# Women and Careers:

## Skill-Specific Atrophy and Repair

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February 14, 2019

# Motivation

- The gender wage gap is a persistent characteristic of the labor market.
- Men and women have similar *ex ante* abilities, but women self-select into vastly different occupations.
- Career interruptions are costly, but vary by occupation.

# What We Do

- Estimate skill-specific human capital depreciation rates

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- Estimate skill-specific human capital depreciation rates

1. Simple model illustrating optimal occupational choice with skill-specific human capital depreciation

2. Derive regessions and compute skill-specific costs of career interruptions

3. Compute monetized mismatch (partial equilibrium) of individual skills and occupational requirements by gender

# Literature

- Mincer & Polachek (1974): women acquire human capital taking into account their expectations of family formation and future labor market attachment.
- Polachek (1981): occupational choices driven by occupation-specific skill depreciation combined with length of career breaks
- McDowell (1982): women avoid fields where knowledge depreciates quickly and this selection bias is correlated with aggregate fertility patterns.
- Mincer & Ofek (1982): find evidence of wage "rebound" when estimating income losses from labor market withdrawal and re-entry.
- Goldin & Katz (2008): find in the Harvard & Beyond Sample that career interruption costs are large; $MBA > PhD, JD > MD$

# Productivity Across Different Skills

- Agents' wage:

$$\omega_a^{ij} = \sum_{k=1}^{n} \left[ \alpha_k \Theta_k^j + \gamma_k \left( \theta_{k,a}^i - \Theta_k^j \right) \Theta_k^j \right].$$

- Occupation made up of $n$ skill-type requirements
- Returns to occupations by skill type $k$: $\left( \alpha_k \Theta_k^j \right)$
- Penalty for mismatch: $\left( \gamma_k \left( \theta_{k,a}^i - \Theta_k^j \right) \right)$
- Complementarity of skills and requirements: $\left( \left( \theta_{k,a}^i - \Theta_k^j \right) \Theta_k^j \right)$

  - $\Theta_k^j$ skill-k requirement in occupation $j$
  - $\theta_{k,a}^i$ individual skill-k at age $a$
  - $\alpha_k, \gamma_k$ returns

