What Drives Commodity Prices in the Long Run?

David S. Jacks (Simon Fraser and NBER)
Martin Stuermer (Dallas Fed)

April 2015

Understanding drivers of commodity prices of first-order importance for the global economy:

(1) determination of incomes/welfare of both commodity-consuming and -producing nations;

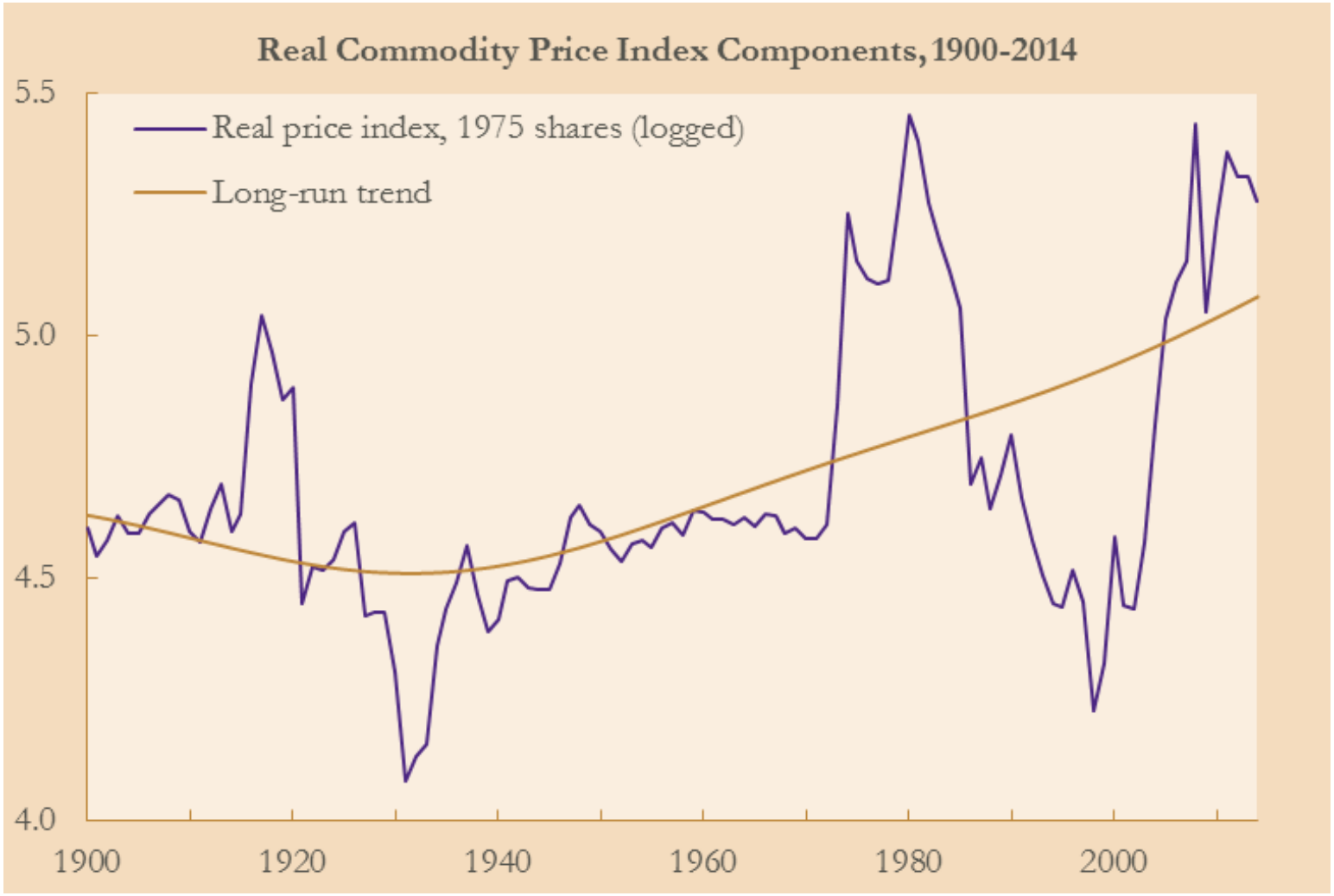
(2) determination of income distribution within nations as ownership of resources varies widely;

