Modeling Fluctuations in the Global Demand for Commodities

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Global Real Activity Is Not A Proxy for Demand

- Shifts to the consumption demand for commodities are an important determinant of real commodity prices and of global real activity.

- Not every change in global real activity reflects consumption demand shocks. Commodity supply shocks also affect global real activity. Nor is every demand shock the same.

- Uncovering shifts in the consumption demand involves disentangling each of the many demand and supply shocks that jointly drive real commodity prices and real activity.

- This requires estimating a structural model of the commodity market based on an appropriate measure of global real activity.

Criteria for Selecting an Index of Global Real Activity

1. The coverage of the index must be global.

2. The index must span a long enough time period to facilitate the estimation of structural models.

3. Monthly indices are preferred because the use of monthly data facilitates the imposition of identifying assumptions in structural models of commodity markets.

4. The index must account for the fact that over time, the share of the industrial sector in output has declined, while that of the services sector has increased.

5. The index must be leading indicator for industrial production.

This requirement follows from the fact that inputs must be ordered and shipped before starting the production process. Because shipping takes time, the index must be a leading indicator for global industrial production.

An immediate implication is that the amplitude of fluctuations in this leading indicator reflects firms' expectations of future production, so both the timing and magnitude of the index may differ from conventional real output proxies.

6. If the index is to be used for forecasting, it must also be available in real time.

The Candidates

1. World real GDP

2. Industrial production (OECD, OECD+6)

3. World steel production

4. Indices based on real commodity prices

5. Regression-based proxies for “global demand”

6. Indices based on the volume of bulk dry cargo ocean shipping

Properties of OECD+6 Industrial Production

1. Global coverage subject to data availability and reliability constraints (both for PPP weights and for real output data).

   Example: China excluded prior to 2006.

2. Available since 1973.

3. Available at monthly frequency.

4. Not robust to changes in commodity intensity of industrial production.

5. Not a leading indicator, but a coincident indicator for real output.

6. Not available in real time.

Global Real Commodity Price Indices

1. Unweighted indices of cumulative changes in real prices of industrial raw materials or metals

   Barsky & Kilian (2002), Alquist et al. (2013)

2. Real commodity price factors extracted using factor models

   Alquist and Coibion (2014); Delle Chiae et al. (2016)

Premise:

Supply shocks in individual commodity markets average out, so common factor must be demand-driven.

Properties of Real Commodity Price Indices

1. Global coverage.

2. Available since 1970s (with some caveats).

3. Available at monthly frequency.

4. Robust to changes in technology and changes in the sectoral composition of real output.

5. Leading indicator for industrial real output.

6. Available in real time.

Drawbacks of Factors in Real Commodity Prices

1. Not all important commodities are freely traded (e.g., iron ore before 2009, crude oil before 1973).

2. No consensus yet on how to select the real commodity prices from which the common factor is extracted and how to extract that factor. Which way this is done also affects for how long the index may be constructed.

3. Constructing these indices may require additional smoothing.

Regression-based proxies for "global demand"

Hamilton (blog 2014) and Bernanke (blog 2016) postulate that copper prices, interest rates and the value of the dollar are good proxies for "global demand," allowing them to estimate the "global demand component of the change in oil prices":

$$\Delta p_t^{oil} = \beta_0 + \beta_1 \Delta p_t^{copper} + \beta_1 \Delta exch_t^{ROW/USD} + \beta_1 \Delta i_t^{long-term} + u_t$$

►Fitted value is interpreted as the change in the price of oil that reflects changes in "global demand".

►The strength of "global demand pressures" on the percent change in the price of oil is measured by the pairwise correlations with the regressors, as though the regressors were exogenous.

Caveats

1. Using a single commodity such as copper as a proxy for an index of all non-oil industrial commodities may not be a good idea.

2. Positive correlations between nominal variables may arise simply from a common inflationary component.

3. Correlation with changes in interest rates and the dollar exchange rate need not reflect global demand pressures:

   ⇨ Changes in U.S. interest rates also affect the supply side of commodity markets as do exchange rates (Frankel 2012).

4. No causal interpretation.

5. No consideration of dynamics

Kilian (2009) Index of Cycles in Global Real Activity

- Based on percentage changes in representative freight rates for bulk dry cargoes such as grain, oilseeds, coal, iron ore, fertilizer, and scrap metal, further differentiated by the size of the vessel and the shipping route.

