

Commodity price uncertainty co-movement: Does it matter for global economic growth?

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Motivations

- Evidence of negative correlation between uncertainty fluctuations and macroeconomic activity
- Literature tries to show evidence of causality from uncertainty shocks to macro (Bernanke, 1983; Bloom, 2009 + many others ...)
- Uncertainty comes from various sources: Financial markets (VIX), Economic policy (EPU), real activity (Jurado et al. 2015) ...
- Part of literature also focuses on *oil uncertainty* shocks (Elder and Serletis, 2010, Jo, 2014) and points out significant recessionary effects on U.S. activity.
- Here: we focus on **commodity uncertainty** shocks as a whole and we assess their impact on economic activity (Investment, Exports, Consumption, GDP)

What do we do in this paper?

- We consider various 12 commodity prices split into 3 groups: metal, agricultural and energy
- We measure uncertainty on each commodity price by taking the quarterly realized variance starting from daily returns (uncertainty=volatility)
- We extract the common uncertainty factor underlying all the commodities through a DFM with block structure (Kose et al., 2003), as well as the 3 group-specific factors.
- Then we sequentially integrate those factors into small-scale SVARs for a bunch of ADV and EME countries and compute IRFs to commodity uncertainty shocks

Measuring uncertainty

- We get log-returns from $n = 12$ daily commodity future prices for: agricultural (corn, cotton, soybeans, wheat), metals (copper, gold, silver, platinum) and energy (crude oil, heating oil, petroleum, gasoline).
- We estimate quarterly commodity price uncertainty for any commodity i using realized variances:

$$RV_{i,t} = \frac{252}{T} \sum_{d=1}^T (r_{t,d}^i - r^i)^2 \quad (1)$$

- We cover the period ranging from 1988q1 to 2025q2

Estimating the Global Uncertainty (GLUN) Factor

- We get $n = 12$ quarterly realized variances from 3 groups
- We estimate the following DFM: quarterly commodity price uncertainty for any commodity i using realized variances:

$$RV_{i,t} = \beta_i^C F_t^C + \beta_i^g F_t^g + \varepsilon_{i,t} \quad (2)$$

where F_t^C is the common factor and F_t^g are the 3 group factors ($g=1,2,3$)

- Residuals are supposed to follow an AR(p) process:

$$\varepsilon_{i,t} = \sum_{l=1}^p \psi_{i,l} \varepsilon_{i,t-l} + \epsilon_{i,t} \quad (3)$$

Estimating the Global Uncertainty (GLUN) Factor

- Unobserved factors are also supposed to follow AR(p) processes:

$$F_t^C = \sum_{l=1}^p \psi_l^C F_{t-l}^C + \nu_t^C \quad (4)$$

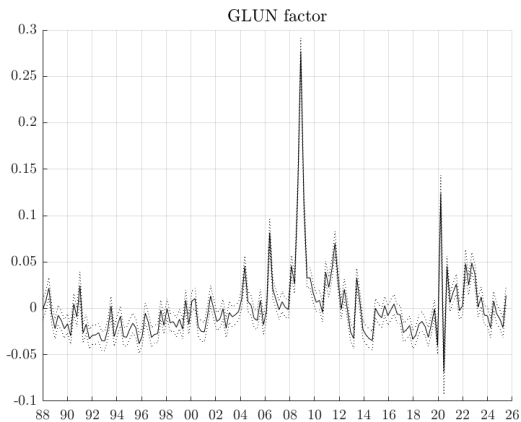
and for $g = 1, 2, 3$:

$$F_t^g = \sum_{l=1}^p \psi_l^g F_{t-l}^g + \nu_t^g \quad (5)$$

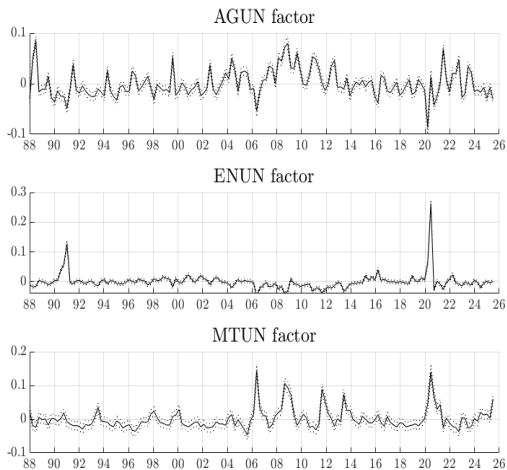
where $\nu_t^C \sim \mathbf{N}(0, \sigma_C^2)$ and $\nu_t^g \sim \mathbf{N}(0, \sigma_g^2)$

