Financial Shocks and Job Flows

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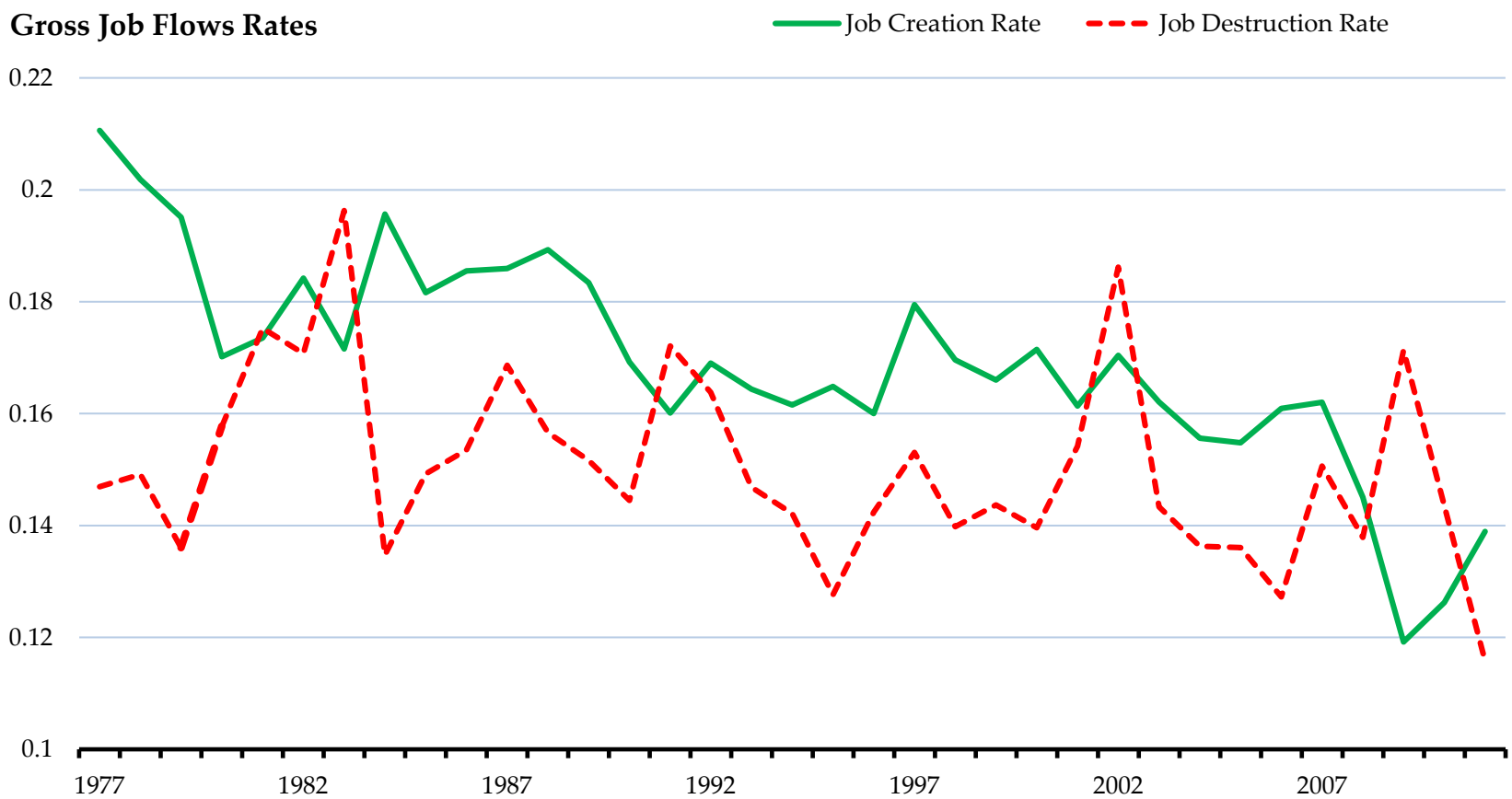
ESSIM, Tarragona
May 29, 2015

Job Flows and the Great Recession



Source: Business Dynamic Statistics

$$JCR_t = \frac{1}{N_t}\sum_i \max\{0, \Delta N_{i,t}\}, \qquad JDR_t = \frac{1}{N_t}\sum_i \max\{0, -\Delta N_{i,t}\}$$

Job Flows (HP)

What we do?

Questions

- How do financial shocks affect aggregate job flows?
- How do financial shocks affect job flows by firms age and size?

Approach

- Model
  - Build a heterogenous firm dynamics model with financial frictions
  - Analyze effects of financial and productivity shocks on job flows
- Empirics
  - Determine effects of financial shocks on MSA-level job flows
  - Document differences across firm size and firm age categories

Results: Model

Aggregate effects

- Productivity and financial shocks operate via distinct margins
- Financial shock accounts for about 25% of decline in employment in Great Recession

Category-specific effects

- Largest effect on *job creation* for new/young and middle sized firms
- Raises *job destruction* for small firms, lowers for young/middle sized firms

Results: Empirics

Aggregate effects of financial shock

- Persistent decrease in job creation
- Lagged decrease in job destruction

Category-specific effects

- Largest job flows effect for new and young firms relative to mature firms
- Largest job flows effect for medium sized firms relative to small firms
- New establishments at existing firms versus new firms

Contribution to the Literature

Firm dynamics models

- Cooley and Quadrini (2001), Khan and Thomas (2013)
- **This paper**: Analysis of job flows

Job flows by firm size and firm age

- Moscarini and Postel-Vinay (2012), Haltiwanger, Jarmin, Miranda (2010), (2012), Fort, Haltiwanger, Jarmin, Miranda (2012), Chari, Christiano and Kehoe (2012)
- **This paper**: Differential effect of financial shocks

Real effects of financial shocks

- Mian and Sufi (2011), Gan (2007), Chodorow-Reich (2014)
- **This paper**: Job flows and multiple recessions

Economic Environment

- Time: $t = 0, 1, 2, ...$
- Goods: consumption good (c)
- Assets: capital, riskless bonds
- Technology: $y_{i,t} = z_t \epsilon_{i,t} \left(k_{i,t}^{\alpha} n_{i,t}^{1-\alpha} \right)^{\phi}$
- Agents: households, firms, intermediaries

Identical Households

$$V^H(a,x) = \max_{c,n,a'} \left\{ u\left[c - v(n)\right] + \beta \int V^H(a',x') d\Phi(x'|x) \right\}$$

$$\text{s.t.} \quad c + a' = wn + (1+r)a + \Pi$$

- $x = \{z, \chi, \mu\}$ - aggregate state
  - z - aggregate productivity shock
  - χ - aggregate financial shock
  - μ - distribution of firms over state space

FIRMS

$$V^F(\epsilon, a, x) = \max_{k,n,a'} \int \left\{ \sigma \Lambda' a' + (1-\sigma) V^F(\epsilon', a', x') \right\} d\Phi(x'|x) dG(\epsilon'|\epsilon)$$

$$\text{s.t.} \quad a' = z\epsilon \left(k^\alpha n^{1-\alpha} \right)^\phi - r_k k - wn + (1+r)a$$

$$k \leq \chi a, \quad \chi \geq 1$$

- $x = \{z, \chi, \mu\}$ - aggregate state
- Λ - stochastic discount factor

INTERMEDIARIES

- Sell one-period riskless bonds for r
- Rent out capital for r_k
- Zero-profit condition:

$$r_k = r + \delta$$

EXERCISES

1. Stationary equilibrium
   - $r = const$
   - $\epsilon_{i,t} = \epsilon_i$

2. Transition path after unanticipated shocks z, χ
   - $\epsilon_{i,t} \neq \epsilon_i$
   - endogenous wages
   - $r = const$

