varphi_t), c_{ft}(\varphi_t), c_{mt}(\varphi_t), c_{Qt}(\varphi_t) \right\}}_{x_t(\varphi_t)} \Bigg\}_{t=1}^3$$

so as to solve their collective life cycle problem

$$\begin{aligned} \overline{U}_y^{\theta_f \theta_m} &= \max_{x(\varphi)} E_0 \sum_{t=1}^{T=3} \delta^{t-1} \left\{ u_m(x_t(\varphi_t)) \right\} \\ \text{s.t.} \quad & E_0 \sum_{t=1}^{T=3} \delta^{t-1} \left\{ u_f(x_t(\varphi_t)) \right\} \geq \overline{U}_x^{\theta_f \theta_m} \\ & \forall \varphi_t, t > 0 : \quad c_{ft} + c_{mt} + c_{Qt} = w_{ft}(\omega_{ft}) I_{ft} + w_{mt}(\omega_{mt}) I_{mt} \end{aligned}$$

- ▶ Optimal household behavior determines distribution of worker types,  $\{\omega_{it}\}$ .

# Marriage Market

- ▶ Potential partners in the MM take as given:
  - ▶ Idiosyncratic taste shocks,  $\beta^{\theta_i \theta_j}$
  - ▶ wage rates,  $w(\omega_i)$ ;
  - ▶ firm's training and promotion policies,  $tr(\omega_2) \in \{0, 1\}$  and  $mg(\omega_3/tr) \in \{0, 1\}$ 
    - ▶ Anticipate  $\overline{U}_y^{\theta_f \theta_m}(\overline{U}_x^{\theta_f \theta_m}) \rightarrow$  value of any potential household
- ▶ Male  $\theta_m$  partner-choice problem is to choose the type  $\theta_f \cup \emptyset$  that maximizes:

$$\max \left\{ \underbrace{\overline{U}_y^{\emptyset \theta_m} + \beta_m^{\emptyset \theta_m}}_{single}, \underbrace{\{\overline{U}_y^{\theta_f \theta_m} + \beta_m^{\theta_f \theta_m}\}}_{marry \theta_f} \right\}$$

- ▶ Competitive equilibrium in the MM pins down outputs:
  - ▶ MM matching function  $\mu(\theta) \rightarrow$  who marries whom,
  - ▶ Indirect Expected Utilities  $(\overline{U}_x^{\theta_f \theta_m}, \overline{U}_y^{\theta_f \theta_m}) \rightarrow$  why.



# Firm's Production Function Paramters

Symbol	Description	Par.	s.e.	Sensitivity Moments		
$b_{L_1,p}$	Slope (producers) in $L_1$	0.020	0.000	EP1	MM4	MM3
$a_{L_1,mg}$	Intercept (managers) in $L_1$	0.110	0.019	EP11	EP24	EP19
$b_{L_1,mg}$	Slope (managers) in $L_1$	0.022	0.000	EP4	EP19	EP17
$a_{L_2,p}$	Intercept (producers) in $L_2$	-0.070	0.001	EP13	MM4	EP11
$b_{L_2,p}$	Slope (producers) in $L_2$	0.025	0.000	MM4	EP1	MM3
$a_{L_2,mg}$	Intercept (managers) in $L_2$	0.000	0.051	EP26	EP22	EP19
$b_{L_2,mg}$	Slope (managers) in $L_2$	0.025	0.000	EP3	LS9	EP22
$\zeta$	Cost of training	5.0018e-07	0.000	MM4	LS9	EP17

► Moments and Fit I (EP)

► Moments and Fit II (MM)

► Moments and Fit III (FP)

► Moments and Fit IV (LS)

► Moments and Fit V (FI)

► Go back

# Market Human Capital Parameters

Symbol	Description	Par.	s.e.	Sensitivity Moments		
$\mu_1^\eta$	Mean of initial hk draw of $\theta_1$	9.909	0.041	LS1	EP1	LS3
$\mu_2^\eta$	Mean of initial hk draw of $\theta_2$	10.504	0.046	EP11	EP6	LS9
$\mu_3^\eta$	Mean of initial hk draw of $\theta_3$	9.360	0.190	EP4	EP7	EP17
$\mu_4^\eta$	Mean of initial hk draw of $\theta_4$	11.200	0.088	MM4	MM1	EP1
$\sigma^\eta$	Variance of initial hk draw	4.145	0.203	EP1	EP17	MM4
$\alpha_{L_1,1}$	Accumulation rate in $L_1$ for $\theta_1$	1.199	0.071	EP11	EP1	EP21
$\alpha_{L_1,2}$	Accumulation rate in $L_1$ for $\theta_2$	2.271	0.163	EP6	EP16	EP24
$\alpha_{L_1,3}$	Accumulation rate in $L_1$ for $\theta_3$	4.709	0.216	EP17	EP13	EP25
$\alpha_{L_1,4}$	Accumulation rate in $L_1$ for $\theta_4$	5.446	0.119	EP19	EP18	MM1
$\alpha_{L_2,1}$	Accumulation rate in $L_2$ for $\theta_1$	1.511	0.166	EP15	EP21	EP10
$\alpha_{L_2,2}$	Accumulation rate in $L_2$ for $\theta_2$	2.383	0.035	LS10	MM1	EP3
$\alpha_{L_2,3}$	Accumulation rate in $L_2$ for $\theta_3$	4.714	0.189	EP17	EP13	MM3
$\alpha_{L_2,4}$	Accumulation rate in $L_2$ for $\theta_4$	5.215	0.088	EP19	EP18	MM1
$\delta_{L_1}^P$	PT Depreciation rate in $L_1$	0.200	0.070	LS9	EP28	FI2
$\delta_{L_2}^P$	PT Depreciation rate in $L_2$	0.290	0.034	EP11	EP1	EP21
$\delta_{L_1}^N$	NT Depreciation rate in $L_1$	1.588	0.026	MM4	MM3	EP4
$\delta_{L_2}^N$	NT Depreciation rate in $L_2$	1.402	0.279	EP11	EP1	EP24
$\delta_{L_1}^S$	Skill boost from working SFT in $L_1$	0.002	0.074	FI1	MM4	LS9
$\delta_{L_2}^S$	Skill boost from working SFT in $L_2$	0.002	0.001	FI6	EP24	EP19
$\tau$	Skill boost from training	1.235	0.021	MM4	EP5	EP22

