Monetary Policy Responses to Food and Fuel Price Volatility

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Cornell University, Brookings Institution and NBER
Presentation draws on:


Motivation

- Low and stable inflation is a key objective of monetary policy

- Choosing appropriate price index important operational issue in implementing any version of monetary policy

- Operational issues I do not look at:
  - Level of inflation
  - Point vs. band target
**Related literature**

- Targeting core (excl. food and energy prices) is optimal
  - It is a suitable measure of inflation (Wynne, 1999)
  - Food and energy shocks are supply shocks, so no monetary intervention is required (Mishkin, 2007, 2008)

- Theoretical Basis
  - Goodfriend and King (1997)
  - Aoki (2001)

- Major assumption - complete markets
  - Price stickiness is the only distortion
But...

- Markets are far from complete
- Consumers are credit constrained
- Unable to smooth consumption over time
## Share of population with access to formal finance

<table>
<thead>
<tr>
<th>Emerging Markets</th>
<th>Percent with access</th>
<th>Advanced Economies</th>
<th>Percent with access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>28</td>
<td>Belgium</td>
<td>97</td>
</tr>
<tr>
<td>Brazil</td>
<td>43</td>
<td>Canada</td>
<td>96</td>
</tr>
<tr>
<td>Chile</td>
<td>60</td>
<td>Denmark</td>
<td>99</td>
</tr>
<tr>
<td>China</td>
<td>42</td>
<td>France</td>
<td>96</td>
</tr>
<tr>
<td>Egypt</td>
<td>41</td>
<td>Germany</td>
<td>97</td>
</tr>
<tr>
<td>India</td>
<td>48</td>
<td>Italy</td>
<td>75</td>
</tr>
<tr>
<td>Indonesia</td>
<td>40</td>
<td>Netherlands</td>
<td>100</td>
</tr>
<tr>
<td>Iran</td>
<td>31</td>
<td>Spain</td>
<td>95</td>
</tr>
<tr>
<td>Korea</td>
<td>63</td>
<td>Sweden</td>
<td>99</td>
</tr>
<tr>
<td>Malaysia</td>
<td>60</td>
<td>Switzerland</td>
<td>88</td>
</tr>
<tr>
<td>Mexico</td>
<td>25</td>
<td>United Kingdom</td>
<td>91</td>
</tr>
<tr>
<td>South Africa</td>
<td>46</td>
<td>United States</td>
<td>91</td>
</tr>
<tr>
<td>Average</td>
<td>44</td>
<td>Average</td>
<td>94</td>
</tr>
</tbody>
</table>
High share of expenditure on food in household expenditure in EMs

<table>
<thead>
<tr>
<th>Emerging Markets</th>
<th>Average</th>
<th>Advanced Economies</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>53.0</td>
<td>Japan</td>
<td>14.7</td>
</tr>
<tr>
<td>Vietnam</td>
<td>49.8</td>
<td>Germany</td>
<td>11.5</td>
</tr>
<tr>
<td>India</td>
<td>48.8</td>
<td>Australia</td>
<td>10.8</td>
</tr>
<tr>
<td>China</td>
<td>36.7</td>
<td>Canada</td>
<td>9.3</td>
</tr>
<tr>
<td>Russia</td>
<td>33.2</td>
<td>United Kingdom</td>
<td>8.8</td>
</tr>
<tr>
<td>Malaysia</td>
<td>28.0</td>
<td>USA</td>
<td>5.7</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>41.6</strong></td>
<td><strong>Average</strong></td>
<td><strong>10.1</strong></td>
</tr>
</tbody>
</table>
Financial frictions imply...

- Idiosyncratic shocks matter for consumption choice

- Income and expenditure of households depend on
  - Composition of household expenditure
  - Price elasticity of demand for goods
Figure 2. Income Elasticity of Demand for Food, 1996

Source: WDI and International Food Consumption Patterns Dataset, Economic Research Service, USDA.
Price elasticity of demand for food is low
Contributions

- Analytically determine choice of appropriate price index in an economy with financial frictions

- More realistic modeling of emerging market economies

- Results more generally applicable to economies with significant financial frictions
Model incorporates these features:

- Incomplete markets – “rule of thumb consumers”
- Subsistence level food consumption
- Low elasticity of substitution for food
- Share of expenditure on food in total household expenditure high
- Closed economy, no physical capital
Model

- Two sector, two good closed economy new Keynesian model

- Sectors
  - Flexible price sector (food)
  - Sticky price sector (non food)

- Goods
  - One type of flexible price good ($C_F$)
  - Continuum of monopolistically produced sticky price goods

\[ c(z) \text{ indexed in } z \in (0,1) \]
1+\lambda Continuum of infinitely lived households
  - Heterogeneous in terms of borrowing opportunities
  - No storage technology or investment

\lambda fraction face liquidity constraint: consume their wage income every period

Others are free to borrow

Each household owns a firm and produces one good (labor immobile between sectors)
- Households, indexed by $i$, maximize the discounted stream of utility

$$E_0 \sum_{t=0}^{\infty} \beta^t [U(C_t^i, N_t^i)]$$

- $u(.)$ represents the utility of the form

$$U(C_t^i, N_t^i) = \frac{(C_t^i)^{1-\sigma}}{1-\sigma} - \phi_n \frac{(N_t^i)^{1+\psi}}{1+\psi}$$

$$C_t^i = \left[ \gamma^{\frac{1}{\eta}} (C_{f,t}^i - C^*)^\frac{-1}{\eta} + (1 - \gamma)(C_{s,t}^i)^{1-\frac{1}{\eta}} \right]^{\frac{1}{1-\frac{1}{\eta}}}$$

$$C_{s,t}^i = \left[ \int_0^1 c_t^i(z) \frac{\theta-1}{\theta} \right]^\frac{\theta}{\theta-1}$$
- **Monetary policy rule (Taylor rule)**

  \[
  \log(R_t / \bar{R}) = \rho_i \log(R_{t-1} / \bar{R}) + \rho_{\Pi} \log(\Pi_t / \bar{\Pi}) + \rho_y \log(Y_t / \bar{Y})
  \]

