Effects of Commodity Price Shocks on Inflation: A Cross Country Analysis

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August 10, 2014, SWET
Motivation

- Recent increases in commodity prices made central bankers worried about high inflation

- However, there is **no strong consensus** on effects of non-energy commodity price shocks on inflation
  - **Transitory** and **modest** effects on inflation (Yellen, 2011)
  - In contrast, **upside risks** to the price stability (ECB, 2008; IMF, 2008)

- **Question:** How do non-energy commodity price shocks affect the CPI and inflation?
Two questions

1. **Q:** How persistent are effects of commodity price shocks on inflation?
Two questions

1. **Q:** How persistent are effects of commodity price shocks on inflation?

![Graph showing transitory and persistent price levels over months.](image)
Two questions (cont’d)

2. Q: What factors matter for effects of commodity price shocks?

![Graph showing the price level over time with a high long-run effect marker.](image-url)
Two questions (cont’d)

2. **Q:** What factors matter for effects of commodity price shocks?
Main results

1. Q: How persistent?
   
   A: Commodity price shocks have transitory effects on inflation
      
      • under high inflation regime
      
      • but not under low inflation regime

2. Q: What factors matter?

   A: Exchange rate regimes and the level of economic development have a significant impact on the price responses
      
      • under high inflation regime
      
      • but not under low inflation regime
Main result 1

- The CPIs are almost fully adjusted **within a year** in response to a commodity price shock

<table>
<thead>
<tr>
<th>Month</th>
<th>CPI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>1.5</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>2.5</td>
</tr>
<tr>
<td>24</td>
<td>3</td>
</tr>
</tbody>
</table>

![Graph showing CPI adjustment over time](image_url)
Main result 1 (cont’d)

- Commodity price shocks have more persistent effects on inflation under the low inflation regime

![Graph showing speed of price adjustment](image)

**Note:** We normalize the CPI in period 24 to unity.
Main result 2

- Exchange rate regimes have a significant impact on effects of commodity price shocks

Note: The panel shows impulse responses (IRs) for developed countries.
Main result 2 (cont’d)

- The level of economic development also has a significant impact on effects of commodity price shocks.

**Note:** The panel shows IRs for countries with the flexible exchange rates.
Main result 2 (cont’d)

- Qualitatively unchanged under the high inflation regime

Notes: Panel (a) shows IRs for developed countries. Panel (b) corresponds to those for countries with the flexible exchange rates.
Main result 2 (cont’d)

- But it is not the case under the low inflation regime

Notes: Panel (a) shows IRs for developed countries. Panel (b) corresponds to those for countries with the flexible exchange rates.
1. **Q:** How persistent?

   - Commodity price shocks have only *transitory* effects on inflation (Cecchetti and Moessner, 2008)

2. **Q:** What factors matter?

   - Previous studies on effects of commodity price shocks focus on
     - *exchange rate regimes*: Rigobon (2010)
   
     - On the other hand, price responses to changes in firms’ costs are different between
Methodology and data

- Employ panel local projections and smooth transition autoregressive (STAR) models following Auerbach and Gorodnichenko (2012)

- Use 120-country balanced monthly panel data of the headline CPIs published by IFS

- Use non-energy Commodity Price Index (in terms of US dollar) published by the World Bank

- Period: January 2000 – December 2010
Model: benchmark regressions

- Using panel local projections, we estimate the following equation for country $j$ in each forecast horizon $k = 0, 1, 2, \ldots, K$

$$p_{j,t+k} - p_{j,t-1} = \alpha_{j,k} + \sum_{i=1}^{q} \beta_{i,k}(p_{j,t-i} - p_{j,t-i-1}) + \gamma_k FE_t + u_{j,t+k}^k$$

where

- $p_{j,t}$ represents the logarithm of the CPI for country $j$ in period $t$
- $\alpha_{j,k}$ includes the country fixed effect for country $j$ in forecast horizon $k$
- $FE_t$ is an **exogenous commodity price shock** in period $t$
- The IR of the CPI for $k$th period after a commodity price shock can be written as

$$IR(k) = \gamma_k$$
Chen, Rogoff, and Rossi (2010) demonstrate that exchange rate growth of Australia, Canada and New Zealand (vis-a-vis US dollar) has forecasting power for commodity prices.

Following Chen, Rogoff, and Rossi (2010), we assume that the forecasting model is given by

$$\pi_{c,t} = a + b\pi_{c,t-1} + c_{AUS}\Delta s_{t-1}^{AUS} + c_{CAN}\Delta s_{t-1}^{CAN} + c_{NZ}\Delta s_{t-1}^{NZ} + \varepsilon_{c,t} \quad (3)$$

where

- $\pi_{c,t}$ represents commodity price inflation
- $\Delta s_{t}^{j}$ denotes the nominal exchange rate growth in country $j$ vis-à-vis the US for $j = AUS, CAN, NZ$

We denote the resulting residuals by $FE_{t} \ (= \pi_{c,t} - \hat{\pi}_{c,t})$
How persistent are effects of commodity price shocks on inflation?

