

Anatomy of a Credit Crunch: from Capital to Labor Markets

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Background and Questions

- Understand macro and firm-level implications of credit crunches
- ① Why do financial crises lead to severe recessions, and sustained rise in unemployment?
 - ▶ Great Depression, 2007-2008 recession (Reinhart and Rogoff, 2009)
 - ▶ Propose theory integrating credit and labor market frictions

Background and Questions

- Understand macro and firm-level implications of credit crunches
 - ① Why do financial crises lead to severe recessions, and sustained rise in unemployment?
 - ▶ Great Depression, 2007-2008 recession (Reinhart and Rogoff, 2009)
 - ▶ Propose theory integrating credit and labor market frictions
 - ② Which type of firms are more strongly affected by credit crunch?
 - ▶ Age/size as indicators financial constraints of firms
 - ▶ Employment growth in small/young businesses falls relative to old/large
- Fort, Haltiwanger, Jarmin and Miranda (2012)
- ▶ Explore role of age and size in the model

Model Economy

- Heterogeneous agents in entrepreneurial productivity and wealth
 - ▶ run an individual specific technology,
 - ▶ work for the wage w_t if employment opportunity,
 - ▶ search for a job and earn subsidy w_t (unemployed).
- Capital expenditures financed by:
 - ▶ internal funds
 - ▶ external funds, subject to collateral constraint (Buera and Shin, 2009)
- Labor market friction:
 - ▶ Walrasian equilibrium with matching frictions (Veracierto, 2009)

Main Results

- Credit crunch \implies reallocation of factors from constrained to unconstrained entrepreneurs
 - ▶ Reduction in TFP (misallocation)
 - ▶ Increase in unemployment, as reallocation is mediated by labor friction
- Reallocation process well captured by firm age and size:
 - ▶ small/young businesses: more likely to be constrained, higher return to K
 - ▶ net employment growth falls relative to old/large entrepreneurs
- Aggregate TFP shock has no effect on unemployment (flexible prices)

Literature Review

- Financial frictions and business cycles: Kiyotaki Moore (1997), Bernanke and Gertler (1989)
 - ▶ credit frictions and amplification of aggregate shocks
- Credit shocks and macroeconomic dynamics: Jermann and Quadrini (2009)
 - ▶ representative agent model, explicitly model debt and equity financing
- Credit Shocks and Heterogeneous Agents: Khan and Thomas (2013), Lorenzoni and Guerrieri (2011), Zettlin-Jones and Shourideh (2012), Buera and Moll (2012)
 - ▶ frictionless labor markets
- Cyclical behavior of firms: Gilchrist and Gertler (1994); Chari, Christiano and Kehoe (2007); Moscarini Postel-Vinay (2012); Fort, Haltiwanger, Jarmin and Miranda (2012)

Worker (and Unemployed)'s Problem

$$v_t^W(a, z) = \max_{c, a' \geq 0} u(c) + \beta \mathbf{E} [v_{t+1}(a', z')]$$

$$c + a' = w_t + (1 + r_t) a - \tau_t$$

- full insurance against unemployment risk
- Lump-sum taxes τ_t financing unemployment subsidies
- continuation value: $v_{t+1}(a', z') = \max \{ v_{t+1}^W(a', z'), v_{t+1}^E(a', z') \}$

Entrepreneur's Problem

$$v_t^E(a, z) = \max_{c, k, l, a'} u(c) + \beta \mathbf{E} [v_{t+1}(a', z')]$$

$$a' + c = A_t z k^\alpha l^\theta - w_t l - (r_t + \delta) k + (1 + r_t) a - \tau_t$$

$$k \leq \lambda_t a$$

- Time series for λ_t and $A_t \implies$ non-stationary problem

Process of Entrepreneurial Productivity

$$z' = \begin{cases} z & \text{w/ prob. } \psi \\ \xi & \text{w/ prob. } 1 - \psi \end{cases}$$
$$\xi \stackrel{iid}{\sim} \eta \xi^{-\eta-1}, \quad \xi \geq 1$$

- Stationary CDF of productivity: $\mu(z) = 1 - z^{-\eta}$.

