Inflation Dynamics During the Financial Crisis

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Motivation

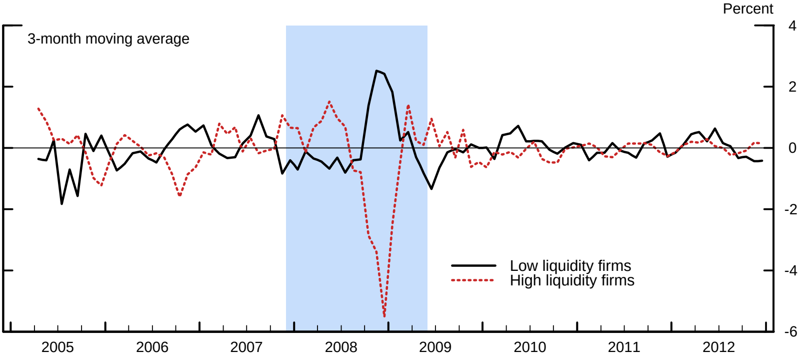
- In spite of massive contraction in economic activity during the 2008-2009 financial crisis, the general level of prices has remained surprisingly stable.
- Can financial factors account for the absence of deflationary pressures in light of the enormous resource slack in the economy?
- Intuition: In a customer-markets model with financial frictions, firms have the incentive to raise prices to increase cash flow at the cost of future market share (Gottfries [1991]; Chevalier and Scharfstein [1996]).

DATA SOURCES

- Monthly good-level price data underlying the PPI.
  (Nakamura & Steinsson [2008]; Goldberg & Hellerstein [2009]; Bhattarai & Schoenle [2010])
- Match 584 PPI respondents to their income and balance sheet data from Compustat.
- Sample period: Jan2005–Dec2012

Relative Inflation

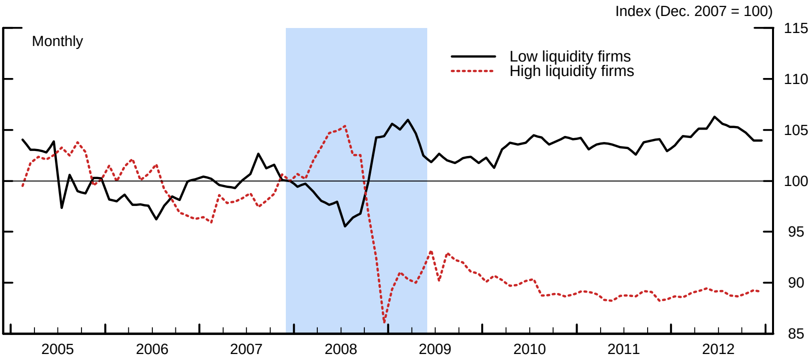
Financially unconstrained vs constrained firms



Note: Weighted average monthly inflation relative to industry (2-digit NAICS) inflation.

Relative Inflation

Effect of Financial Frictions, Cumulated Response



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Price Adjustment and Firm Characteristics

- Multinomial logit specification:

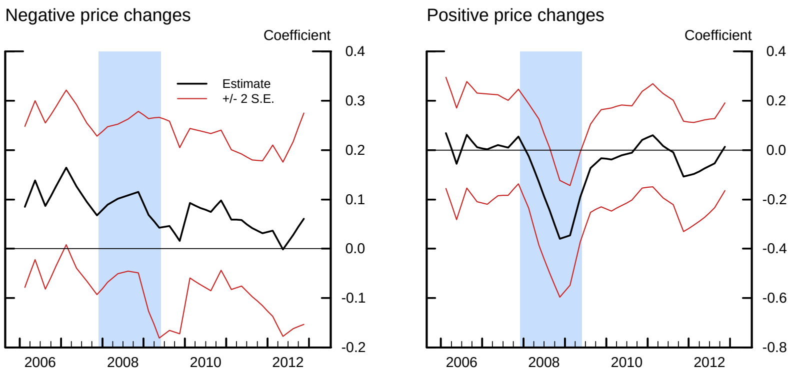
$$\Pr(p_{i,j,t+3} - p_{i,j,t}) = \begin{cases} + & \\ 0 & \text{(base)} \\ - & \end{cases} = \Lambda(\mathbf{X}_{jt}; \boldsymbol{\beta}_t)$$

- Price change regression:

$$log(p_{i,j,t+3}) - log(p_{i,j,t}) = \beta X_{j,t} + \epsilon_{i,j,t+3}$$

- $\mathbf{X}_{jt}$ = liquidity ratio and other controls.
  - Includes fixed time effects and 3-digit inflation.
  - Estimated using four-quarter rolling window.

