

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

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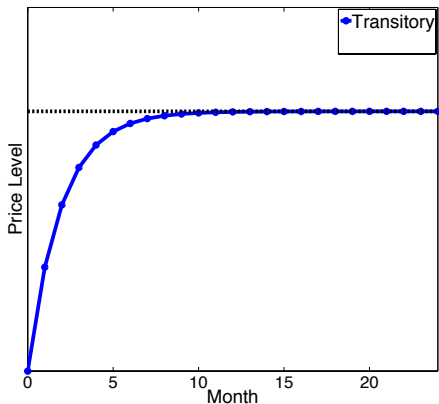
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Motivation

- 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?

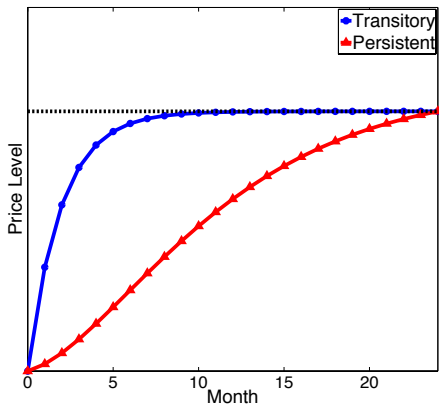
Two questions

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



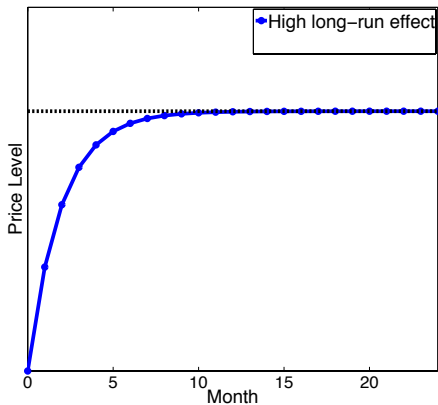
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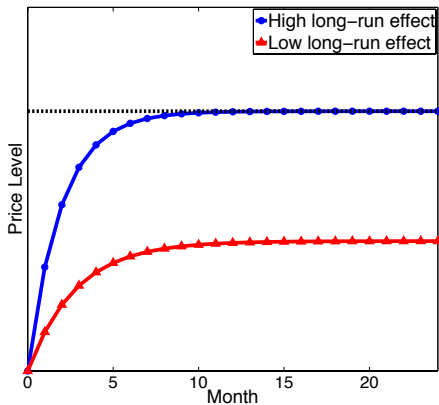
Two questions (cont'd)

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



Two questions (cont'd)

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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

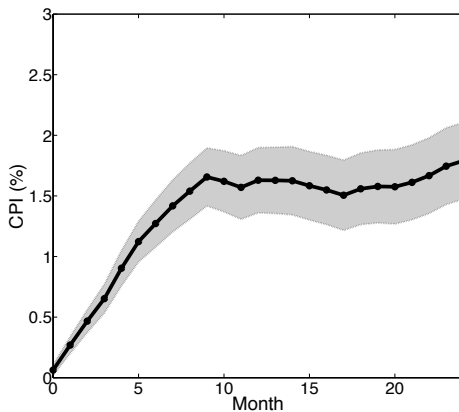
2. Q: What factors matter?

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

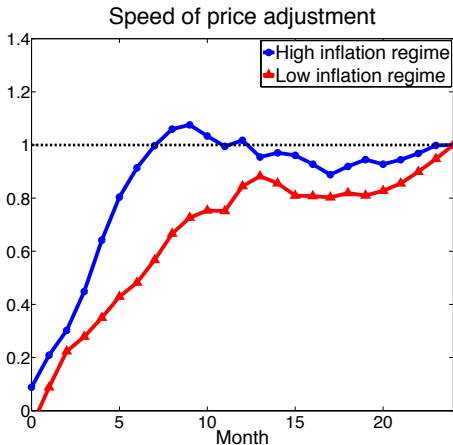
Main result 1

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



Main result 1 (cont'd)

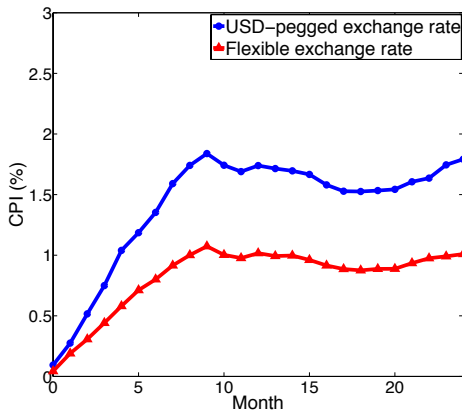
- Commodity price shocks have more persistent effects on inflation under the **low inflation regime**



