

Coordinated Work Schedules and the Gender Wage Gap

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Intro

- Women have made remarkable gains in the labor market over the past five decades.
- The rate of convergence in female and male earnings has stalled since 2000. [▶ figure](#)
- The rate of convergence has stalled especially for college educated [▶ figure2](#)

Intro

- Bertrand, Goldin, and Katz (2010) follow career progression of Chicago MBAs.
- Men and women begin their careers with similar earnings but women are 60 log points behind a decade later.
- Gap arises from career interruptions and lower hours related to children.
- Recent work on child penalty reinforce these findings, e.g. Kleven et al. (2018)

Intro

- Goldin (2014) cites flexible work schedules as key in the “last chapter” of gender convergence
- What is the right way to measure [flexibility](#)?
- Demand for long hours disadvantages women (Goldin, 2014; Erosa et. al., 2017; Gicheva, 2013; Cha and Wheeden, 2014; Cortes and Pan, 2016)

Our Paper

- Focus on the *timing of work* and how it conflicts with the demands of family time.
- We look at observed hours chosen by workers.
- Work schedules at the occupational-level.

Our Story

- The demand for family time is higher for women relative to men.
- It restricts their hours choices.
- It conditions their occupational choice.
- There are occupations in which workers are more productive if they work at the same time (*need to coordinate*) but there are others for which that is not important (*do not need to coordinate*).

What do we do?

Facts

- We use American Time Use Surveys (ATUS) to establish the following facts
 - Among married women and men with children, women have more “missing hours” from work
 - Women correspondingly do more household care
 - Occupations differ in terms of how work hours are *bunched* during peak hours
 - Bunching is compensated but less so if women

What do we do?

Theory

- A general equilibrium model of occupational choice where:
 - Occupations differs in terms of the productivity of workers when they balance working time during the day.
 - Heterogenous workers, occupation-specific tastes.
 - Household care and market goods. Women derive more utility from household care.

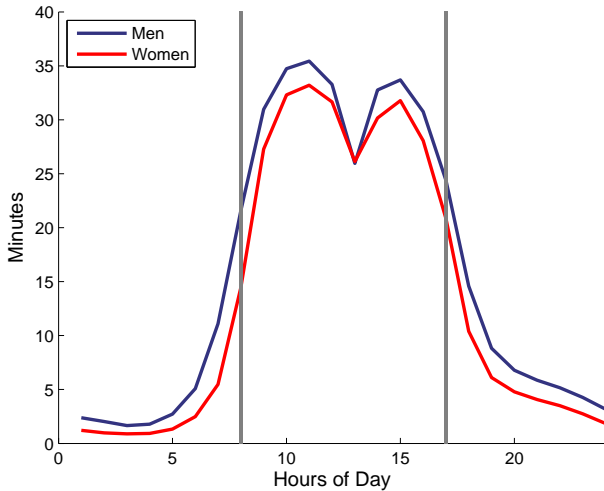
Outline of the Talk

- Facts
- Theory
- Quantitative Exercises (preliminary results)

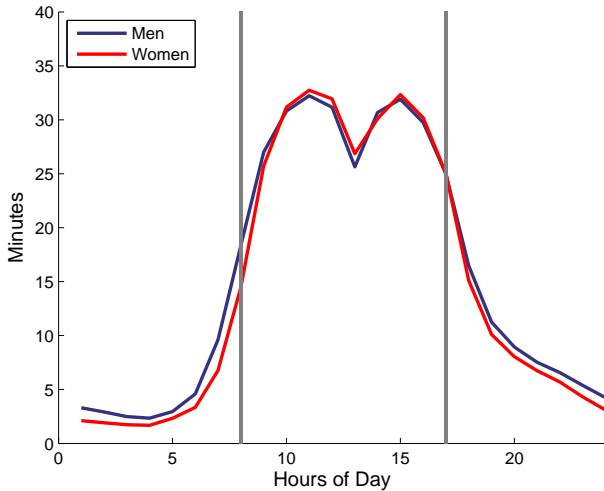
Data

- 2003-2014 American Time Use Surveys (ATUS) and CPS. One respondent per household is drawn from the Current Population Survey.
- We focus on two activities, work and work-related activities and caring for and helping household members
- We focus on adults who are 18 to 65 years old and are *full time workers*.
- There are 108,426 respondents and 67,134 are full-time