Description of Labor Market Friction

- workers hired in centralized, competitive labor market
- Friction: only a fraction of unemployed matched to hiring markets
- Wages adjust to equalize demand and supply in hiring market
- it takes time for fired, unemployed, agents to match with the centralized hiring market

▶ FM ▶ matching

Mechanics of Labor Market Friction

- M_t unemployed workers matched to the hiring market ▶ matching

$$M_t = \gamma (U_t + JD_t)$$

- evolution of unemployment

$$U_{t+1} = U_t - M_t + JD_t$$

Competitive Equilibrium

Given $G_0(a, l_{-1}, z)$ and a sequence $\{\lambda_t\}_{t=0}^{\infty}$, a competitive equilibrium consist of sequences of distributions $\{G_t(a, l_{-1}, z)\}_{t=1}^{\infty}$, allocations, lump-sum taxes, unemployment, and prices $\{w_t, r_t\}_{t=0}^{\infty}$ such that:

- Allocations solve individuals' problem given prices
- Government budget is balanced, $\tau_t = w_t U_t$
- Capital and hiring markets clear

$$\int k_t(a, , z) G_t(da, dl_{-1}, dz) = \int a G_t(da, dl_{-1}, dz)$$

$$\int l_t(a, z) G(da, dl_{-1}, dz) + U_{t+1} = L$$

- Unemployment evolves according to

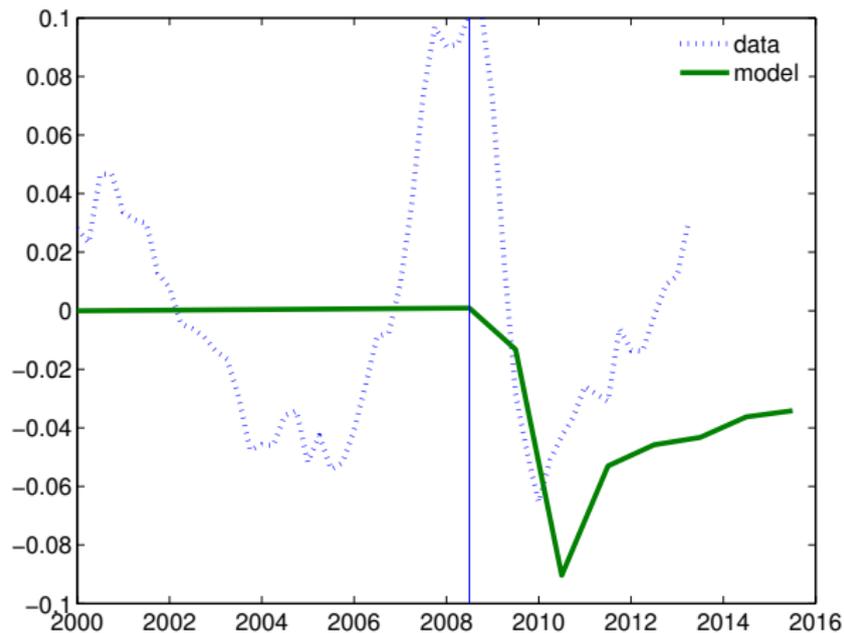
$$U_{t+1} = U_t - M_t + JD_t$$

- The joint distribution $G_t(a, l_{-1}, z)$ evolves according to the equilibrium mapping...

