Labor markets and financial frictions

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Outline

1. Wasmer, Weil (2004)
2. Hall (2014)
3. Kehoe, Midrigan, Pastorino (2015)

Wasmer, Weil (2004)

Introduction

- combine financial and labor market frictions
- amplifications of employment fluctuations
- key ingredients
  - search in the labor market
  - search in the credit market
  - wage rigidity
- interaction between credit and labor market
  - entrepreneurs have to borrow to create a vacancy

Model

- agents: workers , banks, entrepreneurs
- workers: only work in production
- entrepreneurs: have ideas, no wealth, cannot produce
- banks: have credit, no ideas, cannot produce
- entrepreneurs: have to borrow to post a vacancy

Search

- entrepreneurs and workers
  - u, v – unemployed workers, vacancies
  - $\frac{h(u,v)}{v} = q(\theta)$ – vacancy filling probability
  - $\theta = v/u$ – labor market tightness
- banks and entrepreneurs
  - b, e – number of banks, entrepreneurs
  - $\frac{m(b,e)}{e} = p(\phi)$ – probability that E finds B
  - $\phi = e/b$ – credit market tightness

Timing

- stage 0: fund-raising
  - E searches for B in the credit market, flow cost c
  - B searches for E in the credit market, flow cost k
  - note: c is nonpecuniary, E does not have wealth
- stage 1: recruitment
  - E with credit posts a vacancy, flow cost γ
  - E has to repay B flow ρ during the match
- stage 2: creation
  - E with a W produce output y
  - E has to pay B flow ρ
  - E has to pay W flow wage ω
- stage 3: destruction
  - exogenous rate s
  - match between E and B is destroyed as well

Value functions of a bank

- B_0, B_1, B_2,B_3 – values at different stages
- Bellman equations

$$
\begin{aligned}
rB_0 &= -k + \phi p(\phi)(B_1 - B_0) \\
rB_1 &= -\gamma + q(\theta)(B_2 - B_1) \\
rB_2 &= \rho + s(B_3 - B_2)
\end{aligned}
$$

Value functions of an entrepreneur

- E_0, E_1, E_2 – values at different stages
- Bellman equations

$$\begin{aligned} rE_0 &= -c + p(\phi)(E_1 - E_0) \\ rE_1 &= q(\theta)(E_2 - E_1) \\ rE_2 &= y - \omega - \rho + s(E_3 - E_2) \end{aligned}$$

Bargaining between E and B

- contract
  - B finances E's vacancy in the labor market, γ per period
  - E repays ρ per period for the duration of the match
- Nash bargaining between E and B

$$\rho = \arg\max \left(B_1 - B_0\right)^{\beta} \left(E_1 - E_0\right)^{1-\beta}$$

- $\beta \in (0,1)$ – bargaining power of B
- solution satisfies

$$(1-\beta)\left(B_1 - B_0\right) = \beta \left(E_1 - E_0\right)$$

Equilibrium

- free entry of B and E: $B_0 = 0$, $E_0 = 0$, and then

$$B_1 = \frac{k}{\phi p(\phi)}, \quad E_1 = \frac{c}{p(\phi)}$$

- combine with surplus sharing rule

$$\phi^* = \frac{e}{b} = \frac{1-\beta}{\beta}\frac{k}{c}$$

- Nash bargaining

$$\begin{aligned}
\rho &= \beta\left(y-\omega\right)+\left(1-\beta\right)\left(r+s\right)\gamma/q\left(\theta\right) \\
\frac{\rho}{r+s} &= \beta \underbrace{\frac{y-\omega}{r+s}}_{\text{PDV of net output flow}} + \left(1-\beta\right) \underbrace{\frac{\gamma}{q\left(\theta\right)}}_{\text{PDV of a loan}}
\end{aligned}$$

- since $q'\left(\theta\right) < 0$, ρ is increasing in θ (it takes longer to find a worker)
- ϕ affects ρ through θ

Labor market tightness

- joint surplus from creating a vacancy

$$V(\theta) = E_1 - E_0 + B_1 - B_0 = \frac{q(\theta)}{r + q(\theta)} \left[\frac{y - \omega}{r + s} - \frac{\gamma}{q(\theta)} \right]$$