Timing of Work: Married W/ Children



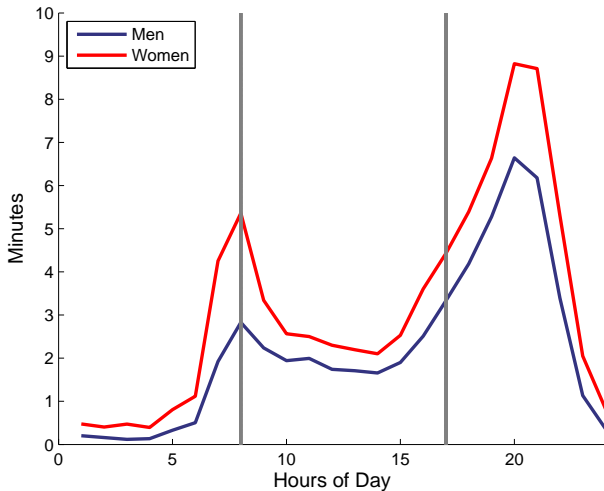
Timing of Work: Single No Children



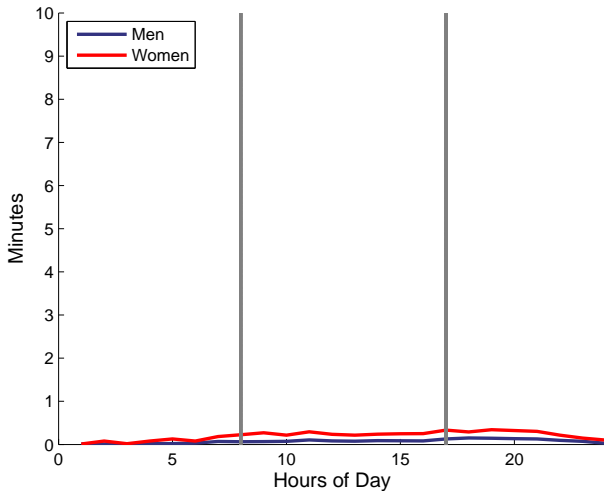
Gender Gap in Hours Worked: Married W/ Children

	Weekday	Weekend	Weekday	Weekday		
Female Gap in Hours	-0.896***	-0.731***	-0.906***	-0.902***	-0.687***	-0.447***
	(0.0722)	(0.0709)	(0.0720)	(0.0730)	(0.0725)	(0.0800)
Observations	11339	11438	11339	11339	11339	7863
Day of Week and Year			X	X	X	X
Education ,Age and Race				X	X	X
Usual Weekly Hours					X	X
Usual Weekly Hours less than 50						X

Timing of Household Care: Married W/ Children



Timing of Household Care: Single No Children



Gender Gap in Household Care: Married W/ Children

	Weekday	Weekend	Weekday	Weekday		
Female Gap in Household Care	.456*** (0.0291)	.266*** (0.0354)	.455*** (0.0291)	.363*** (0.0285)	.334*** (0.0287)	.275*** (0.0348)
Observations	11339	11438	11339	11339	11339	7863
Day of Week and Year			X	X	X	X
Education ,Age and Race				X	X	X
Usual Weekly Hours					X	X
Usual Weekly Hours less than 50						X