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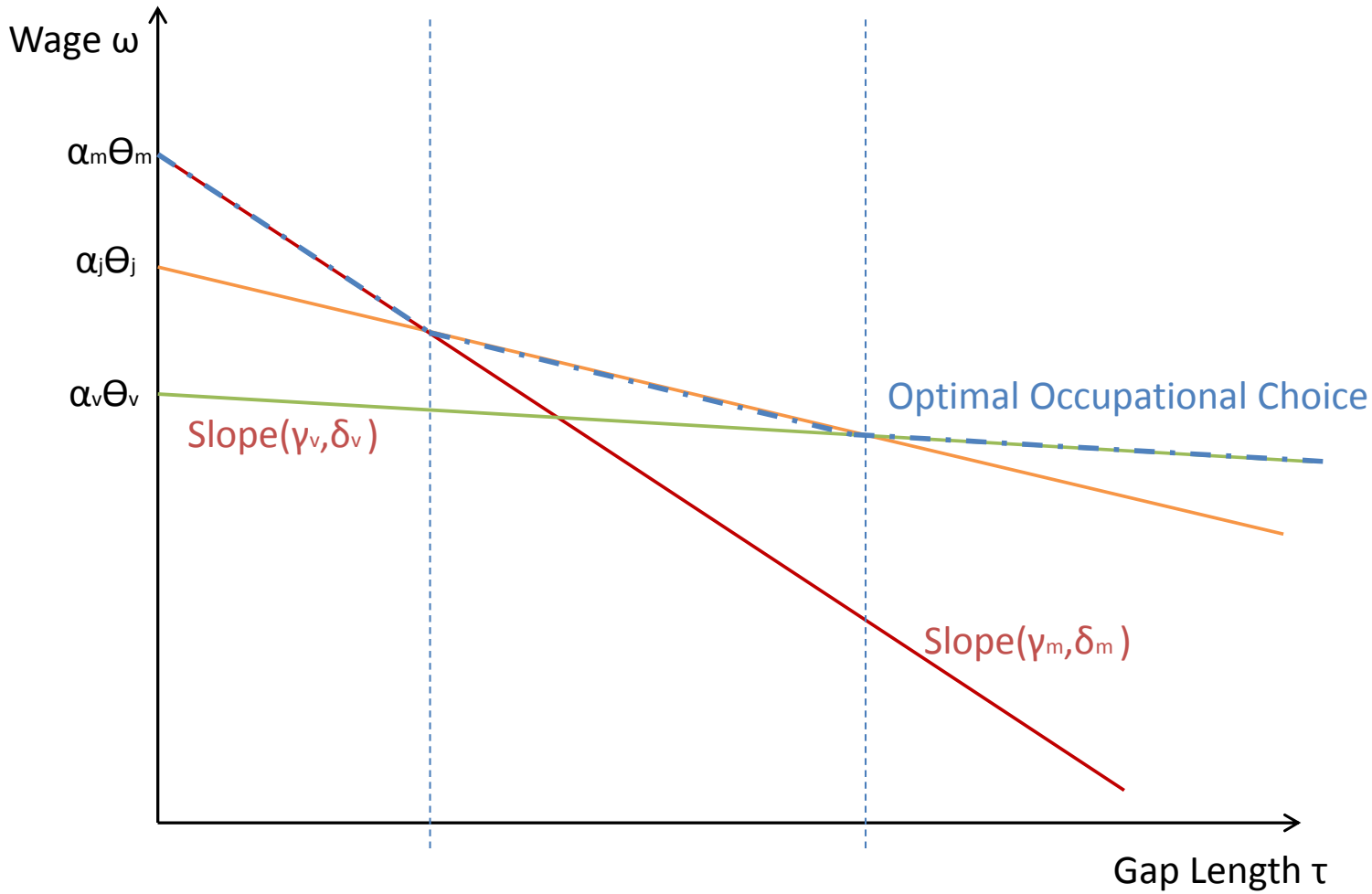
$$\omega_a^{ij} = \sum_{k=1}^{n} \left[ \alpha_k \Theta_k^j + \gamma_k \left( \theta_{k,0}^i (1+\delta_{k,e})^{a-\tau} (1+\delta_{k,g})^{\tau} - \Theta_k^j \right) \Theta_k^j \right].$$

- Time off: $(\tau)$
- Learning-by-doing: $(\delta_{k,e} \geq 0)$
- Depreciation of skill with break: $(\delta_{k,g} \leq 0)$

  - $\Theta_k^j$ skill-k requirement in occupation $j$
  - $\theta_{k,a}^i$ individual skill-k at age $a$
  - $\alpha_k, \gamma_k$ returns

# Illustration of Productivity




- Larger $\tau \Rightarrow$ sort into lower skill depreciating occupations, $\delta_k$

# Sources

- National Longitudinal Survey of Youth 1979 (NLSY)
  - Original sample of 12,686 men and women aged 14-22 in 1979
  - *Ex ante* measure of abilities: Armed Services Vocational Aptitude Battery (ASVAB)
  - Weekly employment status variables (gap measurement)
  - Wage observations at the survey dates
- Occupational Information Network 2010 (O*net)
  - 26 occupational descriptors
  - O*net occupational descriptors matched to the ASVAB test sections: math, verbal, science and technical

# Occupational Information

- O*net survey questions sent to workers who answer one-quarter of questions
- Expert matching of O*net to ASVAB tests:

1. Math is composed of "Arithmetic Reasoning" and "Mathematics Knowledge."
2. Verbal is composed of "Word Knowledge" and "Paragraph Comprehension."
3. Science is composed of "General Science Knowledge."
4. Technical is composed of "Auto and Shop, Mechanical Comprehension" and "Electronics Information."

