What Shifts the Beveridge Curve?

Recruiting Intensity and Financial Shocks

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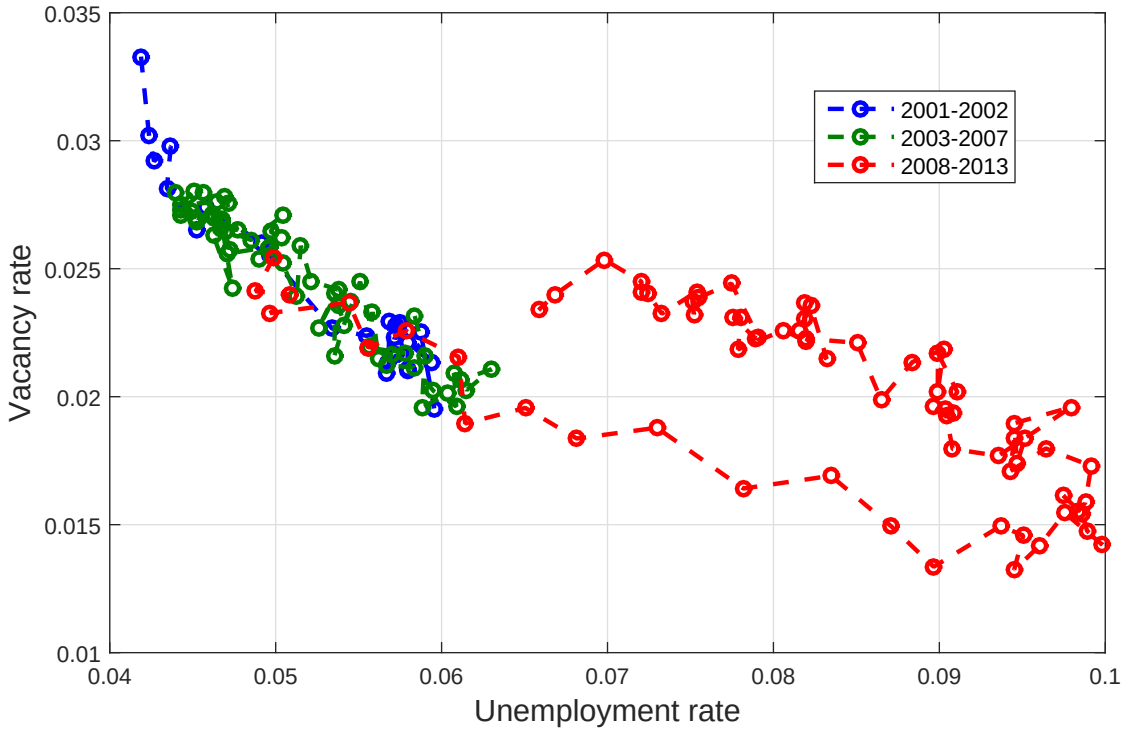
The outward shift in the Beveridge curve



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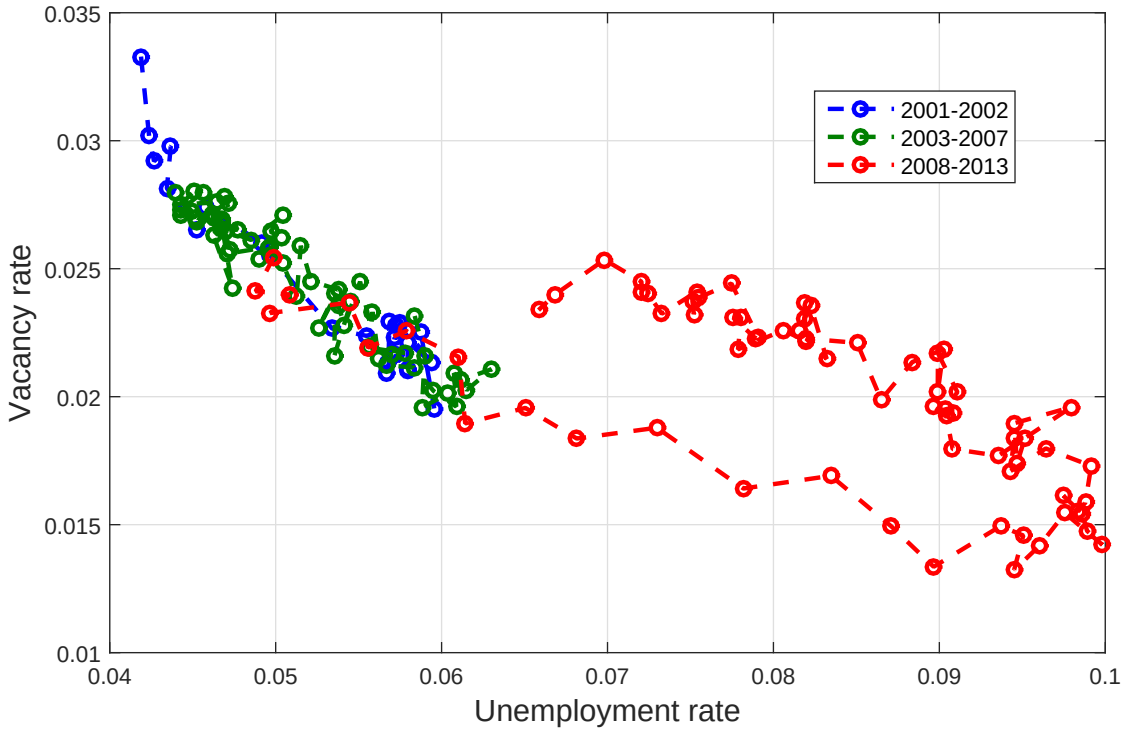

It indicates a deterioration in **aggregate matching efficiency** Φ_t

$$H_t = \Phi_t V_t^{\alpha} U_t^{1-\alpha}$$

Measurement of Φ_t

Estimating Φ_t accounting for compositional changes

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- Hall and Schulhofer-Wohl $\rightarrow$ among job-seekers, include
  - Nonparticipants (N_t)
  - Employed (E_t)

$$H_t = \Phi_t \cdot \underbrace{\left(1 + s_t^N \frac{N_t}{U_t} + s_t^E \frac{E_t}{U_t}\right)^{1-\alpha}}_{\text{composition factor}} \cdot V_t^{\alpha} U^{1-\alpha}$$

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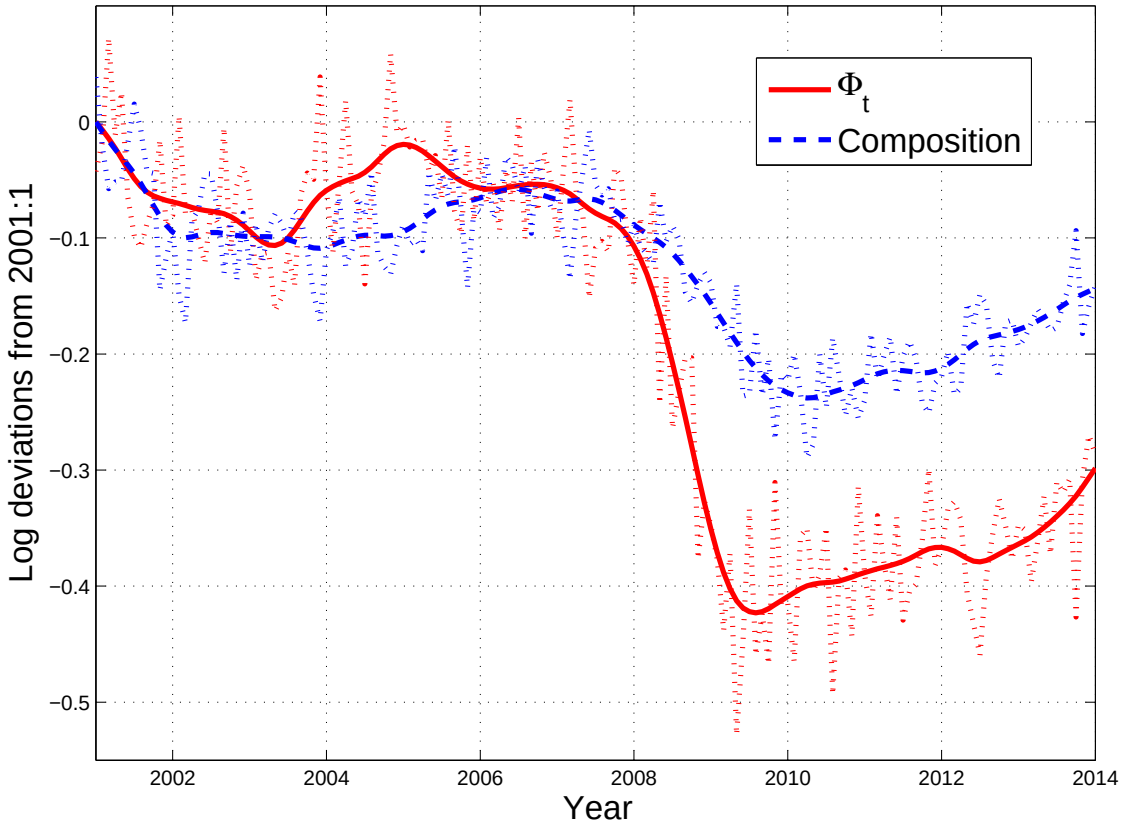
- Veracierto $\rightarrow$ estimate (s_t^N, s_t^E) through data on worker flows
- Fujita and Moscarini $\rightarrow$ exclude workers on temporary layoff from the matching function
- Fix $\alpha = 0.5$, compute composition factor, and get Φ_t as a residual

