Quantitative Macro-Labor: Endogenous Separations

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Announcements

- Briefly review Mortensen and Pissarides.
- Show extension incorporating endogenous separations.
- Everyone should have started the "empirical regularities" project.

Part-Time Employment and Labor Market Volatility

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A long time ago

Overview

- Here, we extend the Mortensen-Pissarides model to include heterogeneous match productivity.
- There will be an "endogenous separation" threshold and an "endogenous promotion" threshold.
- We generate the separate threshold through different costs.
- Ultimate goal of project is to show that acylical cost generates more procyclical employment and countercyclical unemployment.
- But here focus is on showing use of surplus and ex-post match heterogeneity to generate cool model features.

Paper Outline

- Start with "empirical regularities"
  - What we will explore;
  - Motivate our model construction.
- Show existence of part-time jobs in steady-state model.
- Characterize productivity thresholds.
- Use discrete time version to simulate out of steady-state.
- (I will present this like a seminar to show a template for talk.)
- Bullet points vs. sentences:
  - Sentence: contains a subject, verb, and a complete idea.
  - Bullet point in talk: fits on one line.
- The current version of the paper is much less theory, much more quantitative. This is more elegant.

Part and Full-Time Employment

- Part-time employment large component of labor market:
  - Part-time employment rate: 22% (Prime age, 17%)
  - Ages 18-24: 35%, up from 25% a decade ago.
  - Ages 55-64: 47%
  - Production: 40 hours/week for full-time, 28 hours/week for part-time
- Search models rarely feature part-time employment.

Cyclicality

- Different cyclicality of part and full-time jobs.

Figure: Employment

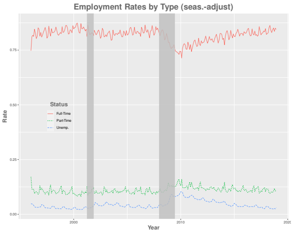


Figure: Unemployment

- Would PT improve fit?

Cyclicality of Flows

- Different cyclicality of part and full-time jobs.

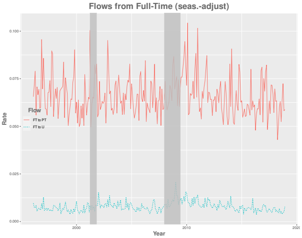


Figure: Employment

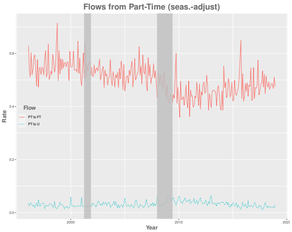


Figure: Unemployment

- Would PT improve fit?

Question

- How much of part and full-time employment is driven by
  - aggregate shocks?
  - match quality composition.
- What are the consequences of ignoring part-time employment?
- Policy analysis
  - UI vs. job-keeper
- Today: first part.

What We Do

- Develop a search and matching model of the labor market with
  - endogenous part and full-time employment.
  - endogenous transitions (PT/FT and to unemployment).
- Mortensen-Pissarides (1994) with
  - procyclical productivity that is higher for full-time jobs;
  - acyclical costs that are asymmetric between part and full-time jobs;
  - aggregate shocks.

Preview of Findings

- How much of part and full-time employment is driven by
  - aggregate shocks?
    - Primarily drives job-finding.
  - match quality composition.
    - Drives almost all fluctuations in part and full-time.
- What are the consequences of ignoring part-time employment?
  - Understates the cost of business cycles & magnitudes.
- Policy analysis
  - UI vs. job-keeper
    - Job keeper very effective at limiting size of recession.

Model Environment

- Random search and matching with endogenous separations.
- Continuous time, discount rate r.
- Agents:
  - Unemployed and employed workers.
  - Matched and unmatched firms.
- Technology:
  - Random matching in labor markets.
  - Production: $zY_T\epsilon$ (agg, type, idiosyncratic).
  - Endogenous transitions: between emp. types & unemp.
- For simplicity: assume agg. productivity (z) fixed (for now).

Agents

- Workers:
  - May be unemployed, or employed part or full-time.
  - Nash bargained wages, i.e., share of current match surplus.
- Firms:
  - Post single-worker vacancies at cost κ.
  - Pay wages and costs depending on part or full-time worker.
  - Costs: τ_F and τ_P for part and full-time.
- Jointly decide if match is full-time, part-time, or separate any time a shock occurs.