Stationary Equilibrium

Households

$$w = v'(n)$$

Intermediaries

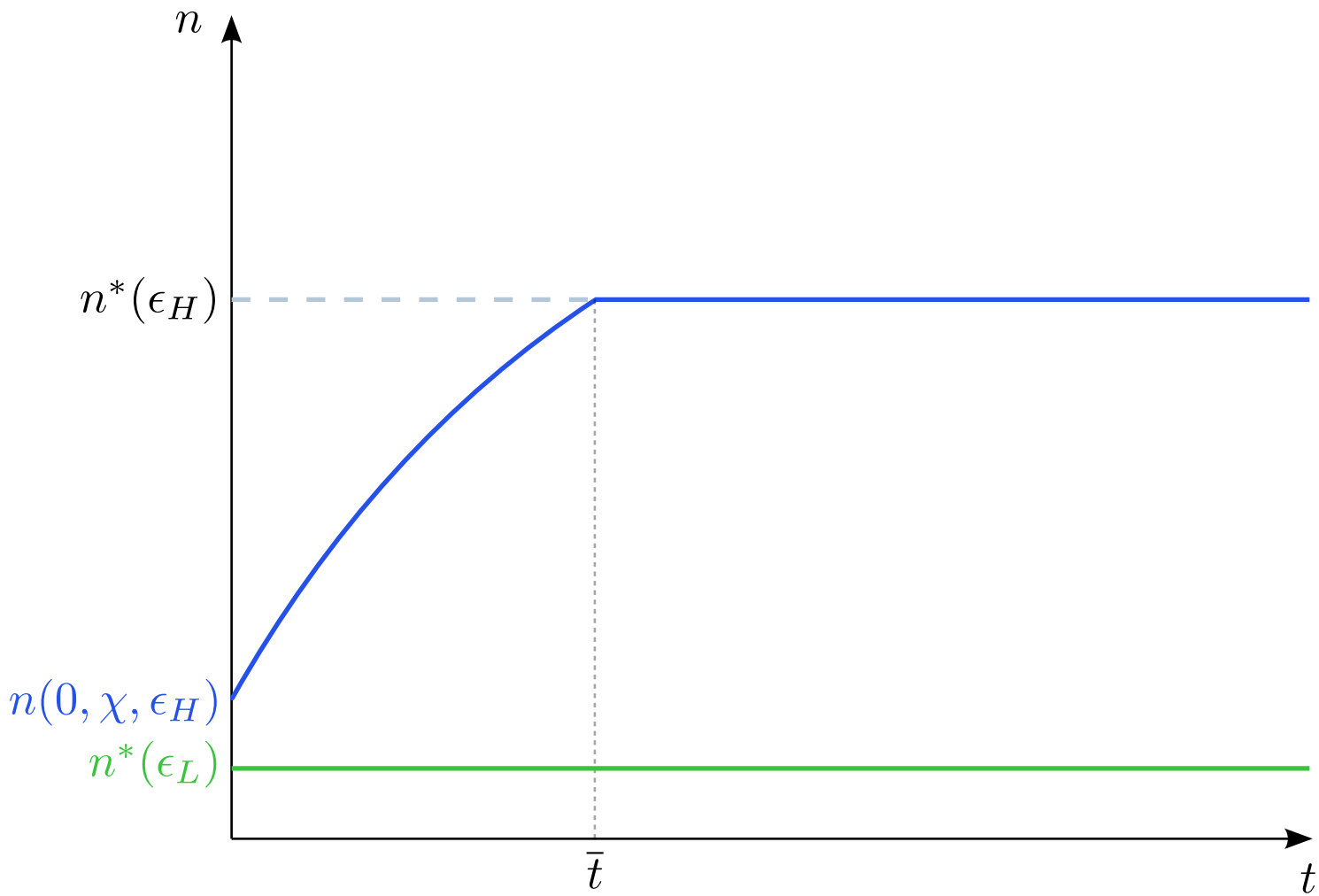
$$r_k = r + \delta$$

Firms

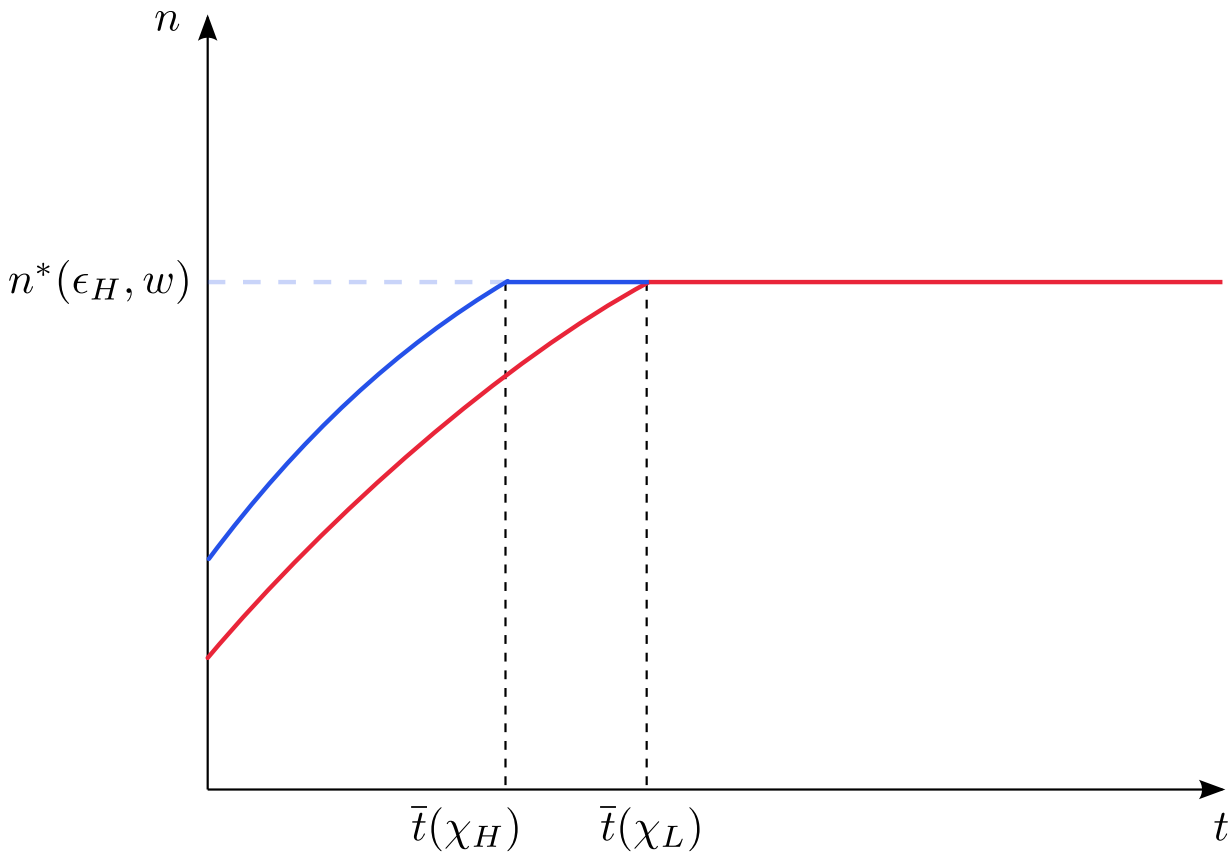
$$MPN = w$$

$$MPK = r_k + \frac{\eta}{\lambda}$$

Firm Life Cycle



Comparative Statics: Financial Shock



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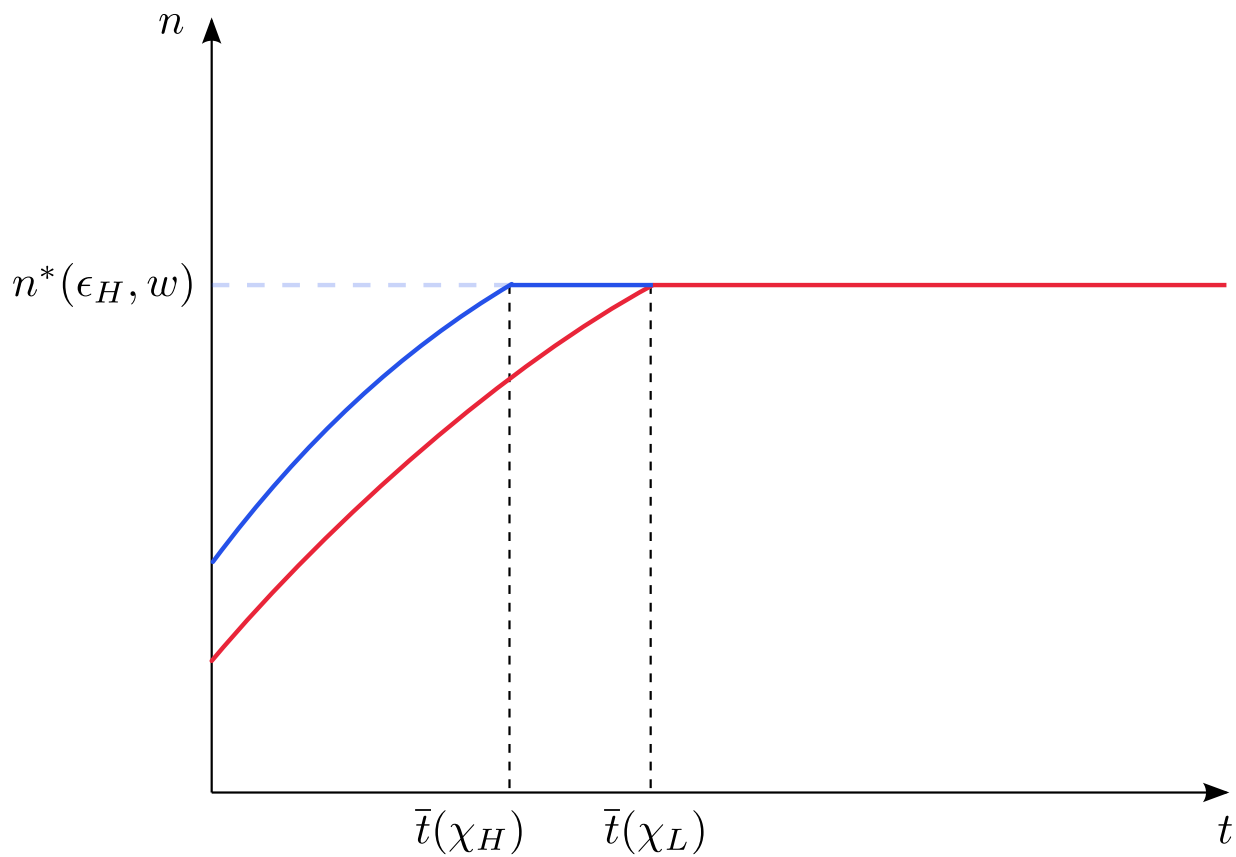