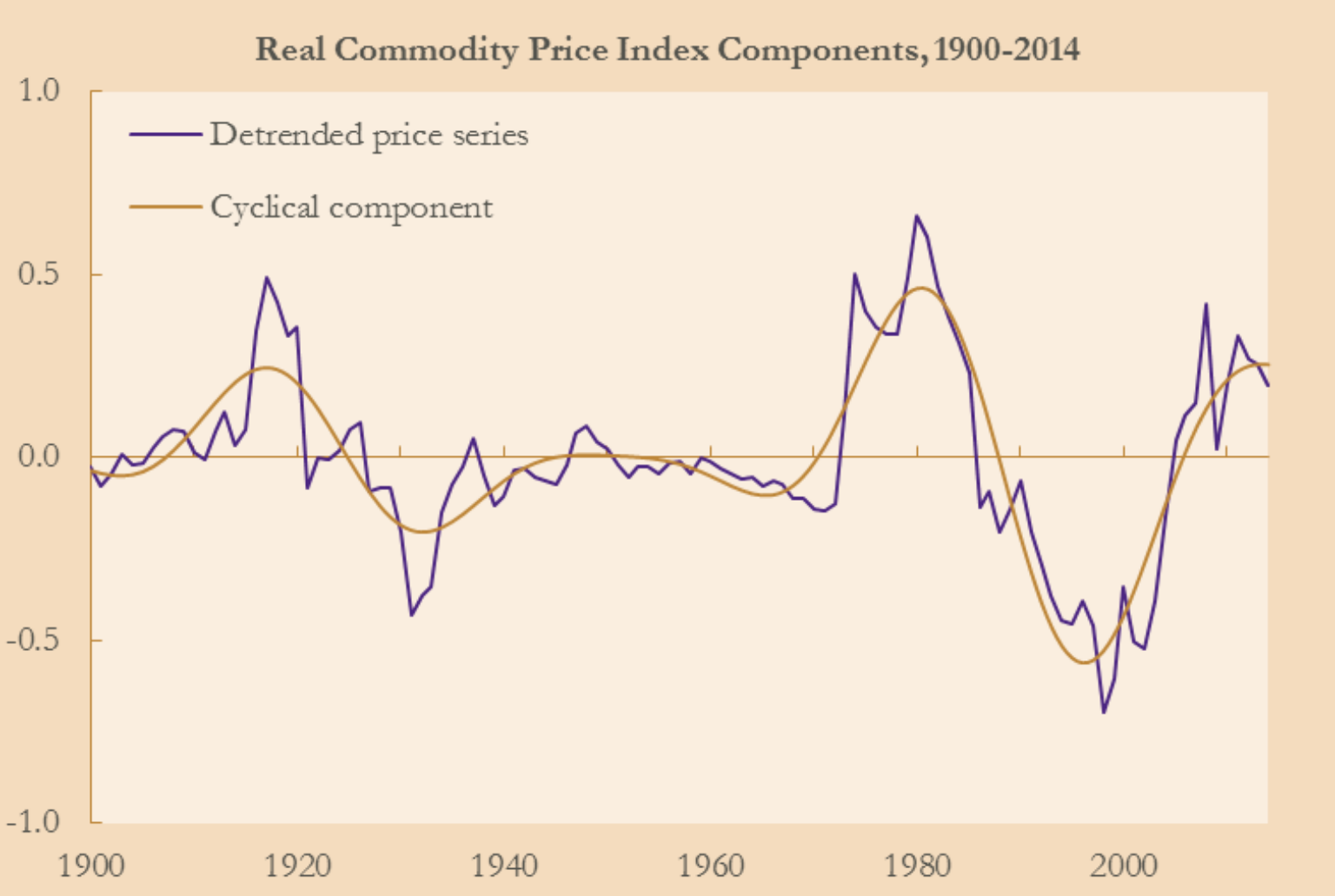
(3) implications for formation and persistence of growth-enhancing/detracting institutions.

But for all this, outside spectators remain divided in assessing importance of the various forces determining commodity prices.

Recent history of commodity prices indicative: bouncing off lows of late 1990s, real prices rose relentlessly, culminating in spike of 2008.

Observers have battled it out, variously pointing to the role of fundamentals versus speculation.


Real Commodity Price Index Components, 1900-2014
Real price index, 1975 shares (logged)
Long-run trend
5.5
5.0
4.5
4.0
1900
1920
1940
1960
1980
2000


Real Commodity Price Index Components, 1900-2014
Detrended price series
Cyclical component
1.0
0.5
0.0
-0.5
-1.0
1900
1920
1940
1960
1980
2000

Building on a large academic literature following Kilian (2009), we evaluate potential sources of commodity price dynamics through SVARs.

In this literature, changes in commodity prices are decomposed into different types of shocks.

Identification achieved by assigning restrictions based on assumptions related to inelastic demand and supply curves in the short-run.

Our contribution comes in providing evidence on drivers of real commodity prices over both a broader set of commodities and span of time.

Rather than using monthly data over years, we use annual data over the past 165 years.

This perspective allows us to abstract away from the assumption of an inelastic supply curve in the long run embedded in previous literature.

Instead, identification based on the idea that increases in real commodity prices set in motion two processes: investment and innovation.

Allows us to specify three (commodity-specific) orthogonal shocks to real commodity prices:

(1) a global demand shock;
(2) a commodity supply shock; and
(3) an inventory or other demand shock.

In particular, start with a VAR model with three endogenous variables (estimated by commodity):

$$z_t = (\Delta Y_t, \Delta Q_t, P_t)' = \alpha_1 z_{t-1} + \ldots + \alpha_p z_{t-p} + \beta D_t + u_t$$

(1) global GDP (%);
(2) global commodity production (%); and
(3) world commodity price (ln).