- **Flexible price sector shock**

  \[
  A_{f,t+1} = \rho_{af} A_{f,t} + \xi_t, \quad \xi_t \approx i.i.d (0, \sigma_{a,f})
  \]

- **Sticky price sector shock**

  \[
  A_{s,t+1} = \rho_{as} A_{s,t} + \nu_t, \quad \nu_t \approx i.i.d (0, \sigma_{a,s})
  \]
Two market specifications

- Complete financial markets
- Incomplete financial markets
Policy regimes

- **Strict core inflation targeting**
  \[ \log \left( \frac{R_t}{\bar{R}} \right) = \rho_i \log \left( \frac{R_{t-1}}{\bar{R}} \right) + \rho_\pi \log \left( \frac{\Pi_{s,t}}{\bar{\Pi}_s} \right) \]

- **Strict headline inflation targeting**
  \[ \log \left( \frac{R_t}{\bar{R}} \right) = \rho_i \log \left( \frac{R_{t-1}}{\bar{R}} \right) + \rho_\pi \log \left( \frac{\Pi_t}{\bar{\Pi}} \right) \]

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Calculating welfare gains

- Welfare under strict core inflation targeting as baseline

- Welfare cost, $\omega^c$, is defined as consumption needed to make consumers as well off under strict core inflation targeting as under regime $a$

$$V_0^a = E_0 \sum_{t=0}^{\infty} \beta^t U((1 + \omega^c)C_t, N_t)$$

- Positive number indicates welfare is higher under regime $a$

- $\omega^c \times 100$ gives the percentage of life time consumption
## Results: Welfare cost of targeting different price indices

<table>
<thead>
<tr>
<th></th>
<th>Complete Markets</th>
<th>Incomplete Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strict Headline Targeting</td>
<td>Flexible Headline Targeting</td>
</tr>
<tr>
<td>Welfare gain (in % of strict core inflation targeting consumption)</td>
<td>-0.07</td>
<td>-0.22</td>
</tr>
</tbody>
</table>
Explanation of results

- Constrained households’ demand is insensitive to interest rate fluctuations, determined by real wages.

- Financial friction – establishes a link between real income of constrained consumers and aggregate demand.
• So, price in flexible price sector affects aggregate demand

• In order to affect aggregate demand, central bank must stabilize prices in flexible price sector

• Also, inflation and output may move in opposite directions – stabilizing output gap is welfare improving
Sensitivity analysis

- Without subsistence level of food consumption
- Elasticity of substitution between food and non food
- Lots of additional analysis of sensitivity to model parameters

Results hold up quite well
Extensions

- Alternate characterization of complete markets

- More general setting – where households in either sector can be credit constrained
Alternate complete market setting

- In most models – households can insure fully against income risks *ex-ante*

- We look at setting – when households can insure only *ex-post*
## Results under alternate complete market settings

<table>
<thead>
<tr>
<th>Elasticity of Substitution</th>
<th>Flexible Headline Inflation Targeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.24</td>
</tr>
<tr>
<td>0.7</td>
<td>0.05</td>
</tr>
<tr>
<td>0.8</td>
<td>-0.02</td>
</tr>
</tbody>
</table>
Complete general market setting

- A fraction of people in both sectors are credit constrained

- We choose the fractions such that overall 50% of the households in the economy are credit constrained
### Results of general market setting

<table>
<thead>
<tr>
<th>Fraction of households in sticky price sector with access to formal finance</th>
<th>Fraction of households in flexible price sector with access to formal finance</th>
<th>Welfare gains from flexible headline inflation targeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10</td>
<td>0.90</td>
<td>0.38</td>
</tr>
<tr>
<td>0.20</td>
<td>0.80</td>
<td>0.22</td>
</tr>
<tr>
<td>0.30</td>
<td>0.70</td>
<td>0.21</td>
</tr>
<tr>
<td>0.40</td>
<td>0.60</td>
<td>0.22</td>
</tr>
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<td>0.50</td>
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<td>0.24</td>
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<td>0.10</td>
<td>0.30</td>
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Conclusions

- In the presence of financial frictions – core inflation targeting not optimal
- Presence of credit constrained consumers – establishes a link between price in the flexible price sector and aggregate demand
- Since inflation and output may move in opposite direction – targeting flexible headline inflation optimal
Policy implications, broader intuition

- In real world, central bank has to respond to food price volatility from a pure welfare perspective

- Inflation expectations another channel

- Sub-optimal response to supply shocks
  Yes, but…
New challenges facing central banks

- Sovereign debt rising; financial repression?
- Exchange rate
- And...food/fuel/commodity price increases
The Art of Central Banking

**Objectives**
- Low, stable inflation
- Low unemployment
- Financial stability
- Bank regulation, supervision
- Prevent / clear up asset boom-busts
- Manage exchange rate

**Instruments**
- Policy interest rate
- Reserve requirements
- Regulatory policy
- Fx intervention, capital controls

**Independence**

**Credibility**

**Accountability, Transparency**

**Effectiveness**

Central Bank