# Sample Summary Statistics

| | Male | | | | Female | | | |
|---|---|---|---|---|---|---|---|---|
| | LTC | | C+ | | LTC | | C+ | |
| Age | 31 | (9) | 35 | (8) | 32 | (9) | 35 | (8) |
| LF Attachment | 75 | (43) | 94 | (24) | 56 | (50) | 75 | (43) |
| Home Wks Last Yr | 6 | (12) | 3 | (9) | 9 | (15) | 5 | (11) |
| O*net M Rank | 46 | (29) | 65 | (27) | 46 | (26) | 62 | (28) |
| O*net V Rank | 43 | (30) | 65 | (26) | 48 | (26) | 66 | (25) |
| O*net S Rank | 50 | (30) | 61 | (27) | 44 | (27) | 58 | (29) |
| O*net T Rank | 57 | (29) | 58 | (28) | 40 | (26) | 52 | (28) |
| Pre-ASVAB M Rank | 43 | (26) | 76 | (20) | 43 | (25) | 75 | (21) |
| Pre-ASVAB V Rank | 43 | (27) | 74 | (21) | 44 | (26) | 72 | (21) |
| Pre-ASVAB S Rank | 45 | (26) | 72 | (22) | 44 | (27) | 71 | (24) |
| Pre-ASVAB T Rank | 48 | (28) | 67 | (23) | 44 | (27) | 67 | (25) |
| Observations | 32,839 | | 9,444 | | 30,720 | | 9,147 | |
| Individuals | 2,123 | | 661 | | 2,176 | | 694 | |

# Regression of Depreciation

$$
\begin{aligned}
\log(w_{i,t}) \quad = \quad & \sum_k \alpha_{k,t}\Theta^i_{k,t} + \sum_k \gamma_{k,t}\left(\theta^i_k - \Theta^i_{k,t}\right)\Theta^i_{k,t} + \\
& \sum_k \gamma_{ke,t}\left(\theta^i_k \times \exp^i_t\right)\Theta^i_{k,t} + \sum_k \gamma_{ke2,t}\left(\theta^i_k \times \left(\exp^i_t\right)^2\right)\Theta^i_{k,t} + \\
& \sum_k \gamma_{kg,t}\left(\theta^i_k \times \mathrm{gap}^i_t\right)\Theta^i_{k,t} + \sum_k \gamma_{kg2,t}\left(\theta^i_k \times \left(\mathrm{gap}^i_t\right)^2\right)\Theta^i_{k,t} + \\
& X'_{it}\beta_t + \epsilon_{i,t},
\end{aligned}
$$

- Two regression specifications:
  1. OLS with Robust SEs: issue with serially correlated error terms
  2. Fixed effects by gender

# FE (Women): Wage Growth ($\log(w_{i,t}) - \log(w_{i,t-1})$)

| Gaps | Any Gap | | 3-month | |
|---|---|---|---|---|
| | LTC | C+ | LTC | C+ |
| General | -0.612*** | -0.973* | -0.567*** | -0.535 |
| | (0.168) | (0.519) | (0.184) | (0.588) |
| Math | 1.290 | -1.371 | -0.350 | -4.044* |
| | (0.882) | (1.889) | (0.867) | (2.241) |
| Verbal | -1.281* | 1.584 | -0.384 | 2.005 |
| | (0.745) | (1.583) | (0.760) | (1.902) |
| Science | 1.584* | 1.139 | 2.638** | 1.865 |
| | (0.899) | (1.697) | (1.039) | (2.071) |
| Technical | -0.590 | -0.904 | -0.712 | 0.135 |
| | (0.997) | (2.307) | (1.169) | (2.377) |
| Obs | 14,696 | 5,618 | 14,696 | 5,618 |
| R-squared | 0.015 | 0.025 | 0.014 | 0.025 |
| IDs | 1,767 | 686 | 1,767 | 686 |

Statistical significance levels: *** p<0.01, ** p<0.05, * p<0.1
Include experience, experience squared, age, age squared, dummies for years, region, marital status (married, never married, and other), and last school degree (high school drop out, high school graduate, some college, college graduate, and post-college graduate).

