Monetary Policy Transmission through Commodity Prices

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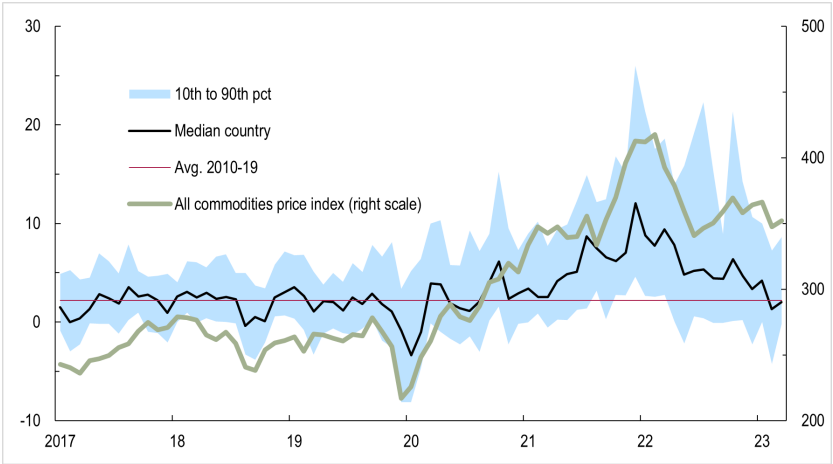
Headline inflation and commodity prices 2017-2023



Note: Year to year headline inflation distribution (shaded area) covers countries accounting for around 83.9% of WEO World GDP (in weighted purchasing power parity terms). Sources: Haver Analytics; IMF, Primary Commodity Price System; IMF staff calculations.

What we do

- Address the fact that commodity prices are not exogenous to Monetary Policy (MP)
  - Interest rate affects: US dollar, cost of carry channel, current/expected demand
- Using Local Projections (LP) estimate the daily response of 39 commodity prices to identified MP shocks (*commodity price channel*)
  - Shocks to US/UK/ECB monetary policy rates, mainly using Jarocinski and Karadi (2020)
- Use proxy-SVAR to estimate monthly effects of US MP on inflation, through the *commodity price channel*
  - Estimate the effect of MP on inflation absent the endogenous response of commodity prices
- Study the international spillovers of US monetary policy through its effects on international commodity prices

Preview of findings

- LP results show large and fast response of several commodity prices
  - a 10bp increase in Feds fund rate leads to a 2.5% and 2% increase in the price of oil and base metals (within 3 weeks)
  - Most responsive commodities are highly storable and industrial commodities
- Proxy-SVAR indicates that the commodity price channel accounts for a 41% of the total effect of US MP on inflation (6-months)
  - Oil has large effects on headline and base metals on core inflation
- Oil and base metal responses also account for a large fraction of the cross-country inflationary spillovers of US monetary policy (66% of total effect)

Contribution to the literature

- To the literature on the determinants of commodity prices. Provide systematic evidence for a wide range of commodities on their responsiveness to MP
  - Kilian (2009), Hamilton (2009), Frankel (2014), Kilian and Murphy (2014), Rosa (2014), Baumeister and Kilian (2016), Jacks and Stuermer (2020)

- Literature on the international spillovers of US monetary policy. Emphasize an important channel for which spillovers occur
  - Dedola, Rivolta, and Stracca (2017), Camara (2021)

- Literature on the transmission mechanisms of monetary policy. Document the commodity-price channel
  - Blanchard and Galı (2007), Gertler and Karadi (2015), Nakamura and Steinsson (2018), Jarociński and Karadi (2020), Gagliardone and Gertler (2023), Bernanke and Blanchard (2023), Breitenlechner, Georgiadis, and Schumann (2022) and Ider, Kriwoluzky, Kurcz, and Schumann (2023)

High-frequency responses of commodity prices to MP shocks

Data

- Daily data on 39 commodities denominated in USD for the period 1990-2019
  - Energy: Brent and WTI crude oil
  - Base metals: Copper, Aluminum, Lead, Nickel
  - Precious metals: Gold, Silver, Platinum
  - Beverages: Cocoa, Coffee
  - Cereals: Corn, rice, wheat

- Use identified monetary policy shocks for the USA, ECB, and UK.
  - High-frequency identification from FOMC meetings from Jarocinski and Karadi (2020), filtering out episodes with $corr(i, S\&P) > 0$
  - Also use UK shocks from Cesa-Bianchi et al. (2020) who follow a similar approach