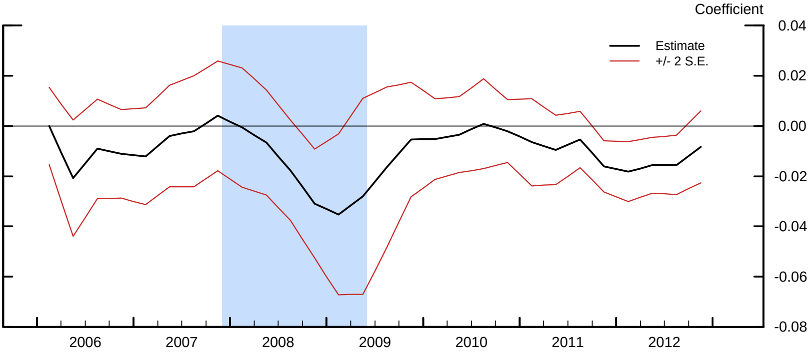
PROBABILITY OF PRICE CHANGE
Marginal effect with respect to liquidity ratio



- Quantitative implication: a two std. dev. reduction in liquidity implies a 33% higher probability of a price increase.

Inflation

Marginal effect with respect to liquidity ratio



- Quantitative implication: A two std. dev. reduction in liquidity implies a 5% increase in annualized inflation.

- Demand for monopolistically competitive good:

$$c_{it} = \left(\frac{p_{it}}{\tilde{p}_t}\right)^{-\eta} s_{i,t-1}^{\theta(1-\eta)} c_t$$

where

$$s_{it} = \rho s_{i,t-1} + (1-\rho) c_{it}$$

- Firms are forward looking – set low price today to build future stock of customer base.

Financial Frictions

- Firms make production decision prior to realization of cost:

$$y_{it} = \left(\frac{h_{it}}{a_{it}}\right)^{\alpha} - \phi_k$$

- If realized operating income is negative, firms must raise costly equity finance:
  - $\varphi \in (0, 1) =$ constant per-unit dilution costs of new equity
- Setting a low price exposes the firm to the risk of operating losses, which must be covered by external financing.

Log-Linearized Phillips Curve

New Keynesian model with cost channel

$$\hat{\pi}_t = -\frac{\omega(\eta-1)}{\gamma_p}\left[\hat{\mu}_t + \mathbb{E}_t \sum_{s=t}^{\infty} \chi \tilde{\delta}^{s-t+1} \hat{\mu}_{s+1}\right] + \beta \mathbb{E}_t[\hat{\pi}_{t+1}]$$
$$+\frac{1}{\gamma_p}\left[\eta - \omega(\eta-1)\right] \mathbb{E}_t \sum_{s=t}^{\infty} \chi \tilde{\delta}^{s-t+1}\left[(\hat{\xi}_t - \hat{\xi}_{s+1}) - \hat{\beta}_{t,s+1}\right]$$

- $\hat{\mu}_t$ = (financially-adjusted) mark-up
- $\hat{\beta}_{t,s+1}$ = capitalized growth of customer base
- $\hat{\xi}_t$ = shadow value of internal funds

Log-Linearized Phillips Curve

The role of "deep habits"

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Log-Linearized Phillips Curve
The role of financial frictions

$$
\begin{aligned}
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&\quad + \frac{1}{\gamma_p}\left[\eta - \omega(\eta-1)\right]\mathbb{E}_t \sum_{s=t}^{\infty} \chi\tilde{\delta}^{s-t+1}\left[(\hat{\xi}_t - \hat{\xi}_{s+1}) - \hat{\beta}_{t,s+1}\right]
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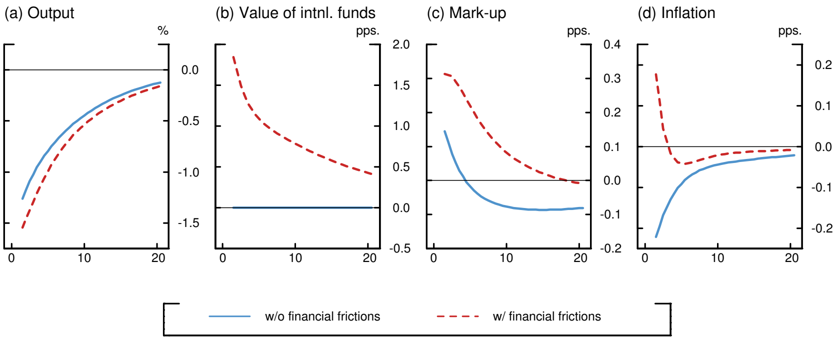
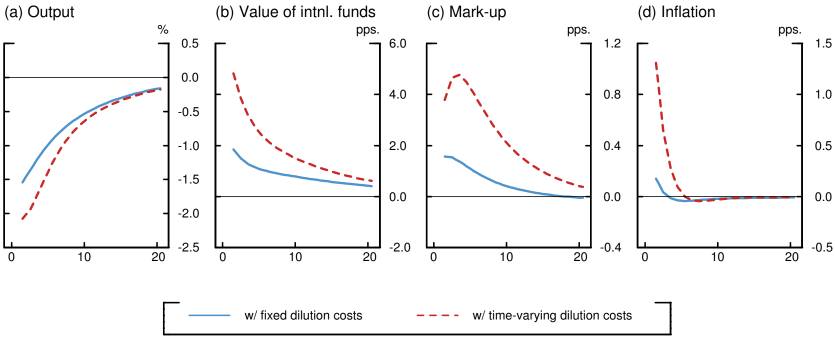
DEMAND SHOCK: FINANCIAL CRISIS ($\varphi = 0.5$)