- All the innovations are supposed to be White Noise and mutually orthogonal.
- Parameter estimation is carried out using Bayesian methods

Global Uncertainty (GLUN) Factor



Group-Specific Uncertainty Factors



Assessing IRFs using SVARs

- Let's consider a standard SVAR(p) model of the following form for a set of k variables contained in the vector Y_t :

$$A_0 Y_t = c + A_1 Y_{t-1} + \dots + A_p Y_{t-p} + \varepsilon_t \quad (6)$$

where A_0 is the matrix of contemporaneous variables, A_1 to A_p are matrices of coefficients controlling the dynamics and ε_t is a vector of structural shocks

Assessing IRFs using SVARs

- Following Caggiano et al. (2014), we estimate small-scale SVAR models with 5 variables in the following order:

$$Y_t = (p_t, un_t, \pi_t, x_t, i_t)'$$

where p_t : global commo prices, un_t : previously estimated common commodity uncertainty factor, π_t : quarterly inflation rate, x_t : a given macroeconomic variable of interest expressed in growth rate and i_t : the nominal policy interest rate

- A robustness check is carried out without commodity prices first, leading to qualitatively similar results.
- We estimate this model for a bunch of 24 ADV and EME countries

Assessing IRFs using SVARs

- As usual with SVARs, A_0 has to be identified
- Here we follow the Bloom's (2009) strategy by putting directly the exogenous shock into the model as defined by

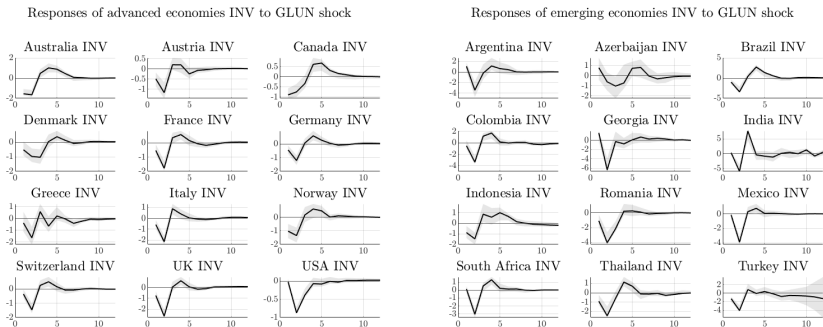
$$un_t = F_t^C \times \mathbf{1}_t(event) \quad (7)$$

where $\mathbf{1}_t(event)$ is the indicator function that takes 1 if an uncertainty event occurs and 0 otherwise

- The definition of uncertainty events that we take is the one from Bloom (2009), i.e. when spikes are above 2 standard errors from the filtered common uncertainty factor.

IRFs from a Global Uncertainty shock: Investment

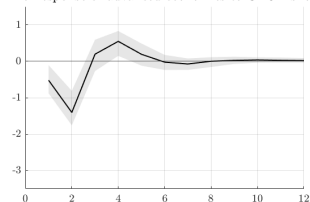
- We compute IRFs from the 24 SVARs applied to each country: Evidence of negative impact on **Investment** growth after a global uncertainty shock, without any bounce-back



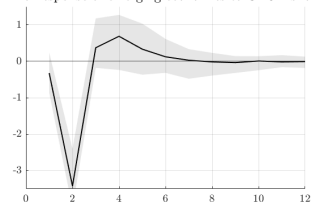
IRFs from a Global Uncertainty shock: Investment

- We summarize the information for ADVs and EMEs

INV response of advanced economies to GLUN shock



INV response of emerging economies to GLUN shock



- Large negative impact, especially for EMEs
- Lack of bounce-back after initial fall, leading to both short-term and long-term adverse effects (permanent loss in the level of investment, meaning lower potential growth)