Calibrating Preference and Technologies

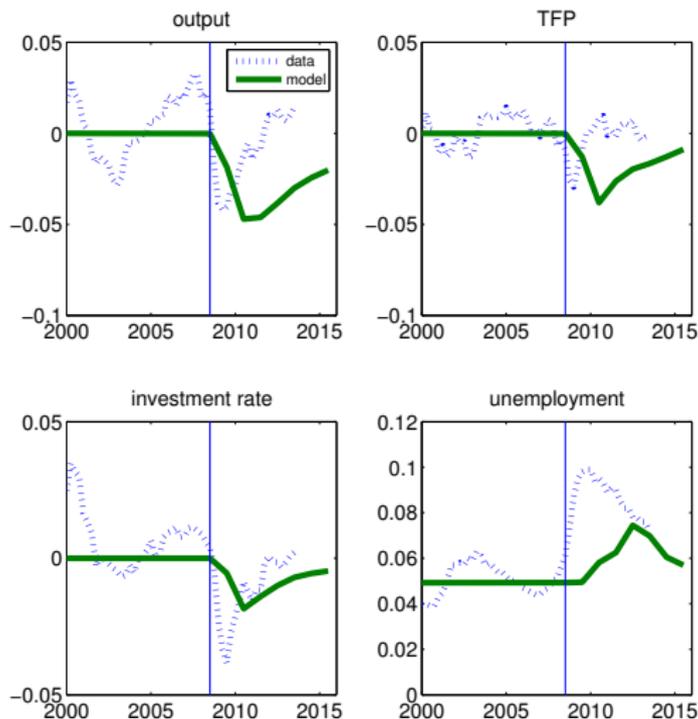
	US data	Model	Parameter
Top 10 % Employment	0.69	0.69	$\eta = 5.25$
Top 5% Earnings Share	0.30	0.30	$\alpha + \theta = 0.79$
Establishment Exit Rate	0.10	0.10	$\psi = 0.89$
Real Interest Rate	0.04	0.04	$\beta = 0.91$
Unemployment Rate	0.05	0.05	$\gamma = 0.67$
Credit to Non-Financial Assets	0.70	0.70	$\lambda = 7.5$