# Individual Response?

- Does it matter that depreciation rates differ by skill?

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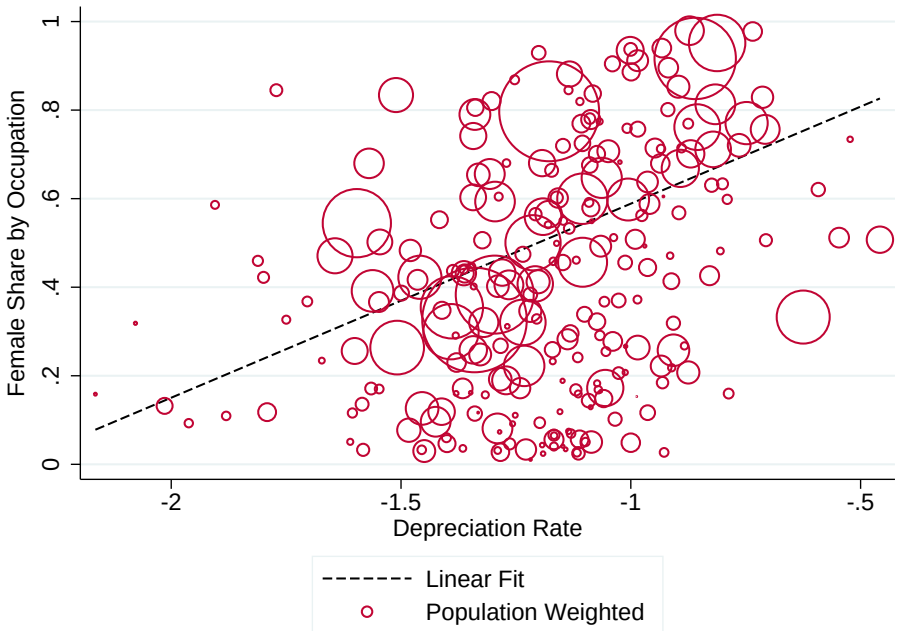
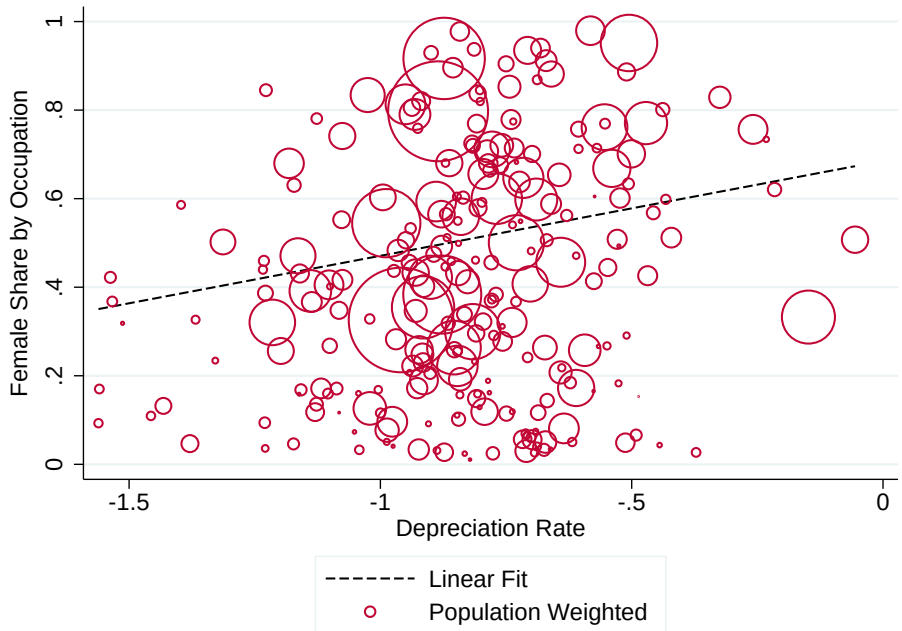
1. Correlation of CPS female employment share with occupational depreciation rates (computed from NLSY estimates above).