PE: $N(\chi_L, w) < N(\chi_H, w)$, $JD(\chi_L, w) < JD(\chi_H, w)$, $JC(\chi_L, w) < JC(\chi_H, w)$

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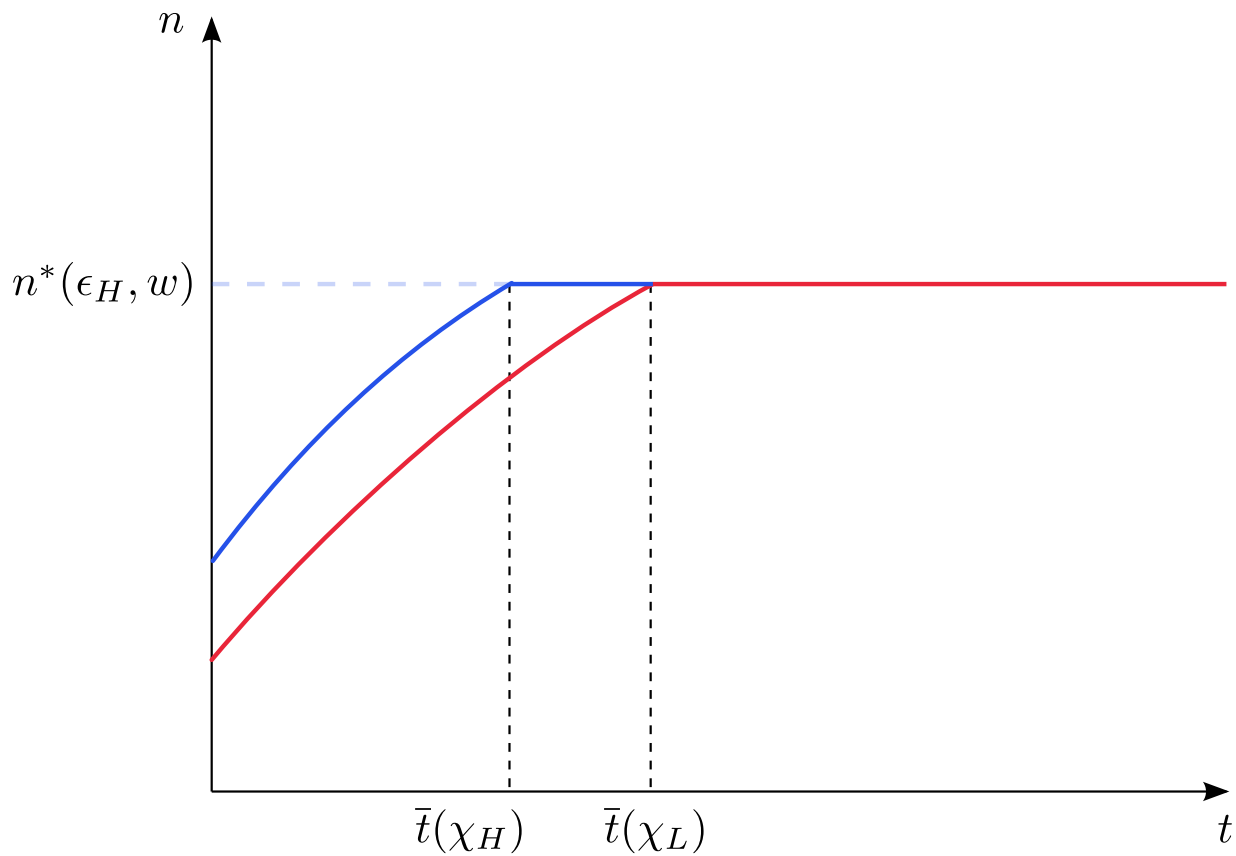


PE: $N(\chi_L, w) < N(\chi_H, w)$, $JD(\chi_L, w) < JD(\chi_H, w)$, $JC(\chi_L, w) < JC(\chi_H, w)$

GE: $N(\chi_L) < N(\chi_H)$, $JD(\chi_L) < JD(\chi_H)$, $JC(\chi_L) < JC(\chi_H)$

Stationary Equilibrium Calibration

Standard calibration

- r, α, δ, ϕ are chosen to match standard moments Parameters

Firm-specific productivity $\epsilon_{i,t} = \bar{\epsilon}_i \cdot \widetilde{\epsilon}_{i,t}$

- Distribution $f(\bar{\epsilon}_i)$ matches size distribution of mature firms employment in BDS, 2000-2006
- $\widetilde{\epsilon}_{i,t}$ is set to match job flows of 15% of employment

Firm exit rates σ

- Approximate empirical age distribution of firms using BDS averages, 2000-2006

Financial parameter χ and initial assets a_0

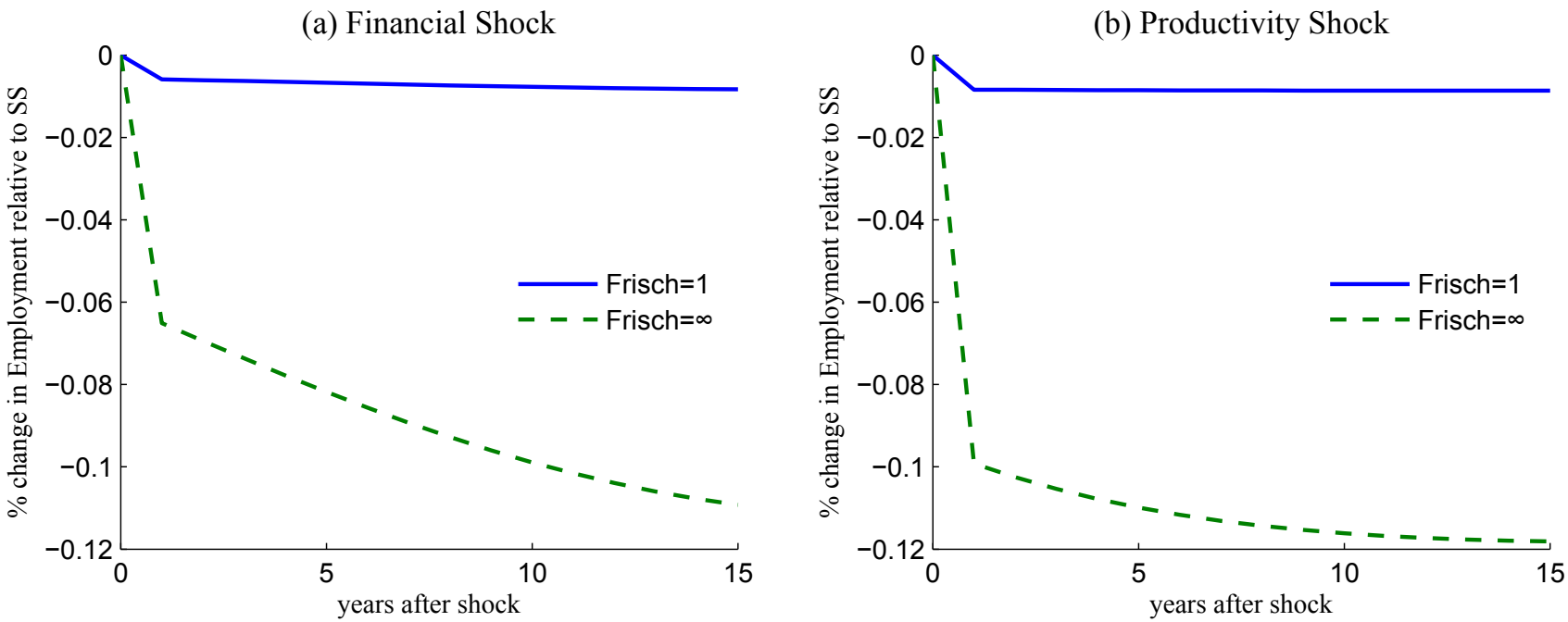
- Target distribution of employment by firm age and firm size