- These rates of growth are averaged, cumulated, adjusted for inflation and for the long-run trend in the cost of shipping.

- To the extent that the supply of bulk carriers is inelastic in the short run, increased global flow demand for industrial commodities drives up this index. The index thus is a proxy for changes in the volume of shipping of industrial raw materials.

- Increases in the volume in turn are linked to increased future production of manufactured goods and trade in manufactured goods (Khalil 2017).

Properties of the Kilian Index

1. Global coverage, as shipping brokers have an incentive to cover all important trading routes.

2. Available since January 1968.

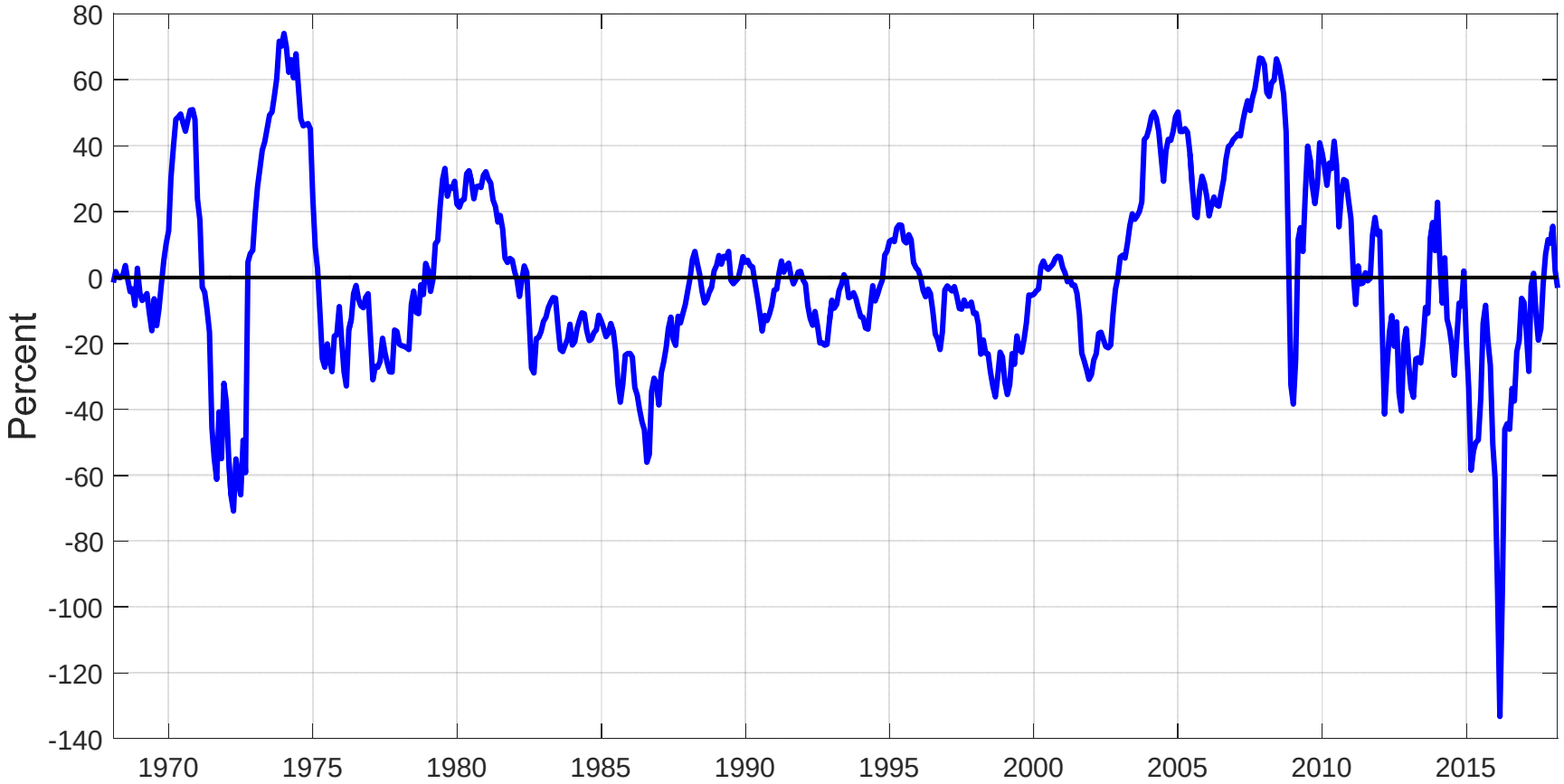
3. Available at monthly frequency.