Calibrating the Credit Crunch: External Finance / Capital

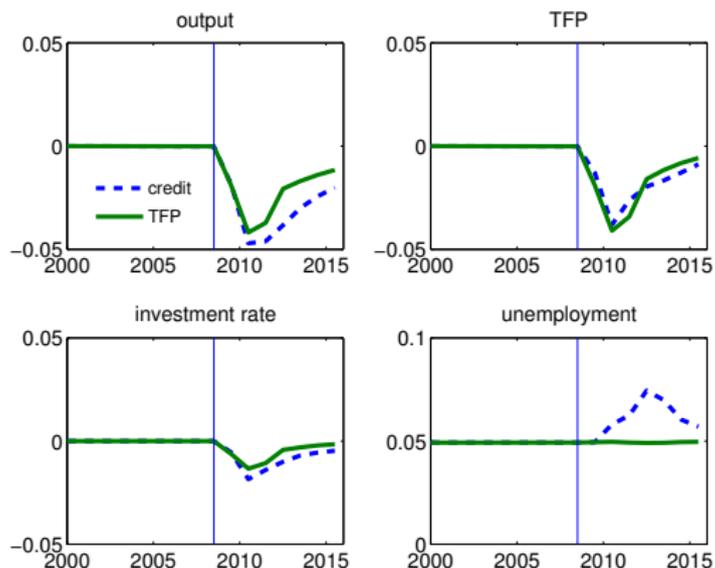


MACRO IMPLICATIONS

Aggregate Implications

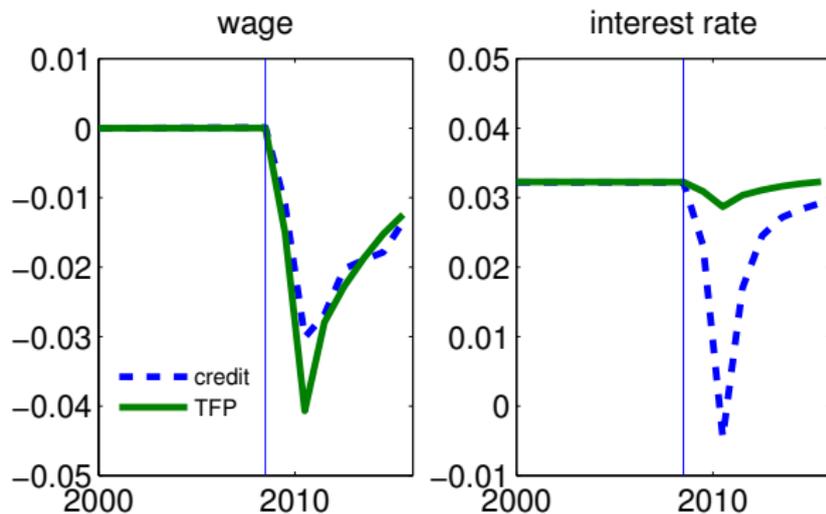


Comparison to an Exogenous TFP Shock

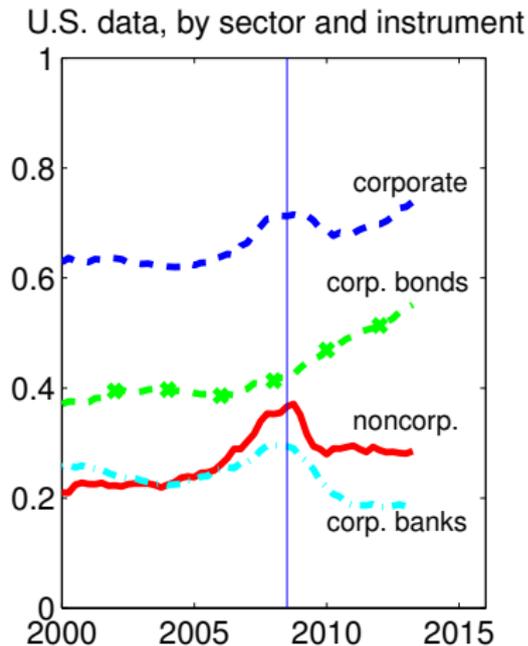
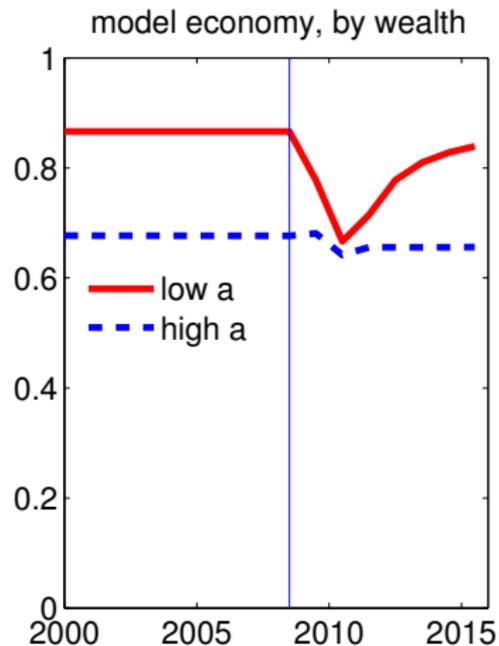


- Re-allocative nature of credit shock key for unemployment

Comparison to an Exogenous TFP Shock: Prices



Reallocating External Finance



MICRO-IMPLICATIONS CREDIT CRUNCH

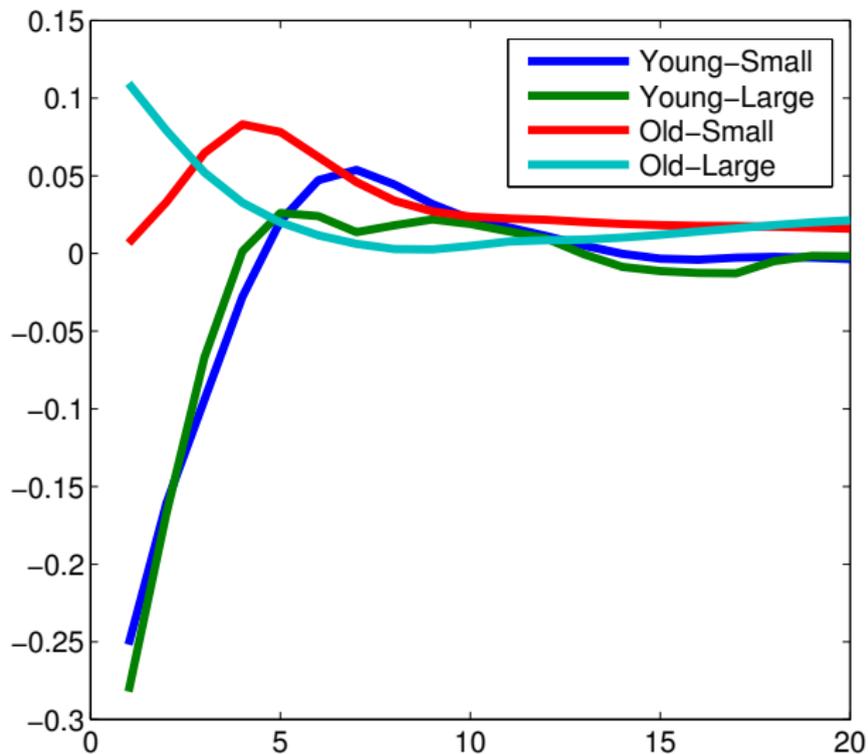
Steady State Properties of Firm Age-Size Distribution

