LABOR SEARCH MODELS: PARTIAL-EQUILIBRIUM DYNAMICS

JANUARY 23, 2017

LABOR-MARKET EQUILIBRIUM

- **Aggregate law of motion of employment**

$$n_{t+1} = (1-\rho_x)n_t + m(u_t, v_t)$$

- **Matching-market equilibrium**

$$m(u_t, v_t) = u_t \cdot k^h(\theta_t) = v_t \cdot k^f(\theta_t)$$

- **Vacancy-posting (aka job-creation) condition**

$$\gamma = k^f(\theta_t) E_t \left\{ \Xi_{t+1|t} \left(z_{t+1} - w_{t+1} + \frac{(1-\rho_x)\gamma}{k^f(\theta_{t+1})} \right) \right\}$$

- **Wage determination**

$$w_t = \eta \left[z_t + \gamma \theta_t \right] + (1-\eta) b$$

Does a good job explaining long-run (steady-state) phenomena

- **Shimer (2005) and Hall (2005): analyze the stochastic dynamics of the labor market equilibrium**
  - **Not general equilibrium dynamics**

Basic Issues and Results

- Shouldn't a model that does well at explaining long-run phenomena also be expected to do reasonably well at explaining cyclical phenomena? (should it?....)

- Labor search model's key endogenous variables
  - Unemployment u_t (equivalently, $n_t = 1 - u_t$)
  - Vacancies v_t
  - Labor-market tightness θ_t

BASIC ISSUES AND RESULTS

- Shouldn't a model that does well at explaining long-run phenomena also be expected to do reasonably well at explaining cyclical phenomena? (should it?....)

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- **Main Conclusion:** model's predicted volatility in (u_t, v_t, θ_t) far lower than empirically-observed volatility

Recall $z_{t+1} - w_{t+1}$ the (future) payoff governing vacancy-posting decision

- **Main Model Shortcoming:** the wage-setting process (i.e., assumption of Nash bargaining at a particular parameterization)
  - Exogenous rise in productivity is nearly-fully absorbed by a rise in the wage → virtually no change in firms' incentives to post vacancies
  - Vacancy-posting key economic margin of basic labor search model

EMPIRICAL FACTS

- **Basic cyclical labor-market facts**

Data Sources:

CPS, JOLTS, and Conference Board

Labor-market tightness θ **Worker matching rate $k^h(\theta)$**

TABLE 1—SUMMARY STATISTICS, QUARTERLY U.S. DATA, 1951–2003

		u	v	v/u	f	s	p
Standard deviation		0.190	0.202	0.382	0.118	0.075	0.020
Quarterly autocorrelation		0.936	0.940	0.941	0.908	0.733	0.878
Correlation matrix	u	1	−0.894	−0.971	−0.949	0.709	−0.408
	v	—	1	0.975	0.897	−0.684	0.364
	v/u	—	—	1	0.948	−0.715	0.396
	f	—	—	—	1	−0.574	0.396
	s	—	—	—	—	1	−0.524
	p	—	—	—	—	—	1

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Data displays a cyclical Beveridge Curve

Labor-market tightness θ

Worker matching rate $k^h(\theta)$

Extremely high correlation consistent with basic labor-matching model (in which k^h depends on *only* θ)

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- **Estimated matching function elasticity** $m(u_t, v_t) = u_t^{\alpha} v_t^{1-\alpha}$ **: α = 0.72**

- **Question: How well can stochastic dynamic (partial-equilibrium) labor-search model match key labor-market business cycle facts?**

MODEL DETAILS

- **Exogenous processes**
  - **Labor productivity, z**
  - **Separation rate, ρ_x**
  - **(Markov processes, continuous time → can re-cast as AR(1)'s in discrete time)**

Model Details

- **Exogenous processes**
  - Labor productivity, z
  - Separation rate, ρ_x
  - (Markov processes, continuous time → can re-cast as AR(1)'s in discrete time)

- **Calibration**
  - Mean productivity $z = 1$ (normalization)
    - Implies real wage < z because of posting costs

    Accounting profit $z - w$ each period

  - Worker Nash bargaining power $\eta = 0.72$ $(= \alpha)$
    - Satisfies Hosios (1990 *ReStud*) condition for search efficiency
  - Mean quarterly separation rate $\rho_x = 0.1$
  - "Unemployment benefit" $b = 0.4$
    - Replacement rate about 40 percent of labor income
    - But also measures flow value of leisure / home production
    - A critical parameter (Hagedorn and Manovskii (2008))

Model Simulation Results

- **Productivity shocks alone**

Model displays a cyclical Beveridge Curve

All much lower than the data

TABLE 3—LABOR PRODUCTIVITY SHOCKS

		u	v	v/u	f	p
Standard deviation		0.009	0.027	0.035	0.010	0.020
		(0.001)	(0.004)	(0.005)	(0.001)	(0.003)
Quarterly autocorrelation		0.939	0.835	0.878	0.878	0.878
		(0.018)	(0.045)	(0.035)	(0.035)	(0.035)
Correlation matrix	u	1	−0.927	−0.958	−0.958	−0.958
			(0.020)	(0.012)	(0.012)	(0.012)
	v	—	1	0.996	0.996	0.995
				(0.001)	(0.001)	(0.001)
	v/u	—	—	1	1.000	0.999
					(0.000)	(0.001)
	f	—	—	—	1	0.999
						(0.001)
	p	—	—	—	—	1

Model Simulation Results

- **Separation-rate shocks alone**

Model fails to display a cyclical Beveridge Curve

All much lower than the data

TABLE 4—SEPARATION RATE SHOCKS

		u	v	v/u	f	s
Standard deviation		0.065	0.059	0.006	0.002	0.075
		(0.007)	(0.006)	(0.001)	(0.000)	(0.007)
Quarterly autocorrelation		0.864	0.862	0.732	0.732	0.733
		(0.026)	(0.026)	(0.048)	(0.048)	(0.048)
Correlation matrix	u	1	0.999	−0.906	−0.906	0.908
			(0.000)	(0.017)	(0.017)	(0.017)
	v	—	1	−0.887	−0.887	0.888
				(0.020)	(0.020)	(0.021)
	v/u	—	—	1	1.000	−0.999
					(0.000)	(0.000)
	f	—	—	—	1	−0.999
						(0.000)
	s	—	—	—	—	1

- **Proceeds to dismiss fluctuations in separation rate**
  - **A point of controversy**

MODEL MECHANISM(?)