4. Robust to changes in technology and changes in the sectoral composition of real output.

5. Coincident indicator for volume of shipping; leading indicator for industrial real output.

6. Available in real time.

Kilian (2009) Global Business Cycle Index, 1968.1-2018.2



As with other indices, the magnitude has no intrinsic meaning.

Expansions and contractions are highly correlated with survey data on the global economy and export orders since 1998.

1. Does the Kilian Index Depend on the Oil Price?

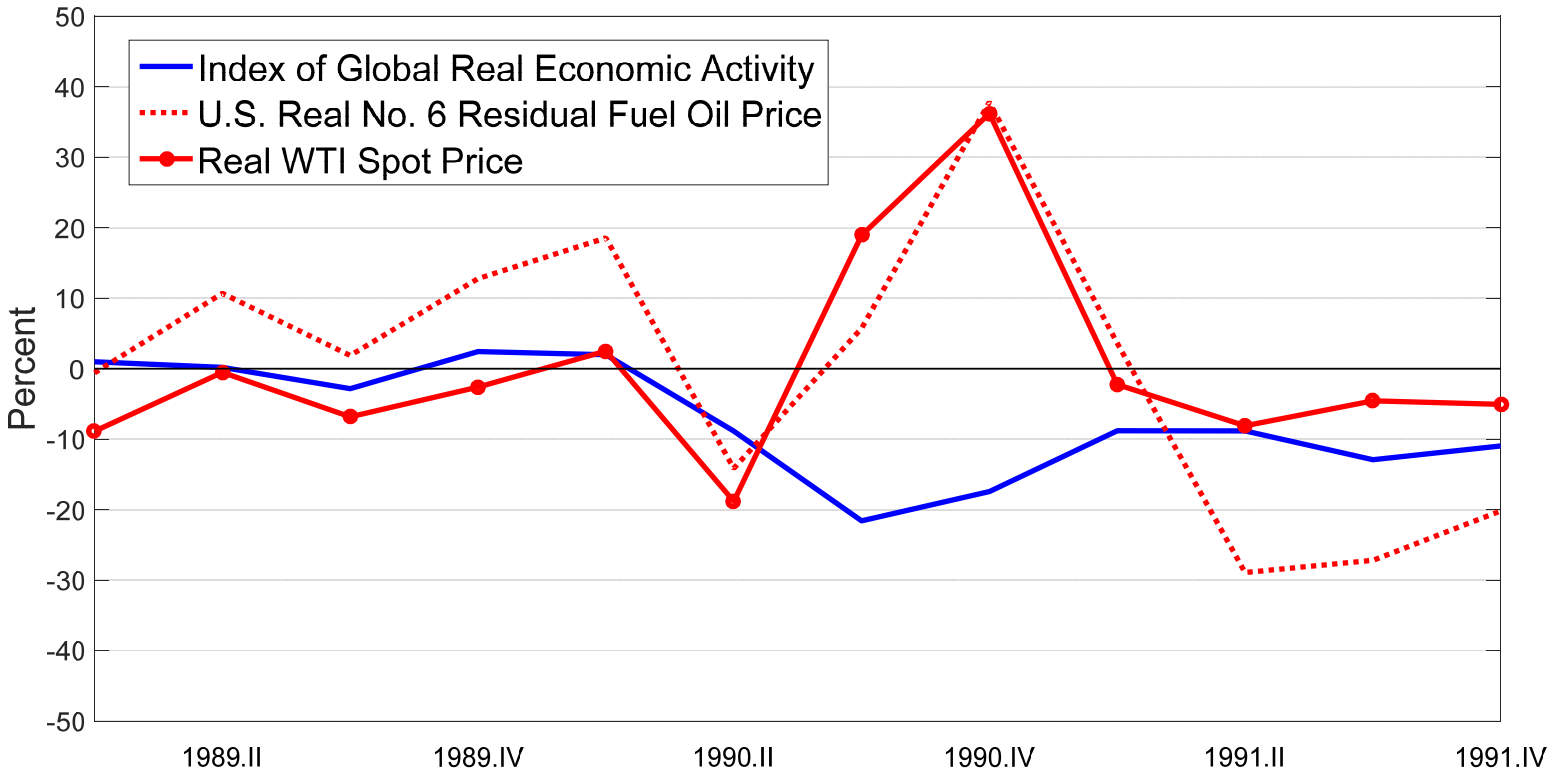
Fact: Changes in the real price of oil help predict changes in the index of global real activity.