Measured drop in aggregate matching efficiency



2001: -10 percent $\&$ fast rebound

2007-09: -30 percent $\&$ slow recovery

Explaining the deterioration in matching efficiency

$$H_t = \Phi_t V_t^{\alpha} U_t^{1-\alpha}$$

1. Mismatch $\uparrow$
   - Sahin-Song-Topa-Violante 2014; Elsby-Michaels-Ratner 2014
2. Worker's search effort $\downarrow$
   - Mukoyama-Patterson-Sahin 2014; Hagedorn-Karahan-Manovskii-Mitman 2014
3. Firm's recruiting intensity $\downarrow$
   - Davis-Faberman-Haltiwanger 2012; Kaas-Kircher 2014

Firms' recruiting intensity

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- Effective vacancies:

$$V_t^* = \int e_{it} v_{it} di$$

- v_{it}: max open positions ready to be staffed and costly to create

- $e_{it} \in [0, 1]$: probability of filling an open position —an outcome of how much firms choose to spend on recruitment activities

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- Aggregate matching function:

$$H_t = (V_t^*)^{\alpha} U_t^{1-\alpha} = \Phi_t \cdot V_t^{\alpha} U_t^{1-\alpha} \quad \text{with} \quad \Phi_t = \left[\int e_{it} \left(\frac{v_{it}}{V_t} \right) di \right]^{\alpha}$$

MECHANISM

Mechanism

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- TFP shock: more neutral across firms, so smaller effect on Φ_t

Economic Environment

Random-matching model with multi-worker firms

Cooper-Haltiwanger-Willis 07, Elsby-Michaels 13, Acemoglu-Hawkins 14

Cast of characters

1. Firms
   - Operate a DRS technology $y(z, n)$, z stochastic
   - Hire in frictional labor markets: choose (e, v)
   - Face non-negative dividend constraint $\rightarrow$ borrowing
   - Endogenous entry and exit/default
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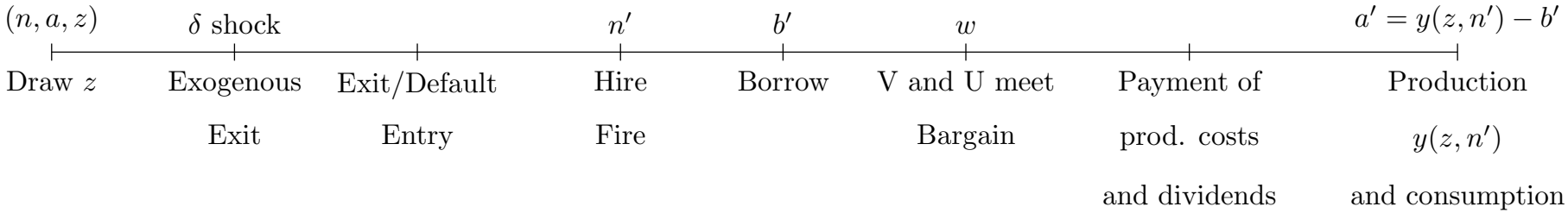
3. Households
   - Risk neutral representative family (some members unempl.)
   - Save into bank deposits and mutual fund that owns all firms

Timeline



Individual firm's state variables:

- n: initial employment (pre-hiring)
- a: initial net worth
- z: productivity

Entry, exit, hire/fire decisions

- Entry decision: λ_0 potential entrants drawing $z \sim \Gamma_0(z)$
  - fraction ε of start-up cost χ_0 financed by equity

$$-\varepsilon\chi_0 + \mathbb{V}^i(0, -(1-\varepsilon)\chi_0, z^*) = 0$$

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$$\mathbb{V}(n, a, z) \quad = \quad \max\left\{\mathbb{V}^i(n, a, z), a, 0\right\}$$

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- Incumbent: fire or hire

$$\mathbb{V}^i(n, a, z) = \max\left\{\mathbb{V}^f(n, a, z), \mathbb{V}^h(n, a, z)\right\}$$

Incumbent firms' decisions: fire

$$\mathbb{V}^f(n,a,z) = \max_{n',b'} d^f + \beta(1-\delta)\sum_{z'\in\mathcal{Z}} \mathbb{V}(n',a',z')\Gamma(z',z)$$

$$s.t.$$

$$n' \leq n$$

$$d^f \equiv a - w(z,n',b')n' - \chi + Q(n',b',z)b' \geq 0$$

$$a' = y(z,n') - b'$$

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Note: wage determined by Nash bargaining (Stole-Zwiebel solution)

Incumbent firms' decisions: hire

$$\mathbb{V}^h(n,a,z) = \max_{e\in[0,1],v>0,b'} d^h \quad + \quad \beta(1-\delta)\sum_{z'\in\mathcal{Z}} \mathbb{V}(n',a',z')\Gamma(z',z)$$

$$s.t.$$

$$n' - n \quad = \quad q(\theta^*)ev$$

$$d^h \equiv a - w(z,n',b')n' \; - \; \chi - C(e,v,n) + Q(n',b',z)b' \geq 0$$

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Choice of functional form for $C(e, v, n)$

DFH: Log-linear relation btw job-filling rate $q(\theta^*)e$ and growth rate

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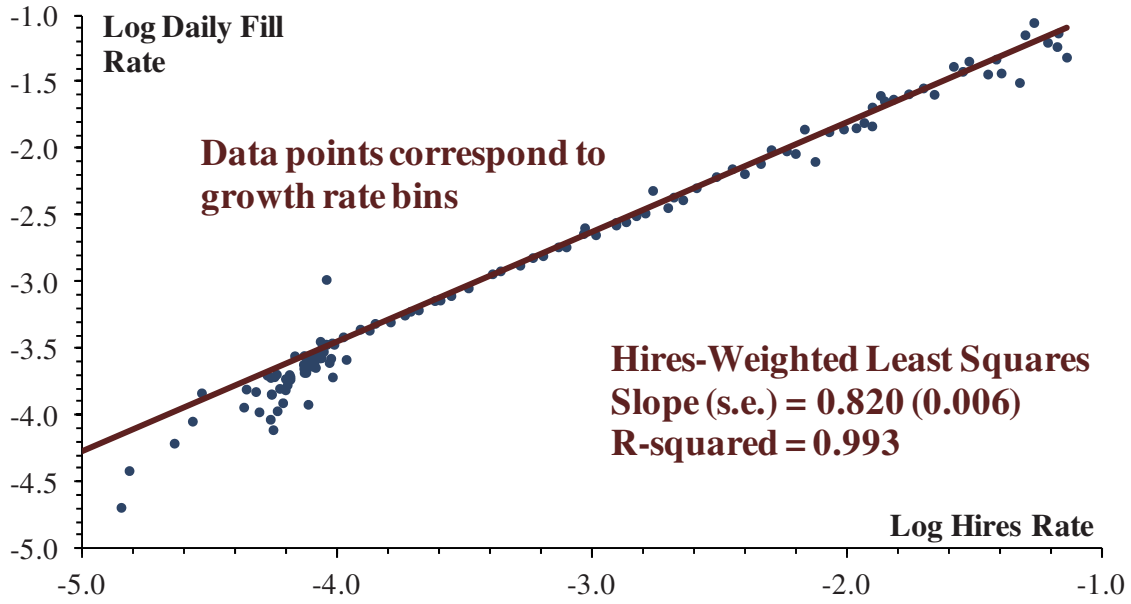

Reverse engineer $C(\cdot)$ that yields the above relationship

Hiring problem

1. Stage I: Choose target employment level $n' > n$

2. Stage II: Choose max new positions v, and recruitment effort e

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$$\begin{aligned} C^*(n, n') &= \min_{e \in [0,1], v > 0} \left[\frac{\kappa_1}{\gamma_1} e^{\gamma_1} + \frac{\kappa_2}{\gamma_2 + 1} \left(\frac{v}{n} \right)^{\gamma_2} \right] v \\ & s.t. \\ n' - n &= q(\theta^*) e v \end{aligned}$$

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- The solution yields the job filling-rate:

$$\log\left(\frac{h}{v}\right) \equiv q(\theta^*)e = \Omega\left(\kappa_1,\kappa_2,\theta^*\right) + \frac{\gamma_2}{\gamma_1+\gamma_2}\log\left(\frac{n'-n}{n}\right)$$

Why is recruiting effort increasing in the growth rate?

$$\frac{n' - n}{n} = q(\theta^*) \cdot e \cdot \left(\frac{v}{n}\right)$$

1. e and v/n are both inputs in the production of employment growth

$$\frac{C}{v} = \left[\frac{\kappa_1}{\gamma_1} e^{\gamma_1} + \frac{\kappa_2}{\gamma_2 + 1} \left(\frac{v}{n}\right)^{\gamma_2}\right]$$

2. cost of creating a new position is increasing in both e and v/n

3. relative curvature of cost function C with respect to e and v/n determines their elasticity with respect to the desired growth rate

