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Online annex for BIS Bulletin no 96: "Commodity prices and monetary policy: old and new challenges"

Annex A: Assessing the effects of commodity price shifts

This annex assesses the effects of supply- and demand-driven commodity price shifts ("shocks") on output and inflation. To identify supply shocks for energy prices, we use the impact of OPEC announcements on oil prices (Känzig (2021)), while for food we use global harvest shocks (De Winne and Peersman (2016); Mareels (2024)). Demand shocks are identified by the change in global activity in periods when activity, commodity production and commodity prices for either oil (Baumeister and Hamilton (2019)) or food, respectively, all move in the same direction.[1] With these shocks in hand, we then estimate instrumental variable local projection regressions on a panel of 62 economies from January 1995 to June 2024 for energy and from Q1 1995 to Q4 2022 for food. The objective is to consider only the impact of the commodity price shifts due to the relevant supply or demand shock, which is done through an instrumental variable technique. We include energy and food prices in separate regressions, not together, as follows:

$$y_{i,t+h} = \alpha^{h} + \beta^{h}[\Delta \log(energy\ or\ food\ prices_{i,t})|\ supply\ or\ demand\ shock_{t}] + \boldsymbol{\Theta}^{\boldsymbol{h}} Controls_{i,t} + \varepsilon_{i,t+h}$$

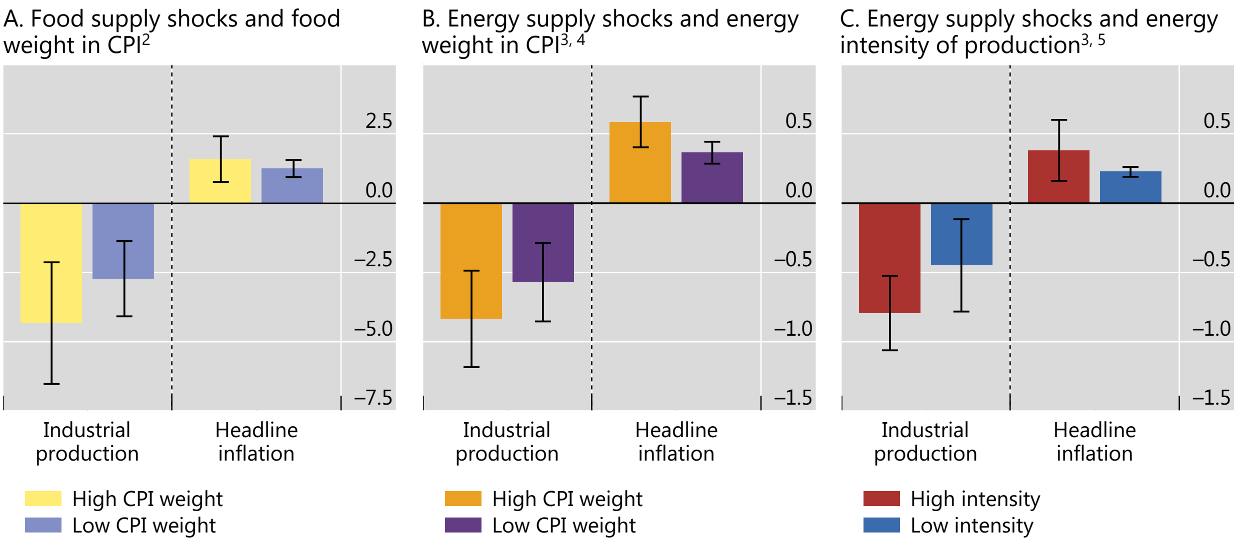
where our dependent variables of interest, $y_{i,t+h}$, are either the 12-month growth rate of industrial production, the level of year-on-year headline CPI inflation, core CPI inflation, 12-month-ahead inflation expectations or the 12-month growth rate in the nominal effective exchange rate in country *i*, *h* periods ahead, up to a 36-month horizon. The main parameter of interest, β^h, captures the influence of either the instrumented month-on-month energy or quarter-on-quarter food price growth on the dependent variable *h* months ahead. We also include country fixed effects, α^h, to capture time-invariant country-specific factors and include control variables for lagged inflation, the real effective exchange rate and monthly US real GDP growth, the latter as a proxy for global activity.

[1] We also derived commodity-specific demand shocks, ie periods when commodity prices and commodity production both move in the same direction, but in the absence of a similar shift in global activity. Overall, the average effect of these shocks across countries is often in between the results for supply and global demand.