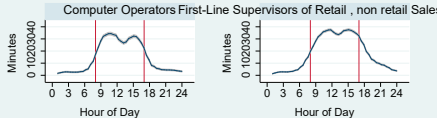
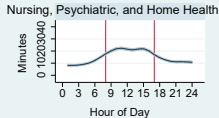
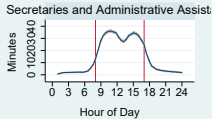
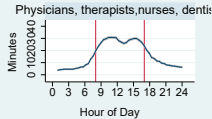
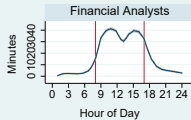
Hours Spent in Childcare by Mothers

	Full-time Workday	Full-time Nonwork Day	Non-Employed
Mothers of 0-4 Year Olds			
Routine Childcare	0.9	1.9	1.9
Enriching Childcare	0.7	1.4	1.9
Other Childcare	0.4	0.2	0.3
Mothers of 5-9 Year Olds			
Routine Childcare	0.5	0.6	0.7
Enriching Childcare	0.7	1.4	1.6
Other Childcare	0.4	0.3	0.4
Mothers of 10-15 Year Olds			
Routine Childcare	0.1	0.1	0.3
Enriching Childcare	0.4	0.9	1.0
Other Childcare	0.2	0.2	0.3

Source: Stewart (2010), Table 1, 2003-2007 ATUS

Timing of Work Across Occupations

Timing of Work in Selected Occupations



Measuring Bunching: The *8to5ratio*

- Divide the day in three time intervals: 12 a.m.-8 a.m. (A), 8 a.m.-5 p.m.(B) and, 5 p.m.-12 a.m. (C)
- A_{ij} , B_{ij} , and C_{ij} refer to the sum of minutes worked by individual i in occupation j .
- Then, at the occupation level we have that

$$A_j = \sum_{i=1}^{N_j} w_i A_{ij}, B_j = \sum_{i=1}^{N_j} w_i B_{ij}, C_j = \sum_{i=1}^{N_j} w_i C_{ij}$$

$$ratio8to5_j = \frac{B_j}{A_j + B_j + C_j}.$$

8to5ratio - More Educated Workers

Table: Ratio8to5 For Occupations With Fraction Of College $> .4$

	Occupations	Work
1	Geological, chemical, natural scienceTechnicians	0.619
2	Air Traffic Controllers and Airfield Operations Specialists	0.626
3	Photographers, sound and light technicians	0.637
4	sports ,entertainment	0.663
5	Physicians, therapists,nurses, dentists	0.668
6	Directors, Religious Activities and Education	0.669
7	other miscellaneous managers	0.736
25	Travel,sales Agents	0.801
26	Training and development specialists,business operations	0.805
27	Other Healthcare Practitioners and Technical Occupations	0.819
28	natural science, biology	0.838
29	Librarians, teacher assistatns	0.840
30	Math,stats, operations research, actuaries	0.860
31	Judges, Magistrates, and Other Judicial Workers	0.882

8to5ratio - Less Educated Workers

Table: Ratio8to5 For Occupations With Fraction Of College $\leq .4$

	Occupations	Work
1	Fishers and Related Fishing Workers	0.304
2	Forest and Conservation Workers, logging	0.501
3	Firefighters	0.502
4	Dishwashers, hosts, hostesses	0.517
5	Nursing, Psychiatric, and Home Health Aides	0.532
6	Wardens, jailors, correctional officers	0.545
7	Combined Food Preparation and Serving Workers	0.549
57	Electronic Equipment Installers and Repairers, Motor Vehicles	0.797
58	Clerks	0.812
69	Audio-Visual and Multimedia Collections Specialists, lib. Workers	0.839
60	Secretaries and Administrative Assistants	0.843
61	Occupational Therapy Assistants and Aides	0.923
62	Morticians, Undertakers, and Funeral Directors	0.925
63	Tour and Travel Guides	0.960