Comparing with other shocks: Investment

- Comparison VIX /WUI shocks: Stronger negative IRF from GLUN

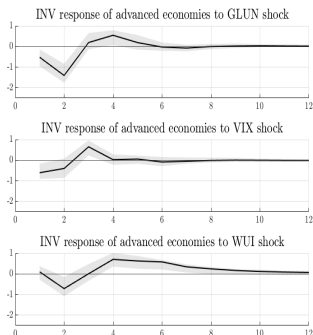


Figure: *ADVs*

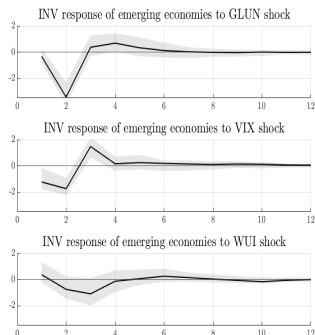


Figure: *EMEs*

IRFs from Group-Uncertainty shocks: Investment

- Comparison between group-specific uncertainty shocks on Investment, **once we account for global component**
- Agricultural and Metals: Significantly negative / Energy: Significantly positive

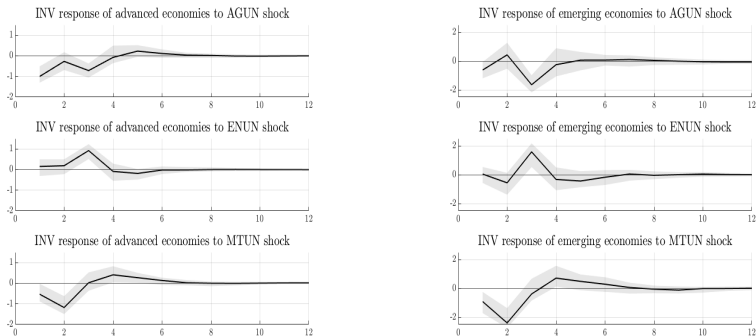


Figure: ADVs

Figure: EMEs

Oil price uncertainty shocks: Good vs Bad outcomes

- Let's focus specifically on energy/oil price uncertainty shock
- Large literature showing negative macro impact of oil price uncertainty shock (Elder and Serletis, 2010; Jo, 2014)
- Yet in principle, uncertainty shocks are likely to generate positive outcomes : *growth option theory* (Bloom, 2014)
- Only few empirical evidence: Forni, Gambetti and Sala (2021) in macro or Segal et al. (2015) in finance
- Punzi (2019) puts forward a SOE DSGE model in which oil price uncertainty shocks generate positive macro outcomes

IRFs from Energy shocks: Investment

- Evidence of overall positive response at country level:
Country-specific IRFs from an energy price uncertainty shock after controlling from global uncertainty component

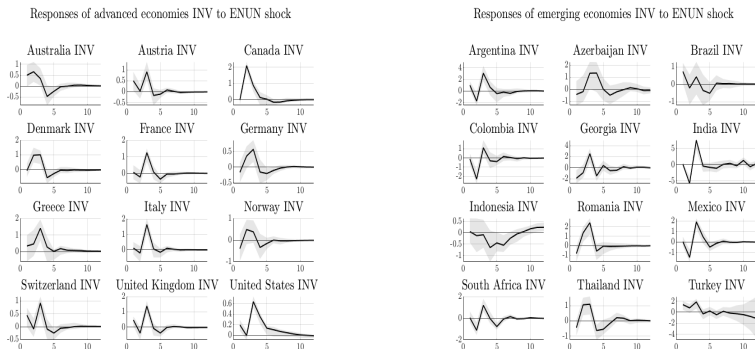


Figure: *ADVs*

Figure: *EMEs*

Oil price uncertainty shock: Good vs Bad outcomes

We carry out various exercises:

- 1/ Estimate IRFs from *pure* energy/oil price uncertainty shock (ie common factor on the 4 energy price volatilities)
- 2/ Estimate IRFs from good/bad commodity uncertainty shocks
- 3/ Supply or Demand shocks?

IRFs from Energy shocks: Investment

- Similar effects on Investment of global and "pure" energy uncertainty shocks

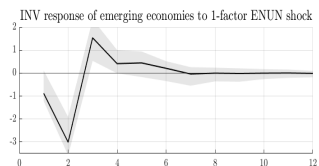
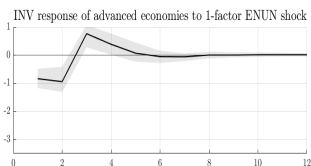
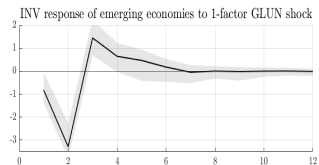
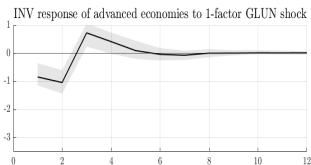