Employment Across Firm Age/Size (%)

	Employment	Job Creation	Job Destruction		Employment	Job Creation	Job Destruction
Panel A: data							
Births	2.8	18.5	0.0	1-19 emps	19.3	28.0	23.0
1-5 years	13.2	16.5	15.7	20-99 emps	17.8	17.5	18.1
6+ years	84.0	65.0	84.3	100+ emps	62.9	54.4	58.9
Panel B: model							
Births	3.0	20.3	0.0	1-19 emps	18.9	33.8	23.4
1-5 years	13.1	15.2	16.5	20-99 emps	22.1	19.7	21.6
6+ years	84.0	64.5	83.5	100+ emps	59.0	46.5	55.0

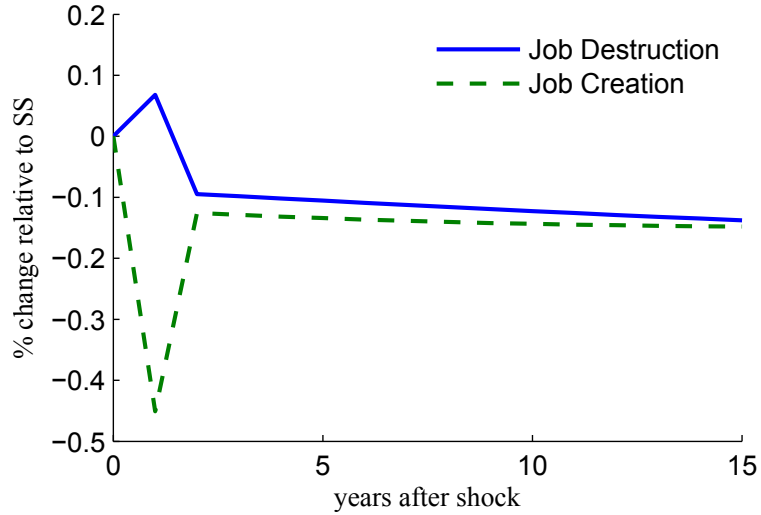
- Vast majority of firms are unconstrained (89%)

Employment Response

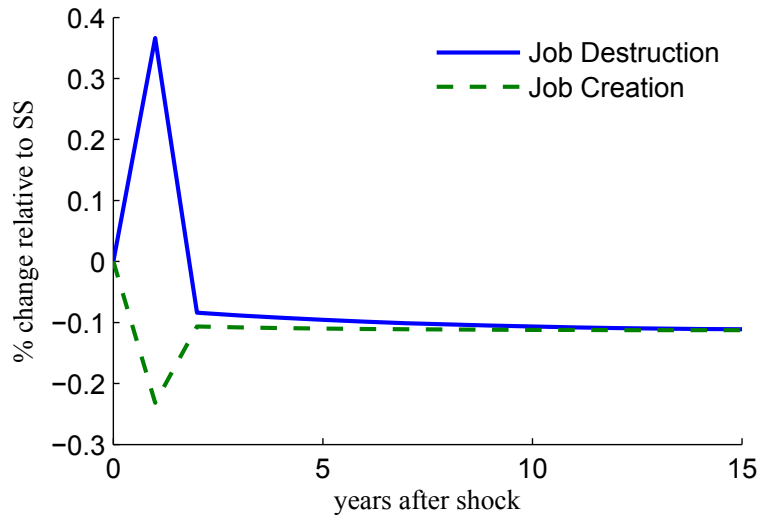


Aggregate Gross Job Flows

(a) Financial Shock (Frisch=∞)



(c) Productivity Shock (Frisch=∞)



Interest Rate Shocks

Aggregate Gross Job Flows

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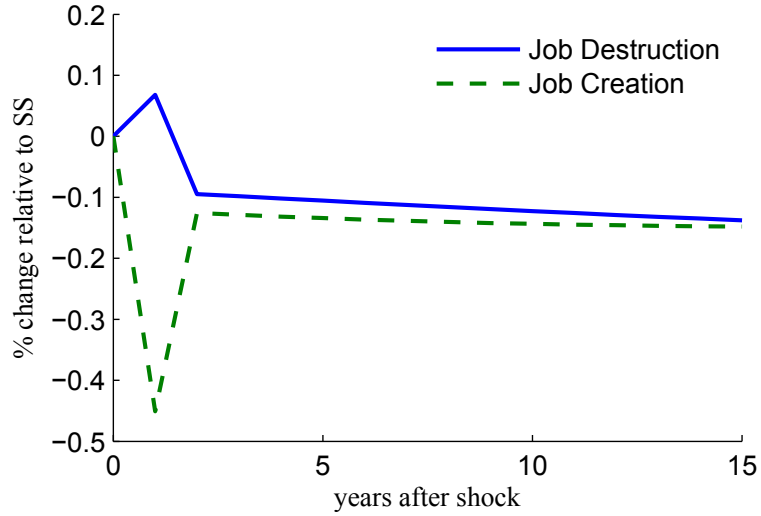
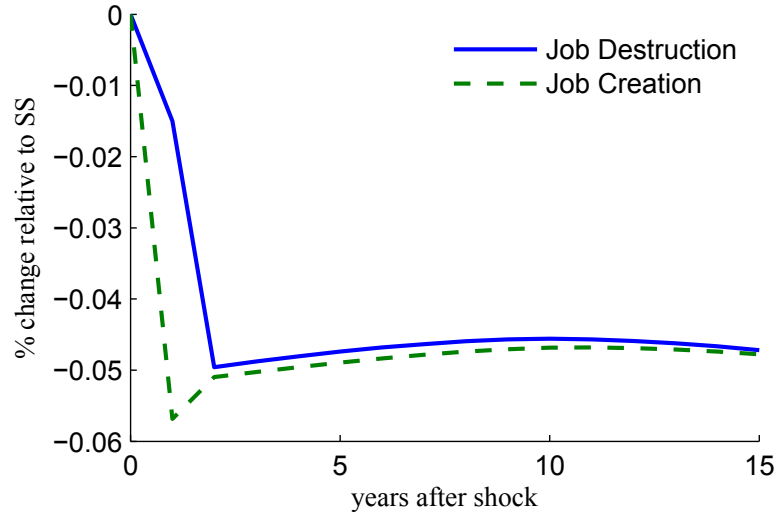
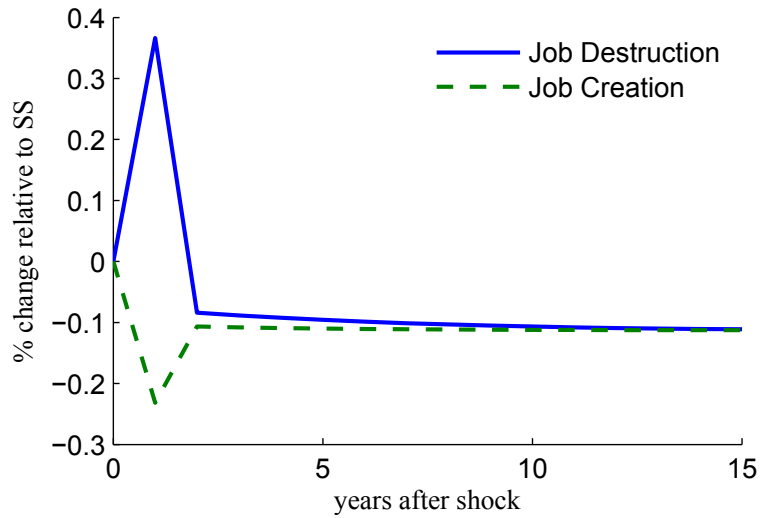


(b) Financial Shock (Frisch=1)



(c) Productivity Shock (Frisch=∞)



(d) Productivity Shock (Frisch=1)

Interest Rate Shocks

Gross Job Flows: Age and Size Effects

		Permanent Financial Shock		Permanent Productivity Shock	
		Frisch = ∞	Frisch = 1	Frisch = ∞	Frisch = 1
Job Creation					
Age	Births	-0.12	-0.07	-0.07	0.00
	1-5 years	-0.47	-0.32	-0.12	0.00
	6+ years	-0.23	0.00	-0.18	-0.01
Size	1-19 emps	-0.07	0.04	-0.06	-0.01
	20-99 emps	-0.33	-0.12	-0.17	0.00
	100+ emps	-0.35	-0.10	-0.21	-0.01
Job Destruction					
Age	1-5 years	-0.07	-0.07	0.02	0.01
	6+ years	-0.04	-0.03	0.07	0.01
Size	1-19 emps	0.00	0.02	0.07	0.01
	20-99 emps	-0.07	-0.07	0.06	0.01
	100+ emps	-0.05	-0.05	0.07	0.01