- costly search in the credit market $V(\theta) > 0$, unlike in DMP
- surplus splitting implies

$$B_1 = \beta V(\theta), \quad E_1 = (1 - \beta) V(\theta)$$

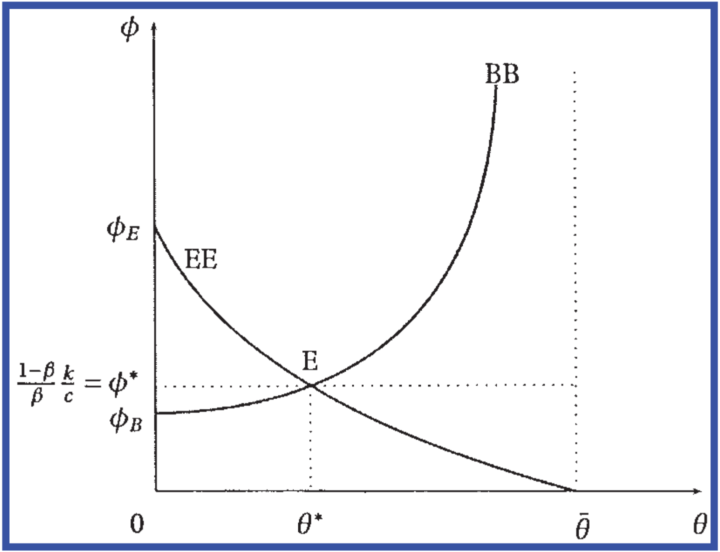
- using $B_3 = B_0 = 0, E_3 = E_0 = 0$, one can derive a system of 2 equations

$$B_0 = 0 \quad : \quad \frac{k}{\phi p(\phi)} = \beta \frac{q(\theta)}{r + q(\theta)} \left[\frac{y - \omega}{r + s} - \frac{\gamma}{q(\theta)} \right]$$

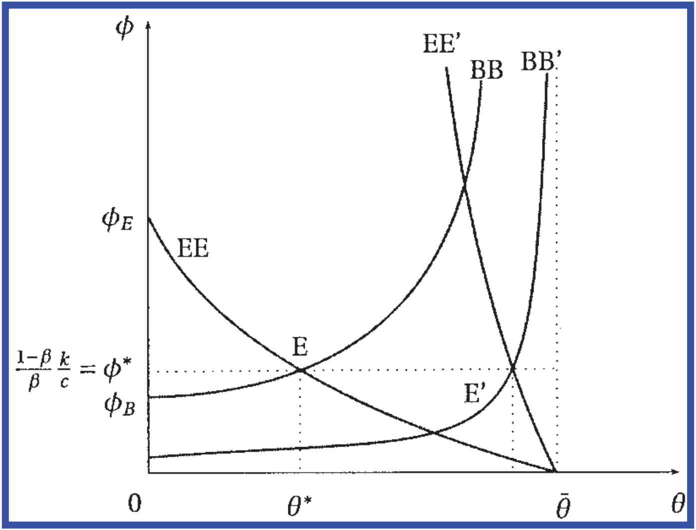
$$E_0 = 0 \quad : \quad \frac{c}{p(\phi)} = (1 - \beta) \frac{q(\theta)}{r + q(\theta)} \left[\frac{y - \omega}{r + s} - \frac{\gamma}{q(\theta)} \right]$$

- this system determines ϕ^* and θ^*
- credit frictions lower θ: $\theta^* < \bar{\theta}$ where $V\left(\bar{\theta}\right) = 0$ which would be attained as $p(\phi) \to \infty$

Equilibrium credit and labor market tightness



More efficient credit market



Amplification of employment fluctuations

- simplify the math

$$V = B_1 + E_1 - B_0 - E_0 = \frac{k}{\phi p(\phi)} + \frac{c}{p(\phi)} \equiv K(\phi)$$

- job creation

$$\begin{aligned} (r + q(\theta)) K(\phi^*) &= q(\theta) \frac{y - \omega}{r + s} - \gamma \\ q(\theta)(y - \omega - (r + s) K(\phi^*)) &= (r + s)(\gamma + rK(\phi^*)) \end{aligned}$$

- assume a C-D matching function $q(\theta) = A\theta^\alpha$, then

$$\eta_{\theta,y} = \frac{d \log \theta}{d \log y} = \frac{1}{\alpha} \frac{y}{y - \omega - (r + s) K(\phi^*)}$$