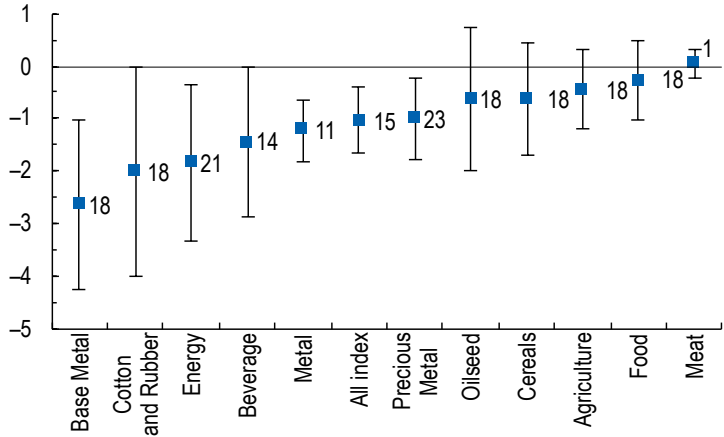
High-frequency response of commodity prices

Following Jorda (2005) we run the following Local Projection (LP) regression

$$\ln y_{i,t+h} - \ln y_{i,t-1} = \alpha_{i,t} + \beta_{i,h} MPS_t^{US} + \sum_{l=1} \phi_{x,l} \mathbf{x}_{t-l} + \mu_{i,t}$$

- $y_{i,t+h}$ is the price of commodity i at time $t+h$
- MPS_t^{US} is the monetary policy surprise (measured in basis points), to the three-months-ahead federal funds futures, estimated by Jarociński and Karadi (2020)
- x_{t-l} represents the lags of the dependent variable and potentially the shock

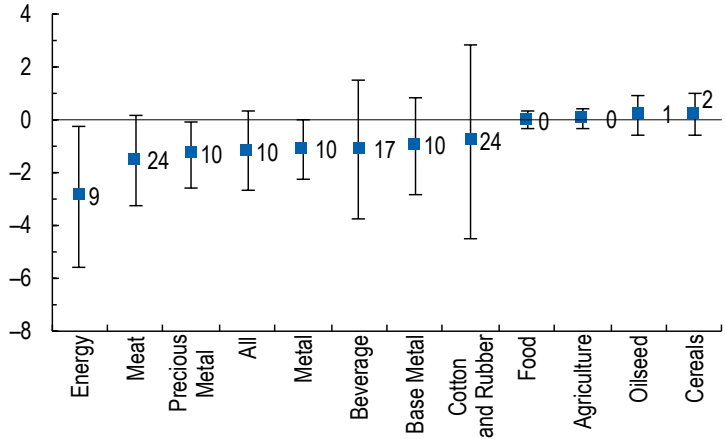
Peak response of commodity prices to a 10bp ↑ in Fed funds rate



90% confidence bands reported. The numbers by the box indicate the day (h) of the peak response.

See also response of [FFR and USD index] and [Inventories]. [Commodity-specific results]

Peak response of commodity prices to a 10bp ↑ in ECB funds rate



90% confidence bands reported. The numbers by the box indicate the day (*h*) of the peak response.

See also [specific commodities]

Commodity-price channel of MP Proxy-SVAR

Proxy-SVAR methodology

Structural VAR:

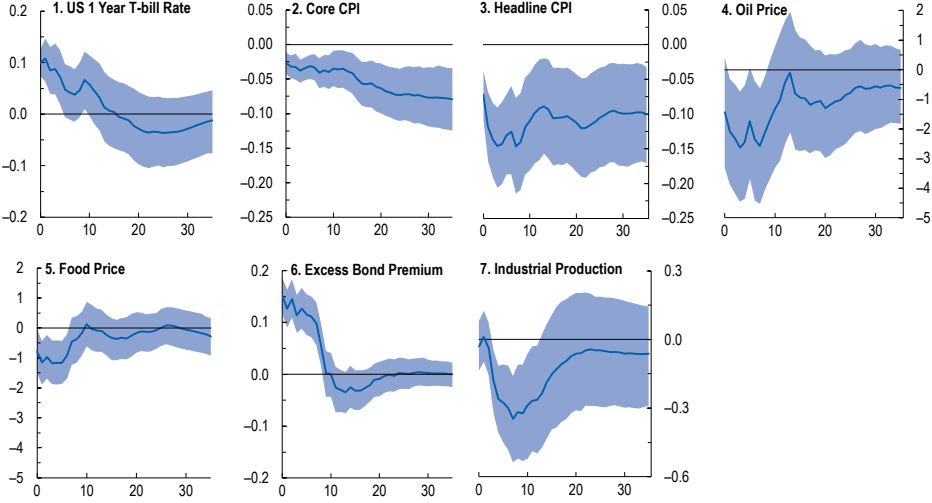
$$A_0 Y_t = \sum_{j=1}^{p} A_j Y_{t-j} + B\varepsilon_t$$