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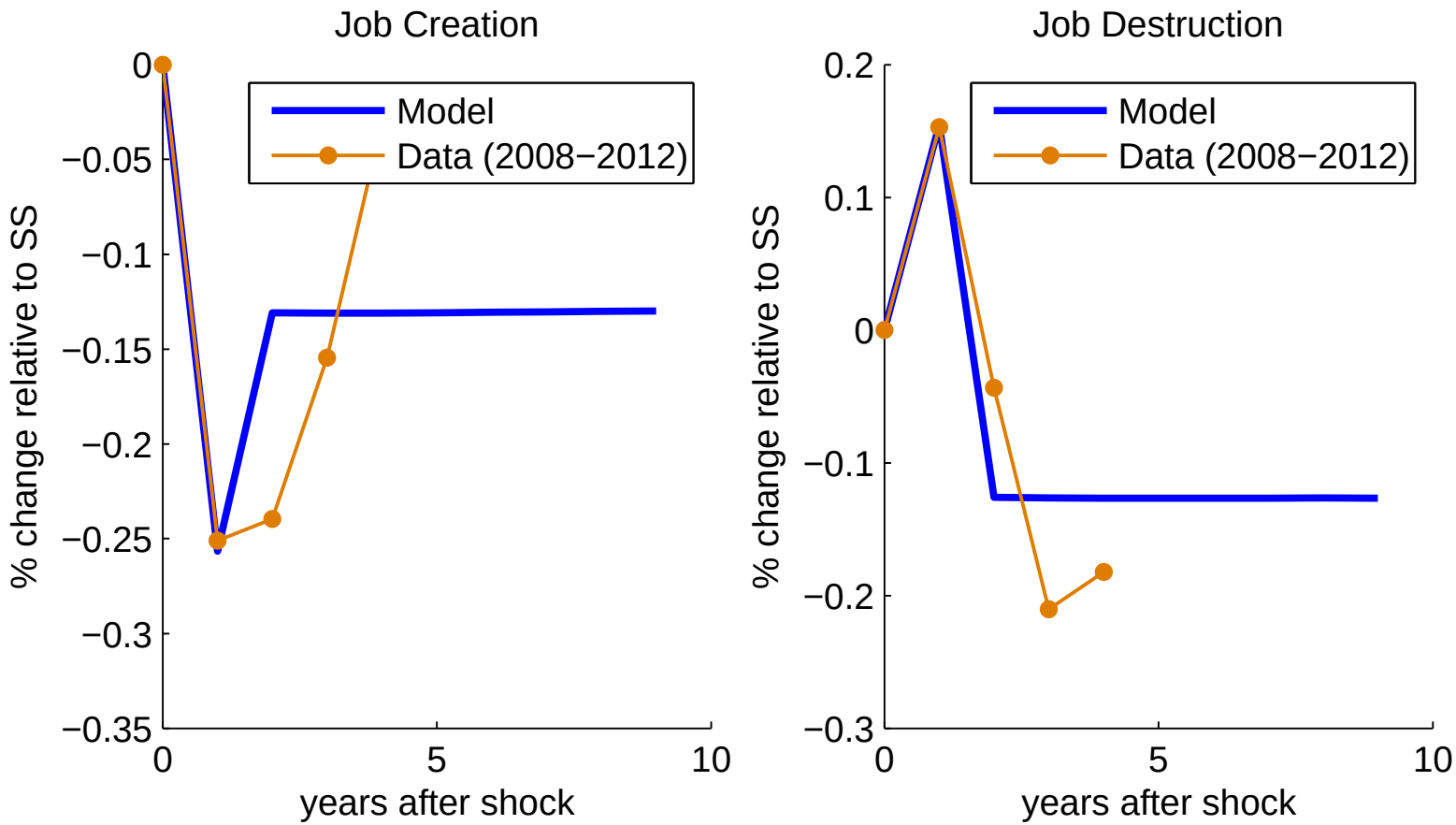
Impulse Response Matching



- $\Delta\chi_t/\chi_{t-1} = -0.33,\ \Delta A_t/A_{t-1} = -0.04$
- 25% fall in employment is due to financial shock

Model v. Data by Age and Size

Empirical Strategy

Effect of financial shocks on job creation and destruction?

$$y_{it} = \beta(L)\Delta hp_{it} + \epsilon_{it}$$
$$y_{it} \in \{\log(JobCreation_{it}),\ \log(JobDestruction_{it})\}$$

Empirical Strategy

Effect of financial shocks on job creation and destruction?

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Financial shocks measure?

- Use housing prices as proxy for shocks to collateral

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Sufficient observations?

- Use MSA-level variation in job flows and housing prices

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Sufficient observations?

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Endogeneity?

Regression Specification and Data

OLS Specification

$$y_{it} = \alpha_i + \delta_t + \gamma(L)\,\Delta cyc_{it} + \beta(L)\,\Delta hp_{it} + \epsilon_{it}$$

Regression Specification and Data

OLS Specification

$$y_{it} = \alpha_i + \delta_t + \gamma(L)\,\Delta cyc_{it} + \beta(L)\,\Delta hp_{it} + \epsilon_{it}$$

Bartik approach

$$\begin{aligned} y_{it} &= \alpha_i + \delta_t + \beta(L)\,\Delta \widetilde{hp}_{it} + \epsilon_{it} && \text{(2nd stage)} \\ \Delta hp_{it} &= \alpha_i + \delta_t + \rho_i(L)\Delta hp_t + u_{it} && \text{(1st stage)} \end{aligned}$$

Regression Specification and Data

OLS Specification

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$$y_{it} = \alpha_i + \delta_t + \beta(L)\,\Delta \widetilde{hp}_{it} + \epsilon_{it} \qquad \text{(2nd stage)}$$
$$\Delta hp_{it} = \alpha_i + \delta_t + \rho_i(L)\Delta hp_t + u_{it} \qquad \text{(1st stage)}$$

Data

- 1982-2011 $\times$ 366 MSAs panel
- job flows (BDS), housing prices (FHFA), personal income (BEA)

Job Creation

	OLS	IV
Δhp_t	0.34**	0.31**
Δhp_{t-1}	0.18**	0.06
Δhp_{t-2}	0.00	0.20**
Sum of coefs	0.53**	0.57**

- Job creation falls on impact after negative shock
- The shock has a persistent effect on job creation

Job Destruction

	OLS	IV
Δhp_t	-0.34**	-0.21
Δhp_{t-1}	0.13**	-0.48**
Δhp_{t-2}	0.29**	0.64**
Sum of coefs	0.09*	-0.05

- Job destruction increases on impact after negative shock
- The shock has a persistent **lagged** effect on job creation

Category-Specific Regressions

OLS regression for category-specific job flows

$$y_{iht} = \alpha_i + \delta_t + \kappa_h + \gamma_h(L)\,\Delta cyc_{it} + \beta_h(L)\,\Delta hp_{it} + \epsilon_{iht}$$

IV regression for category-specific job flows

$$y_{iht} = \alpha_i + \delta_t + \kappa_h + \beta_h(L)\,\Delta \widetilde{hp}_{it} + \epsilon_{iht} \qquad \text{(2nd stage)}$$

$$y_{iht} \in \{\log(JobCreation_{iht}),\ \log(JobDestruction_{iht})\}$$

Job Creation by Firm Age

Categories	OLS	IV
Births	0.88**	0.66**
Young Firms, 1-5 years	0.48**	0.63**
Mature Firms, 5+ years	0.33**	0.31**
H = Births - Mature	0.55**	0.36**

- Job creation by new/young firms decline the most after negative shock

Job Creation by Firm Size

Categories	OLS	IV
1-19 employees	0.37**	0.25**
20-99 employees	0.75**	0.73**
100+ employees	0.58**	0.81**
(20-99 emp) - (1-19 emp)	0.38**	0.49**

- Middle-sized firms are the most sensitive to financial shock

Job Destruction by Firm Age

Categories	OLS	IV
Young Firms, 1-5 years	0.36**	0.20**
Mature Firms, 5+ years	-0.06	-0.19**
H = Young - Mature	0.43**	0.40**

- Job destruction by young firms falls after negative shock
- Job destruction by mature firms increases after negative shock

Job Destruction by Firm Size

Categories	OLS	IV
1-19 employees	-0.10**	-0.34**
20-99 employees	0.28**	0.01
100+ employees	0.13**	0.23**
(20-99 emp) - (1-19 emp)	0.38**	0.35**

- Job destruction by small firms increases after negative shock
- Job destruction by middle-sized and large firms falls after negative shock

New Firms vs. New Establishments (of Existing Firms)

Notation (examples)

- New firm: new independent coffee shop
- New establishment of existing firm: new Starbucks location

Effects of housing price decline

1. Decline in household demand: new firms and new establishments are expected to respond similarly
2. Decline in credit supply to firms: new firms are expected to respond by more than new establishments

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Job Creation

	New Firms		New Establishments of Existing Firms	
	OLS	IV	OLS	IV
Sum of coefs	0.56**	0.47**	-0.11	0.03

Does Construction Sector Drive Results?