Question:
Does this evidence establish reverse causality from real oil prices to global real activity and invalidate the Kilian index?

Answer:
No, a positive shock to the demand for all industrial commodities raises both the real price of oil and global real activity, inducing precisely this type of comovement.

► To validate this claim, we need to identify exogenous increases in the real price of oil caused by oil supply shocks or shocks to storage demand driven by political turmoil in the Middle East and to show that they raise the Kilian index.

Example: Invasion of Kuwait in 1990



Why?

1. Fuel charge underlying single-voyage rates is predetermined.
2. Time-charter rates do not depend on fuel price at all.

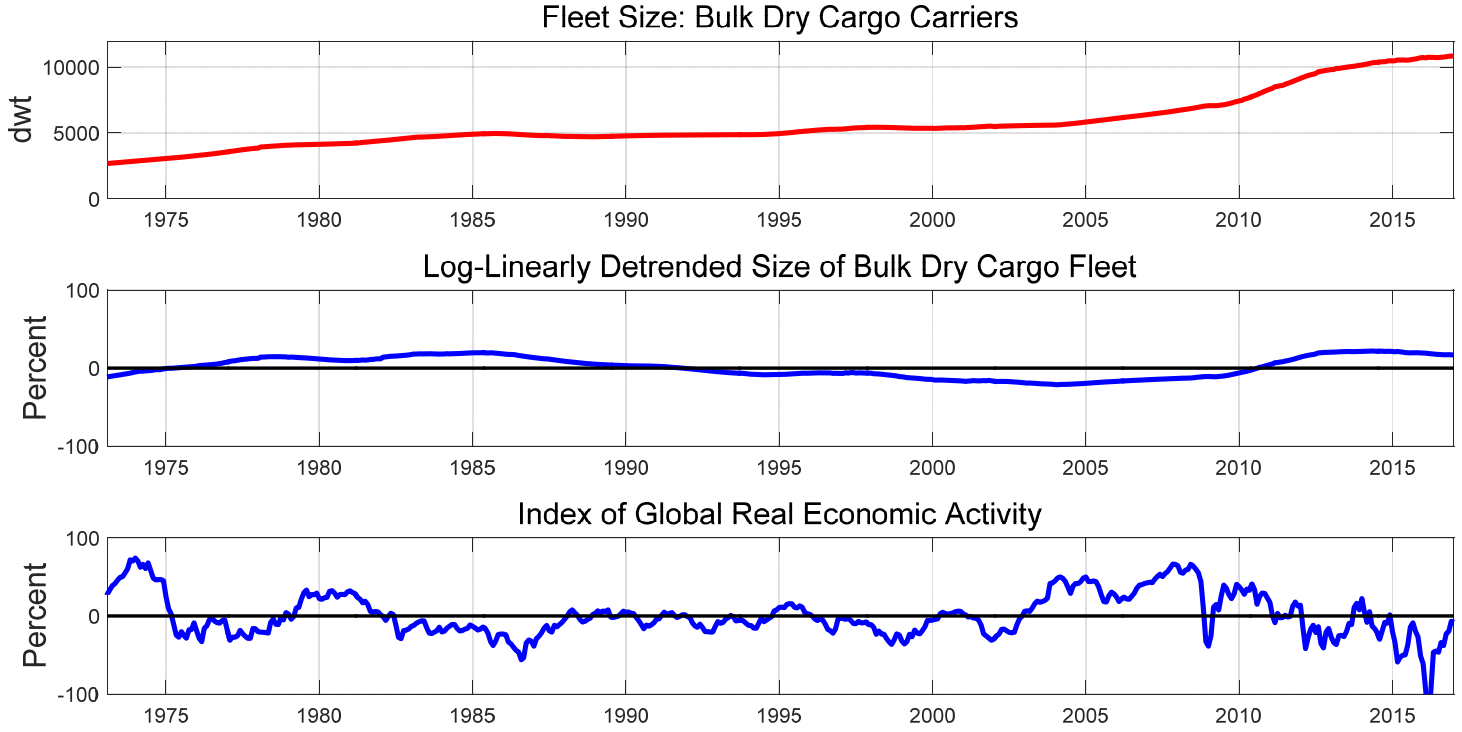
2. Is It Driven by Shipbuilding/Scrapping Cycle?