Banks

- Competitive sector with free entry
- Intermediate funds at cost $\varphi > 0$ (financial wedge)
- Pay risk-free return $\bar{Q}^{-1} = \beta^{-1}$ on deposits
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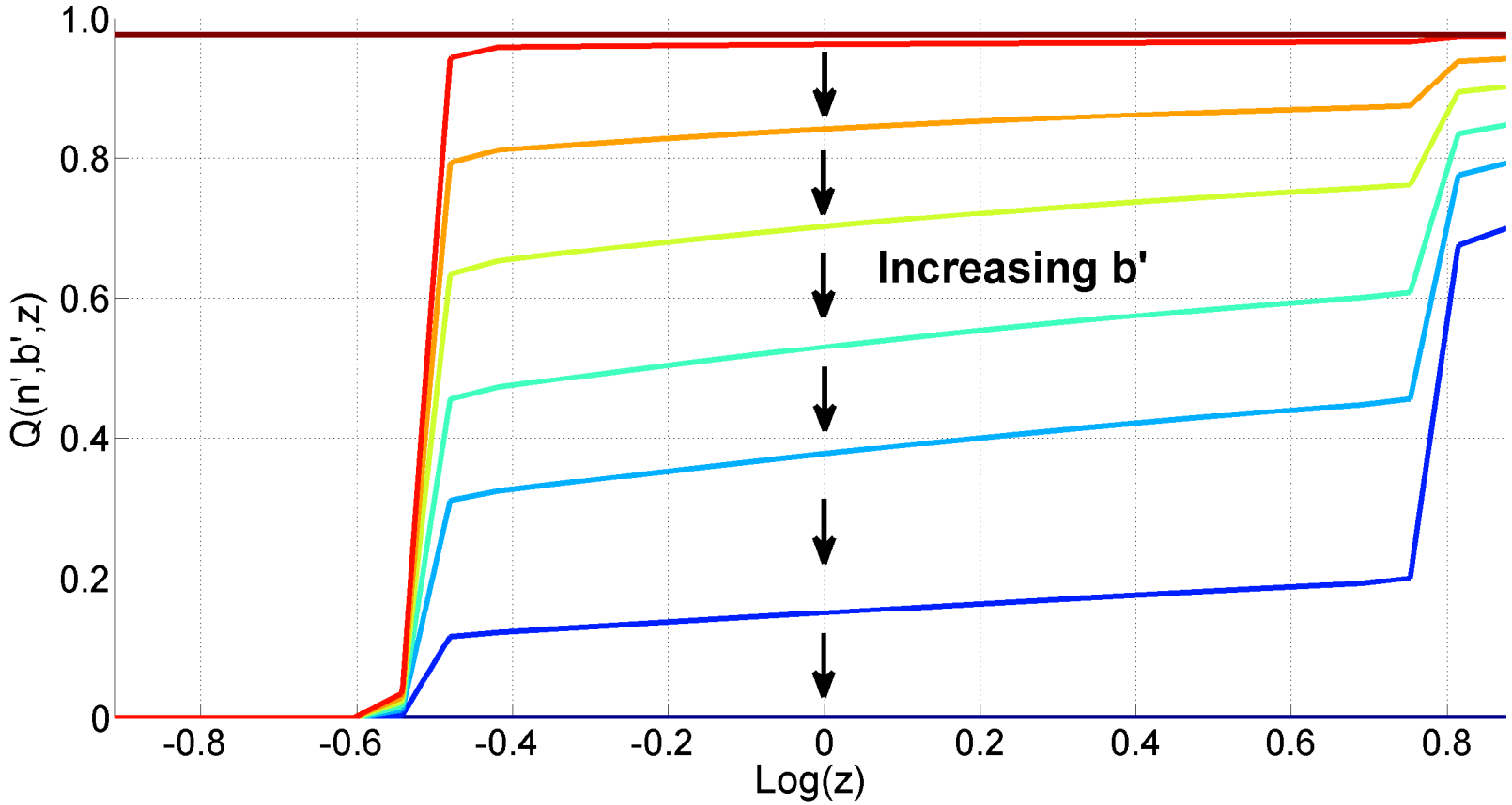
- Upon firm's default, i.e., $x^D(n', a', z') = 1$, recover nothing
- Equilibrium price of a loan to a firm of type (n', b', z):

$$Q(n', b', z) = \bar{Q}(1-\varphi)(1-\delta)\left[1 - \sum_{z' \in \mathcal{Z}} x^D(\cdot)\Gamma\left(z', z\right)\right]$$

(Inverse of) price of debt for start-ups



Representative household

$$\begin{aligned}
\mathbb{W}(U,T,M) &= \max_{M',T'} \; C+\beta\mathbb{W}(U',T',M') \\
&s.t. \\
C+\bar{Q}M'+PT' &= \int w(z,n',b')n'd\lambda+\omega U+(D+P)M+T \\
U' &= U+\delta(1-U)-\Phi V^{\alpha}U^{1-\alpha}
\end{aligned}$$

- T: household deposits
- M: shares of the mutual fund owning all firms
- D: average dividends paid by firms

PRELIMINARY

PARAMETERIZATION

Externally calibrated

Parameter		Value	Target
Discount factor (monthly)	β	0.9967	Risk-free rate
Potential entrants	λ_0	0.02	Meas. of incumbents = 1
Size of labor force	Λ	18.7	Average firm size = 17.5
Nash bargaining share of workers	η	0.5	—
Elasticity of matching function wrt V_t	α	0.5	Empirical estimates
Financial intermediation wedge (monthly)	φ	0.002	Excess bond premium
External equity share of start-up cost	ε	0.50	Kauffman Firm Survey

Model period is 1 month

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Addition to the model: heterogeneity in DRS across firms

Internally calibrated

Parameter		Value	Target	Model	Data
Flow of home production	ω	0.62	Monthly separ. rate	0.03	0.02
Scaling of match. funct.	$\bar{\Phi}$	0.42	Monhtly job finding rate	0.40	0.30
Midpoint DRS in prod.	ν	0.70	Dividend share	0.06	0.05
High-Low DRS in prod.	$\Delta\nu$	0.20	Empl. share 500+	0.25	0.47
Persistence of z shocks	Γ	0.99	Annual $\lvert g\rvert < 0.05$	0.50	0.42
SD of z shocks	Γ	0.11	$SD\left(g\right)$	0.32	0.42
Cost elasticity wrt e	γ_1	3.74	Recr. int. small/large firms	1.23	1.50
Cost elasticity wrt v	γ_2	22.97	Elasticity of job. fill rate wrt g	0.86	0.82
Cost shifter wrt e	κ_1	4.88	Hiring cost/monthly wage	0.03	0.15
Cost shifter wrt v	κ_2	0.08	Vac. share. of small firms	0.18	0.34
Entry cost	χ_0	0.28	Annual entry rate	0.09	0.11
(Exponential) distrib. of z_0	ξ	11.82	Share of JC by entrants	0.33	0.32
Operating cost	χ	0.08	Survive $\geq$ 5 years	0.62	0.50
Exogenous exit shock	δ	0.008	Share of JD by exit	0.24	0.35