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

Main result 2

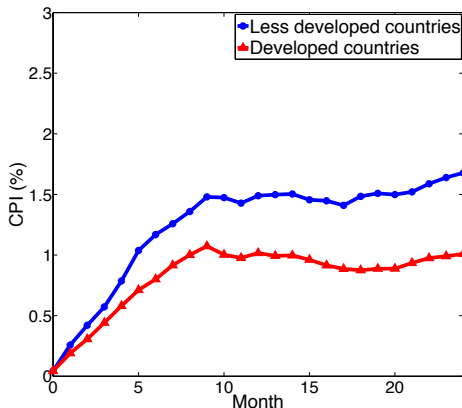
- Exchange rate regimes have a significant impact on effects of commodity price shocks



Note: The panel shows impulse responses (IRs) for developed countries.

Main result 2 (cont'd)

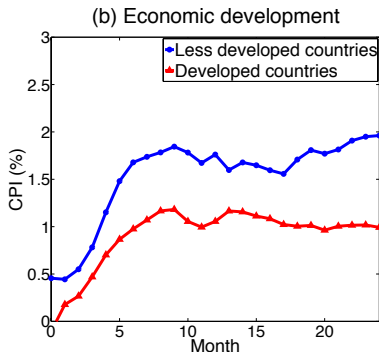
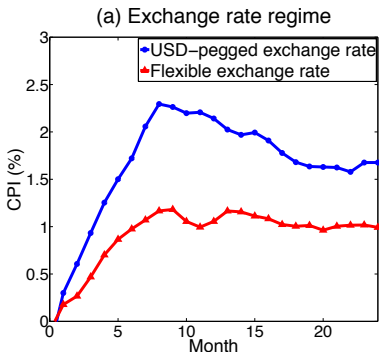
- The **level of economic development** also has a significant impact on effects of commodity price shocks



Note: The panel shows IRs for countries with the flexible exchange rates.

Main result 2 (cont'd)

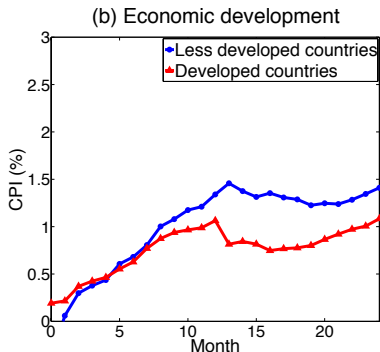
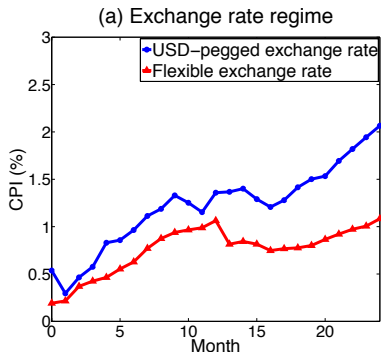
- Qualitatively unchanged under the **high inflation regime**



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.

Literature review

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)
 - **level of economic development**: IMF (2008, 2011), Gelos and Utsyugova (2012)
- On the other hand, price responses to changes in firms' costs are different between
 - **inflation regimes**: Taylor (2000)

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 [▶ Table 1](#)
- 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 $k = 0, 1, 2, \dots, K$

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

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

$$IR(k) = \gamma_k \quad (2)$$

Commodity price shocks

- 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

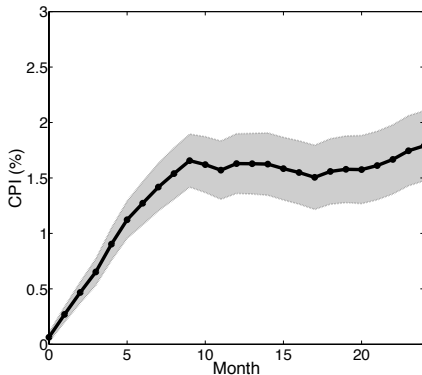
$$\pi_{c,t} = a + b\pi_{c,t-1} + c_{AUS}\Delta s_{t-1}^{AUS} + c_{CAN}\Delta s_{t-1}^{CAN} + c_{NZ}\Delta s_{t-1}^{NZ} + \varepsilon_{c,t} \quad (3)$$

where

- $\pi_{c,t}$ represents commodity price inflation
- Δs_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 $\widehat{FE}_t (= \pi_{c,t} - \hat{\pi}_{c,t})$

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**

$$p_{j,t+k} - p_{j,t-1} = \alpha_{j,k} + \sum_{i=1}^q \beta_{i,k} (p_{j,t-i} - p_{j,t-i-1}) + \gamma_{j,k} FE_t + u_{j,t+k}^k \quad (4)$$