- compare to elasticity from Hall (2005):

$$\eta_{\theta,y} = \frac{y}{y - \omega}$$

Discussion

- recall fundamental surplus – resources that can be used to create vacancies
- fundamental surplus is smaller
  - annuitized value of average search costs incurred to form a E-B pair
- elasticity $\eta_{\theta,y}$ is higher than in Hall (2005)

Discussion

- recall fundamental surplus – resources that can be used to create vacancies
- fundamental surplus is smaller
    - annuitized value of average search costs incurred to form a E-B pair
- elasticity $\eta_{\theta,y}$ is higher than in Hall (2005)
- financial accelerator: in equilibrium, $\theta^* < \bar{\theta}$
- credit market frictions discourage entry of B
- if fewer B, then B is hard to find which discourages entry of E
- lower E further discourages entry of B – loop

Hall(2014)

Motivation

- three observations
  - DMP model cannot account for unemployment fluctuations
  - productivity shocks not important in past several recessions
  - discount factor variation main source of stock prices
- this paper
  - discount factor variation source of unemployment fluctuations

Baseline DMP model

- job value

$$J_t = (1-s)\mathbf{E}_t\{\Lambda_{t,t+1}[x_{t+1} - w_{t+1} + J_{t+1}]\}$$

- recruitment costs = job value

$$cT_t = J_t$$

- expected time to fill vacancy T_t

$$T_t = \frac{V_t}{H_t}$$

- V_t vacancies, H_t hires
- J increases – V_t (recruitment effort) increases – H_t increases

Employment variation in DMP

- variation in job value

$$J_t = \mathbf{E}_t \sum_{i=1}^{\infty} \{(1-s)^i \Lambda_{t,t+i}[x_{t+i} - w_{t+i}]\}$$

- Shimer (2005) – with Nash bargaining, too little variation in $x_{t+i} - w_{t+i}$
- Hall(2005), Shimer (2005) – sticky wages can generate sufficient variation, given variation in x_t
- Hall(2014)– absent volatility in x_t, volatility in $\Lambda_{t,t+i}$ is a candidate

Discount factor variation and job value

- co-movement between stock-market and job value
- job value identified off FOC

$$J_t = cT_t = c\frac{V_t}{H_t}$$

- V_t, H_t measured in the data, $c = 0.43$ from Silva and Toledo (2009)
- notice that J_t is not computed through the PDV of output net of wages – we will come back to it

Job value and stock index

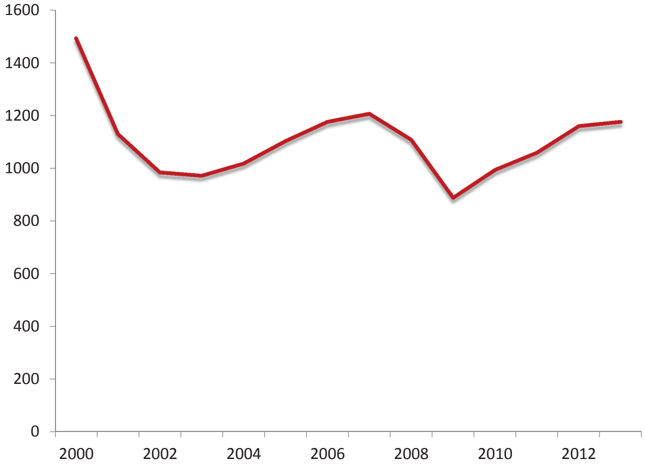


Figure 1: Aggregate Job Value, 2001 through 2013

source: Hall (2014)