Where Y_t is a vector containing n variables of interest (e.g., commodity prices, one-year treasury bill, IP, CPI, etc.), and ϵ_t is a vector of structural shocks.

We identify the MP shock using as instrument the high-frequency surprises in Jarocinski and Karadi (2020). We mainly need

$$\begin{aligned} E[\epsilon_t^{MP}, z_t^{'}] &\neq 0 \\ E[\epsilon_t^{others}, z_t^{'}] &= 0 \end{aligned}$$

Impulse response to US monetary policy using proxy-SVAR



The x-axis denotes months after the shock. The grey area denotes 68% confidence bands

Decomposition Bernanke, Gertler, and Watson (1997)

Suppose we have a three-variables SVAR

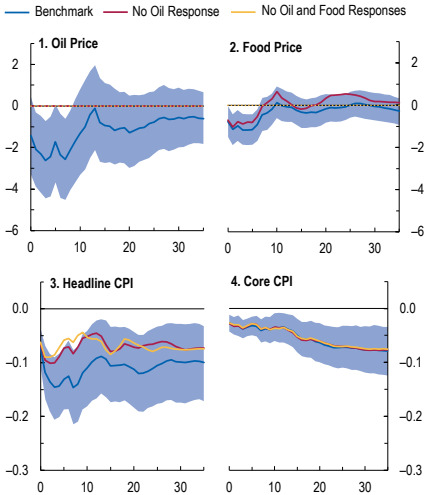
$$\begin{bmatrix} x_t \\ y_t \\ z_t \end{bmatrix} = \sum_{j=1}^{p} \underbrace{A_0^{-1} A_j}_{D_j} \begin{bmatrix} x_{t-1} \\ y_{t-1} \\ z_{t-1} \end{bmatrix} + \underbrace{A_0^{-1} B_0}_{B} \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \varepsilon_{3,t} \end{bmatrix}.$$

Our decomposition imposes that commodity price y does not react contemporaneously to MP shock $\epsilon_{1,t}$, and it does not respond to the dynamic effects from lags of x, y, z either. In particular, we have

$$\begin{bmatrix} x_t \\ y_t \\ z_t \end{bmatrix} = \sum_{j=1}^{p} \begin{bmatrix} d_{1,1} & d_{1,2} & d_{1,3} \\ 0 & 0 & 0 \\ d_{3,1} & d_{3,2} & d_{3,3} \end{bmatrix} \begin{bmatrix} x_{t-j} \\ y_{t-j} \\ z_{t-j} \end{bmatrix} + \begin{bmatrix} b_{1,1} & b_{2,1} & b_{1,3} \\ 0 & b_{2,2} & b_{2,3} \\ b_{3,1} & b_{3,2} & b_{3,3} \end{bmatrix} \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \varepsilon_{3,t} \end{bmatrix}$$

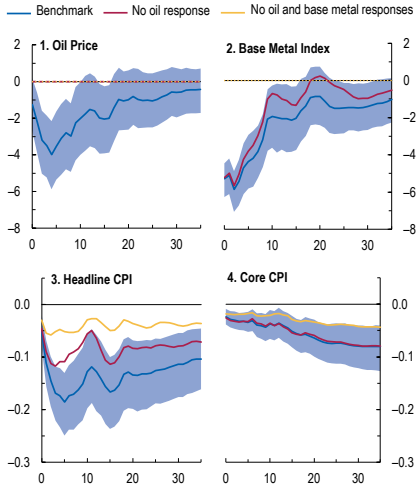
A MP shock ε_1 would work only through its direct effect on x and z and the internal dynamics through lags in z and x.

