Long-term trends in part-time work

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2 February 2023

Motivation

Part I: Key facts about trends in part-time work

- **Fact 1** Increase in the *quantity* of PT work
- **Fact 2** Increase in the *relative price* of PT work

Part II: Model incorporating part-time work

- 'Task-based' approach
- Coexistence of full- and part-time jobs in equilibrium
- Convex hours-earnings relationship in equilibrium

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Why is this important?

- **Theoretical**: non-linear hours-earnings profile
- **Policy:** inequality in hours

Empirical investigation

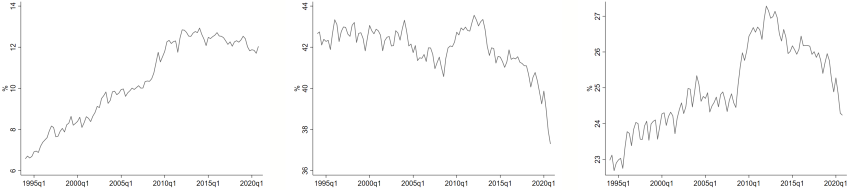
- Quarterly Labour Force Survey
  - Long-term data on hours and earnings - cover the whole business cycle
  - Individual characteristics - selection in PT/FT work
- Key variables:
  - TTUSHR: Total usual hours worked in main job (including overtime)
  - GRSSWK: Gross weekly pay in main job
  -
- Sample selection:
  - Part-time if working < 31 hours a week
  - Age between 16 and 64
  - Working between 5 and 70 hours a week

Fact 1 Increase in the *quantity* of PT work

Increase in PT work in some segments of the labour force

- before GFC - growth in the % of employed men with main job PT (PT share), offsets declining female PT share
- after GFC - sharp growth in the PT share of both genders

Figure 1: Part-time workers (as % of working population)



Male | Female | All

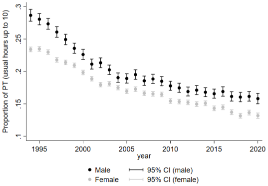
Source: LFS

Fact 1 Increase in the *quantity* of PT work

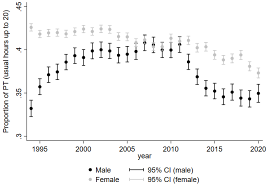
Conditional on working PT, weekly hours have increased

- PT workers are doing more hours than previously
- the share of total working hours done by PT workers has increased

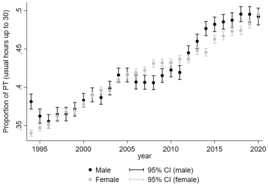
Figure 2: Distribution of PT workers by usual weekly working hours



1-10 hours per week



11-20 hours per week



21-30 hours per week

Source: LFS

Fact 1 Increase in the *quantity* of PT work

Overall, more work is being done by PT workers

- the share of total working hours done by PT workers has increased
- increase in 'PT share of all hours' from 17% in 1994 to 22% in 2013

Figure 3: Distribution of PT workers by usual weekly working hours

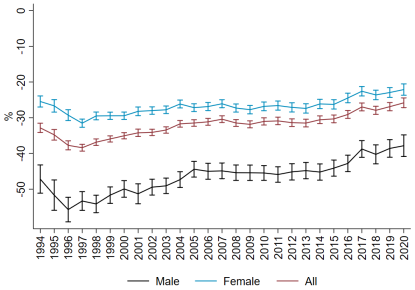
Source: LFS

Fact 2 Changing (relative) price of part-time work

Part-time pay penalty has decreased

$$\log w_{it} = \beta_t PT_{it} + \epsilon_{it}$$

Figure 4: Trend in the part-time pay penalty



Source: LFS

Unadjusted

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$$\log w_{it} = \beta_t PT_{it} + X_{it}\gamma + \epsilon_{it}$$