Job Creation	All Industries		Ex-Construction	
Categories	OLS	IV	OLS	IV
Young Firms, 1-5 years	0.51**	0.75**	0.32**	0.71**
Mature Firms, 5+ years	0.11	0.41**	0.02	0.29**
H = Young - Mature	0.39**	0.34**	0.29**	0.42**
Job Destruction				
Young Firms, 1-5 years	0.24**	0.49**	0.07	0.47**
Mature Firms, 5+ years	-0.17	-0.30**	-0.15	-0.27**
H = Young - Mature	0.42**	0.79**	0.23**	0.74**

- Age patterns remain after removing job flows from construction
- Results not driven by industry composition effects

Conclusion

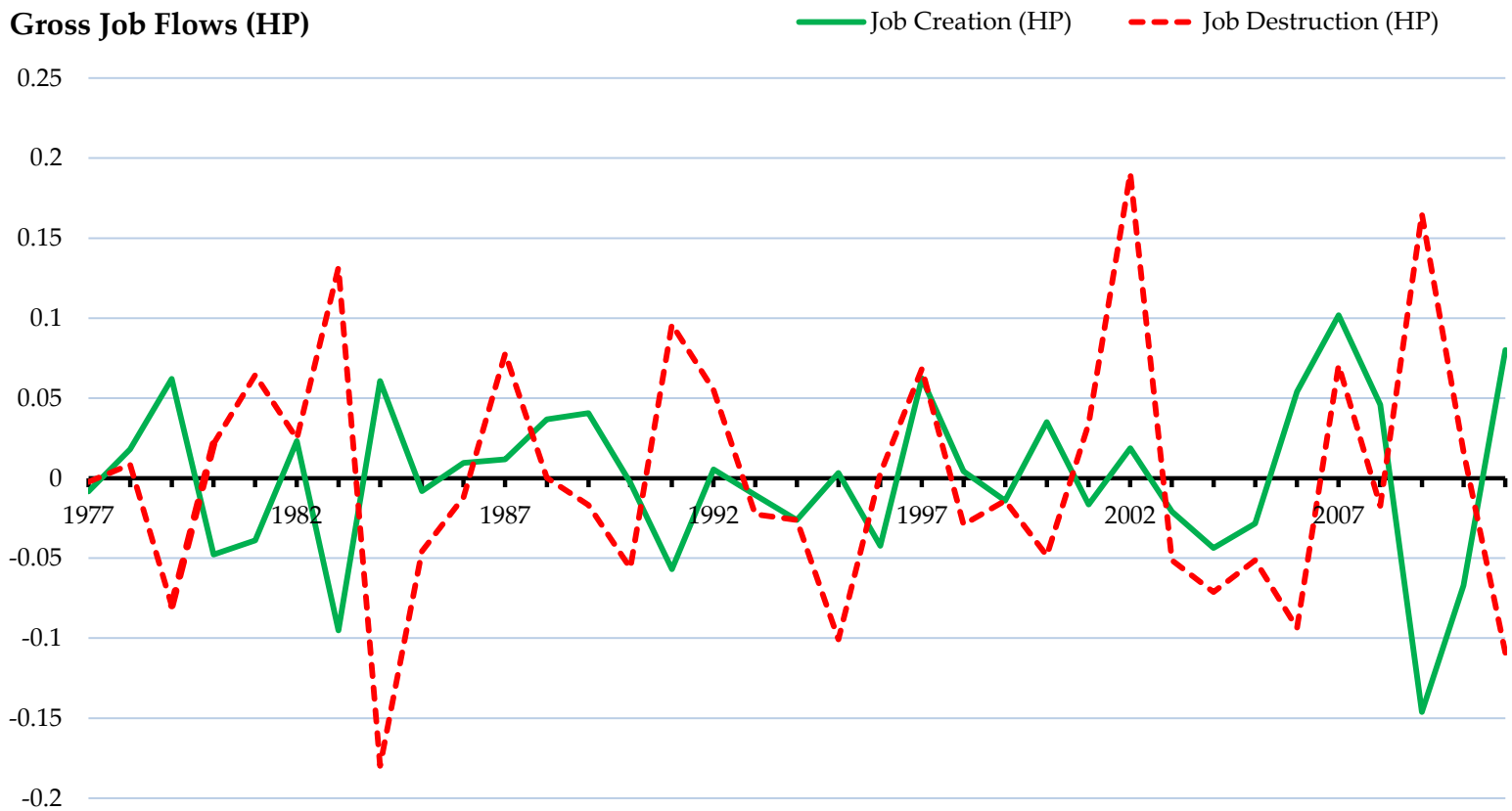
1. *Firm dynamics model*: Effects of financial shocks on job flows

2. *Empirics*: Housing price variations change job flows
   - In line with theoretical model predictions
   - Strongest effects for young and medium-sized firms

3. *Empirics*: New establishments of existing firms do not significantly react to housing price changes while new firms do

Additional Slides

Job Flows (HP)



Source: Business Dynamics Statistics

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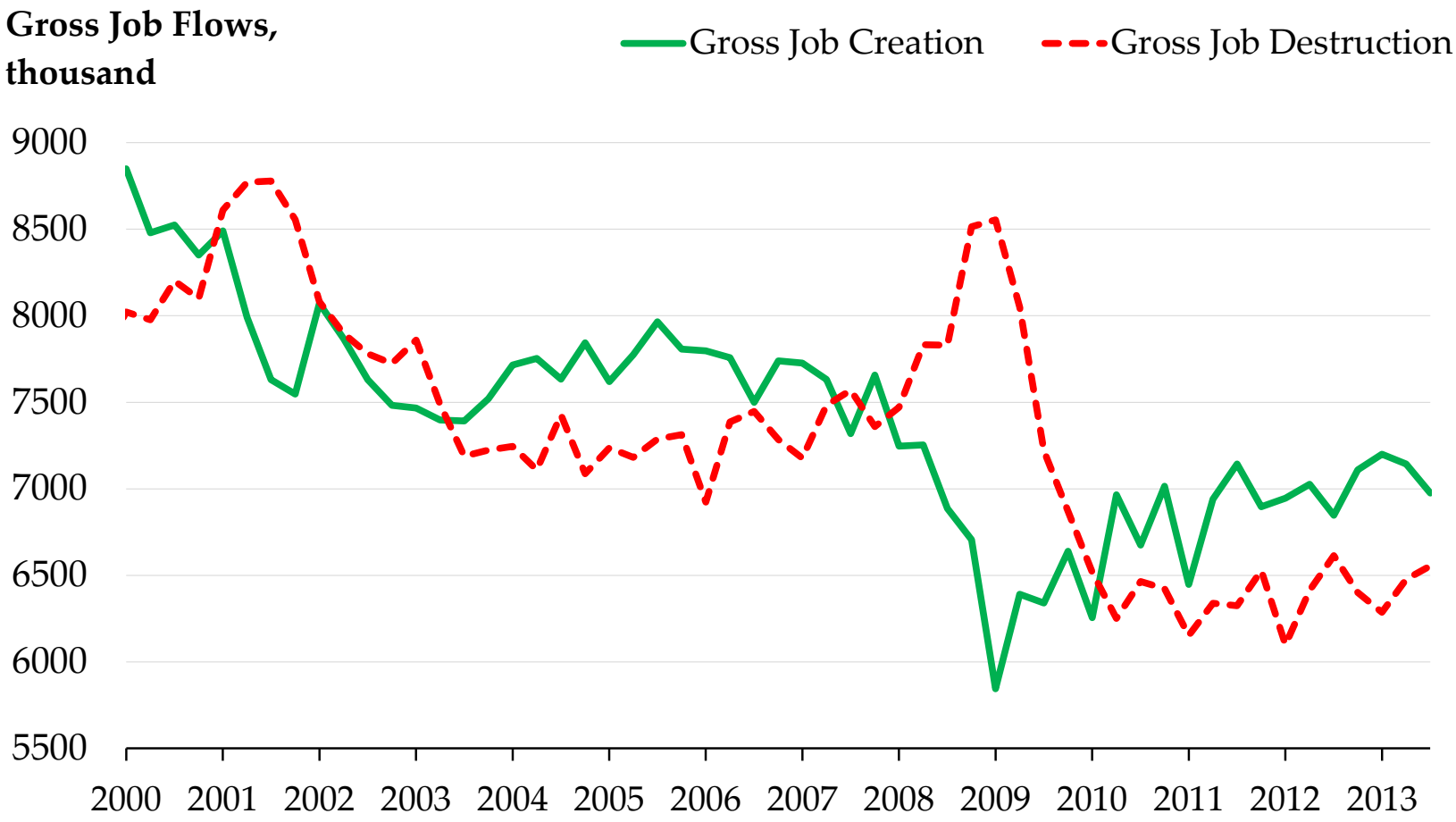
Quarterly Gross Job Flows