Correlation of 8to5ratio and O*NET Characteristics

Table: Rank correlations based on 94 occs

1	Assisting and caring for others	-0.183
2	Coaching and developing others	0.112
3	Developing_and_Building_Teams	0.147
4	Establishing_and_Maintaining_Interpersonal_Relationships	0.365
5	Face-to-Face_Discussions	0.280
7	Social orientation	0.088
8	Training_and_Teaching_Others	-0.013
10	Guiding_Directing_and_Motivating_Subordinates	0.101

Earnings and Time Bunching

- We estimate the following regression

$$\ln W_i = \beta_0 + \beta_1 * female_i + \beta_2 ratio8to5_j + \beta_3 female_i * ratio8to5_j + \beta_4 X_i + \varepsilon_i$$

- We use *ratio8to5* for each occupation and individual level earnings data

Earnings and Time Bunching

	All	Single wo/Kids	Married w/Kids
Female	-.218*** (0.0220)	-0.137*** (0.0183)	-0.262*** (0.0257)
ratio8to5	0.128*** (0.0254)	0.114*** (0.0268)	0.124*** (0.0268)
Female X ratio8to5	-0.0529* (0.0266)	-0.0168 (0.0214)	-0.0683** (0.0338)
Observations	259756	72287	108981

Earnings and Time Bunching + Agg. Educ + Overwork

	All	Single wo/Kids	Married w/Kids
Female	-.245*** (0.0173)	-0.166*** (0.0167)	-0.288*** (0.0257)
ratio8to5	0.0724** (0.0271)	0.0616** (0.0293)	0.0763** (0.0292)
Female X ratio8to5	-0.0371* (0.0215)	-0.0118 (0.0221)	-0.0514** (0.0249)
Observations	259756	72287	108981

Earnings and Time Bunching

College and Non-College

	All	College	Non-College
Female	-.262*** (0.0257)	-0.175*** (0.0383)	-0.287*** (0.0203)
ratio8to5	0.124*** (0.0268)	0.160*** (0.0446)	0.121*** (0.0287)
Female X ratio8to5	-0.0683** (0.0338)	-0.167** (0.0571)	-0.055* (0.0295)
Observations	108981	42987	65994

Earnings of Men and Time Bunching

Wife Makes More

	Only Married Men
wifemore	-0.405*** (0.0145)
ratio8to5	0.124*** (0.0309)
wifemoreXratio	-0.0456** (0.0187)
Observations	40993

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Summary

- Our regression coefficients indicate that one standard deviation in *ratio8to5* leads to approximately 10 percent extra earnings for full time workers.
- Our regression coefficients indicate that one standard deviation in *ratio8to5* leads to approximately 5 percent extra earnings gap for married women with children
- This is about one-sixth of the gender gap in earnings for this population

Interpretation

- Our regression coefficients however reflect decisions, endogenous to production technology of market goods, production technology of home goods, preferences over home and market goods.
- Objects that are *interrelated* and difficult to control for
- How much of the observed earnings gap is due to each these factors?

Interpretation

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We add structure and conduct counterfactual experiments

Model-Environment

- Mass-one continuum of male and female individuals that live 1 period. There are J occupations and choose one of them.
- They consume home care and market goods. Home care purchased through time only.

$$u(c, h) = (h)^{\nu^s} (c)^{1-\nu^s}$$

- Individual draws a taste parameter $\theta_{i,j,g}$ from $F_g(\theta_j)$.

$$\Omega_i = \{\theta_{i,1}, \dots, \theta_{i,J}\}$$

Model-Environment

- Workers decide:
 - the split of their time between home and market, h^i and l^i .
 - the division of their time between the “prime” (l_1^i and l_2^i) and “kids” time (h_1^i and h_2^i).
- The total number of hours during the period is set to one, that means $h_{j,1}^i + l_{j,1}^i + h_{j,2}^i + l_{j,2}^i = 1$ and $h_{j,2}^i + l_{j,2}^i = 0.5$.
- The *timing of work* affects productivity:

$$l_j^i = l_{j,1}^i + l_{j,2}^i - (0.5 - l_{j,1}^i)^{\alpha_j} \quad \text{with} \quad \alpha_j \geq 0 \quad \text{for} \quad j = 1, \dots, J$$