Figure: *ADVs*

Figure: *EMEs*

Pure oil price uncertainty shock

- 1 A *pure* energy/oil price uncertainty shock leads to a negative effect on economic activity, as usually highlighted in the literature
- 2 The effect is the similar to a global commodity price uncertainty shock → An energy/oil uncertainty shock is likely to reflect only global uncertainty
- 3 When decomposing energy (=oil) price uncertainty into two main components, (i) part of uncertainty that comoves with other non-energy commodities and (ii) part of uncertainty that is specific to the energy market, the results suggest that those two components will have on average opposite effects on economic activity
- 4 So our approach: a way to disentangle **“bad”** vs **“good”** oil price uncertainty shocks

Another strategy to identify Good vs Bad shocks

Robustness check: Does another strategy to identify good/bad shocks lead to similar/opposite results?

- 1 We identify a *bad* uncertainty commodity shock when associated with an *increase* in commodity prices, and conversely
- 2 We use the Bry-Boschan algorithm to identify increase and decrease in the GSCI index
- 3 This alternative identification strategy leads to similar IRF results as regards “**bad**” shocks, but not for “**good**” shocks (see Figure next slide). This suggests that our identification strategy should be preferred when trying to identify good/bad uncertainty shocks.

Another strategy to identify Good vs Bad shocks

- Investment responses to good/bad commodity price uncertainty shock

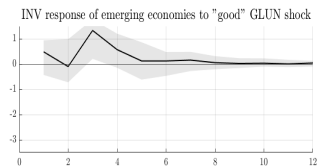
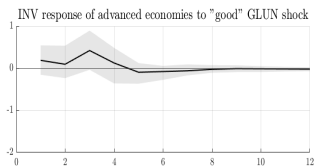
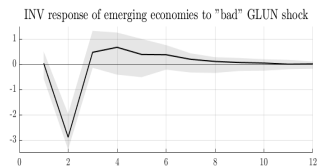
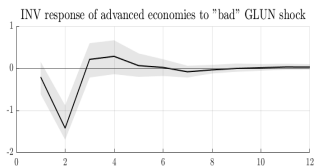


Figure: *ADVs*

Figure: *EMEs*

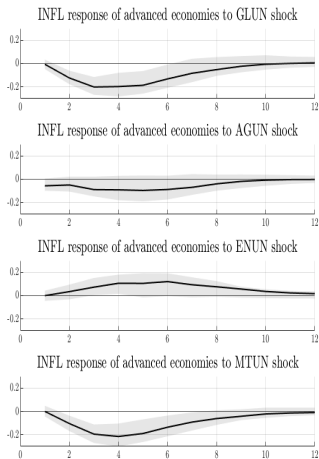
Supply or Demand shocks?

Are commodity price uncertainty shocks acting as demand or supply shocks?

- 1 Not a structural model here, but looking simultaneously at inflation is helpful: a demand shock send output and prices in the same direction, while a supply shock send them in opposite directions
- 2 By looking at IRFs (see Figure next slide), we get that global commodity price uncertainty shock acts as a **negative demand** shock.
- 3 Similarly, specific-commodity price uncertainty shocks tends to act as *demand* shocks: positive for oil and negative for metals and agricultural commodities

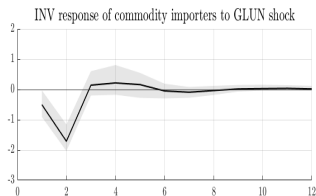
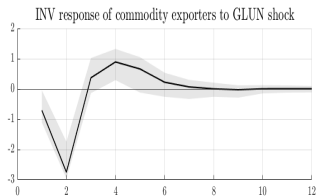
Supply or Demand shocks?

- IRFs of inflation to global uncertainty shock and the 3 commodity-specific uncertainty shocks



Commodity exporters vs importers

- Commodity exporting countries appear more affected by global commodity price uncertainty than commodity importing countries



Conclusions

- A global commodity price uncertainty shock depresses investment and exports, for both ADVs and EMEs, much more than VIX and WUI, acting as a negative demand shock
- No evidence of a bounce-back after a global commodity price uncertainty shock for both ADVs/EMEs, leading to permanent losses
- Our approach is a way to disentangle between *bad* and *good* outcomes of oil price uncertainty shocks:
 - ① *bad* draws are coming from the global uncertainty component embedded in oil price uncertainty and common with other commo price uncertainty
 - ② *good* draws are coming from the oil-specific sectoral uncertainty once the global component has been accounted for