Search and Matching Technology

- Random matching w/ sep. (Mortensen and Pissarides, 1994):
  - Matches random: productivity ϵ not known before contact.
  - Matches separate if ϵ is/falls below threshold (here ϵ_P)
- No OTJS.
- Matching technology:
  - # of matches in labor market: $M = M(u, v)$ (CRS).
  - Labor Market Tightness: $\theta(\cdot) = \frac{v}{u}$
  - Worker finding rate: $q(\theta) = \frac{M(u,v)}{v}$
  - Job finding rates: $p(\theta) = \frac{M(u,v)}{u} = \theta q(\theta)$

Workers

- Either part-time or full-time ($T = \{P, F\}$).
- iid productivity: draw $\epsilon \sim_{iid} F(\epsilon)$; evolve at rate λ_T
- Wages determined by Nash Bargaining (bargaining power α).
- Value of unemployment:

$$r\ U = b + p(\theta) \int_{\underline{\epsilon}}^{\bar{\epsilon}} [\max\{\max\{W^F(x), W^P(x)\}, 0\} - U] dF(x).$$

- Value of employment:

$$r\ W^T(\epsilon) = w + \lambda_T \alpha \int_{\underline{\epsilon}}^{\bar{\epsilon}} [\max\{\max\{S^F(x), S^P(x)\}, 0\} - S^T(\epsilon, H)]\ dF(x)$$

- $S^T(x)$: joint surplus of firm & worker.

Firms

- Post vacancy at cost κ.
- Pay flow cost τ_T by type once employed.
- Value of a filled vacancy:

$$r\ J^T(\epsilon) = zY_T\epsilon - \tau_T - w$$
$$+ \lambda_T(1-\alpha)\int_{\underline{\epsilon}}^{\bar{\epsilon}}[\max\{\max\{S^F(x), S^P(x)\}, 0\} - S^T(\epsilon)]\ dF(x)$$

- Value of unfilled vacancy:

$$r\ V = -\kappa + q(\theta)\int_{\underline{\epsilon}}^{\bar{\epsilon}}[\max\{\max\{J^F(x), J^P(x)\}, 0\} - V]dF(x)$$

- Free entry $(V = 0) \rightarrow$ match rate: $q(\theta) = \frac{\kappa}{\int_{\epsilon_P} J(x,H)dF(x)}$
- Market tightness: $\theta = q^{-1}(\frac{\kappa}{\int JdF(x)})$

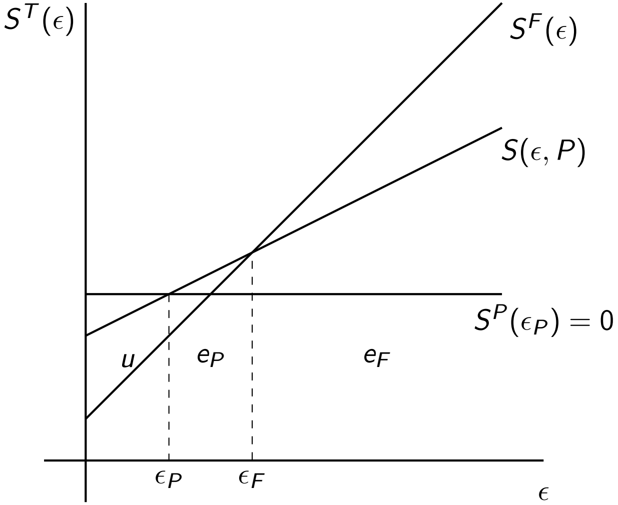
Surplus and Employment Thresholds

- Surplus $S^T(\epsilon) = W^T(\epsilon) - U + J^T(\epsilon) - V$
- Surplus of match for either $T = \{P, F\}$:

$$(r + \lambda_T)\, S^T(\epsilon) = z\epsilon Y_T - \tau_T - b - \frac{\alpha}{1-\alpha}\theta\kappa$$
$$+ \lambda_T[\int_{\epsilon_F}^{\bar{\epsilon}} S^F(x)dF(x) + \int_{\epsilon_P}^{\epsilon_F} S^P(x)dF(x)]$$

- Existence: assume $\exists$ some ϵ_F and ϵ_P st
  1. $zY_F\epsilon_F - \tau_F > zY_P\epsilon_F - \tau_P$ and
  2. $zY_P\epsilon_P - \tau_P > 0$:

Employment Thresholds



Policy Functions

- Super messy for different λ_T. Show for $\lambda_T = \lambda$.
- The part-time treshold is given by the indifference equality: $S^P(\epsilon_P) = 0$:

$$\epsilon_P = \frac{\tau_P + b + \frac{\alpha}{1-\alpha}\theta(z)\kappa}{zY_P} - \frac{\frac{\lambda z Y_F}{r+\lambda}\left(\int_{\epsilon_F}^{\bar{\epsilon}}[1-F(x)]\,dx + \frac{Y_P}{Y_F}\int_{\epsilon_P}^{\epsilon_F}[1-F(x)]\,dx\right)}{zY_P}$$

- And the full-time threshold is given by the indifference condition $S^F(\epsilon_F) = S^P(\epsilon_F)$

$$\epsilon_F = \frac{\tau_F - \tau_P}{z(Y_F - Y_P)}.$$

- $W^* = \alpha S$ and $\theta^* = q^{-1}(\frac{\kappa}{(1-\alpha)S})$ determined by SS surplus.

Steady-State Employment

- Flows:
  1. $u \to PT$, $u \to FT$;
  2. $PT \to FT$, $PT \to u$;
  3. $FT \to PT$, $FT \to u$.
- Must all be equal to 0 in equilibrium.
- Steady-state employment:

$$e^P = \frac{(P(\theta)u + \lambda_F e^F)\,[F(\epsilon_F) - F(\epsilon_P)]}{(\lambda_P[1 - F(\epsilon_F) + F(\epsilon_P)])};$$

$$e^F = \frac{(P(\theta)u + \lambda_P e^P)\,[1 - F(\epsilon_F)]}{(\lambda_F F(\epsilon_F))};$$

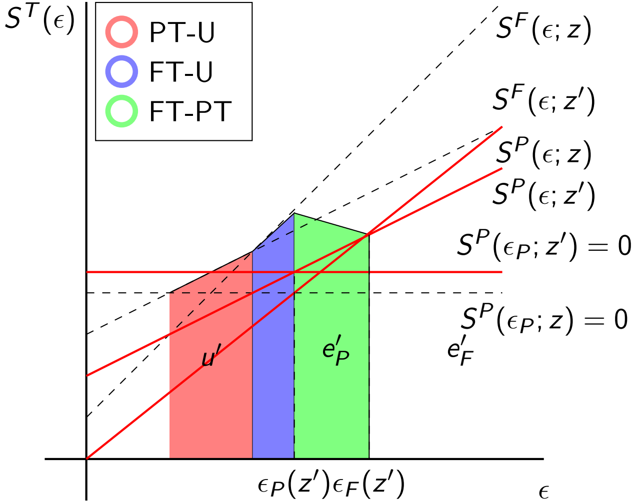
$$u = \frac{\lambda_P F(\epsilon_P)e^P + \lambda_F F(\epsilon_P)e^F}{p(\theta)[1 - F(\epsilon_P)]}.$$

Steady-State Equilibrium

- Equilibrium is defined by the functions $(\theta^*, w^*, \epsilon_F, \epsilon_P)$, corresponding value functions, the steady-state tuple: (e_P, e_F, u) such that
  1. θ is defined by the free entry condition, $V = 0$, given other equilibrium objects, $\theta^* = q^{-1}(\frac{\kappa}{(1-\alpha)S})$.
  2. ϵ_P defines the point at which $S^P(\epsilon_P) = 0$.
  3. ϵ_F defines the point at which $S^F(\epsilon_F) = S^P(\epsilon_F)$
  4. Wages are given by a surplus sharing rule, $w^T(\epsilon) = \alpha S^T(\epsilon)$

Employment Threshold Dynamics

- Suppose $z \downarrow$



Calibration

- Discretize model at weekly frequency.
- Preset parameters to ubiquitous values in literature.
- Estimate parameters related to novel features of the model.
- Target:
  - Steady state employment rates;
  - Steady state employment flows.
- Simulate model 1000 times, with length of 320 quarters each.
- Average over 1000 simulations, toss first 200 quarters.

Outline for Findings

- Describe how model fits data.
- Decompose into match quality and aggregate shocks.