► Moments and Fit I (EP)

► Moments and Fit II (MM)

► Moments and Fit III (FP)

► Moments and Fit IV (LS)

► Moments and Fit V (FI)

# Marriage Market and Family Parameters

Symbol	Description	Par.	s.e.	Sensitivity Moments		
<i>Marriage and Fertility Processes</i>						
$\sigma_\beta$	MM preference shock (scale)	0.003	0.000	EP6	EP27	EP18
$\chi_{1,2}^\emptyset$	Value of singlehood for $\theta_1$ and $\theta_2$	1.351	0.002	EP11	EP27	EP18
$\chi_{3,4}^\emptyset$	Value of singlehood for $\theta_3$ and $\theta_4$	1.441	0.017	MM4	EP4	MM3
$\chi^u$	Utility boost with children	1.169	0.003	FP1	MM3	FP4
$\chi^Q$	Min HP with children	0.037	0.000	FP1	FP3	EP6
$\chi^S$	Penalty both SFT	0.087	0.034	LS9	FI5	MM1
<i>Family Human Capital</i>						
$\mu^\phi$	Mean of initial family shock	0.162	0.001	EP7	EP17	EP1
$\sigma^\phi$	Variance of initial family shock	0.030	0.002	EP11	EP1	EP21
$\kappa$	Biological advantage of women	1.161	0.026	EP11	EP20	EP6
$\gamma$	Depreciation rate	0.681	0.025	EP1	EP28	EP11

► Moments and Fit I (EP)

► Moments and Fit II (MM)

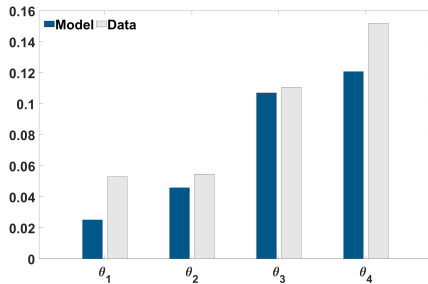
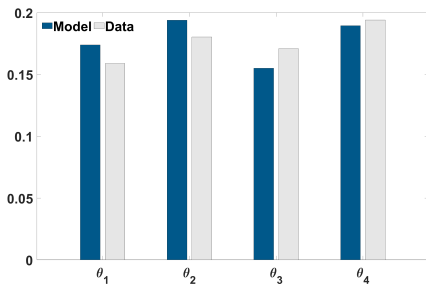
► Moments and Fit III (FP)

► Moments and Fit IV (LS)

► Moments and Fit V (FI)

# Our estimated model captures ambition types very well

Figure: Initial earnings (left) & earnings growth (right) by ambition type



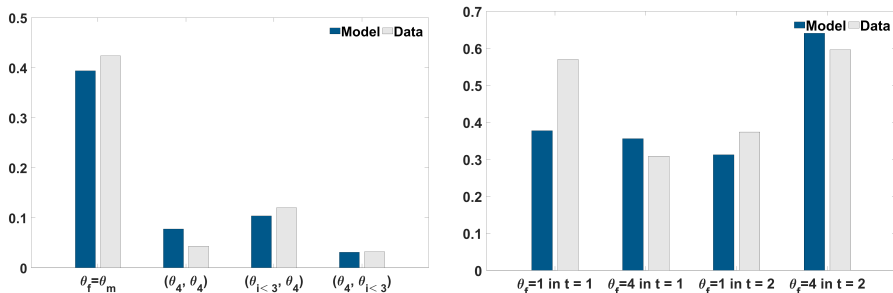
► Go back

## and ladders

- ▶ Productivity of skills in  $J = \{producer, manager\}$  higher in ladder  $L_2$ .
- ▶ Within ladder, managers productivity increase more with skills
- ▶  $L_2$  features:
  - ▶ higher gains in human capital due to full-time work,
  - ▶ a bigger loss of human capital when working part-time, and
  - ▶ slightly bigger super-full-time premium.
- ▶ Therefore we interpret  $L_2$  as the *steep* ladder.

# Our model replicates marriage and fertility patterns

Figure: Frequency of couple type  $(\theta_f, \theta_m)$  (left) & Timing of fertility (right)



# We replicate well gender gaps

- ▶ Initial advantage is estimated at  $\kappa = 1.1613$ .
- ▶ Implies a small initial gender gap in participation
  - ▶ 0.05 (model)—matching the observed 0.04.
- ▶ Initial differences amplify over the life cycle:

Figure: Firm-side investments

