Inflation Dynamics During the Financial Crisis

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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]).
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

3-month moving average

Low liquidity firms
High liquidity firms

NOTE: Weighted average monthly inflation relative to industry (2-digit NAICS) inflation.
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Multinomial logit specification:

\[
\Pr(p_{i,j,t+3} - p_{i,j,t}) = \begin{cases} 
+ & \text{(base)} = \Lambda(X_{jt}; \beta_t) \\
0 & \\
- & 
\end{cases}
\]

Price change regression:

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

\(X_{j,t} = \) liquidity ratio and other controls.
  
  - Includes fixed time effects and 3-digit inflation.
  - Estimated using four-quarter rolling window.
Quantitative implication: a two std. dev. reduction in liquidity implies a 33% higher probability of a price increase.
Quantitative implication: A two std. dev. reduction in liquidity implies a 5% increase in annualized inflation.
Demand for monopolistically competitive good:

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

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.
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:
- \( \varphi \in (0,1) = \text{constant per-unit dilution costs of new equity} \)

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
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Demand Shock: Financial Crisis ($\varphi = 0.5$)

Economy with sticky prices

(a) Output

(b) Value of intnl. funds

(c) Mark-up

(d) Inflation

- w/o financial frictions
- w/ financial frictions
Demand Shock
With temporary increase in financial frictions

- Fixed dilution cost: \( \varphi = 0.5 \)
- Temporary increase: \( \varphi = 0.3 \rightarrow 0.37 \)
“Price War” in Response to Financial Shocks

Heterogeneous firms

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 $\omega_1 = \omega_2 = 0.5$
**Paradox of Financial Strength**

*Heterogeneous firms*

![Graphs of relative prices and output](image)

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