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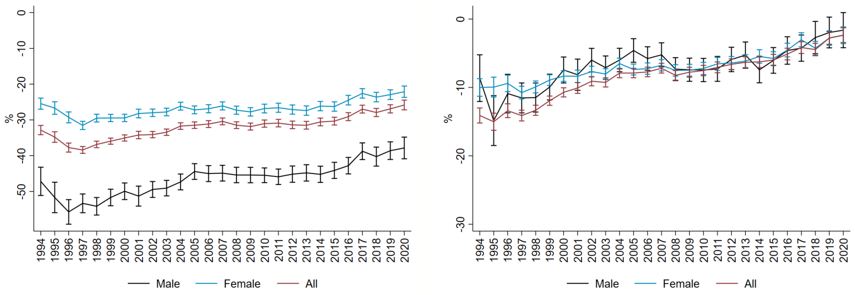


Unadjusted

Adjusted for worker and job characteristics

Source: LFS

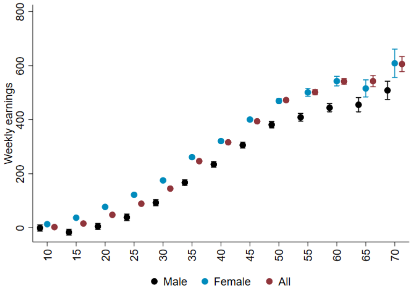
Fact 2 Changing (relative) price of part-time work

Non-linear hours-earnings relationship

- Doesn't change much over time

$$\log e_{it} = \sum_{h \in H} \beta_h d_{ih} + \epsilon_{it} \quad ; \quad h \in H = \{5, 10, 15, ..., 70\}$$

Figure 5: Cross-sectional hours-earnings profile



Unadjusted

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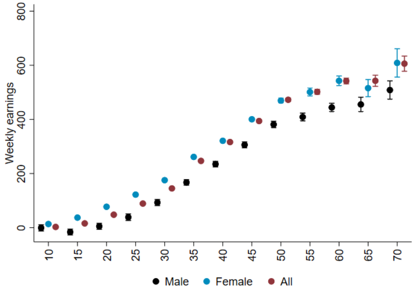

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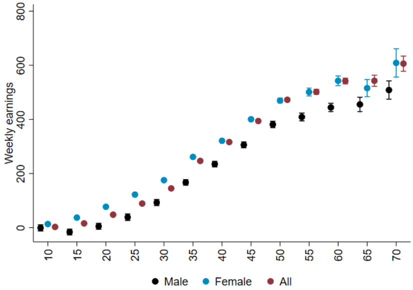


Adjusted for worker and job characteristics

Source: LFS

Further empirical work

- PT work very concentrated in certain industries/occupations
  - Hospitality, service
  - Lower occupational skill requirements (Hirsch, 2005)
- **Question:** Is this related to different *tasks?*
  - Fewer communicating, co-ordinating, analysing tasks?
  - More caring, interacting directly with customers tasks?
- Analysis of PT/FT tasks
  - link LFS data to O*NET task requirements
  - investigate which tasks can predict the PT share within an occupation
  - investigate which tasks are associated with a higher part-time pay penalty

Research questions

Aim of this model: a neoclassical model incorporating PT work in a flexible way, explaining

- workers' *and* firms' preferences for FT/PT work
- the higher hourly wage of FT relative to PT workers

Disentangle the causes of changes in relative quantity and price of PT work

- changes in worker preferences?
- changes in firm technology?

Overview

Output = combination of output from 2 occupations with different tasks

- "Simple" occupation: all tasks the same length
- "Complex" occupation: tasks have uncertain length

Firms decide (1) how many workers to employ (2) how many hours in each occupation

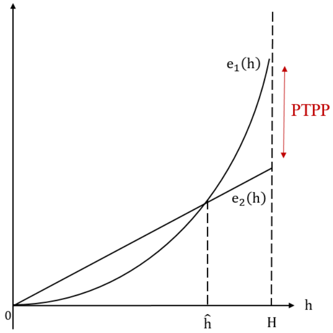
Workers decide (1) which occupation (2) how many hours

In equilibrium:

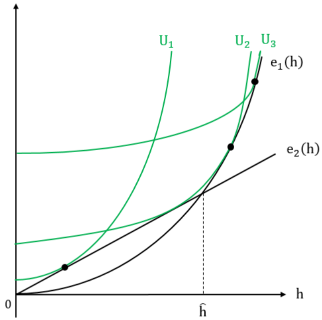
1. earnings for workers "complex" occupations convex in hours
2. earnings for "simple" occupations linear in hours
3. PT/FT workers choose simple/complex occupations
4. workers sort into PT/FT based on disutility of labour

Changes in parameters drive changes in relative wages and quantities

Equilibrium



Equilibrium earnings as a function of hours



Equilibrium earnings as a function of hours

Conclusion

- Long term increase in *both* quantity and relative price of PT work
- Trends are more pronounced for men
- Created a model that replicates
  - part-time pay penalty/non-linear hours-earnings schedule
  - occupational sorting of FT/PT workers
- Extensions to empirical work
  - investigate differences in FT/PT tasks
- Extensions to model
  - individual productivity - allows people to work long hours in low-pay occupations
  - gender differences in preferences

Extra material: Model

Previous approaches

- Bick, Blandin, Rogerson (2020) ; Erosa, Fuster, Kambourov and Rogerson (2018)
    - Assume earnings convex in hours
- Yurdagel (2018); Battisti et al. (2021)
    - Complementarities between individual workers
- Lariau (2018) ; Kang et al. (2020)
    - CES function with FT and PT work

Set up:

- Measure one of workers indexed by $i \in [0, 1]$
- Representative firm produces using occupations indexed by $j \in \{1, ..., J\}$
- Workers must choose which occupation. Expected production in occupation j is $E[y_j(h)]$
- Measure m_{hj} work in occupation j for $h \in [0, H]$ hours
- Total output

$$Y = \Gamma(\sum_{j=1}^{J} A_j Y_j^{\rho})^{\frac{1}{\rho}}$$

$$Y_j = \int_0^H E[y_j(h)] m_{hj} dh$$

Set up:

- Representative firm's problem

$$\max_{\{m_{hj}\},h\in[0,H],j=1,..,J} E[Y] - \sum_{j=0}^{J}\int_0^H e_j(h)m_{hj}dh$$

$$\text{s.t} \quad Y = \Gamma(\sum_{j=1}^{J} A_j Y_j^{\rho})^{\frac{1}{\rho}}$$

- In a competitive market, with perfect substitution ($\rho = 1$)

$$e_j(h) = \Gamma A_j E[y_j(h)]$$

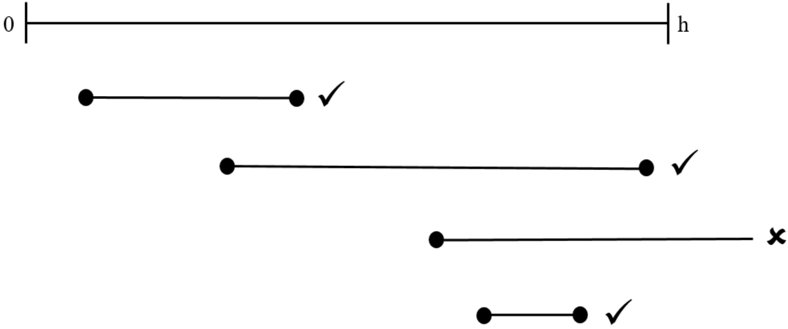
Occupations and tasks

- Tasks arrive at Poisson rate λ
- Length of each task, $x \in [0, H]$, drawn from a distribution $G_j(x)$
- Production equal to the number of tasks completed by the end of the period
- Expected individual production for someone working h hours

$$E[y_j(h)] = \lambda \int_0^h G_j(x)dx$$

Derivation

Occupations and tasks

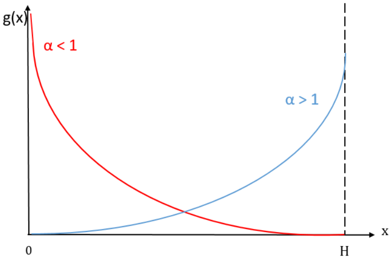


Occupations and tasks

- With Reverse Pareto distribution of task lengths, $G_j(x) = \left(\frac{x}{H}\right)^{\alpha_j}, \quad \alpha_j > 0$

$$E[y_j(h)] = \lambda \frac{h^{\alpha_j+1}}{H^{\alpha_j}(\alpha_j + 1)}$$

- With $\alpha_j \to 0$, $E[y_j(h)] \to \lambda h$



Set up: Workers

1. Choose optimal hours for each occupation h_j given disutility of labour $\phi_i \in [\phi_{min}, \phi_{max}]$ with distribution $H(\phi)$