2. Combining the O*net skill content with the ASVAB test scores for the NLSY cohort provides a measure of mismatch in individual skills and occupation requirements.
   - Skill prices estimated using males only with significant LF attachment.

# Occupations and Employment Shares (C+)




Any Gap




Min 3 Months

- Slight weakening over time:
  - Any Gap: Correlation of 0.51 in 1970 to 0.49 by 2010
  - 3-Month Minimum Gap: Correlation of 0.25 in 1970 to 0.19 by 2010

# Skill Prices

- Skill prices estimated using males only with significant LF attachment:

$$\begin{aligned}\log(w_{i,t}) = & \sum_k \alpha_{k,t}\Theta^i_{k,t} + \sum_k \gamma_{k,t}(\theta^i_k - \Theta^i_{k,t})\Theta^i_{k,t} + \\ & \sum_k \gamma_{ke,t}\left(\theta^i_k \times \exp^i_t\right)\Theta^i_{k,t} + \sum_k \gamma_{ke2,t}\left(\theta^i_k \times \left(\exp^i_t\right)^2\right)\Theta^i_{k,t} + \\ & X'_{it}\beta_t + \epsilon_{i,t}\end{aligned}$$

# Monetized Mismatch (Partial Equilibrium)

- Monetized mismatch is:

$$
\begin{aligned}
m_{kt}^{i} \quad = \quad & \sum_{k} \hat{\alpha}_{k,t} \left( \Theta_{k,t}^{\star} - \Theta_{k,t}^{i} \right) - \sum_{k} \hat{\gamma}_{k,t} \left\{ \left( \Theta_{k,t}^{\star} \right)^{2} - \left( \Theta_{k,t}^{i} \right)^{2} \right\} + \\
& \sum_{k} \left( \hat{\gamma}_{k,t} + \hat{\gamma}_{ke,t} \widehat{\exp}_{t} + \hat{\gamma}_{ke2,t} \widehat{\exp}_{t}^{\,2} \right) \theta_{k}^{i} \left( \Theta_{k,t}^{\star} - \Theta_{k,t}^{i} \right)
\end{aligned}
$$

- Partial equilibrium:
  - What if women were not to take any gaps?
  - Optimal (wage maximizing) occupation $\left( \Theta_{k,t}^{\star} \right)$
  - Potential experience, as if there are no gaps $(\widehat{\exp}_{t})$