Job value and stock index

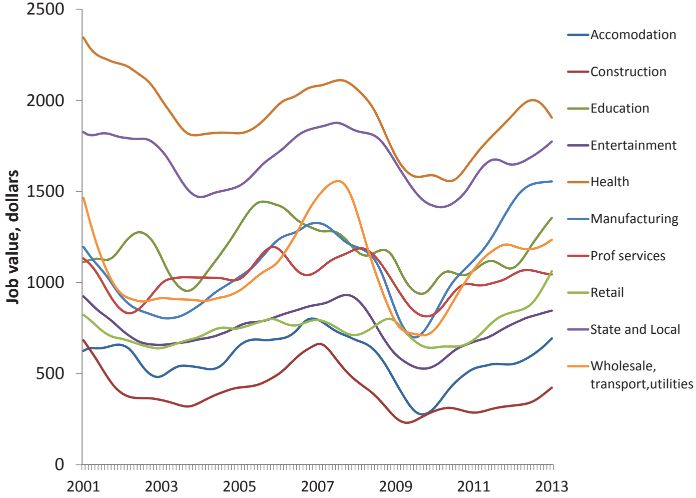


Figure 2: Job Value by Industry, 2001 through 2013

Job value and stock index

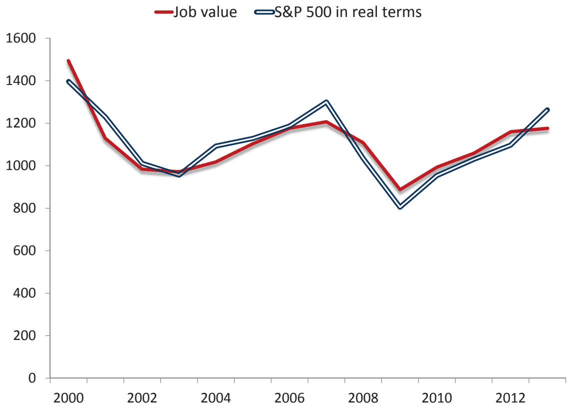
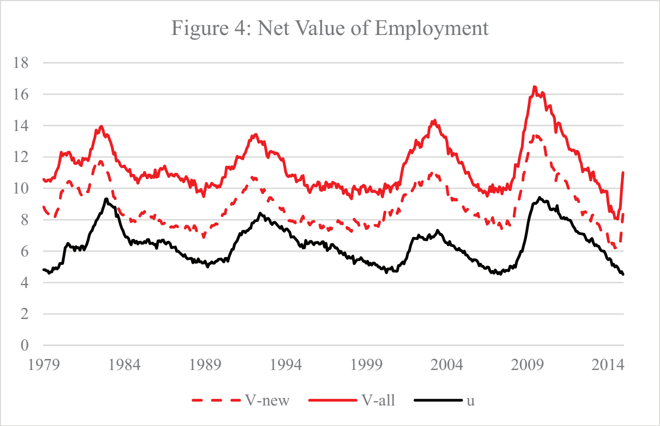


Figure 4: Job Value from JOLTS and S&P Stock-Market Index, 2001 through 2013

source: Hall (2014)

Net value of employment



source: Menzio, Golosov (2015)

Implied volatility of discount rate

- measure θ_t
- measure x_t as average labor productivity
- θ_t and x_t have a low correlation, 0.18
- model:

$$\frac{(1-\beta)(x_t - z_t) - \beta x_t c \hat{\theta}_t}{r_t + s} = c x_t \frac{\sqrt{\hat{\theta}_t}}{\mu}$$

$$z_t = (\alpha \bar{x} + (1-\alpha) x_t) \bar{z}$$

$$\hat{\theta}_t = \psi \theta + (1-\psi) \bar{\theta}$$

- for any ψ, α, solve the above equation for r_t
- report annual standard deviation of r_t

Tightness-insulated wage

- parameter $\psi \in [0, 1]$

$$w = \psi w^N + (1 - \psi) w^x$$

- w^N – Nash bargaining solution
- w^x – wage without tightness effect

$$w^x = (1 - \beta) z + \beta x (1 + c\bar{\theta})$$

- $\bar{\theta}$ is constant, calibrated
- wage responds to productivity shocks, but not much to the tightness

Linking z to productivity

- z unemployment flow

$$z = [\alpha \bar{x} + (1 - \alpha) x] \bar{z}$$

- tightness θ depends on the gap $x - z$
- $\alpha = 1$ standard view
- $\alpha = 0$ leads to $z = x\bar{z}$: now x does not affect θ
- small values of α make θ less responsive to x