“Up or out” dynamics of young firms

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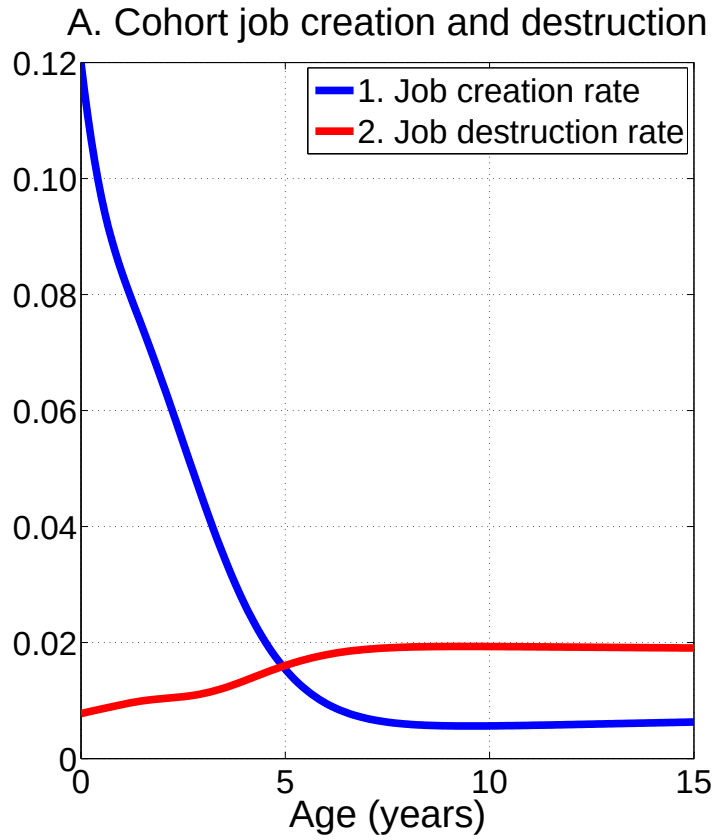
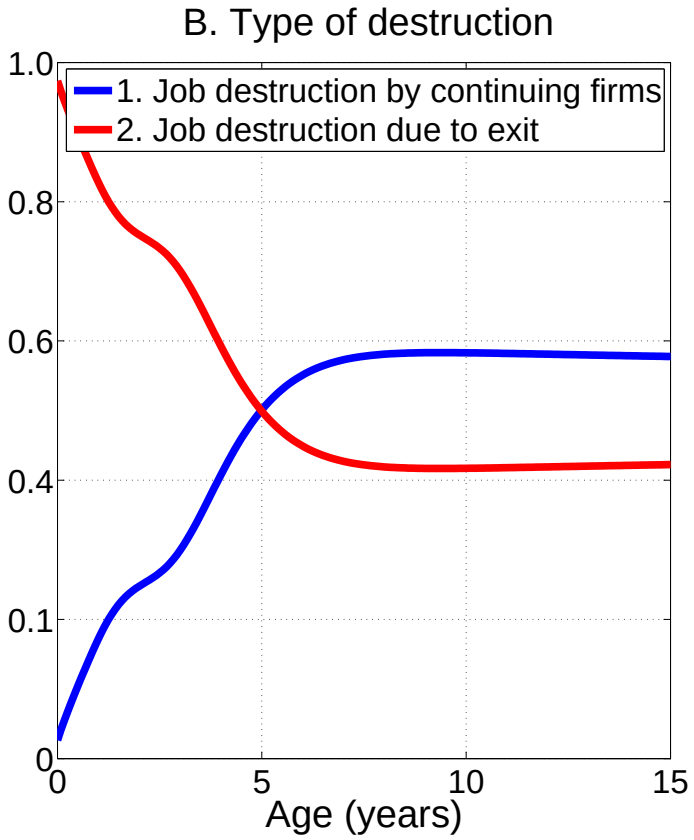
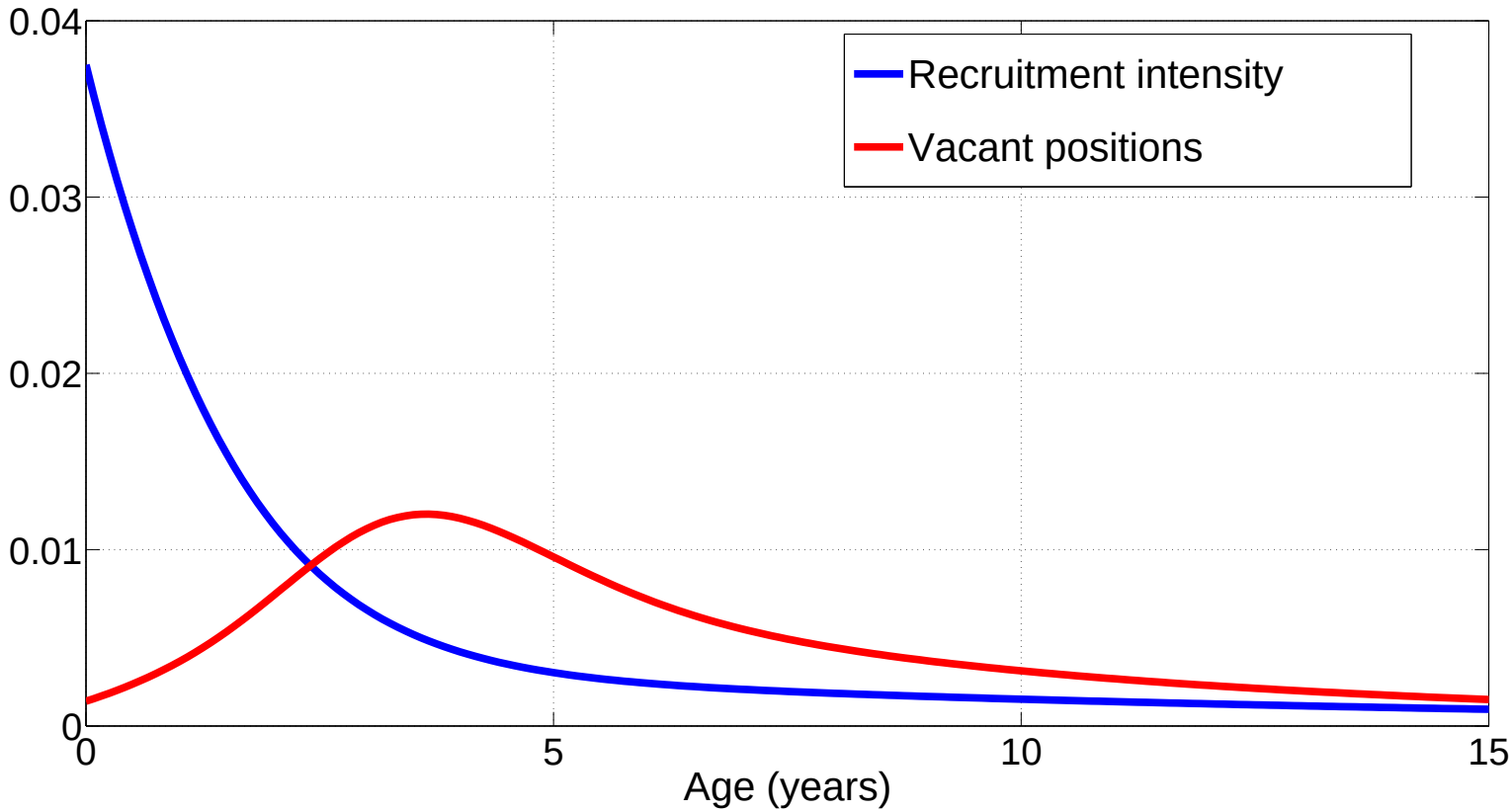
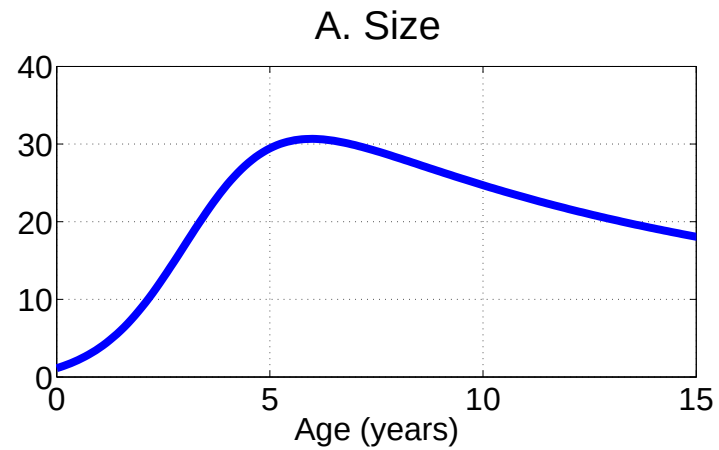


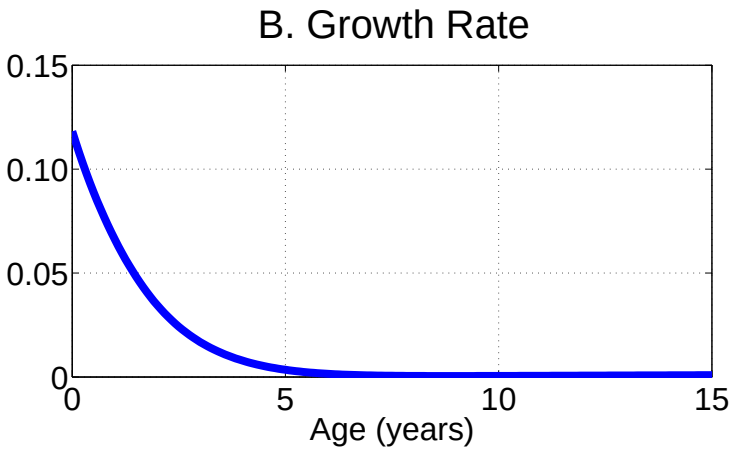


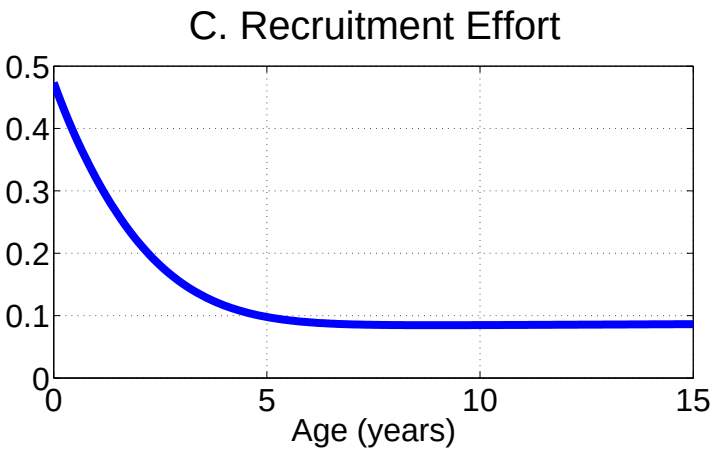
Age distribution of recruiting intensity and vacancies

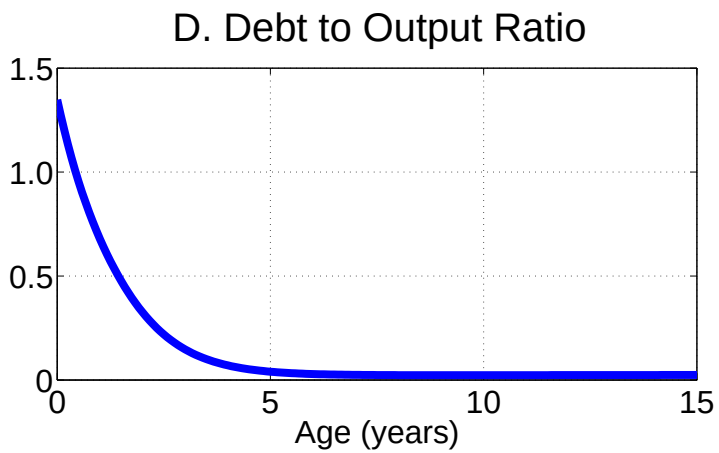


Firms' life-cycle (averages)