► High shipping rates provide an incentive for shipowners to place orders for new vessels.

► Because new vessels take 2-3 years to be completed, they often enter service, when high demand in commodity markets has already subsided, creating temporary excess capacity.

<u>Question:</u>
Has excess capacity in the bulk dry carrier fleet made the Kilian index useless as an indicator of global real economic activity?

Does the Shipbuilding Cycle in Dry Cargo Vessels Matter?

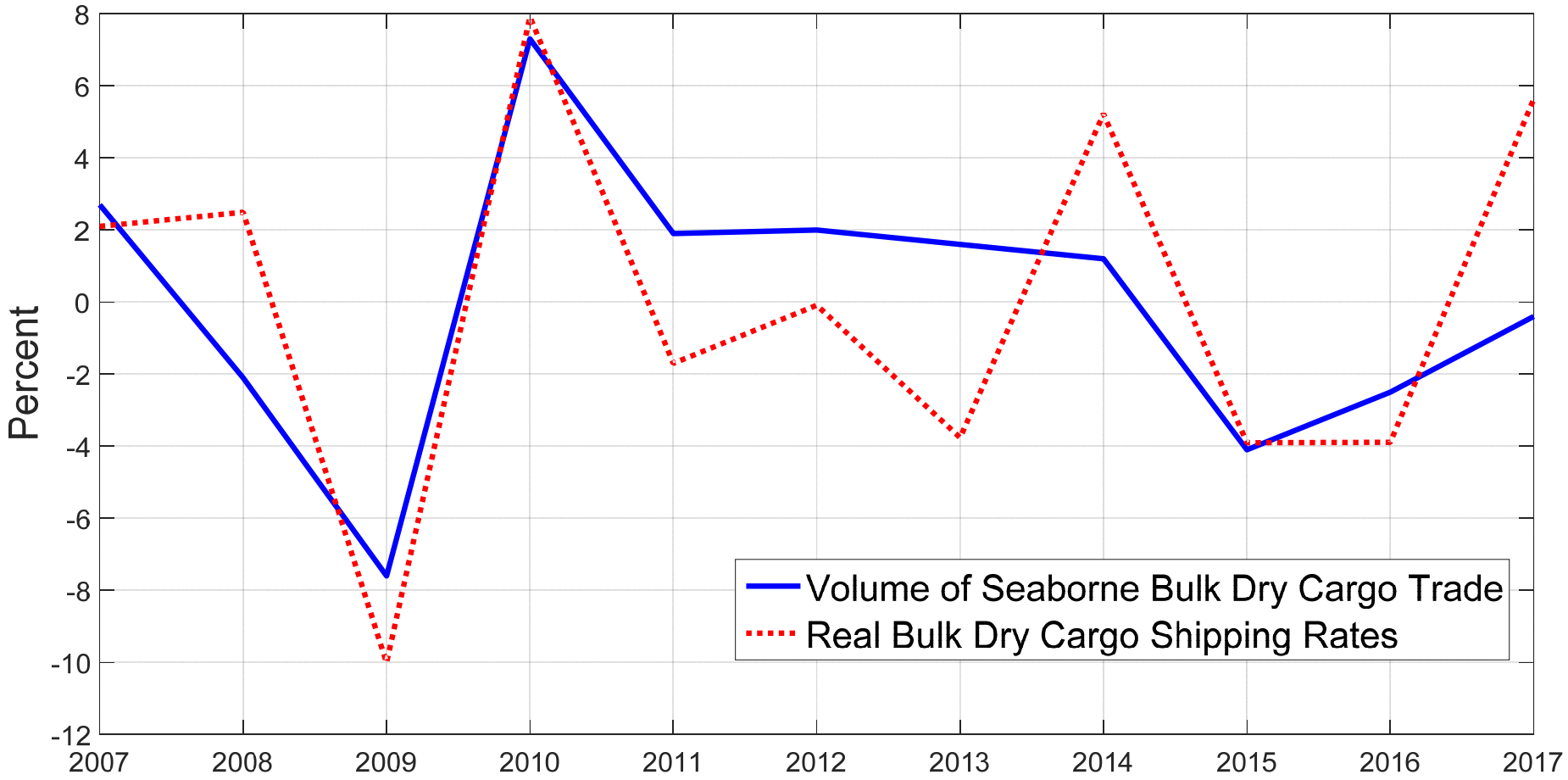


NOTES: The size of the global fleet of bulk dry cargo carriers is measured in dwt, as reported by Clarkson Research.