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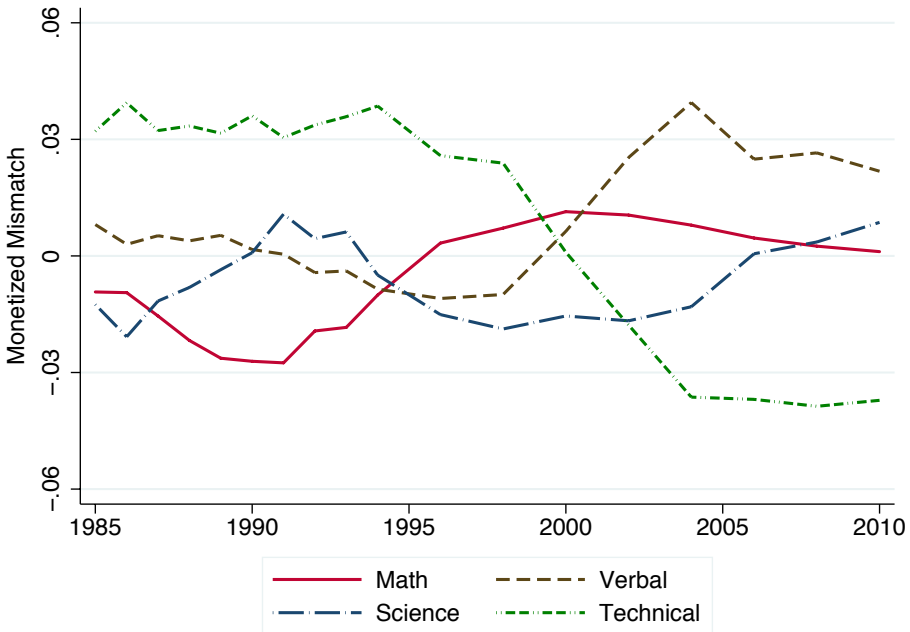
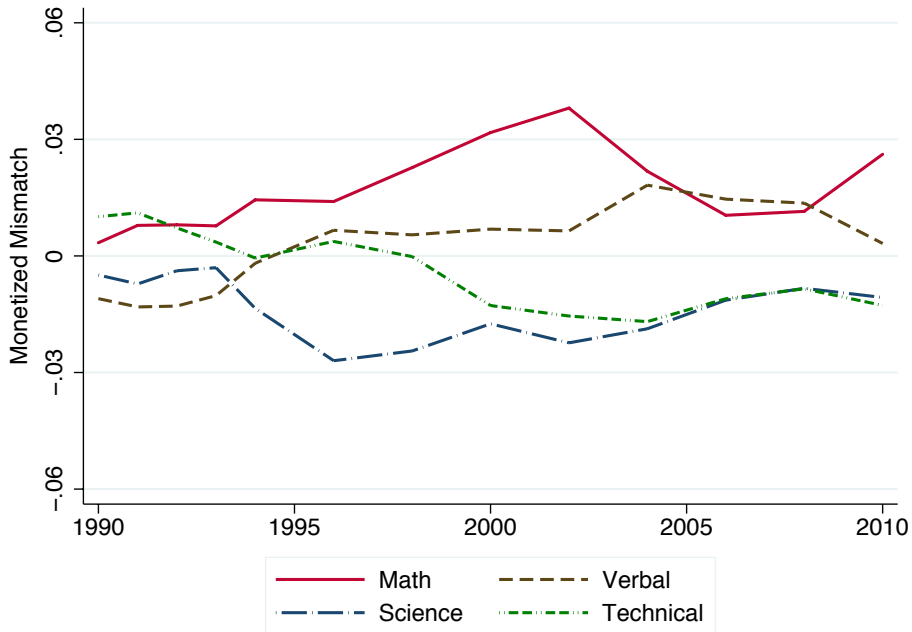
- Partial equilibrium:
  - What if women were not to take any gaps?
  - Optimal (wage maximizing) occupation $\left( \Theta_{k,t}^{\star} \right)$
  - Potential experience, as if there are no gaps $(\widehat{\exp}_{t})$
- Alternative: Optimal occupation choice with gaps and fertility from the NLSY