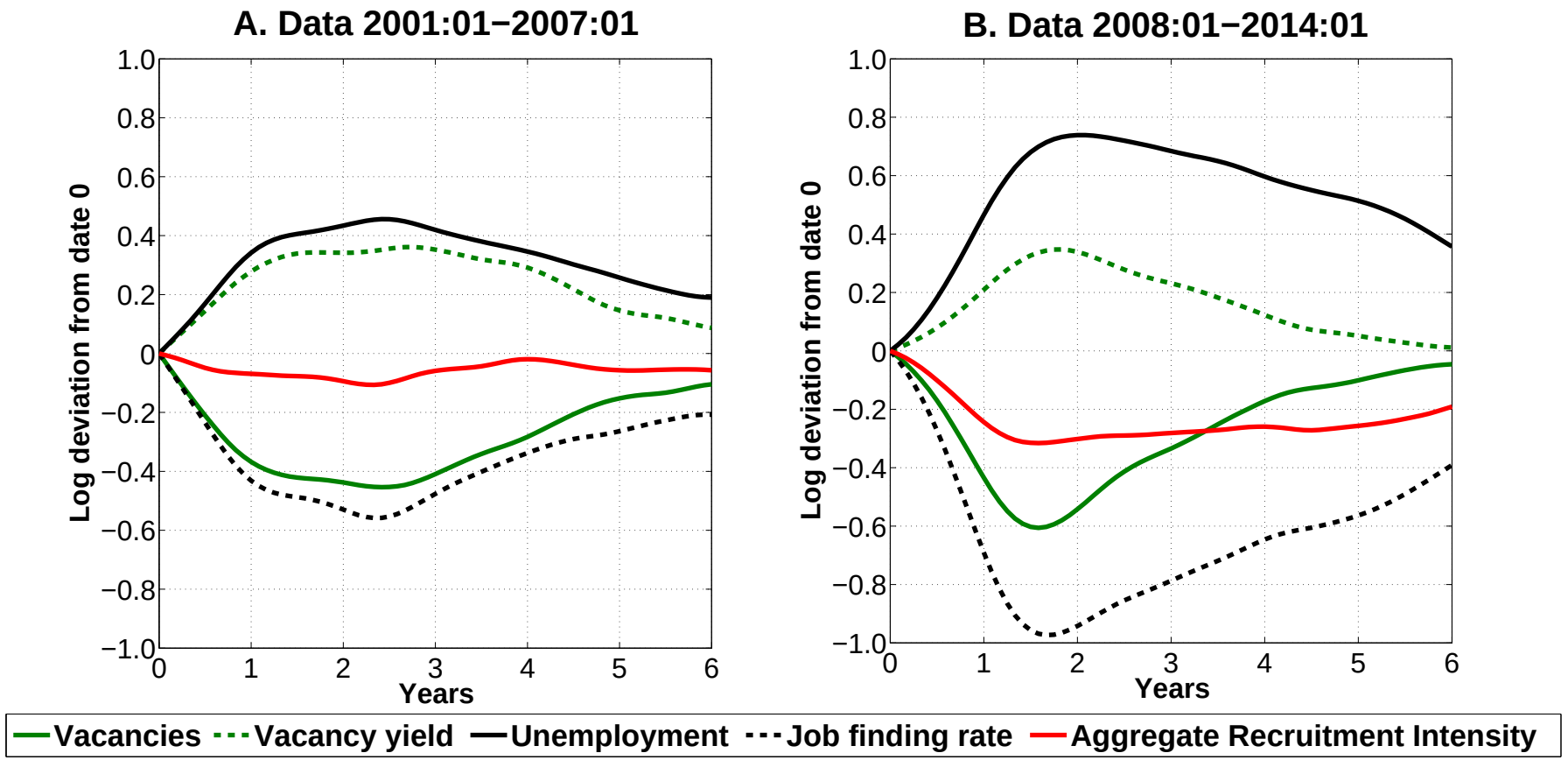






Data to be Explained

Data: 2001 vs 2008



EXPERIMENTS

Experiments

Trace transitional dynamics of the economy in response to:

- 2001 recession
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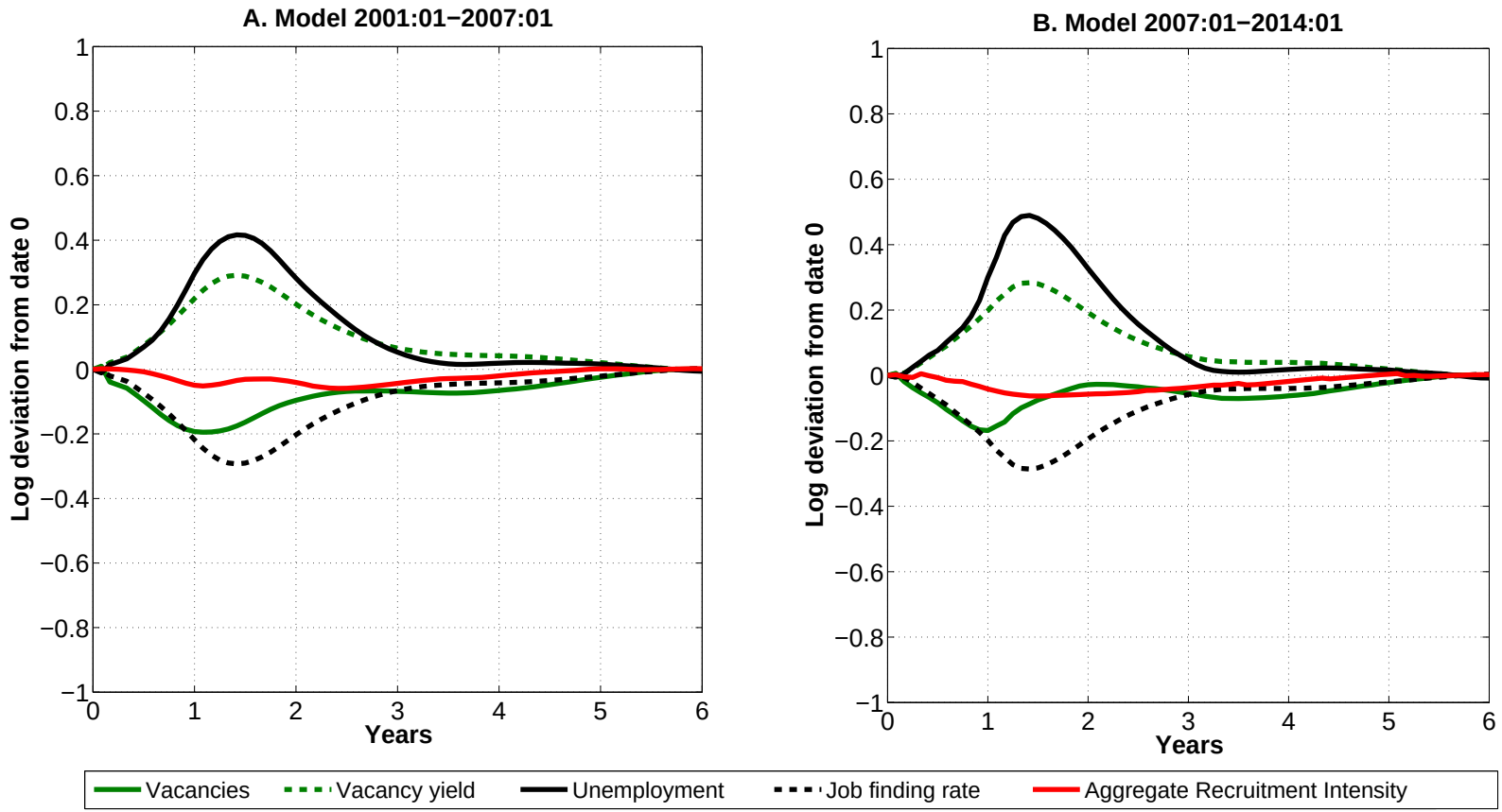
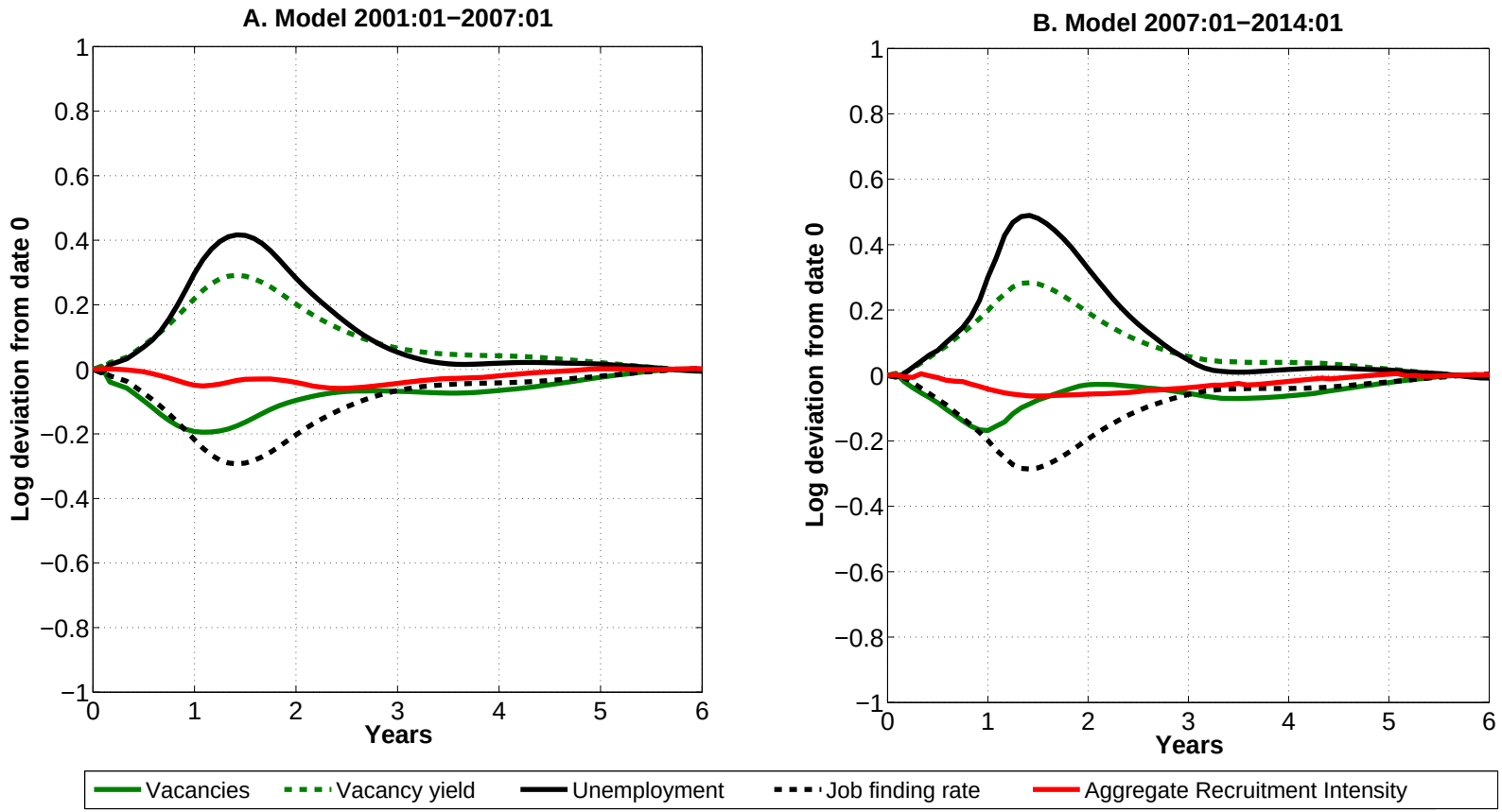
- 2001 recession
  - Aggregate productivity $Z \downarrow$ by 4% and recovers in 6 years
- 2007-09 recession
  - Same aggregate productivity $Z \downarrow$ combined with:
  - Financial shock
    - Financial wedge $\varphi \uparrow$ and recovers in 6 years
    - Initial equity at start-up $\varepsilon \downarrow$ and recovers in 6 years