2. Choose occupation

$$\max_{j\in[1,\dots,J]} \{U_j(h_j))\} \quad \text{s.t.} \quad U_j(h_j) = \max_{h_c} z_{ij} e_j(h_j) - \frac{\phi_i h_j^{1+\theta}}{1+\theta}$$

- Equate the marginal disutility of work to marginal earnings in task j

- Workers sort into occupations based on ϕ_i, z_{ij}

$$h_j^* = \left(\frac{z_{ij} e_j'(h)}{\phi_i}\right)^{\frac{1}{\theta}}$$

Example

- Two occupations with $\alpha_1 > 0, \alpha_1 \to 0$ and $A_1 > A_2$
- $z_{ij} = 1$ for all workers in all occupations
- Equilibrium consists of earnings functions $e_1(h), e_2(h)$, allocation m_{h1}, m_{h2}
  1. firms solve the profit maximisation problem
  2. workers solve the utility maximisation problem
  3. the market for labour clears
- Proposition
  1. In equilibrium, there exists $\hat{h}$ where $e_1(\hat{h}) = e_2(\hat{h})$. For $h < \hat{h}$, $e_1(\hat{h}) < e_2(\hat{h})$ and for $h > \hat{h}, e_1(\hat{h}) > e_2(\hat{h})$

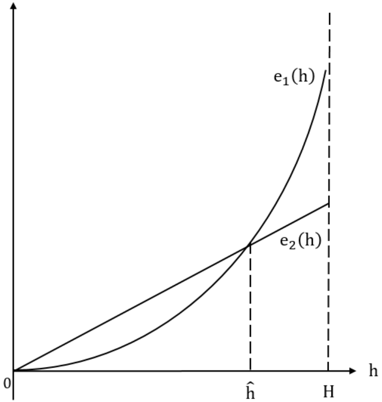
Proposition Part 1

Equilibrium earnings

$$e_1(h) = \Gamma\lambda A_1 \frac{h^{\alpha_1+1}}{H^{\alpha_1}(\alpha_1+1)}$$

$$e_2(h) = \Gamma\lambda A_2 h$$

Figure 6: Equilibrium earnings as a function of hours



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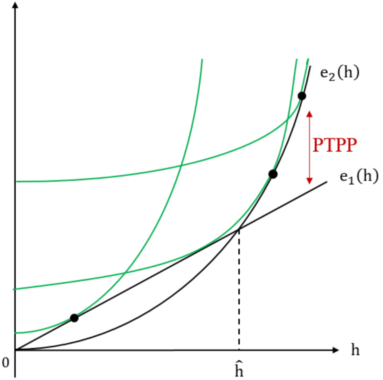
  2. Workers with low ϕ choose Occupation 1, workers with high ϕ choose Occupation 2
  3. If $H(\phi)$ is continuous, there is a worker with $\phi \in [\phi_{min}, \phi_{max}]$ that is indifferent between the occupations

Proposition Part 2

$$PTPP = \frac{e_1(h)/h}{e_2(h)/h} = \frac{A_1 h_1^{\alpha}}{A_2 H_1^{\alpha}(\alpha_1 + 1)}$$

Figure 7: Utility indifference curves

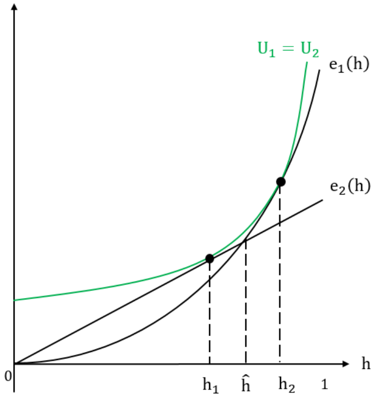


Proposition Part 3

Sorting

- $h_2^* < \hat{h}$: choose occupation 2 for h_2^* hours
- $h_2^* > \hat{h}$ and $h_1^* > H$: choose occupation 1 for H hours
- $h_2^* > \hat{h}$ and $\hat{h} < h_1^* < H$: choose occupation 2 for h_1^* hours