# Gender Gap of Monetized Mismatch




Non-College

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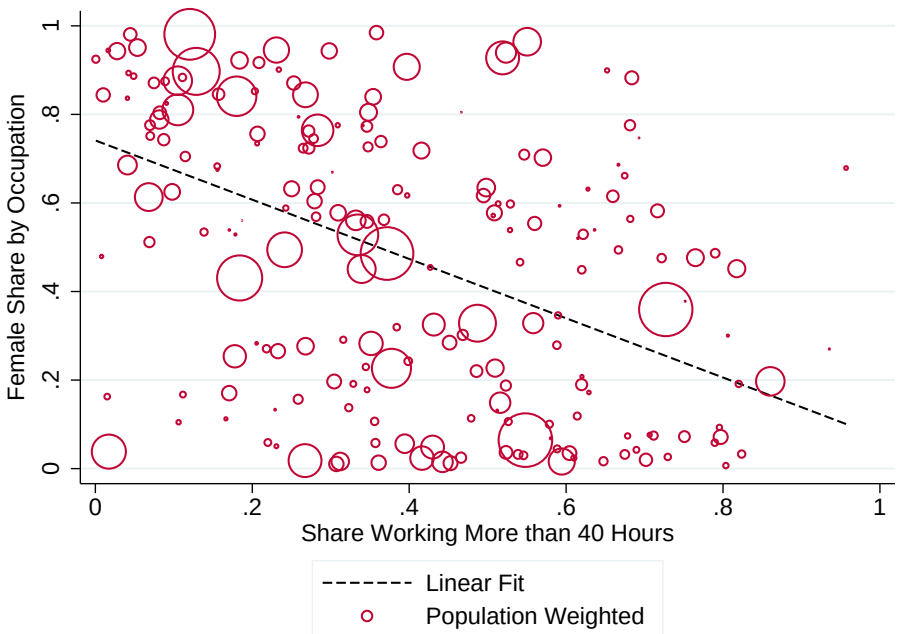
Notes: Average mismatch measures are computed using NLSY 1979 sample weights for all workers (part- and full-time). Results graph average differences between women and men.

# Alternative (Complimentary) Explanations for Mismatch

- Goldin (2014): working hours
- Further O*net Information, "Duration of Typical Work Week" - share of working more than 40 hours

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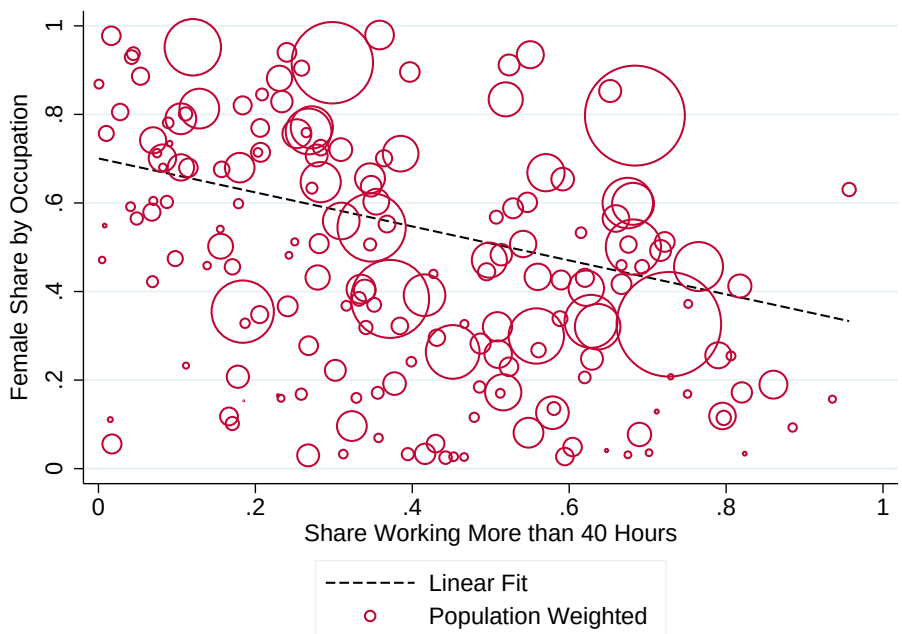


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# Conclusion

- Large differences of male and female occupational choices
- A possible explanation: skill-specific depreciation rates
- Gaps seem to matter more in terms of math for C+ woman
- Pattern less stable for LTC+ woman (depending on specification)

$\Rightarrow$ Future Research: General Equilibrium Effects - How much of educational/occupational choices and resulting gender gaps can these effects explain?