Employment Rates

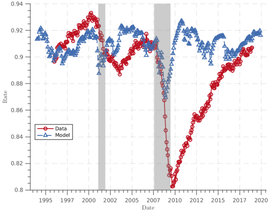


Figure: Full-Time

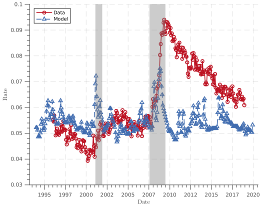


Figure: Part-Time

Employment Flows

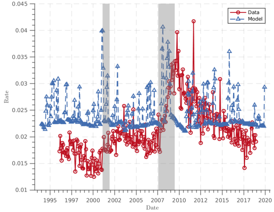


Figure: Full-time to part-time

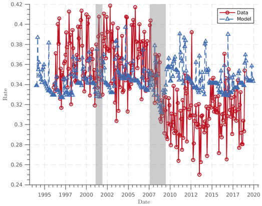


Figure: Part-time to full-time

Findings

- Decompose into contribution of match quality and aggregate shocks:
  - Fix share of part and full-time to steady-state values.
  - Set $\delta_t = \frac{e_t \rightarrow u_{t+1}}{e_t}$, and $p(\theta_t) = \frac{u_t \rightarrow e_{t+1}}{u_t}$
- Fluctuations in pt and ft driven by aggregate shocks. ie within variation.

Employment

- Part-time employment too volatile.
- Employers hoard part-time workers instead of firing them.

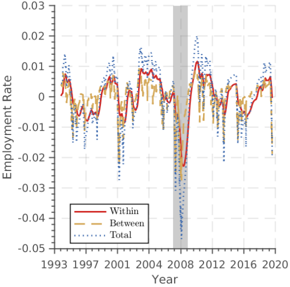


Figure: Full-Time

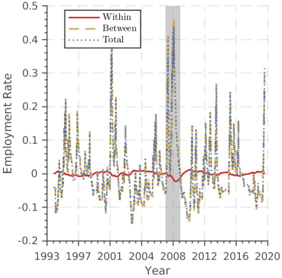


Figure: Part-Time

Wages and output

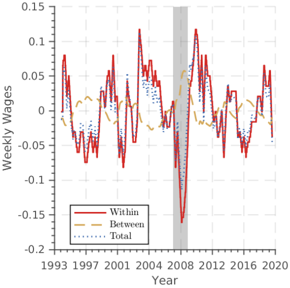


Figure: Wages.

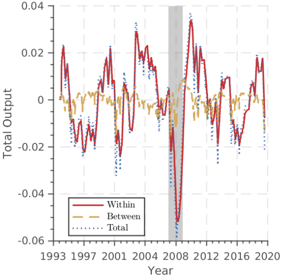


Figure: Aggregate output.

Paper Findings Summary

- Extend Mortensen and Pissarides (1994) to include
  - two types of employment (part and full-time)
  - different acyclical costs by employment type.
- Run calibrated example.
- Findings:
  - Match quality explains fluctuations in part and full-time employment.
  - Job-keeper scheme more effective than UI.

Next Time

- Next Tuesday: presentations (at random). Research proposals due.

- Market Power (please review Hosios Condition slides online)

Preset-Parameters

- AR(1) aggregate shocks & log-normal iid productivity:

$$z_{t+1} = \rho z_t + \nu_z \quad (1)$$

$$\nu_z \sim LN(0, \sigma_Z) \quad (2)$$

$$\epsilon \sim Ln(0, \sigma_\epsilon) \quad (3)$$

- Cobb-Douglas Matching: $M(u, v) = Au^\eta v^{1-\eta}$.
- Preset parameters estimated in related papers.

Parameter	Value	Source
b	0.4	UI Percent of Output (Shimer, 2005)
η	0.7	Matching function elasticity (Shimer, 2005)
α	0.7	Hosios Condition
A	0.113	Matching efficiency (Shimer, 2005)
σ_ϵ	0.16	Variance of match productivity shock (Fujita and Ramey, 2012)
ρ	0.9895	Persistence of aggregate shocks (Fujita and Ramey, 2012)
σ_z	0.004	Variance of aggregate shocks (Fujita and Ramey, 2012)

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Fit

- Matches moments well.

Table: Fit

Moment	Data	Model
Wage Ratio (Full-Time to Part-Time)	1.150	1.166
Full-Time Employment Rate	0.769	0.767
Part-Time Employment Rate	0.180	0.167
Unemployment Rate	0.051	0.067
Separation Rate	0.014	0.014

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Estimated Parameters

Parameter	Value	Source
τ_P	0.18	Acyclical cost for part-time workers
τ_F	0.79	Acyclical cost for full-time workers
Y_P	1.89	Part-time productivity
Y_F	2.60	Full-time productivity

- $Y_F/Y_P \approx 1.38$.
- FT vs. PT hours (data): 40 hrs. vs. 28 hrs (≈ 1.43).
- $\tau_F/\tau_P \approx \$3.18/hour$.
- FT vs. PT costs (data): 9.75/hr. vs. 3.2/hr. ($\approx \$3.05/hour$).

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