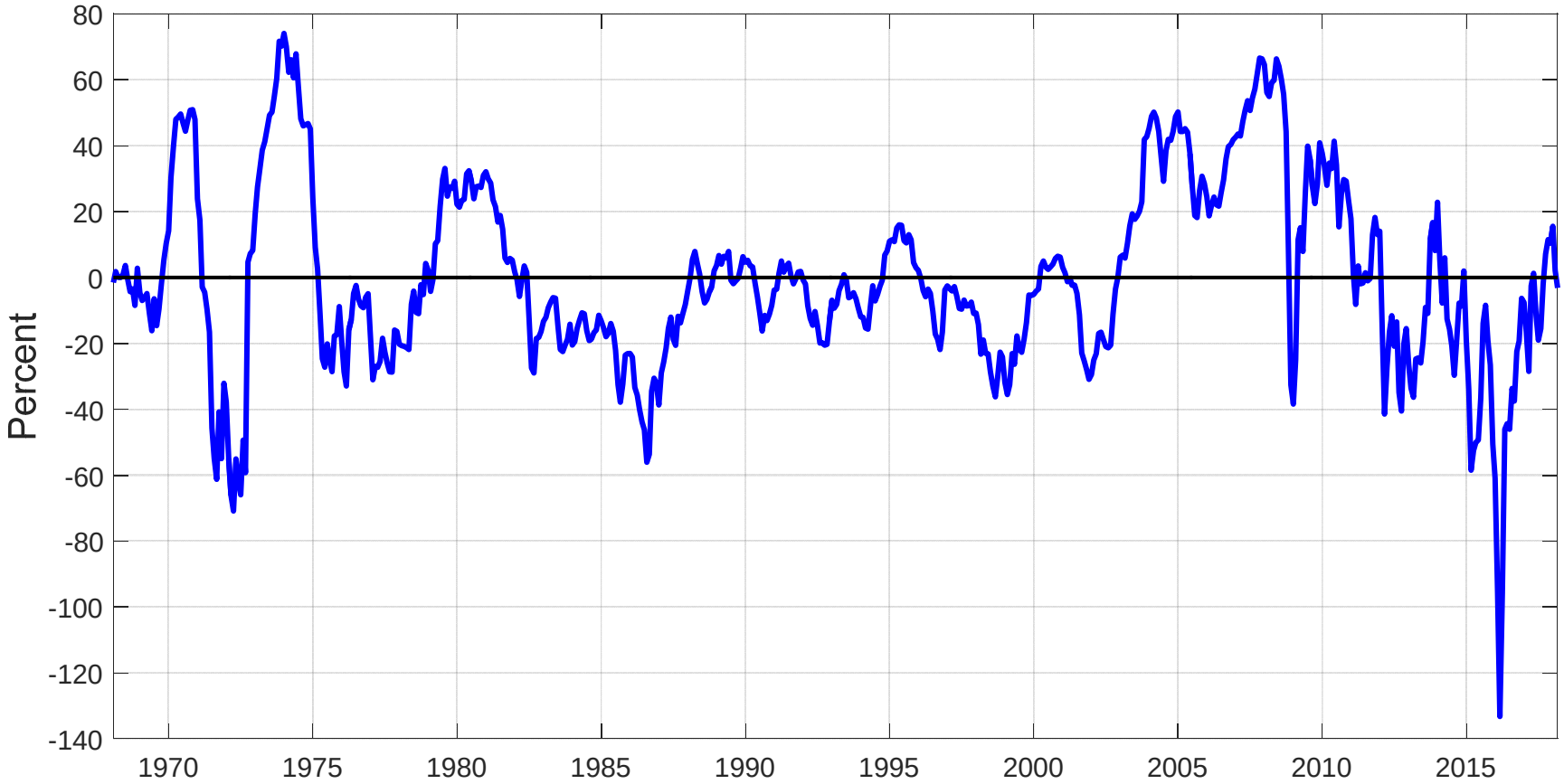
- ⇨ The timing and magnitude of shipping cycle does not explain the higher-frequency variation in the Kilian index
- ⇨ Excess capacity is at best an exacerbating factor (but not an important one for the reasons discussed next)