- Small/large: median employment of employment based distribution
- Young/old: 5 years since entry (Fort, Haltiwanger, et.al. 2012)

Table: Statistics from Steady State Age-Size Distribution

	Fraction Unconstr Entrepreneur	Fraction of Total Employment	Av. Prod.	Av. Wealth	Av Rate of Return	Net Empl. Growth Rate
YS	0.06	0.14	0.59	1.5	0.15	0.42
YL	0.14	0.05	1.18	30.49	0.095	0.28
OS	0.46	0.30	0.57	3.98	0.046	-0.10
OL	0.96	0.51	1.17	100.79	0.042	-0.12

Employment Dynamics by Firm Age/Size



Conclusions

- A credit crunch reallocates credit, capital, and labor, i.e., reallocation shock (\neq TFP shock).
- Matching frictions \Rightarrow reallocation results in protracted rise in unemployment.
- Age/size of firm good predictor of likelihood of being financially constrained
- Labor gets reallocated from small/young to large old/businesses

BACKUP SLIDES

Financial Market

- Competitive financial intermediaries:

- ▶ issue bonds with return r_t
- ▶ accumulate capital

$$K_{t+1} = (1 - \delta)K_t + I_t$$

- ▶ rent capital at rate $r_t + \delta$ to entrepreneurs subject to rental limit

$$k \leq \lambda_t a$$

(isomorphic decentralization where entrepreneurs own capital and issue debt)

▶ LMdesc

Calibrating the Credit Crunch: External Finance / Capital

▶ calib

- model

$$\frac{\overbrace{\int \max \{k_t(a, z) - a, 0\} G_t(da, dz)}^{\text{external finance}}}{K_t}$$

(= $1 - 1/\lambda_t$, if all entrepreneurs are constrained)

- data (non-corporate business sector)

$$\frac{\text{credit market instruments}}{\text{non-financial assets (historical cost)}}$$

Frictional Labor Market

- M_t unemployed workers matched to the hiring market ▶ LM ▶ LMdesc

$$M_t = \gamma U_t^\phi V_t^{1-\phi}$$

where

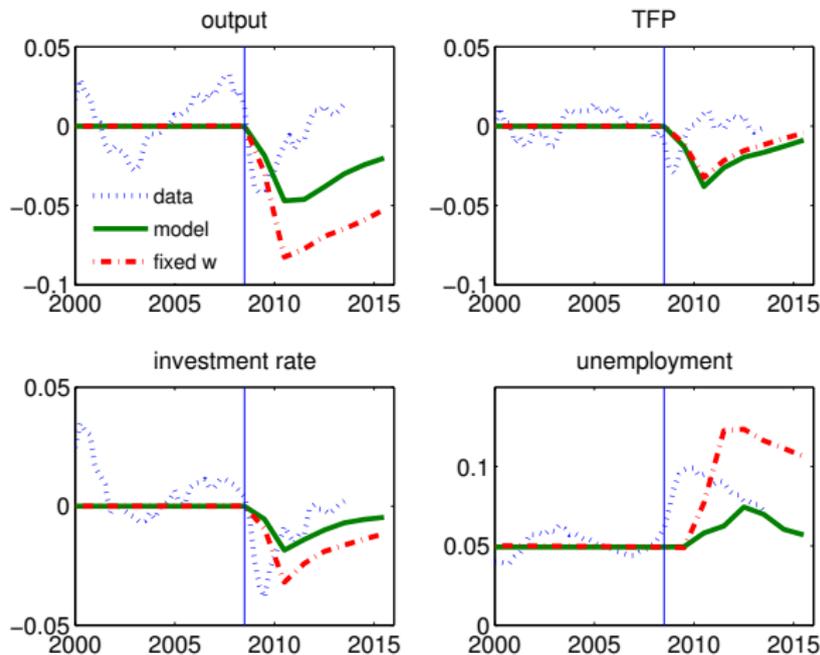
$$V_t = vJC_t \text{ (aggregate hiring investment)}$$