Figure 8: Utility indifference curve of a worker indifferent between occupations



Calibration

Changes in parameters govern the relative quantity and price of PT/FT work

- Worker preferences → changing $G(\phi)$
  - different for men/women?
- Firm technology → changing α, ρ (?)
  - relative productivity and substitutability of PT/FT work
- Aggregate productivity → changing Γ

Next step: calibration of parameters

- Need a way to separately identify 'supply' and 'demand' parameters

Derivation of expected production

- $E[y(h)]$ - expected production for working h hours
- $N(h)$ - number of tasks that arrive in working week
- $y_k(h)$ - production from the k-th task, $k = 1, ...N(h)$
- T_i - arrival time of k-th task

$$
\begin{aligned}
E[y(h)] &= \sum_{n=0}^{\infty} E[y(h)|N(h) = n]P(N(h) = n) \\
&= \sum_{n=0}^{\infty} E[\sum_{k=0}^{n} y_k(h)|N(h) = n]P(N(h) = n) \\
&= E[\sum_{n=0}^{\infty}\sum_{k=0}^{n} E[y_k(h)]P(N(h) = n)
\end{aligned}
$$

Derivation of expected production

T_i is a uniform random variable on the interval $[0, h]$

$$E[y_k(h)] = \int_0^h E[y_k(h)|T_i = x]\frac{1}{h}dx$$
$$= \frac{1}{h}\int_0^h G(h-x)dx$$
$$= \frac{1}{h}\int_0^h G(u)du$$

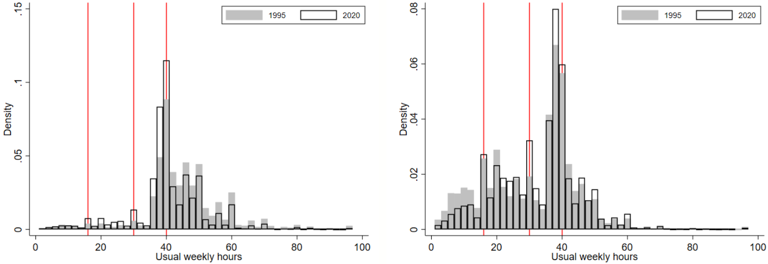
Expected production is

$$E[y(h)] = \frac{1}{h}\int_0^h G(u)du \sum_{n=0}^{\infty} P(N(h) = n)$$
$$= \frac{1}{h}\int_0^h G(u)du E[N(h)]$$
$$= \lambda \frac{h^{\alpha+1}}{H^\alpha(\alpha+1)}$$

Extra material: Motivating facts

Bunching at FT hours

Figure 9: Weekly hours

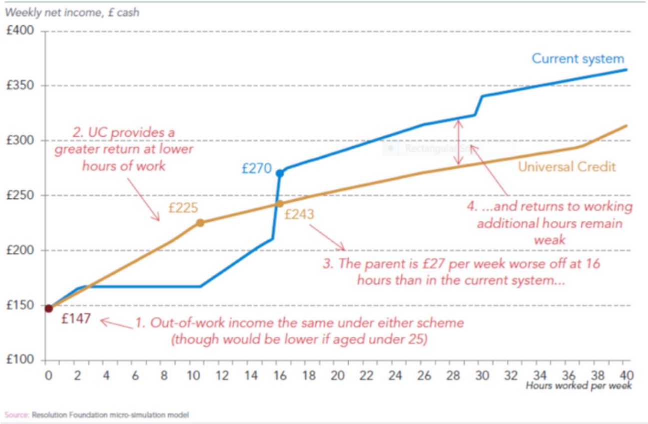


Male Female

Source: LFS

Benefits schedule

Figure 10: Weekly income for a single parent with 1 child (2020)



Source: Resolution Foundation