Model: 2001 vs. 2008



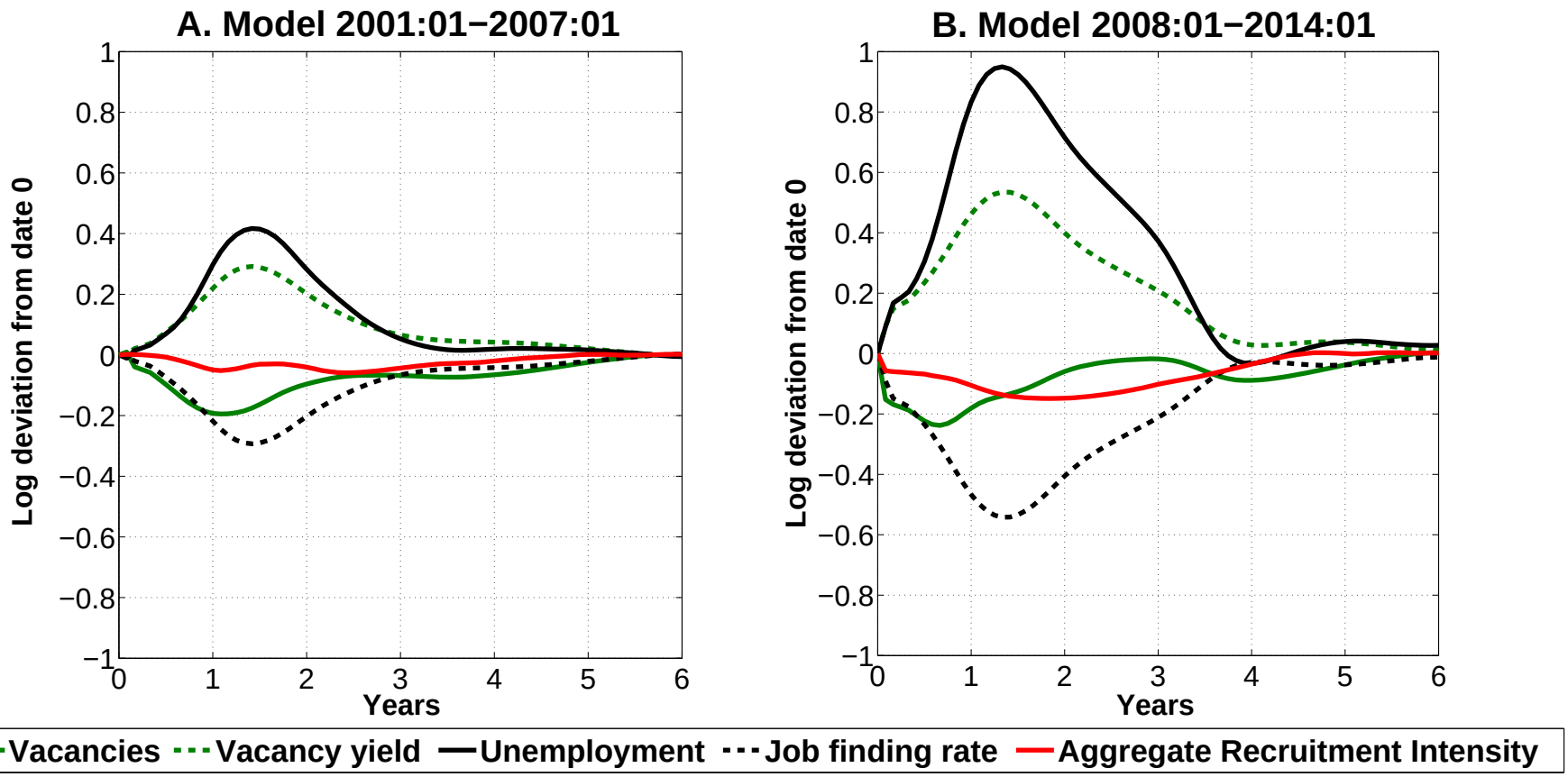
A: TFP Shock

Model: 2001 vs. 2008



B: TFP Shock + increase in intermediation wedge φ

Model: 2001 vs. 2008



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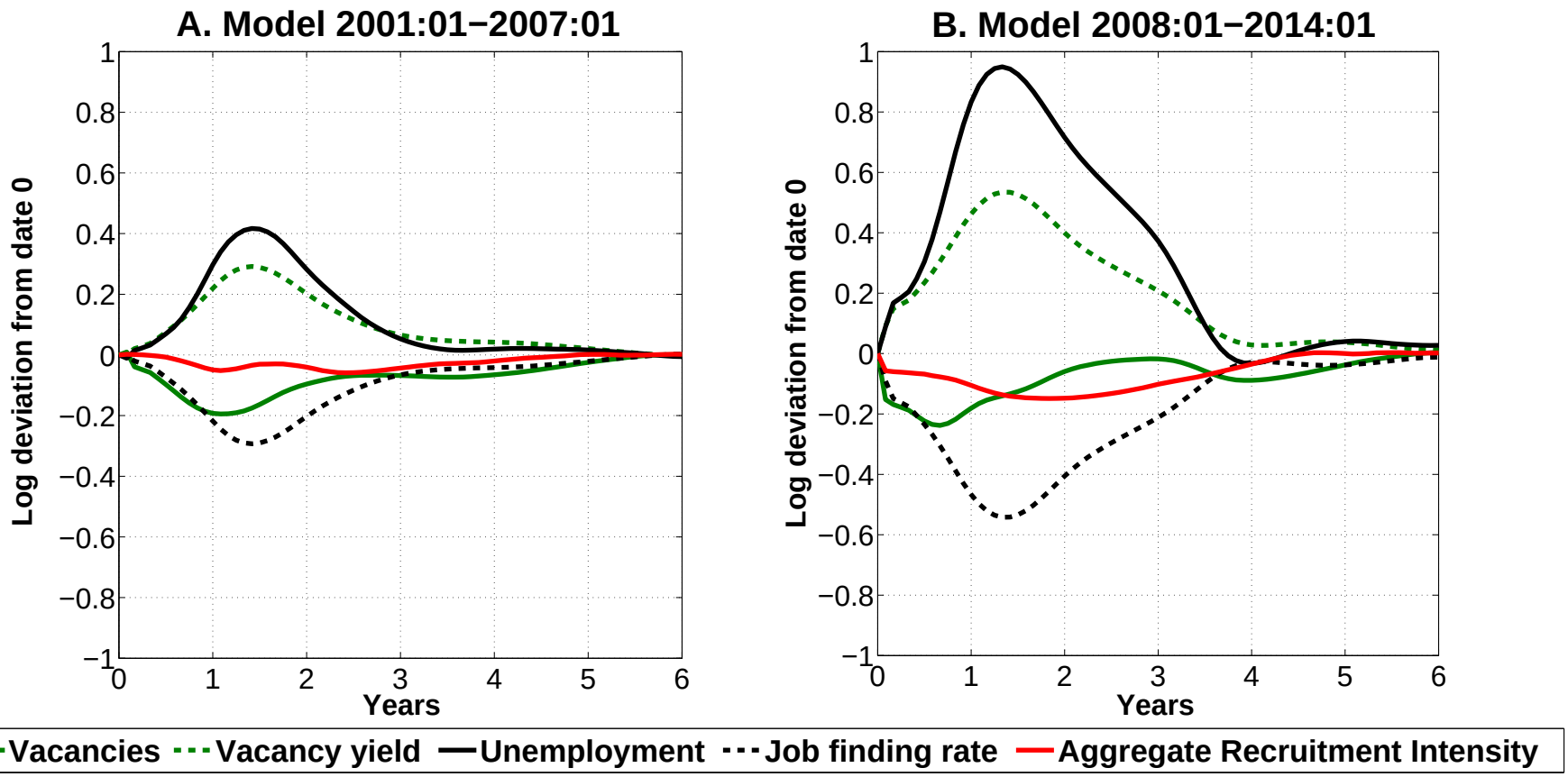

B: TFP shock + fall in share of entry cost financed by equity (ε)