Economy with sticky prices

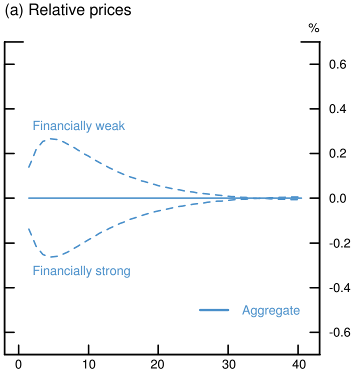


Demand Shock

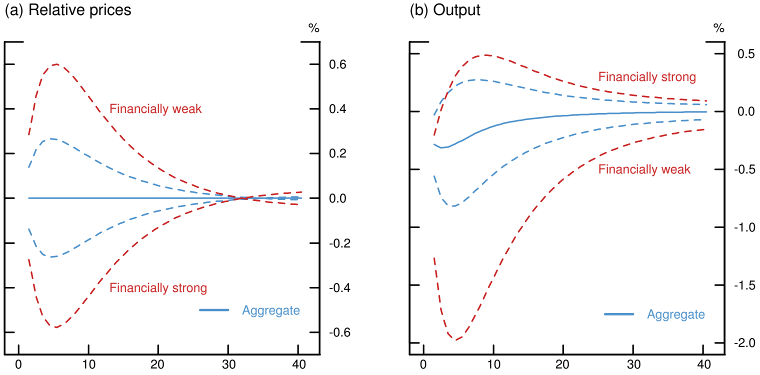
With temporary increase in financial frictions



- Fixed dilution cost: $\varphi = 0.5$
- Temporary increase: $\varphi = 0.3 \rightarrow 0.37$



- Case I: $\phi_1 = 0.8\bar{\phi}$, $\phi_2 = \bar{\phi}$ and $\omega_1 = \omega_2 = 0.5$
- Case II: $\phi_1 = 0$, $\phi_2 = \bar{\phi}$ and $\omega_1 = \omega_2 = 0.5$



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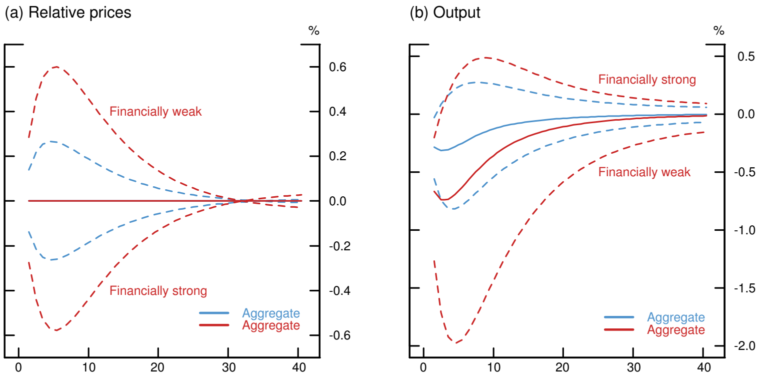
Paradox of Financial Strength

Heterogeneous firms



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Conclusion

- Empirical results imply that financially healthy firms decreased prices, while financially weak firms increased prices during the financial crisis.
- DSGE model implies attenuation of inflation dynamics in response to demand shocks and severe contraction in response to temporary financial shocks.
- Implications for monetary policy: inflation-output tradeoff in response to demand or financial shocks.