The commodity-price channel: the role of oil and food



Over six months, oil accounts for 32% of total effect on headline. Oil and food account for a 42%

The commodity-price channel: the role of oil and base metals

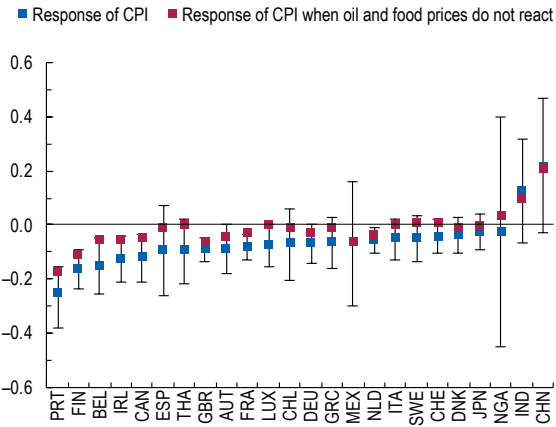


Over six months, base metals have a similar impact on headline than oil. However, base metals have a significant effect on core inflation

International spillovers

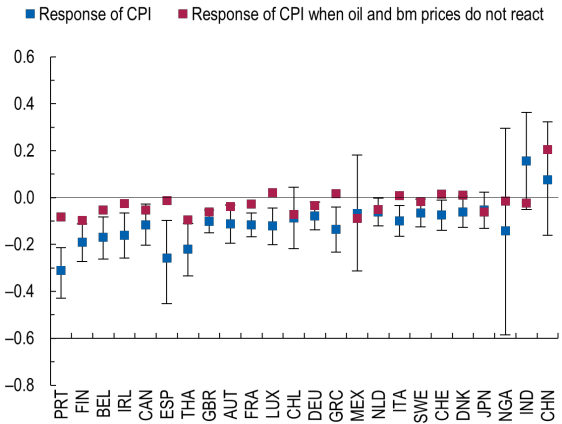
One-year effect of US MP on countries inflation: oil and food

We augment our proxy-SVAR with other countries' inflation and exchange rate (to the USD)



Blue square represents the peak response of headline CPI to US monetary policy. 68% confidence bands are displayed. The red square represents the response of CPI assuming commodity prices do not react to monetary policy.

One-year effect of US MP on countries inflation: oil and base metals



Blue square represents the peak response of headline CPI to US monetary policy. 68% confidence bands are displayed. The red square represents the response of CPI assuming commodity prices (oil and base metals) do not react to monetary policy.

Contribution of the commodity price channel to headline inflation

		0-6 Months	0-12 Months	12-24 Months
United States	Benchmark	-0.12%	-0.12%	-0.02%
	No oil	-0.09%	-0.07%	-0.02%
	Contribution	(32%)	(40%)	NA
	No oil, no food	-0.07%	-0.06%	-0.01%
	Contribution	(41%)	(47%)	NA
Other Countries	Benchmark	-0.07%	-0.07%	-0.00%
	No oil	-0.04%	-0.03%	-0.01%
	Contribution	(48%)	(57%)	NA
	No oil, no food	-0.02%	-0.02%	-0.00%
	Contribution	(66%)	(74%)	NA

Note: This table presents the relative importance of the commodity price channel to the total effect of US monetary policy on inflation.

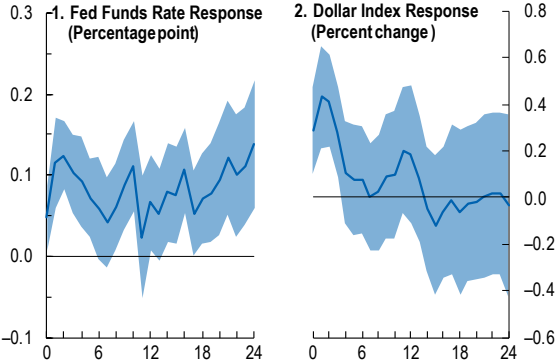
Conclusion

- Monetary policy in large economies (US and ECB) has a strong direct effect on commodity prices, especially for industrial and storable commodities such as oil and metals
- Spillbacks and spillovers to other countries from US monetary policy shocks are large and fast
- Spillovers from US monetary policy shocks tend to be more relevant for consumer prices in other AEs
- The commodity channel for core inflation is mainly driven by base metals (i.e., copper)

Thank you

Appendix: Figure 2

Figure: Impulse response of Fed Funds Rate and Dollar Index to a US monetary policy shock



This figure reports the 24-day (x-axis) response of the Fed Funds rate (left panel) and dollar index (right) to a 10 basis points shock (increase) to the US monetary policy rate. The blue area represents 90% confidence bands, calculated using robust standard errors at each horizon.