Why? 1. Other indicators show similar declines after 2011.
2. Kilian index is consistent with volume proxy:

Demeaned Year-on-Year Growth in
Bulk Dry Cargo Trade Tonnage and Real Freight Rates

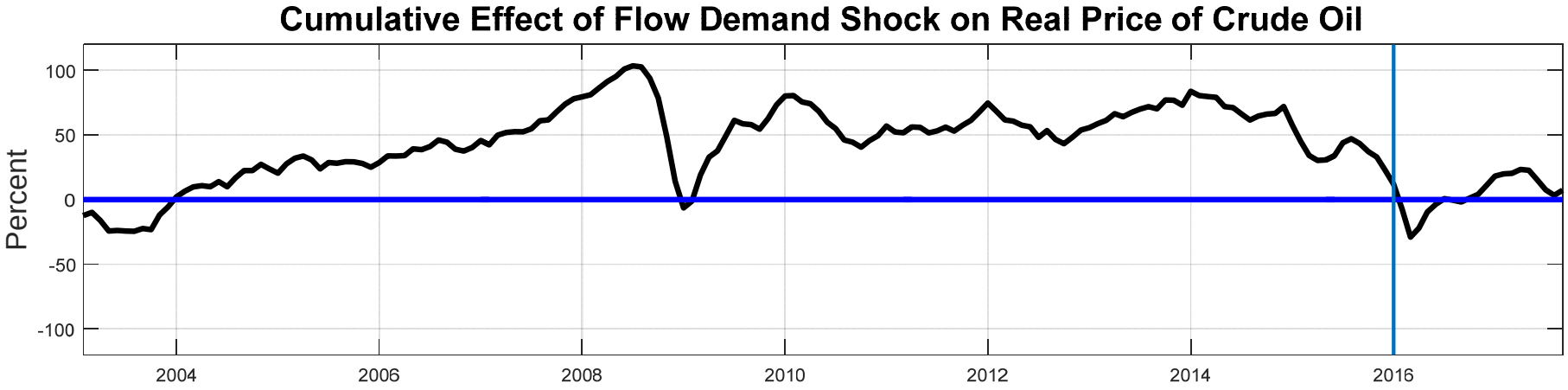


3. Has the Kilian Index Become Too Volatile?



The negative spike in early 2016 in the Kilian index is largely explained by lower demand from China; Brazilian iron ore supply shock is too small to explain sharp temporary decline in the volume of Chinese iron ore imports.

Only modest implications of this spike for real price of oil



NOTES: Based on estimate of Kilian and Lee (2014) oil market VAR model on sample ending in 2017.8. The vertical line marks December 2015 and precedes the drop in Chinese iron ore and coal imports in January and February 2016.

Application: Global Slowdown after 2011?

► When global commodity prices surged across the board after 2003, this increase was attributed to an unexpected economic boom in emerging Asia, led by China.

► Many observers at the time favored the view that real economic activity had increased permanently. Indeed, in 2009, global real commodity prices quickly recovered from the financial crisis.

► The Kilian index suggests that this boom has been largely transitory with large declines after 2011.

This evidence cannot be explained based on the shipbuilding cycle. It is consistent with qualitative survey data, real industrial commodity prices, and proxies for global real output.