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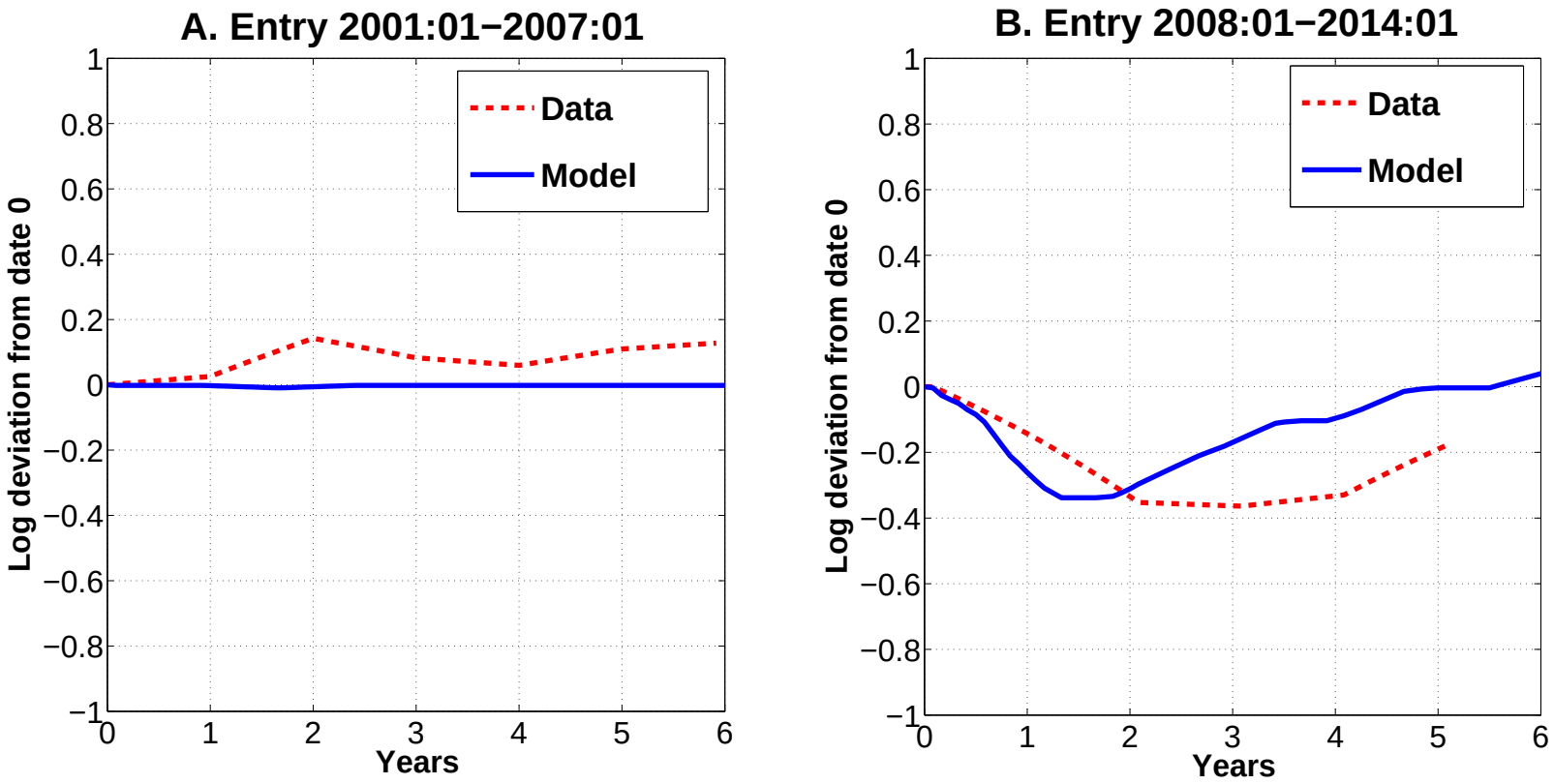

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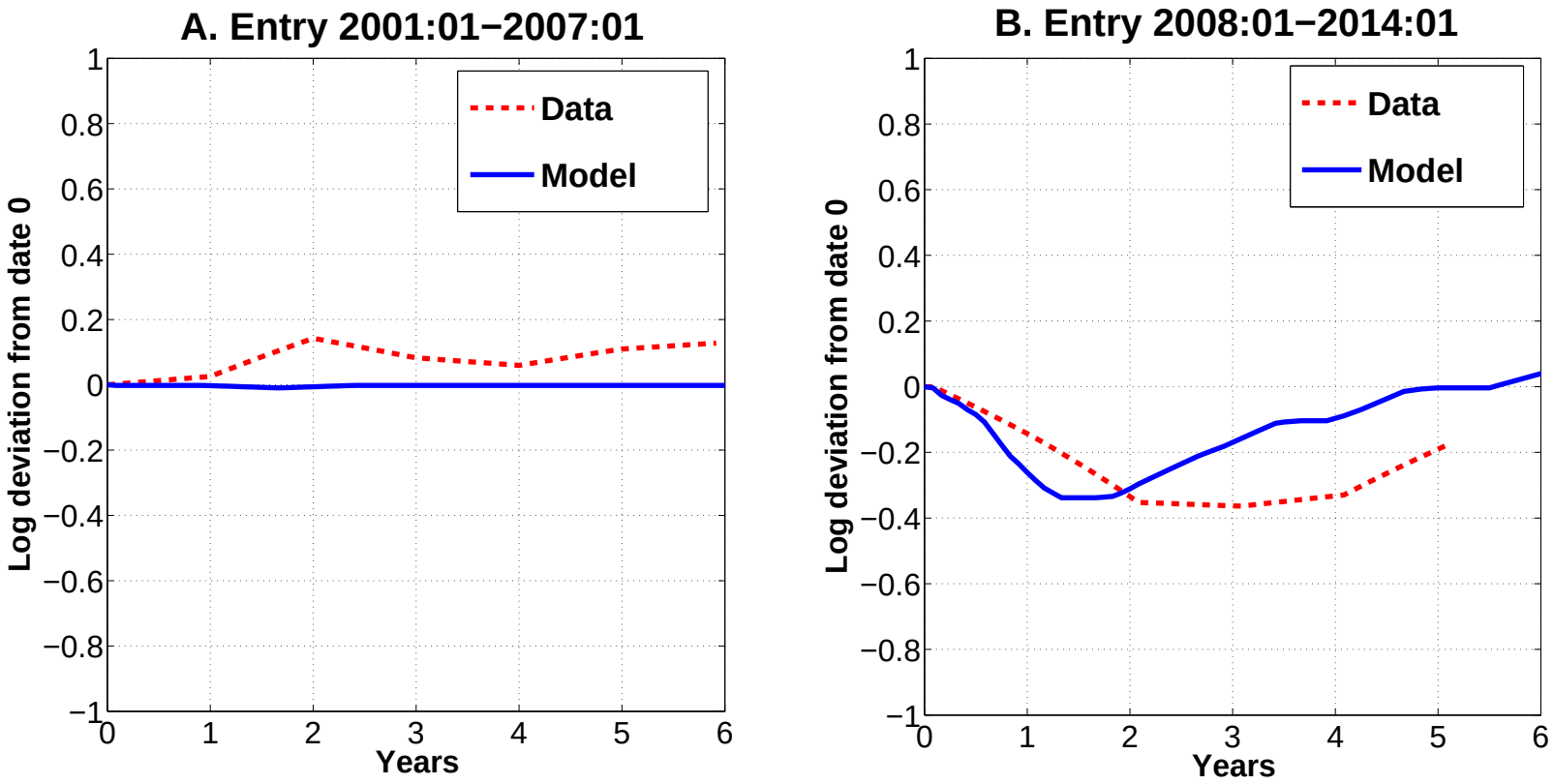

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THANK YOU!

State-level regressions combining HWOL ads and QWI hires

	Log Vacancy Yield		Log Vacancy Yield	
Share of Hires - Firm Age 0-1	0.233***	*(0.702)*	1.838**	*(0.908)*
Share of Hires - Firm Age 2-3	0.417	*(1.648)*	0.355	*(1.786)*
Share of Hires - Firm Age 4-5	1.434	*(1.835)*	1.307	*(1.883)*
Share of Hires - Firm Age 6-10	-0.946	*(1.312)*	-1.090	*(1.279)*
Share of Hires - Firm Size 0-19	-0.395	*(0.815)*	0.231	*(1.231)*
Share of Hires - Firm Size 20-49	0.773	*(1.900)*	1.428	*(2.087)*
Share of Hires - Firm Size 250-499	-1.330	*(1.648)*	-1.815	*(1.789)*
Share of Hires - Firm Size 500+	0.244	*(0.860)*	0.469	*(0.935)*
Constant	0.369	*(0.770)*	0.183	*(0.818)*
Observations	1,606		1,606	
R-squared	0.934		0.934	
State FE	Yes		Yes	
Quarter FE	Yes		Yes	
Seasonally Adjusted	No		Yes	