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Appendix: Table 2

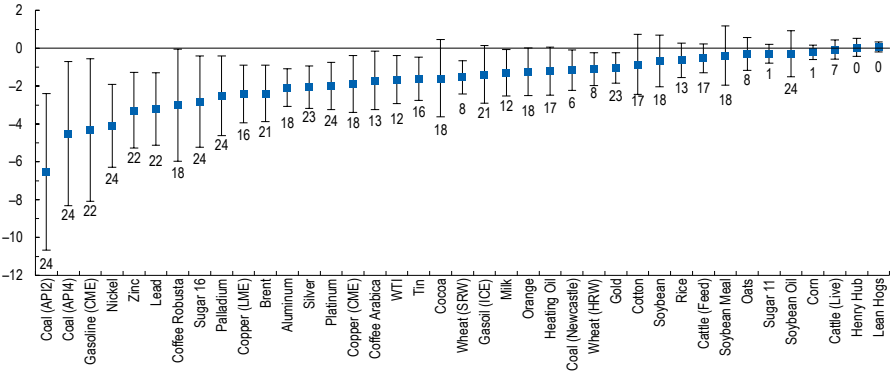
Table: Commodities weights in indexes

Commodity	All	Agriculture	Energy	Metal	Food	Base Metal	Beverage	Precious Metal	Soft	Cereal	Meat	Vegatable Oil
Aluminum	3.1%			8.9%		23.9%						
Beef	4.0%	14.4%			18.2%						57.6%	
Brent Crude	18.4%		50.0%									
Cocoa	1.2%	4.5%					46.1%					
Coffee Arabica	1.4%	5.2%					53.9%					
Copper	6.5%			18.4%		49.6%						
Corn	2.1%	7.6%			9.6%					34.8%		
Cotton	1.6%	5.7%							51.7%			
Gold	19.7%			55.4%				87.9%				
Lead	0.7%			2.0%		5.3%						
Nickel	1.3%			3.7%		10.1%						
Oats	0.1%	0.4%			0.5%					1.7%		
Orange	2.1%	7.5%			9.5%							
Palladium	0.6%			1.6%				2.6%				
Platinum	0.8%			2.4%				3.8%				
Rice	1.2%	4.2%			5.3%					19.1%		
Rubber	1.5%	5.4%							48.3%			
Silver	1.3%			3.6%				5.7%				
Soybeans	3.6%	13.0%			16.4%							85.8%
Soybeans Oil	0.6%	2.1%			2.7%							14.2%
Sugar No. 11	2.7%	9.7%			12.2%							
Swine	2.9%	10.6%			13.4%						42.4%	
Tin	0.3%			0.9%		2.4%						
Wheat	2.7%	9.7%			12.3%					44.4%		
WTI Crude	18.4%		50.0%									
Zinc	1.1%			3.2%		8.6%						

Note: this table presents the list of commodity prices that cover the whole sample period (1990-2019).

Appendix: Figure A1

Figure: Peak cumulative response of commodity prices to a 10bp increase in Fed funds rate.



90% confidence bands reported. The numbers next to the box represent the day of the peak response.

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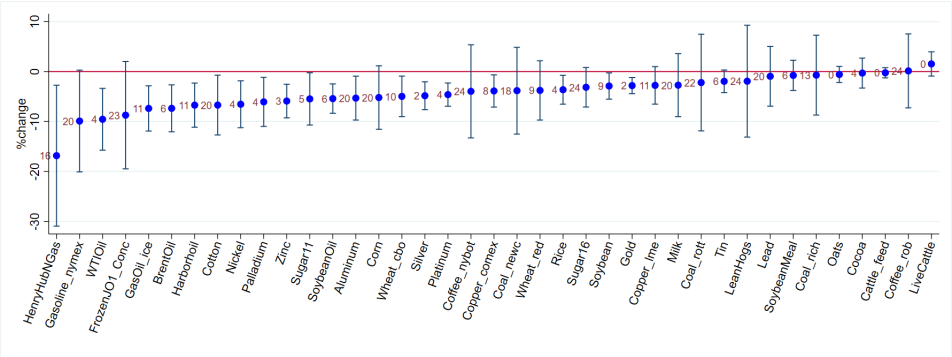
Appendix: Figure A2