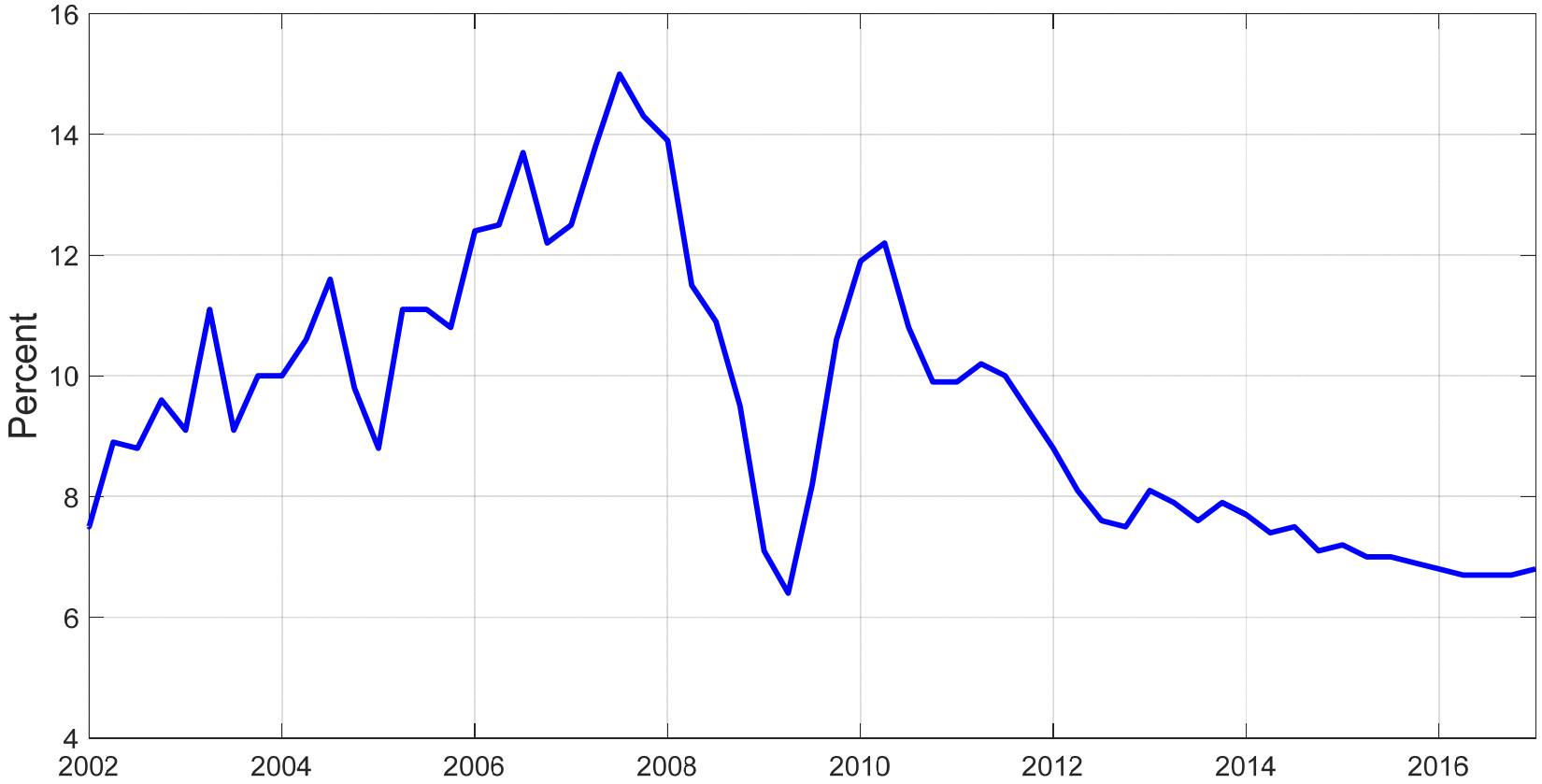
Cumulative Changes in Real Commodity Prices, 2010.5-2015.12

Global Commodity Price Index	Cumulative Change in Real Price (%)
Industrial Raw Materials Price Index	-40.93
Metals Price Index	-51.46
Copper Price	-38.12
Iron Ore Price	-76.87
Brent Price of Crude Oil	-54.32

⇨ Favorable supply shocks are unlikely to explain a broad-based decline in real commodity prices.

⇨ Has there been a slowdown in demand from emerging Asia?

Year-on-Year Growth in China's Real GDP



⇨ Official data are likely to understate the decline.

⇨ Similar pattern in data on Chinese electricity production and industrial value added.

Summary of the Evidence on the Slowdown

1. Global real activity is back to where it was before the surge that started in 2003. This insight has implications for commodity exporters and commodity price forecasting.

2. Possibly related to decline in overall trade growth from 7.4% at annual rates during 1995-2007 to 3.1% during 2012-15. The income elasticity of trade for emerging economies also fell from 1.5 to 0.8.

3. Partial recovery after mid-2016, but barely back to the long-run average. This recovery is not driven by China.