Correlation of productivity and tightness

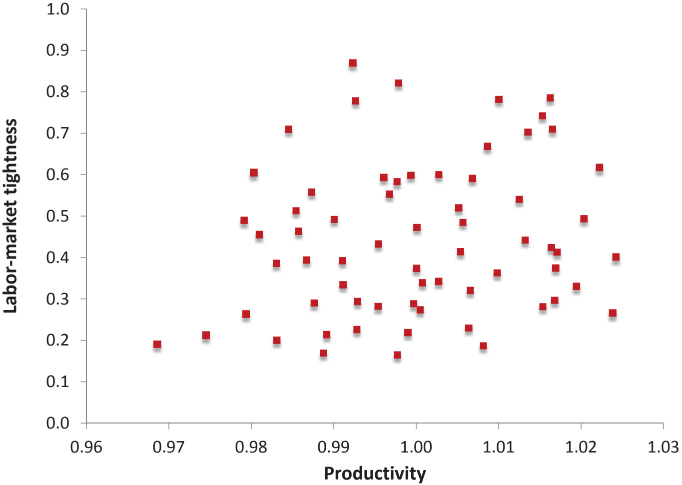


Figure 11: Tightness θ and Productivity x, 1948 through 2012

Implied volatility of discount rate

		ψ: weight on tightness in wage determination										
		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
α: size of constant in non-market value	1	22	30	43	57	71	86	101	115	130	146	161
	0.8	18	28	42	56	71	86	101	116	131	146	161
	0.6	15	27	41	56	71	86	101	116	132	147	162
	0.4	13	27	42	57	72	87	102	117	132	148	163
	0.2	12	27	42	57	72	88	103	118	133	149	164
	0	12	28	43	58	73	89	104	119	134	150	165

Table 1: Standard Deviations of Implied Discount Rates within the Parameter Space, Percents at Annual Rates

Discount rates in the stock market

- return on an asset

$$R_{t+1} \equiv \frac{D_{t+1} + P_{t+1}}{P_t}$$

- expected return

$$E_t[R_{t+1}] = E_t[\frac{D_{t+1}}{P_t}] + E_t[\frac{P_{t+1}}{P_t}]$$

- how to get the expected return R_{t+1} from the data?

- denote R_{t+1} the realized return

$$R_{t+1} = E_t[R_{t+1}] + (R_{t+1} - E_t[R_{t+1}])$$

- regression

$$R_{t+1} = \beta X_t + \varepsilon_t$$

- X_t contains all that is in the information set at time t : D_t/P_t, log consumption-income ratio

- $E_t[R_{t+1}]$ is the one-year ahead forecast from this regression

Implied volatility of discount rate

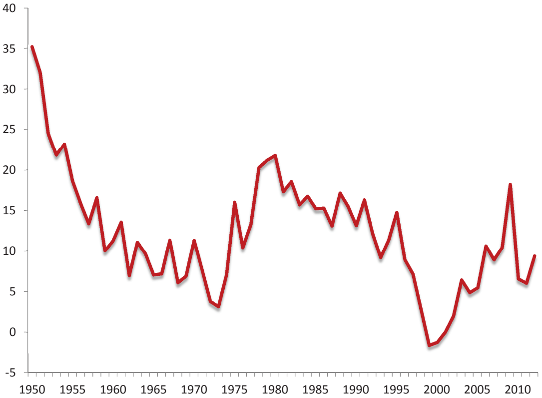


Figure 12: Econometric Measure of the Discount Rate for the S&P Stock-Price Index

Implied volatility of discount rate

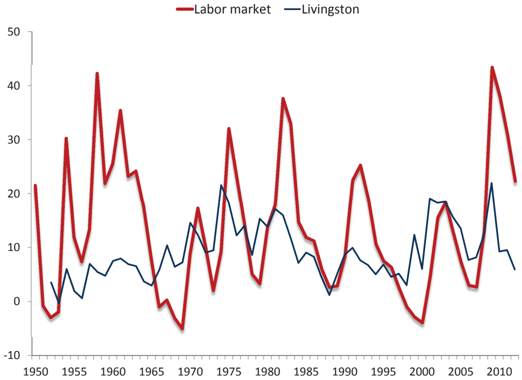


Figure 14: Discount Rate for the Labor Market and the Livingston Panel's Rate for the Stock Market

Direct measure of the value of a new worker

- benefit of a new hire is higher than wage, but close
- suppose $s = 0.035$, $r = 0.0083$ (10% per year)
- then the capitalization at monthly basis: $1/(s + r) = 23$
- decline in job value in great recession was \$300
- monthly decline in flow $x - w$ would be $\$300/23 = \$13$
- median hourly wage in 2011 was \$17
- decline in monthly flow equal to about 45 minutes of wage earnings
- only tiny change in net flows needed to rationalize observed increase in unemployment – hard to measure