- **Consider a single firm's vacancy-posting decision**

$$\gamma = k^f(\theta_t) E_t \left\{ \Xi_{t+1|t} \left(\underbrace{z_{t+1} - w_{t+1}}_{\text{Flow profits, } = pr_{t+1}} + \frac{(1-\rho_x)\gamma}{k^f(\theta_{t+1})} \right) \right\}$$

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- Interpretation of Shimer (2005) result
  - Wages absorb too much of any change in productivity
  - → not much change in firms' vacancy posting incentives
  - → (in equilibrium) not much change in θ
  - → (in equilibrium) not much change in u (because $k^h(\theta)$ governs transitions into/out of jobs)

- "Shimer Puzzle"
  - How to address the model shortcoming?
  - Not a criticism of the labor search structure per se…
  - …a criticism of flexible wage-setting mechanism (Nash-Hosios)

BEYOND THE BASIC MODEL

- Hall (2005): a "social norm" under which *w* doesn't change in response to cyclical fluctuations
  - Permissible as an equilibrium DUE TO the bargaining interval between *z* and *b*
  - NOT something rationalizable in a standard Walrasian view of labor market
  - Larger fraction of *z* shock passed on to change in *pr* → model does better at accounting for volatility in *v*, *u*, *θ*

- DSGE macro models that take on the Shimer Puzzle
  - Krause and Lubik (2005): job-to-job transitions
  - Gertler and Trigari (2009): "staggered (Calvo) Nash bargaining"
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  - …

BEYOND THE BASIC MODEL

- Pissarides (2009 *Econometrica*)
  - Wage stickiness NOT the answer
  - Empirically
    - Wages in new hires are very volatile over the business cycle
    - Wages in ongoing jobs much less volatile (i.e., "sticky")…
    - …but irrelevant for the dynamics of the vacancy-creation condition of a matching model

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- Proposes model of decreasing marginal costs of posting vacancies
  - (Technically, a model of fixed hiring costs and constant MC of posting)
  - Rather than typical constant marginal cost of posting vacancies
  - i.e., increasing returns recruiting/posting technology
  - A type of amplification mechanism

- Micro-level evidence on finer levels of "hiring costs"
  - Barron, Berger, and Black (1997) survey
  - More anecdotal evidence on "hiring standards" by Davis, Faberman, and Haltiwanger (2013 *QJE*)
  - Some ex-ante of a match, some ex-post of a match

Model Mechanism

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- **Flow equilibrium conditions (an accounting identity…)**

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- **HM's key insight: in basic RBC model, "gap" between social value of market work (*z*) and value of non-market activity (*b*) equals ZERO**
  - **Hence ought to be the heart of the issue in a matching model, too…**
  - **…not wage-determination mechanism *per se***

Model Mechanism

- To gain intuition, solve analytically for steady state of labor market (i.e., Pissarides Chapter 1)
- Can show (HM 2008, p. 1695) steady state elasticity of labor market tightness to labor productivity is

$$\varepsilon_{\theta,z} = \frac{z}{z-b}\,\frac{\eta k^{h}(\theta)+(1-\beta(1-\rho^{x}))/\beta}{\eta k^{h}(\theta)+(1-\xi)(1-\beta(1-\rho^{x}))/\beta}$$

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- Depends on many things….
- …in particular, depends on the gap between social value of market work (*z*) and value of non-market activity (*b*)
- Shimer calibration of *b* = 0.4 (unemployment "benefit" 40% of the value of labor income) inconsistent with G.E. business cycle models in which indifference conditions are satisfied in equilibrium

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- Steady-state intuition maybe a guide to dynamics
- Cyclical fluctuations typically pretty linear

BEYOND THE BASIC MODEL

- **Hagedorn and Manovskii (2008)**
  - **Use data on only vacancy posting costs, not broader "hiring costs"**
  - **Consider effects of taxes (which affects the receipt of labor income by households)**

Back out values of η (worker Nash bargaining weight) and b (flow value of unemployment)

$\eta = 0.05$

(much smaller than typical labor literature)

$b = 0.95$

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Table 4: Results from the Calibrated Model.

		u	v	v/u	p
Standard Deviation		0.145	0.169	0.292	0.013
Quarterly Autocorrelation		0.830	0.575	0.751	0.765
Correlation Matrix	u	1	-0.866	-0.966	-0.949
	v	—	1	0.966	0.946
	v/u	—	—	1	0.981
	p	—	—	—	1

Simulations of the Hagedorn and Manovskii calibration: matches data well

Beyond the Basic Model

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  - Intuitively, mechanism generates real wage rigidity

- **All of this raises conceptual question: what are "rigid wages?"**

FULL MACRO MODELS

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  - …
- Pre-Shimer: the effects of labor matching frictions on basic RBC model dynamics?
  - Andolfatto (1996 *AER*)
  - Merz (1995 *JME*)
  - den Haan, Ramey, Watson (2000 *AER*)