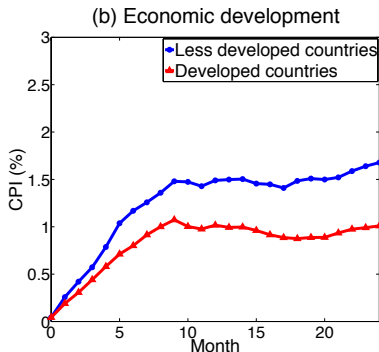
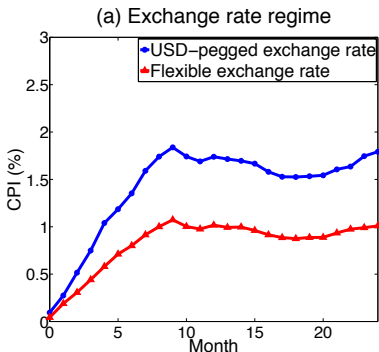
where

$$IR(j, k) = \gamma_{j,k} = \gamma_k + \gamma_{USD,k} D_j^{USD} + \gamma_{LDC,k} D_j^{LDC} \quad (5)$$

- $\alpha_{j,k}$ includes the country fixed effect and the two dummy variables
- D_j^{USD} (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 ▶ Estimation 1



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**

$$\begin{aligned}
 p_{j,t+k} - p_{j,t-1} = & \alpha_{j,k} + F(z_{j,t-d}) \left[\sum_{i=1}^q \beta_{i,k}^L (p_{j,t-i} - p_{j,t-i-1}) + \gamma_{j,k}^L FE_t \right] \\
 & + [1 - F(z_{j,t-d})] \left[\sum_{i=1}^q \beta_{i,k}^H (p_{j,t-i} - p_{j,t-i-1}) + \gamma_{j,k}^H FE_t \right] + u_{j,t+k}^k
 \end{aligned} \tag{6}$$

where

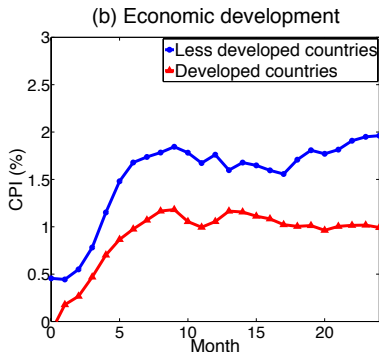
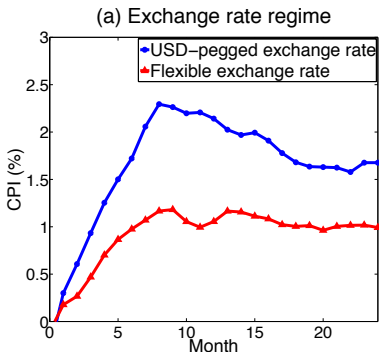
$$F(z_{j,t-d}) = \frac{\exp(-\delta z_{j,t-d})}{1 + \exp(-\delta z_{j,t-d})} \tag{7}$$

- We specify the transition variable $z_{j,t-d}$ as the **standardized past inflation rate**: [▶ Table 2](#)

$$z_{j,t-d} = \frac{\pi_{j,t-d} - \bar{\pi}_j}{\hat{\sigma}_j} \tag{8}$$

IRs of the CPIs: high inflation regime in the STAR model

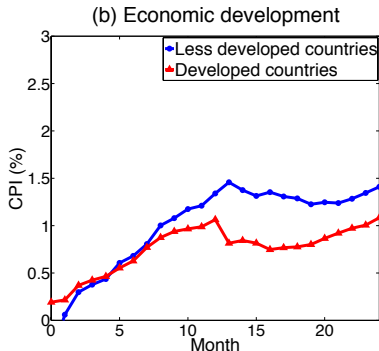
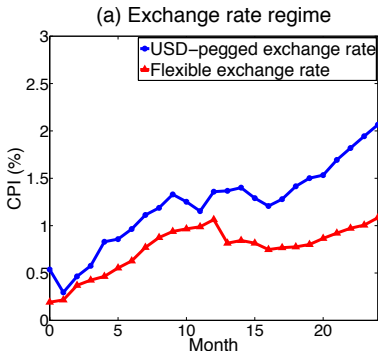
- The effects of the two country-specific factors are detected under the **high inflation regime** ▶ Estimation 2



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

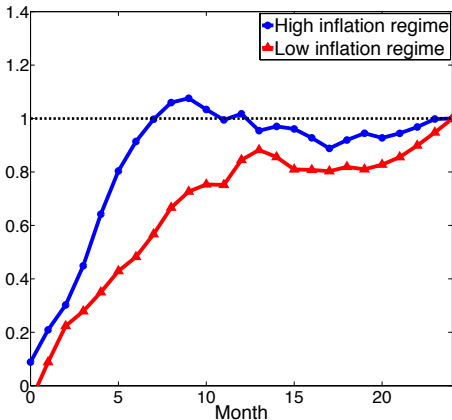
- But not detected under the **low inflation regime** ▶ Estimation 3