- The *timing of home production* affects the production of home goods:

$$h^i = ((h_1^i)^\rho + (h_2^i)^\rho)^{\frac{1}{\rho}}$$

Model-Individual's Decision Problem

- The amount of effective labor supplied by worker of gender s in occupation j is l_j^s . The supply of a unit of *effective* labor is compensated at a rate w_j .
- The value of occupation j for an individual of gender s reads as follows

$$\begin{aligned} V_j^s(\theta_j^s) &= \theta_j \left\{ \max_{c^s, l_{j,1}^s, l_{j,2}^s, h_{j,1}^s, h_{j,2}^s} \{u(c^s, h^s)\} \right\} \\ &\quad s.to. \\ &\quad c^s = l_j^s w_j \\ &\quad h_{j,2}^s + l_{j,2}^s = 0.5 \\ &\quad h_{j,1}^s + l_{j,1}^s + h_{j,2}^s + l_{j,2}^s = 1 \\ &\quad l_j^s = l_{j,1}^s + l_{j,2}^s - (0.5 - l_{j,1}^s)^{\alpha_j} \quad \text{with} \quad \alpha_j \geq 0 \\ &\quad h_j^s = ((h_{j,1}^s)^\rho + (h_{j,2}^s)^\rho)^{\frac{1}{\rho}} \end{aligned}$$

Model-Production

- There are J intermediate good producers (occupations) according to $X_j = N_j$. They solve

$$\max_{N_j} p_j X_j - N_j w_j, \quad s.to \quad X_j = N_j$$

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- Final Goods Technology:

$$Y_j = \prod_{j=1}^J \{X_j^{\kappa_j}\}.$$

Producers solve

$$\max_{X_1, \dots, X_J} \prod_{j=1}^J \{X_j^{\kappa_j}\} - \sum_{j=1}^J p_j X_j$$

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$$\max_{X_1, \dots, X_J} \prod_{j=1}^J \{X_j^{\kappa_j}\} - \sum_{j=1}^J p_j X_j$$

- In equilibrium $X_j = N_j$ and $p_j = w_j$.

Taking the Model to the Data (I)

- Taste shocks distributed Frechet with common dispersion parameter.

$$Prob(\theta \leq \theta_0) = -exp(-T_{j,g}\theta_0)^{-\xi}$$

- Normalize $T_j = 1$ for all j for males.
- Parameters : $\left(\{\alpha\}_{j=1}^{22}, \{\kappa\}_{j=1}^{22}, \{T_{i,f}\}_{j=1}^{22}, \rho, \nu^f, \nu^m \right)$

Taking the Model to the Data (II)

- The labor shares - κ_j - equal ratio of earnings in each occupation as a share of total earnings.
- Choose the remaining parameters to match:
 - Work bunching ratios by occupation.
 - Share of females by occupation.
 - Average hours of males and females.
 - Ratio of work bunching ratio to household care bunching ratio.

Coordination and the Gender Gap

- Correlation bunching ratio earnings per hour: 0.3
- Correlation bunching ratio gender gap: 0.96
- Gender Gap 4.4% (87% of data; 15% of overall).