- evolution of unemployment

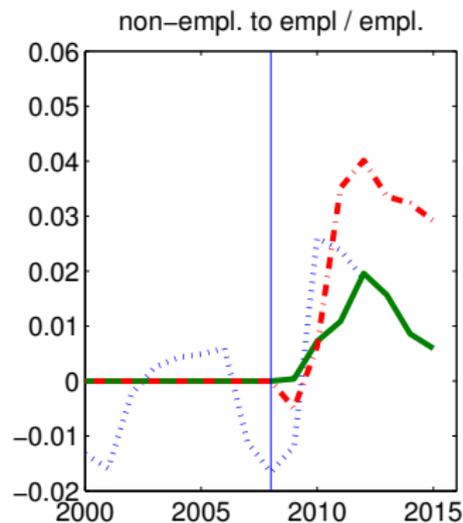
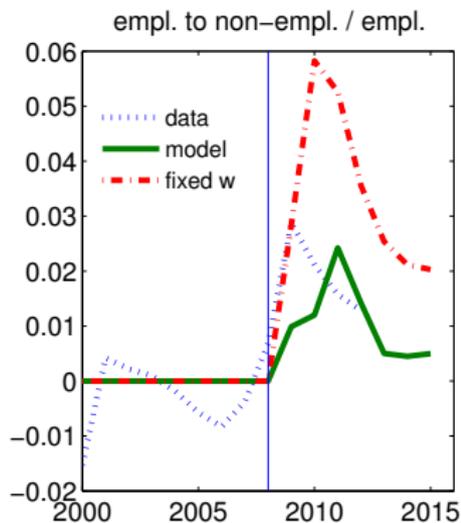
$$U_{t+1} = U_t - M_t + JD_t$$

- Veracierto (2009)

Aggregate Implications of Crunch with Rigid Wages (Shimer, 2012)