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Evidence of Credit Constraints for Small Businesses

- Of firms that had mortgages, 40% used personal real estate as collateral
- Of firms that had credit lines, 62% required collateral, of which 11% was personal real estate

		Firms whose employment . . .			
Percentage of Small Businesses with . . .	All	Expanded	Contracted	Did not Change	New Firms
Use of Personal Credit Card	44%	43%	39%	45%	46%
Use of Business Credit Card	54%	65%	64%	49%	41%
Using Credit Line	**45%**	**65%**	**56%**	**38%**	**28%**
Using Mortgage	**16%**	**22%**	**17%**	**15%**	**13%**
Using Equipment Loan	15%	23%	23%	12%	7%
Request Credit	26%	39%	27%	22%	22%
Median Equity in Residence	$200,000	$250,000	$200,000	$180,000	$140,000

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Recursive Equilibrium Definition

A collection of functions $V^H(a,x), V^F(\epsilon,a,x), c(a,x), a'_H(a,x)$, $n(\epsilon,a,x), k(\epsilon,a,x), a'_F(\epsilon,a,x), w(x), r_k(x), \Gamma(x), \Lambda(x)$ such that

1. households, firms, intermediaries optimize;
2. capital, labor, goods markets clear;
3. Γ: for all Borel $\mathcal{E} \times \mathcal{A} \in \mathbf{R}^+ \times \mathbf{R}^+$

$$\mu'(\mathcal{E} \times \mathcal{A}) = (1-\sigma) \int_{\epsilon' \in \mathcal{E}} \int_{(\epsilon,a) \in \mathcal{B}(x,\mathcal{A})} d\mu(\epsilon,a) dG(\epsilon'|\epsilon) + \sigma \mathbb{1}(a_0 \in \mathcal{A}) G_0(\mathcal{E})$$

where $\mathcal{B}(x,\mathcal{A}) = \{(\epsilon,a) : \pi(x,\epsilon,a) + (1+r(x))a \in \mathcal{A}\}$.

given μ_0.

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Endogenous Entry and Exit

Incumbent

$$V^F(\epsilon, a, x) = \max\Big\{0, -c_F + \max_{k,n,a'} \int \Big[\sigma \Lambda' a' + (1-\sigma) V^F(\epsilon', a', x')\Big] d\Phi(x'|x) dG(\epsilon'|\epsilon)\Big\}$$

$$\text{s.t.} \quad a' = z\epsilon \left(k^\alpha n^{1-\alpha}\right)^\phi - r_k k - wn + (1+r)a$$

$$k \leq \chi a$$

Would-be Firm

$$V^E(\epsilon, a_0, x) = \int V^F(\epsilon', a_0, x') d\Phi(x'|x) dG(\epsilon'|\epsilon)$$

Entry Decision

$$V^E(\epsilon, a_0, x) \geq c_E$$

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CALIBRATION

Aggregate Parameters		Value
Discount rate	β	0.99
Depreciation rate	δ	0.07
Capital share	α	0.3
Decreasing returns	ϕ	0.95
Frisch elasticity	ν	$(0, \infty)$
Persistence of transitory shock	ρ_ϵ	0.6
Size of transitory shock	σ_ϵ	0.025
Initial assets	a_0	8
Collateral constraint	χ	8

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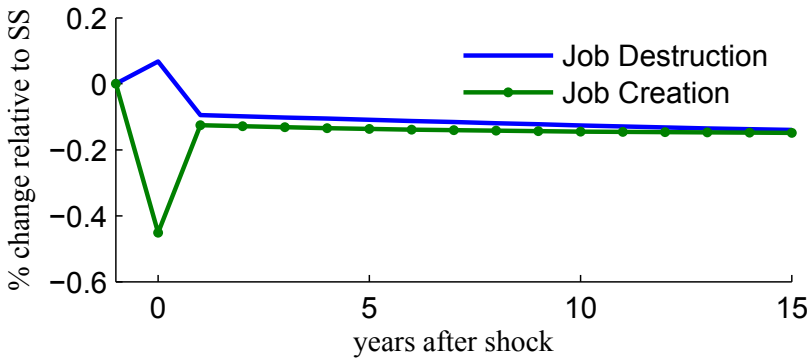
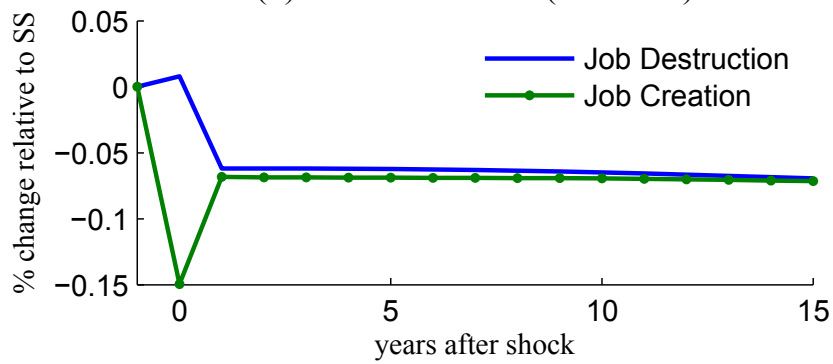
JOB FLOWS WITH INTEREST RATE SHOCKS

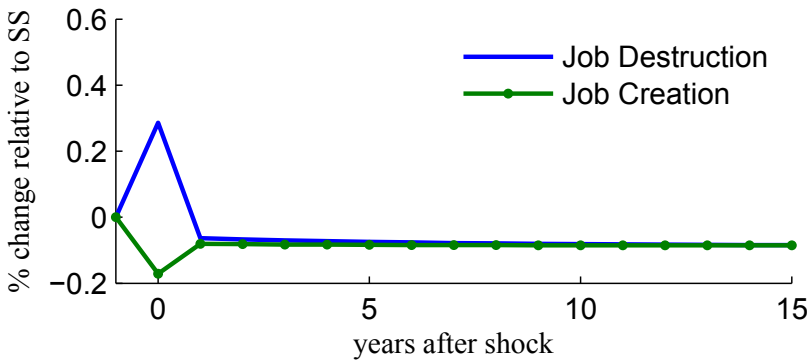
(a) Financial Shock (Frisch=∞)



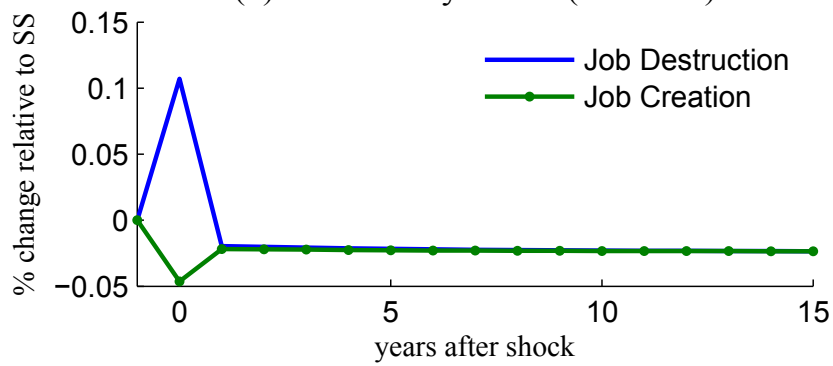
(b) Financial Shock (Frisch=5)



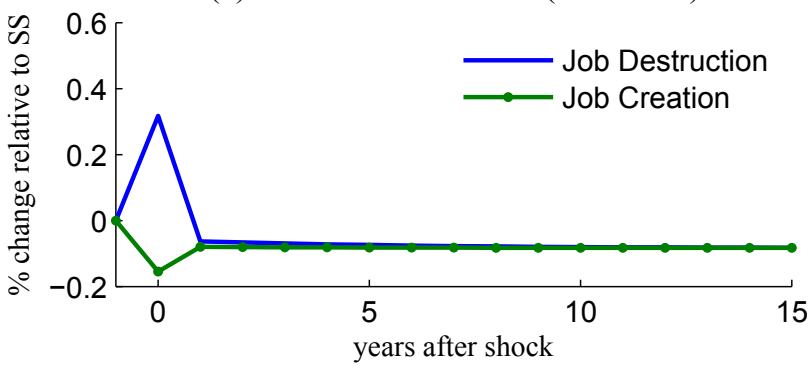
(c) Productivity Shock (Frisch=∞)