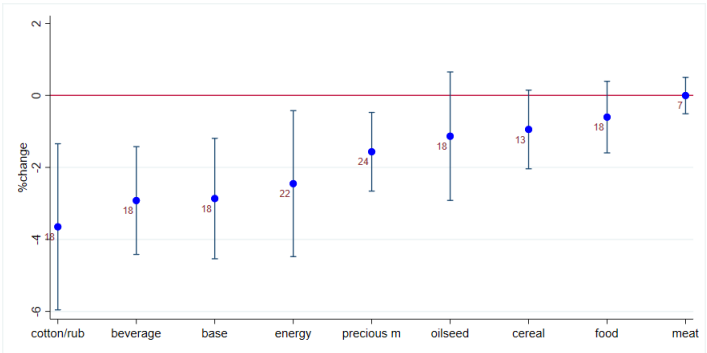
Figure: Peak cumulative response of commodity prices to a 10bp increase in Fed funds rate (2016-2019).



90% confidence bands reported. The numbers next to the box represent the day of the peak response.

Appendix: Figure A3

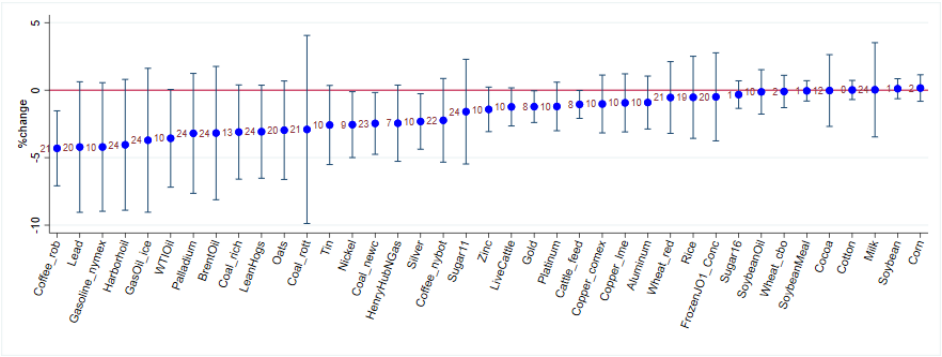
Figure: Peak cumulative response of commodity prices to a 10bp increase in US rate: 1999-2019.



90% confidence bands reported. The numbers next to the box represent the day of the peak response.

Appendix: Figure A4

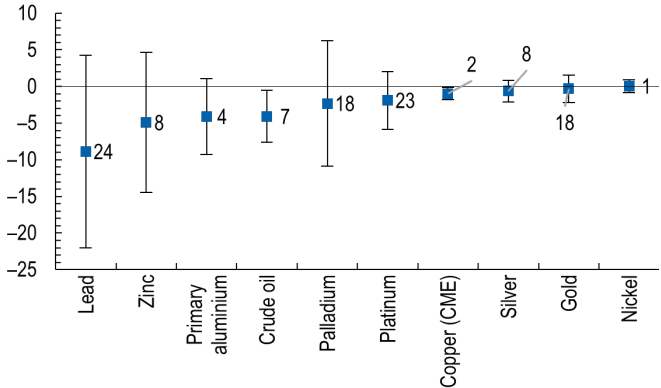
Figure: Peak cumulative response of commodity prices to a 10bp increase in ECB rate.



90% confidence bands reported. The numbers next to the box represent the day of the peak response.