- The CPIs are almost fully adjusted within a year in response to a commodity price shock
What factors matter for effects of commodity price shocks?

- Our benchmark estimation assumes that the IRF is the same across all countries.
- Country-specific factors may substantially influence the shape of each country’s impulse response function.
  1. **Exchange rate regimes** (US-dollar-pegged exchange rate vs Flexible exchange rate)
  2. **Level of economic development** (Less developed countries vs Developed countries)
  3. **Inflation regimes** (High inflation regime vs Low inflation regime)
Model: benchmark regressions with dummies

- Benchmark regression is extended with exchange rate regimes and the level of economic development

\[ p_{j,t+k} - p_{j,t-1} = \alpha_{j,k} + \sum_{i=1}^{q} \beta_{i,k}(p_{j,t-i} - p_{j,t-i-1}) + \gamma_{j,k}F E_t + u_{j,t+k} \]  

(4)

where

\[ IR(j, k) = \gamma_{j,k} = \gamma_k + \gamma_{USD,j}D_{j}^{USD} + \gamma_{LDC,j}D_{j}^{LDC} \]  

(5)

- \( \alpha_{j,k} \) includes the country fixed effect and the two dummy variables
- \( D_{j}^{USD} \) and \( D_{j}^{LDC} \) is the dummy variable for countries with the US-dollar-pegged exchange rates (less developing countries)
IRs of the CPIs: benchmark regressions with dummies

- Exchange rate regimes and the level of economic development have a significant impact on effects of commodity price shocks.

**Note:** Panel (a) shows IRs for developed countries. Panel (b) corresponds to those for countries with the flexible exchange rates.
Model: STAR model

- Our regressions are further extended to allow for inflation regimes

\[
p_{j,t+k} - p_{j,t-1} = \alpha_{j,k} + F(z_{j,t-d}) \left[ \sum_{i=1}^{q} \beta^L_{i,k} (p_{j,t-i} - p_{j,t-i-1}) + \gamma^L_{j,k} FE_t \right] \\
+ [1 - F(z_{j,t-d})] \left[ \sum_{i=1}^{q} \beta^H_{i,k} (p_{j,t-i} - p_{j,t-i-1}) + \gamma^H_{j,k} FE_t \right] + u^k_{j,t+k}
\]

where

\[
F(z_{j,t-d}) = \frac{\exp(-\delta z_{j,t-d})}{1 + \exp(-\delta z_{j,t-d})}
\]

- We specify the transition variable \( z_{j,t-d} \) as the standardized past inflation rate:

\[
z_{j,t-d} = \frac{\pi_{j,t-d} - \bar{\pi}_j}{\hat{\sigma}_j}
\]
IRs of the CPIs: high inflation regime in the STAR model

- The effects of the two country-specific factors are detected under the high inflation regime.

**Notes:** Panel (a) shows IRs for developed countries. Panel (b) corresponds to those for countries with the flexible exchange rates.
IRs of the CPIs: low inflation regime in the STAR model

- But not detected under the **low inflation regime**

**Notes**: Panel (a) shows IRs for developed countries. Panel (b) corresponds to those for countries with the flexible exchange rates.
Speed of price adjustment: high and low inflation regimes

- Commodity price shocks have more persistent effects on inflation under the **low inflation regime**

![Graph showing the speed of price adjustment between high and low inflation regimes](image)

**Note:** We normalize the CPI in period 24 to unity.
Concluding remarks

- Under the **high inflation regime** effects of commodity price shocks on inflation are transitory, which is consistent with Yellen (2011)

- Our findings, however, suggest that under the **low inflation regime** central banks need pay attention to commodity prices for longer time

- **Business cycle factors** such as inflation may play an important role in understanding effects of commodity price shocks on inflation
Table 1: Distribution of countries

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<th></th>
<th>Developed</th>
<th>Less developed</th>
<th>Total</th>
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<tbody>
<tr>
<td>Flexible</td>
<td>27</td>
<td>43</td>
<td>70</td>
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<tr>
<td>USD-pegged</td>
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<td>45</td>
<td>50</td>
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<tr>
<td><strong>Total</strong></td>
<td>32</td>
<td>88</td>
<td>120</td>
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### Table 2: The parameter used for the STAR models

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<tbody>
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<td>6.596</td>
<td>6.514</td>
<td>6.416</td>
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<tr>
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<td>3</td>
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<td>1</td>
<td>1</td>
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</tr>
</tbody>
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**Notes:** The lag length of $q$ is selected by BIC.
Figure 1: The estimates of dummy variables based on benchmark regressions

(a) $\gamma^{USD}$

(b) $\gamma^{LDC}$
Figure 2: The estimates of dummy variables based on the STAR models: high inflation regime

(a) $\gamma_{USD}$

(b) $\gamma_{LDC}$
Figure 3: The estimates of dummy variables based on the STAR models: low inflation regime

(a) $\gamma^{USD}$

(b) $\gamma^{LDC}$

Low inflation regime