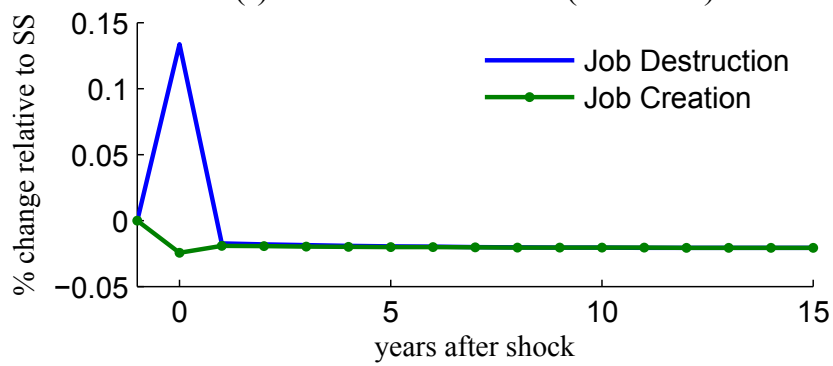
(d) Productivity Shock (Frisch=5)



(e) Interest Rate Shock (Frisch=∞)



(f) Interest Rate Shock (Frisch=5)



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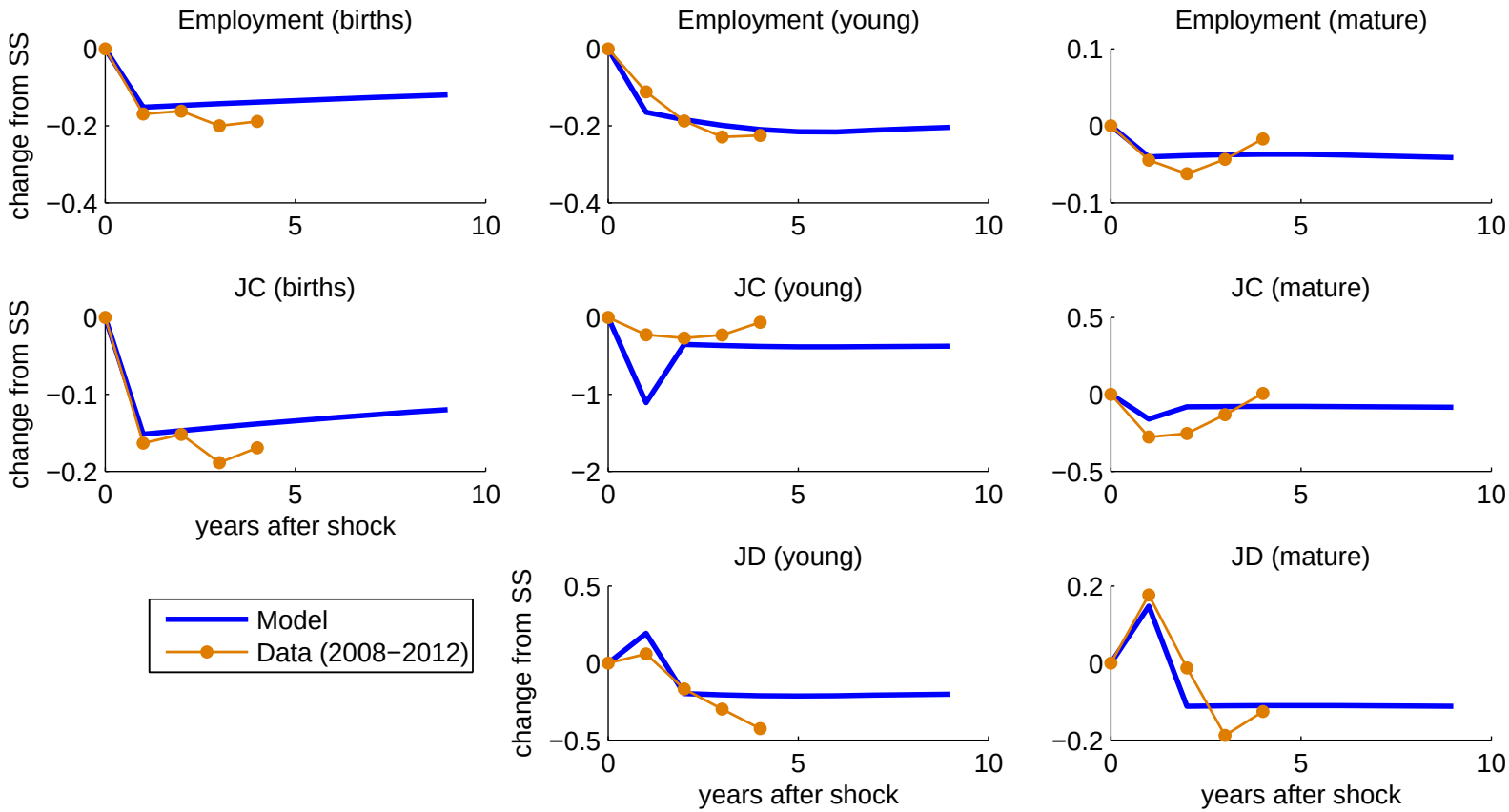
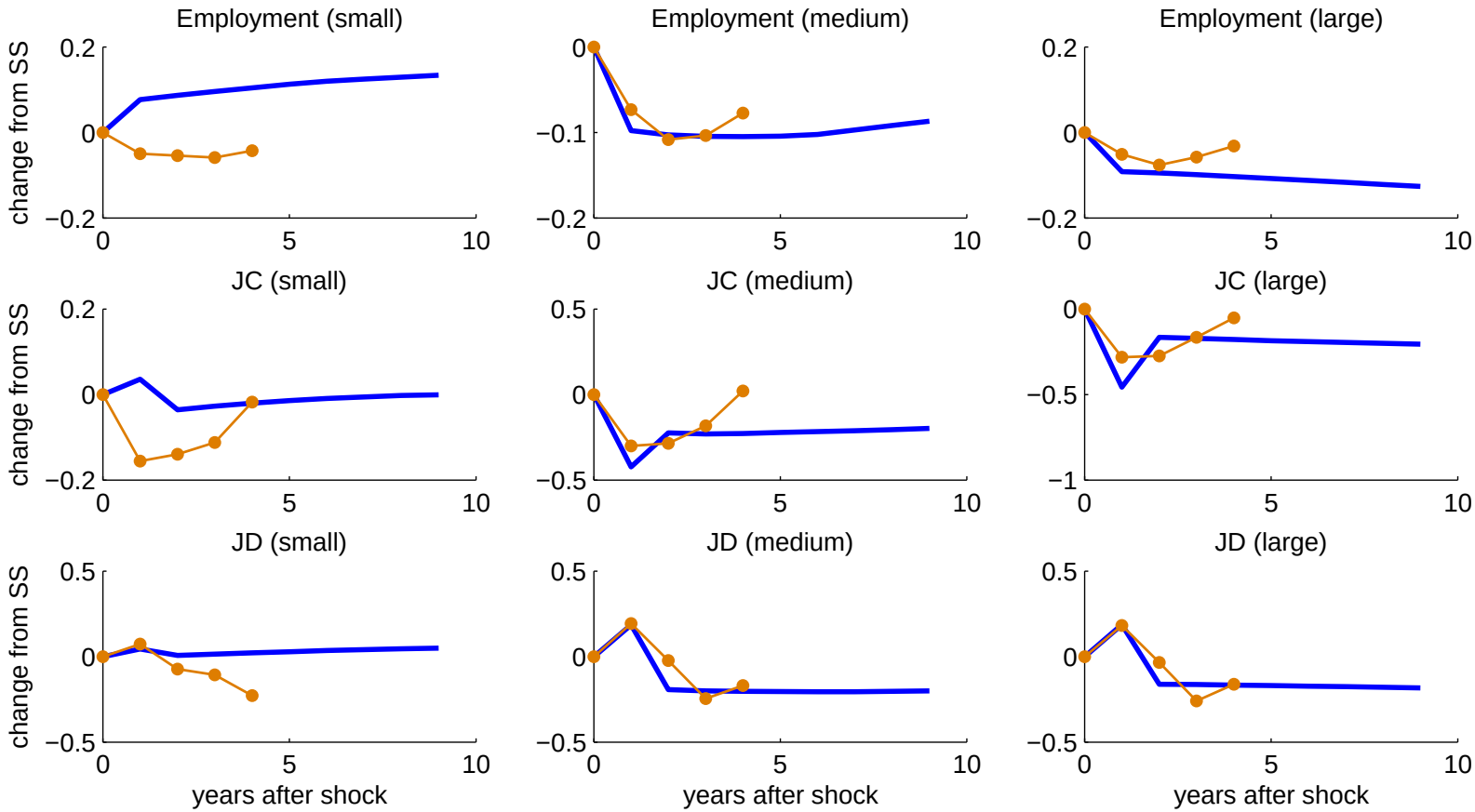
Transition Paths by Firm Age



Transition Paths by Firm Size



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