Appendix: Figure A5

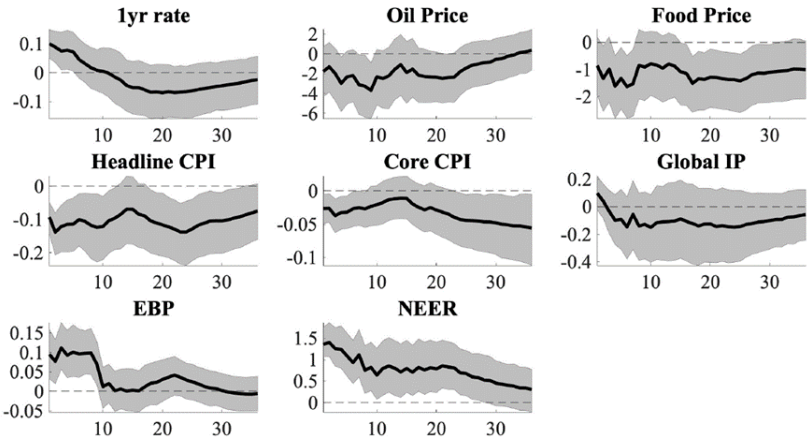
Figure: Peak response of commodity inventories to a 10bp increase in Fed funds rate.



90% confidence bands reported. The numbers by the box indicate the day (h) of the peak response.

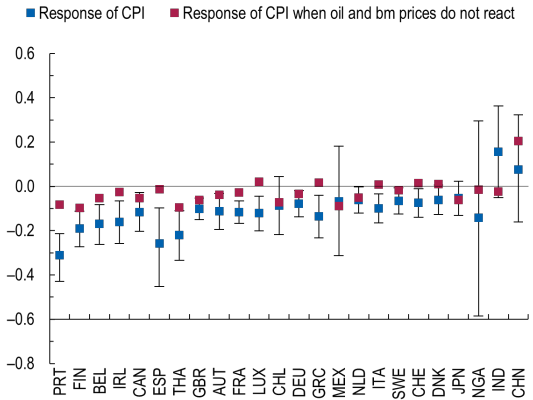
Appendix: Figure A6

Figure: IRF to a 10 bps shock to US monetary policy: extra controls



Appendix: Figure A7

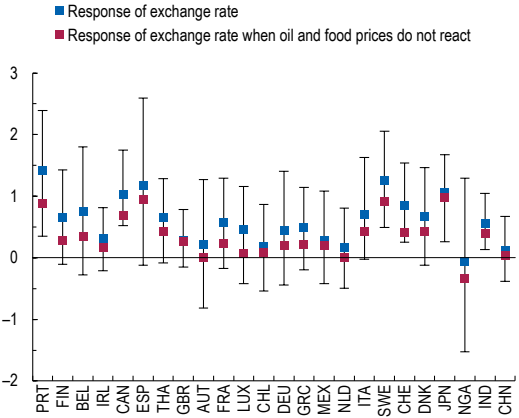
Figure: 12-month response of US monetary policy on countries inflation (proxy-SVAR): oil and base metals



Blue square represents the peak response of headline CPI to US monetary policy. 68% confidence bands are displayed. The red square represents the response of CPI assuming commodity prices (oil and base metals) do not react to monetary policy.

Appendix: Figure A8

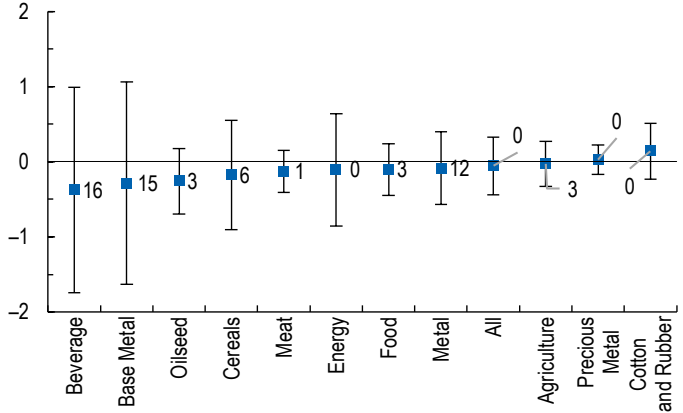
Figure: 12-month effect of US monetary policy on countries exchange rate (proxy-SVAR): oil and food



Blue and red squares are the average one year response of exchange rate after an increase of 10 basis points in the US interest rate. 68 percent confidence intervals are displayed.

Appendix: Figure A9

Figure: Peak response of commodity price sub-indexes to a 10bp increase in UK interest rate



90 % confidence bands are reported. The sample period is 1990 to 2014. The numbers by the box indicate the day (h) of the peak response.

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