The Christiano-Eichenbaum-Trabandt critique

$$U_{t+1} = U_t - \Phi_t V_t^{\alpha} U_t^{1-\alpha} + \delta(1 - U_t)$$

- One can explain joint dynamics of $\{U_t, V_t\}$ w/o any change in Φ_t

The Christiano-Eichenbaum-Trabandt critique

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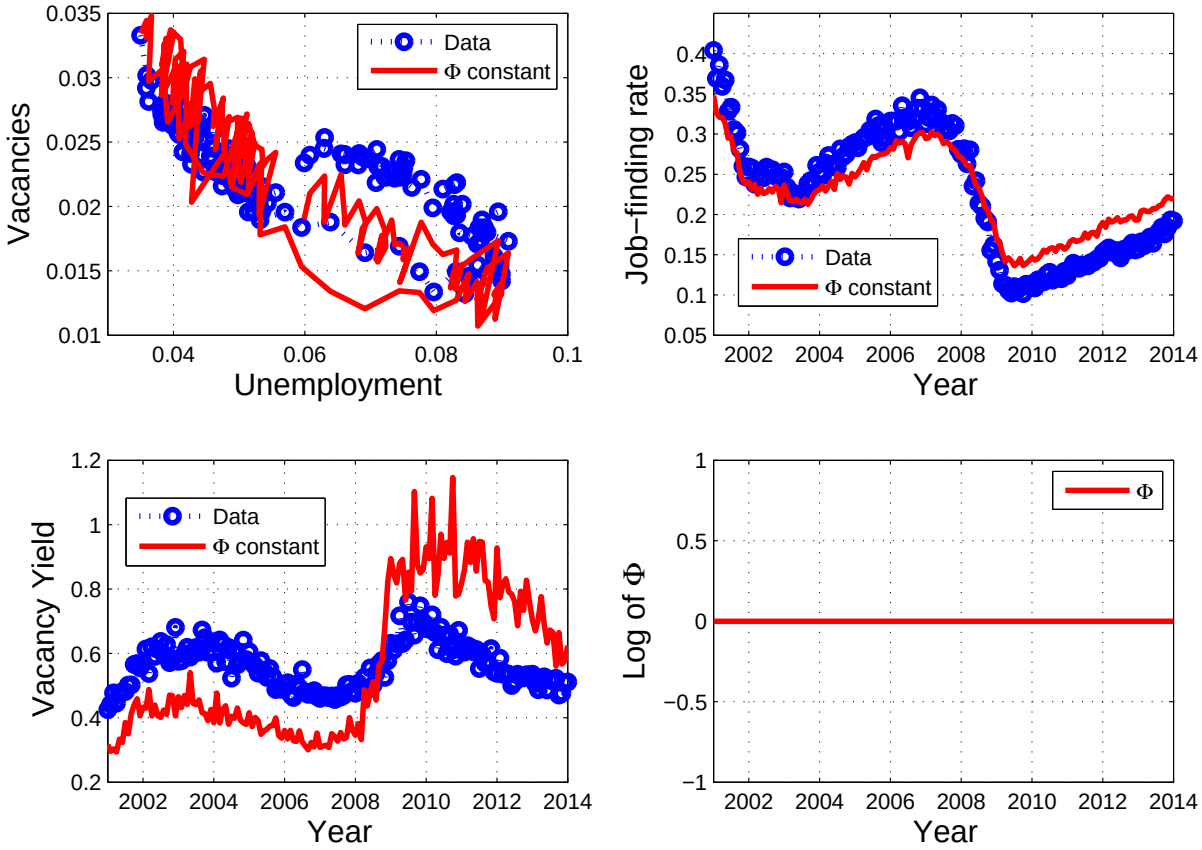
- Estimation yields $\{\hat{V}_t, \hat{H}_t\}$, with $\hat{H}_t = \hat{V}_t^{\alpha} U_t^{1-\alpha}$
- Look at model's implications for:
  1. Job-finding rate $(\hat{H}_t / U_t)$
  2. Vacancy yield $(\hat{H}_t / \hat{V}_t)$

The Christiano-Eichenbaum-Trabandt critique

- One can explain the “shift” without any change in Φ_t



The Christiano-Eichenbaum-Trabandt critique

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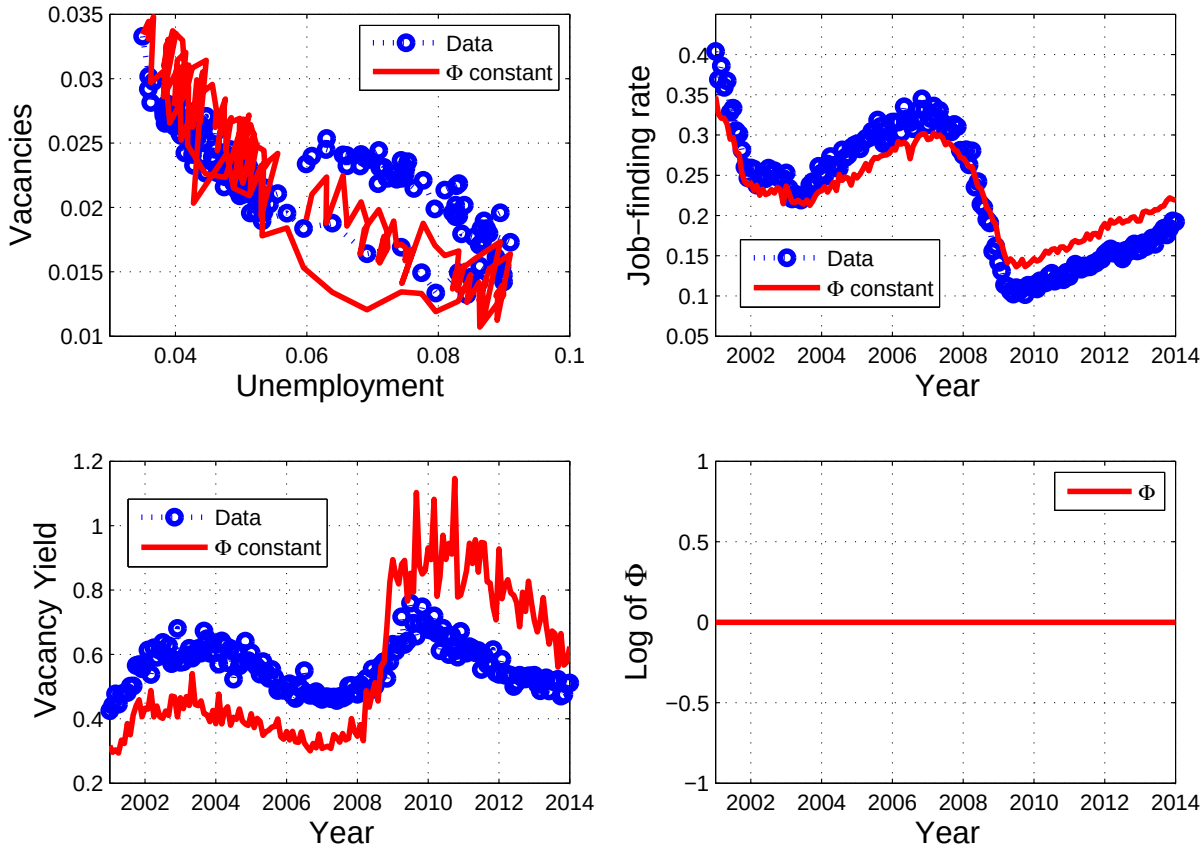
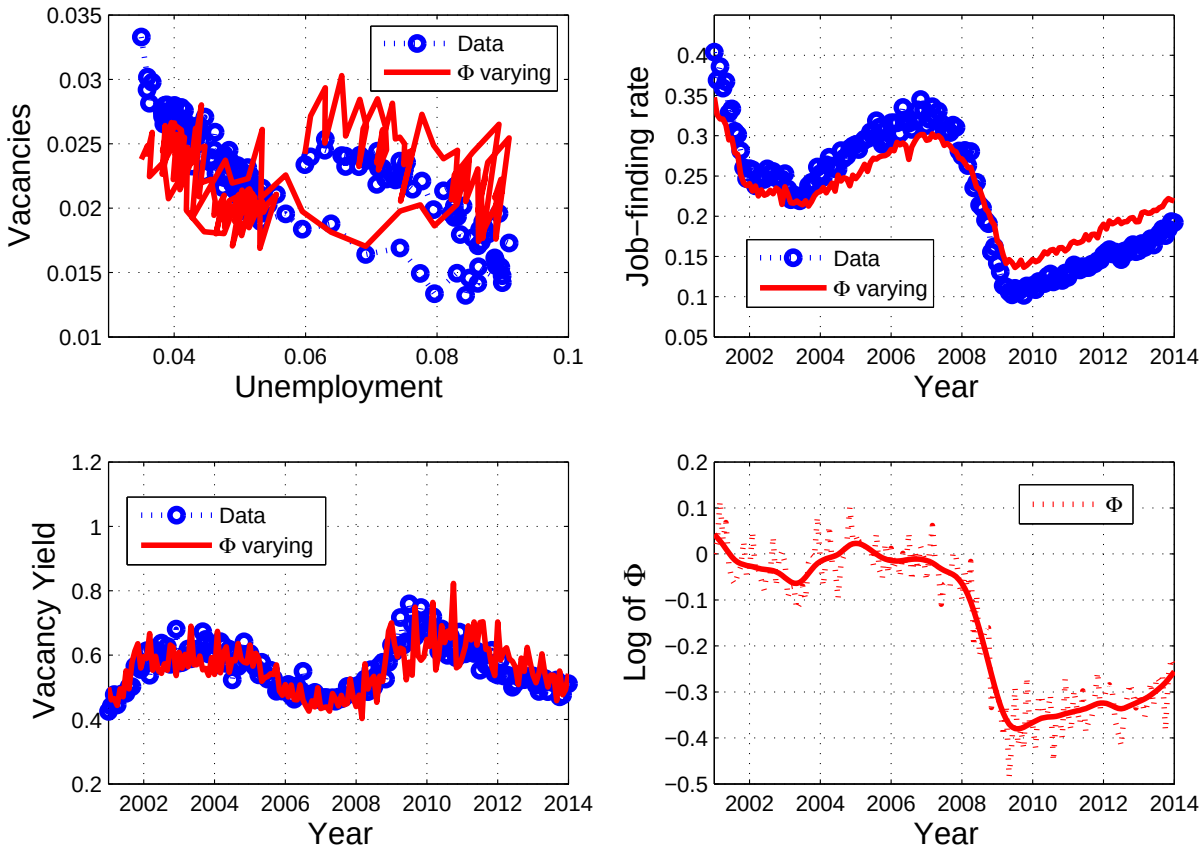


- Fit for the vacancy yield is poor

The Christiano-Eichenbaum-Trabandt critique

- With Φ_t time-varying:



- Fit for the vacancy yield much better