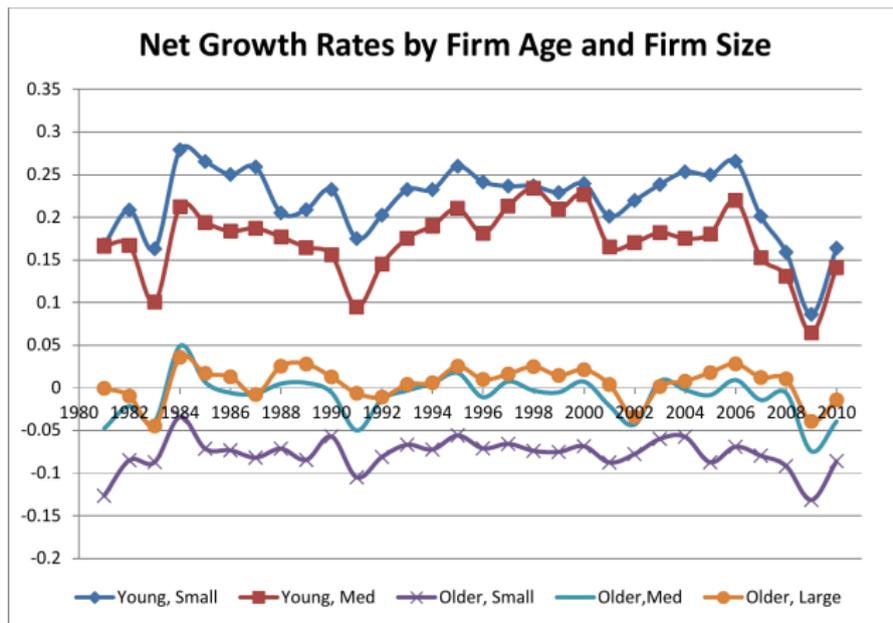
Worker Flows: Flexible vs Rigid Wages



► flexW

Net Employment Growth Rates by Age-Size: The Data

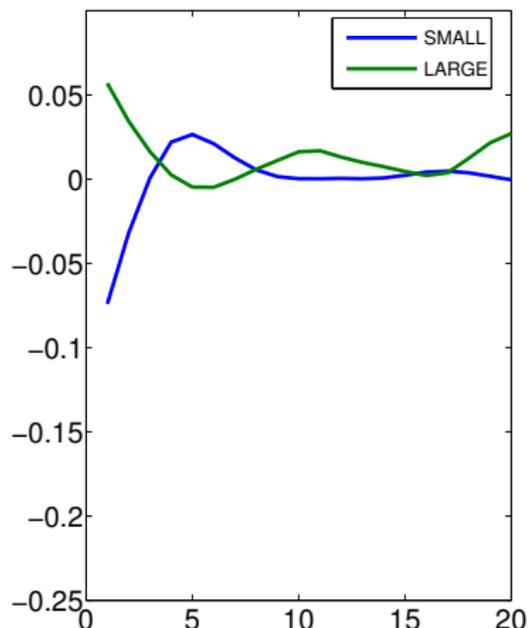
Figure 2



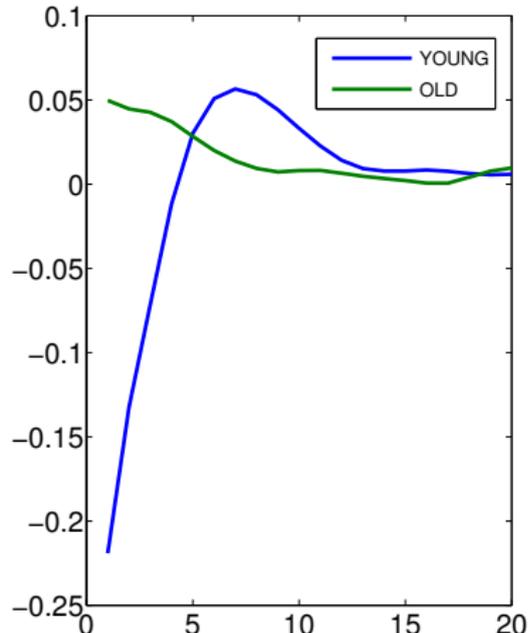
● Source: Fort, Haltiwanger, Jarmin and Miranda (2012)

Are Age and Size Independently Informative?

Net Employment Growth By Size, relative to SS



Net Employment Growth By Age, relative to SS



- Size and Age alone can capture underlying reallocation
- Size results consistent with Girchrist and Gertler (1994); Chari, Christiano and Kehoe (2007)

Implementation Micro-Implications

- ① Given SS equilibrium objects: (wealth accumulation decisions, occupation choices, prices)
 - ① Simulate stationary economy forward. 500,000 agents
 - ② Construct empirical age-size distribution
 - ③ Compute Job Creation and Destruction Rates, and other statistics
- ② Given Equilibrium objects along crunch, and SS age-size distribution:

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- Macro and Firm-level Implications of financial crises:
 - ① Severe contraction, sustained rise in unemployment
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 - ▶ Reinhart and Rogoff, (2009), Fort, Haltiwanger, Jarmin and Miranda (2012)

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 - ▶ Reinhart and Rogoff, (2009), Fort, Haltiwanger, Jarmin and Miranda (2012)
- Propose model with credit and labor market frictions to understand:
 - ▶ interaction between credit shocks and labor frictions for macro variables
 - ▶ role of firm age and size for transmission of credit shock
 - ▶ comparison of implications from TFP shocks