Three Experiments

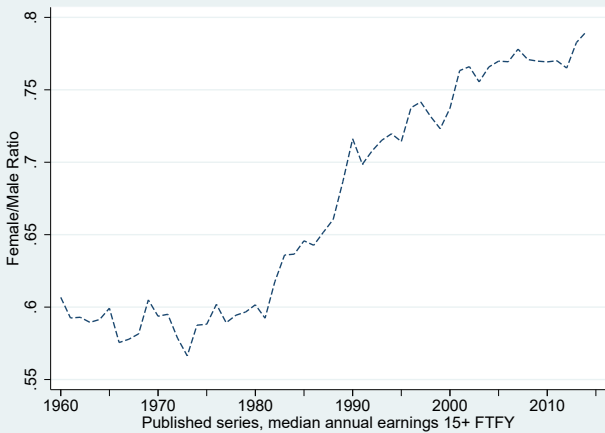
- Equal coord. frictions - lowest- across occupations (maximum of α 's).
 - Gender gap drops by 60%
- Equal ν across females and males.
 - Gender gap vanishes.
- Equal T across occupations and gender.
 - Gender gap rises by 7%

Final Remarks

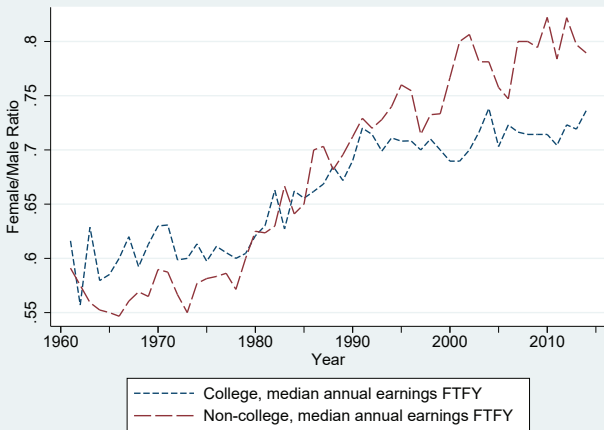
- Using time diaries, we document that even full-time working women “miss” work and do more household care.
- We propose an alternative measure of “(in)flexibility” that characterizes occupations.
- We find a robust relationship between this measure and gender wage gap among married with children.
- Calibration of model suggests about 15 percent of gender wage gap is due to women’s higher demand for home time

Final Remarks

- Cook et al. (2018) find 5 to 7 percent gender wage gap in work with complete flexibility (Uber drivers)
- Experience, driving speed, and choice of when and where to drive explains the differences.
- Duchini et al (2018) study the effects of French school hours reform.
- When schools open on Wednesdays, women work more on Wednesdays, educated women and managers have biggest response



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Shift Work

	Baseline	Baseline+Agg Educ	Baseline+Agg Educ +Overwork
Panel A: Married Women with Children - Including Shift-Workers			
female	-0.322*** (0.0275)	-0.354*** (0.0221)	-0.344*** (0.0222)
ratio8to5	0.120*** (0.0289)	0.0674** (0.0256)	0.0729** (0.0242)
femaleXratio8to5	-0.0521 (0.0372)	-0.0560* (0.0315)	-0.0430 (0.0311)
Observations	3291	3250	3250
Panel B Married Women with Children - Excluding Shift-Workers			
female	-0.324*** (0.0284)	-0.357*** (0.0226)	-0.345*** (0.0225)
ratio8to5	0.128*** (0.0316)	0.0705** (0.0274)	0.0791** (0.0267)
femaleXratio8to5	-0.0634 (0.0383)	-0.0607* (0.0317)	-0.0480 (0.0321)
Observations	2909	2876	2876

Concentration Ratio

Herfindahl Index

	Baseline	Baseline+Agg Educ	Baseline+Agg Educ +Overwork
Married With Children			
female	-0.344*** (0.0272)	-0.360*** (0.0340)	-0.345*** (0.0342)
conc ratio	0.426*** (0.102)	0.220* (0.111)	0.256** (0.118)
femaleXconc ratio	-0.369** (0.129)	-0.269** (0.113)	-0.239** (0.113)
Observations	108981	108981	108981

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .001$

Model Regressions

	Work Time
Female	-1.55*** (0.047)
ratio8to5	2.33*** (0.075)
Female \times ratio8to5	1.94*** (0.10)

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