Macroeconomic effects depend on the economy's structure[1]

In percentage points

Graph A.1



[1] Peak effect of a 10% rise in the respective commodity price. Peaks identified as the maximum of the absolute value of the impulse response over three years. Error bars indicate 90% confidence intervals. [2] Food price growth instrumented by harvest shocks. High/low CPI weight = above-/below-sample median CPI weight for food. [3] Energy price growth instrumented by OPEC oil supply shocks. [4] High/low CPI weight = above-/below-sample median CPI weight for energy. [5] High/low intensity = above-/below-median energy intensity of GDP.

Sources: Baumeister and Hamilton (2019); DeWinne and Peersman (2016); Känzig (2021); Mareels (2024); World Bank; LSEG Datastream; national data; BIS.

The analysis finds that the macroeconomic effects of commodity price shocks depend on their type and size. The effects further depend on the structure of the economy. For example, supply-driven food and energy price shocks are more stagflationary in economies where these items comprise a larger share of the CPI basket (Graphs A.1.A and A.1.B) and where energy intensity is higher (Graph A.1.C). Splitting the sample into energy exporters and importers, with the former defined following UNCTAD as economies where energy exports exceed 60% of total exports, further suggests that supply-driven energy price shocks boost output in exporters and dampens it in importers (Graph 3.A in the main text).

Annex B: Monetary policy responses to commodity price fluctuations

This annex assesses the response of central banks to commodity prices based on estimated Taylor-type monetary policy rules. The standard procedure is to relate the policy interest rate to inflation and the output gap as well as the past level of the policy rate to account for interest rate smoothing. We consider an augmented version of such a rule, splitting headline inflation into core inflation and changes in food and energy prices. We estimate these augmented Taylor-type rules separately for advanced economies (AEs) and emerging market economies (EMEs) using fixed effects panel regressions:

$$i_{j,t} = i_j^* + \phi_i i_{j,t-1} + (1-\phi_i)\left[\phi_\pi\left(\pi_{j,t} - \pi_j^*\right) + \phi_{\hat{y}}\, \hat{y}_{j,t} + \phi_e\, \pi_{j,t}^e + \phi_f\, \pi_{j,t}^f\right] + \varepsilon_{j,t} \qquad (1)$$

where $i_{j,t}$ is the policy rate (annualised) at time t in jurisdiction j, $\pi_{j,t}$ is core inflation (year-on-year), π_j^* is the inflation target, $\hat{y}_{j,t}$ is the output gap, $\pi^e_{j,t}$ is energy price changes (year on year), and $\pi^f_{j,t}$ is food price changes (year on year). i_j^* is the is a country-specific constant reflecting the long-term level of interest rates.[2] The estimation is performed at quarterly frequency. The main parameters of interest are the

[2] In the simplified way the Talyor rule is specified in equation (1), the constant i is an amalgam of the long-term level of the real interest rate, the central bank's inflation target and the model parameters.

responses to core inflation ($\phi\pi$), to energy prices (ϕ_e) and to food prices (ϕ_f). The sample for the AEs includes AU, CA, CH, DK, EA, GB, JP, NO, NZ, SE and US. The estimation period starts in Q1 1980, excluding periods of currency pegs. To further exclude observations in the vicinity of the zero lower bound, we condition our estimation on the policy rate being above 0.5%. The group of EMEs includes AR, BR, CL, CN, CO, HK, HU, ID, IL, IN, KR, MA, MX, MY, PE, PH, PL, RO, SG, TH, TR and ZA. The estimation period starts in Q1 2009, excluding periods of currency pegs.

The results reported in Graph 4.A in the main text highlight that major AE central banks responded strongly to core inflation, while they did not respond to fluctuations in energy and food prices. In contrast, central banks in EMEs responded strongly not only to core inflation, but also to changes in energy and food prices.

Using US data, which are more detailed and available for a longer period, we further distinguish between demand-driven and supply-driven core inflation extending equation (1). Specifically, we substitute core inflation with its demand- and supply-driven components, following Hofmann et al (2024). We estimate the extended rule over the period Q3 1979–Q2 2024 using ordinary least squares, conditioning the policy rate to be above 0.5% to exclude observations in the vicinity of the zero lower bound. We use the decomposition of inflation into supply and demand factors from Shapiro (2024), which is based on the sectoral decomposition of the personal consumption expenditure (PCE) index. The approach splits the PCE basket into demand- and supply-driven groups, identifying the former as those where unexpected changes in prices and quantities move in the same direction and the latter as those where they move in the opposite direction. The weights for the different categories are then used to calculate the supply- and demand-related contributions to aggregate inflation.

The estimation results reported in Graph 4.B in the main text suggest a much stronger response of US policy rates to demand-driven movements in core inflation than to supply-driven ones. This finding is consistent with the look-through approach to the extent that supply-driven changes in core inflation reflect shifts in commodity prices, as suggested by the analysis in Eickmeier and Hofmann (2022).

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