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**



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

	Developed	Less developed	Total
Flexible	27	43	70
USD-pegged	5	45	50
Total	32	88	120

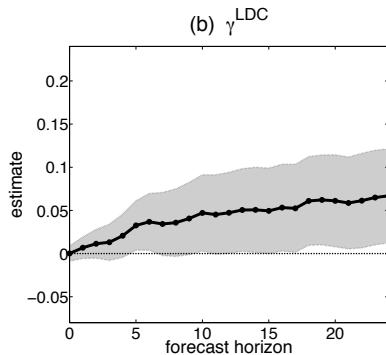
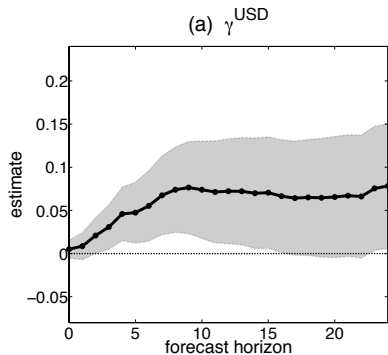
[◀ Data](#)

Table 2: The parameter used for the STAR models

	$k = 0$	$k = 1$	$k = 2$	$k = 3$	$k = 4$	$k = 5$	$k = 6$	$k = 7$	$k = 8$
δ	0.328	2.276	4.670	6.596	6.514	6.416	6.992	5.715	7.452
d	1	1	1	1	1	1	1	1	1
q	12	12	12	12	11	11	11	10	8
	$k = 9$	$k = 10$	$k = 11$	$k = 12$	$k = 13$	$k = 14$	$k = 15$	$k = 16$	
δ	8.106	7.062	7.536	29.994	36.624	31.898	35.154	29.839	
d	1	1	1	1	2	2	2	2	
q	7	7	7	3	1	1	1	1	
	$k = 17$	$k = 18$	$k = 19$	$k = 20$	$k = 21$	$k = 22$	$k = 23$	$k = 24$	
δ	24.788	22.166	27.595	36.263	38.287	43.022	44.570	49.516	
d	2	2	2	2	2	2	2	2	
q	1	1	1	1	1	1	1	1	

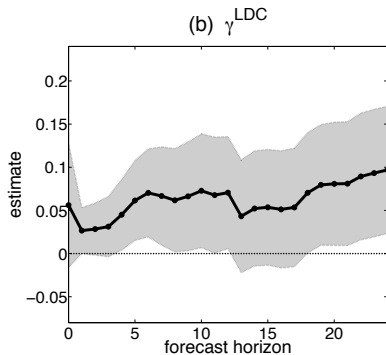
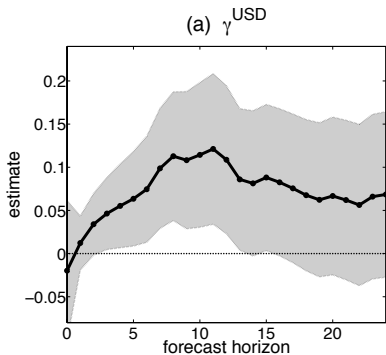
Notes: The lag length of q is selected by BIC.

Figure 1: The estimates of dummy variables based on benchmark regressions



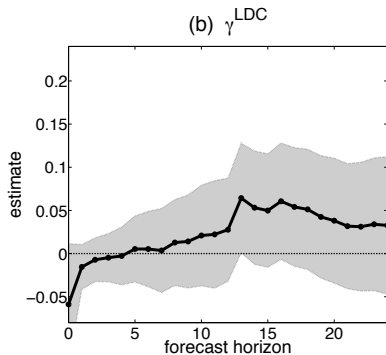
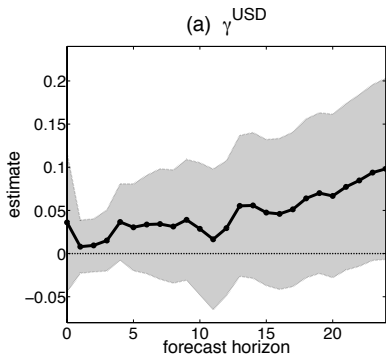
◀ Benchmark with dummies

Figure 2: The estimates of dummy variables based on the STAR models: high inflation regime



◀ High inflation regime

Figure 3: The estimates of dummy variables based on the STAR models: low inflation regime



◀ Low inflation regime