Also includes a few deterministic terms: constant, linear trends, fixed effects for periods surrounding World Wars.

Decomposition of reduced form residuals into three structural shocks using long-run restrictions based on following assumptions on persistent effects of shocks:

	Global GDP	Production	Price
Global demand	YES	YES	YES
Commodity supply	NO	YES	YES
Inventory or other demand	NO	NO	YES

Furthermore, this approach leaves the contemporaneous relationships completely unrestricted, amounting to the following assumptions on transitory effects of shocks:

	Global GDP	Production	Price
Global demand	YES	YES	YES
Commodity supply	YES	YES	YES
Inventory or other demand	YES	YES	YES

With respect to the selection of commodities, the following criteria hold:

(1) evidence of an integrated world market;

(2) no evidence of dramatic structural changes in marketing and/or use over time; and

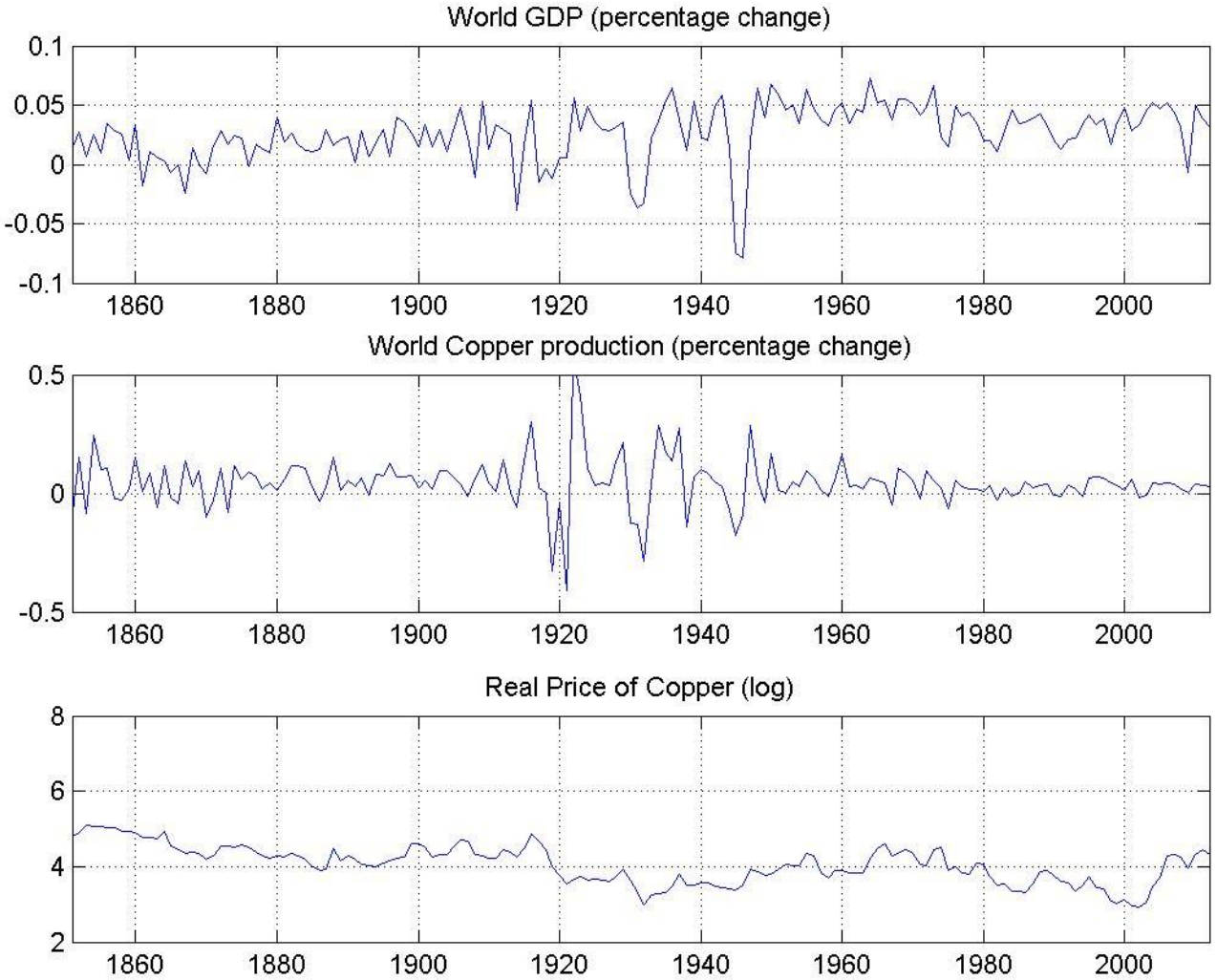
(3) a relatively high degree of homogeneity in the traded product.

We arrive at 14 commodities (grains, metals, and soft commodities) from 1850 (earliest) to 2012.

Prices: mostly derived from UK and US and deflated by US-CPI.

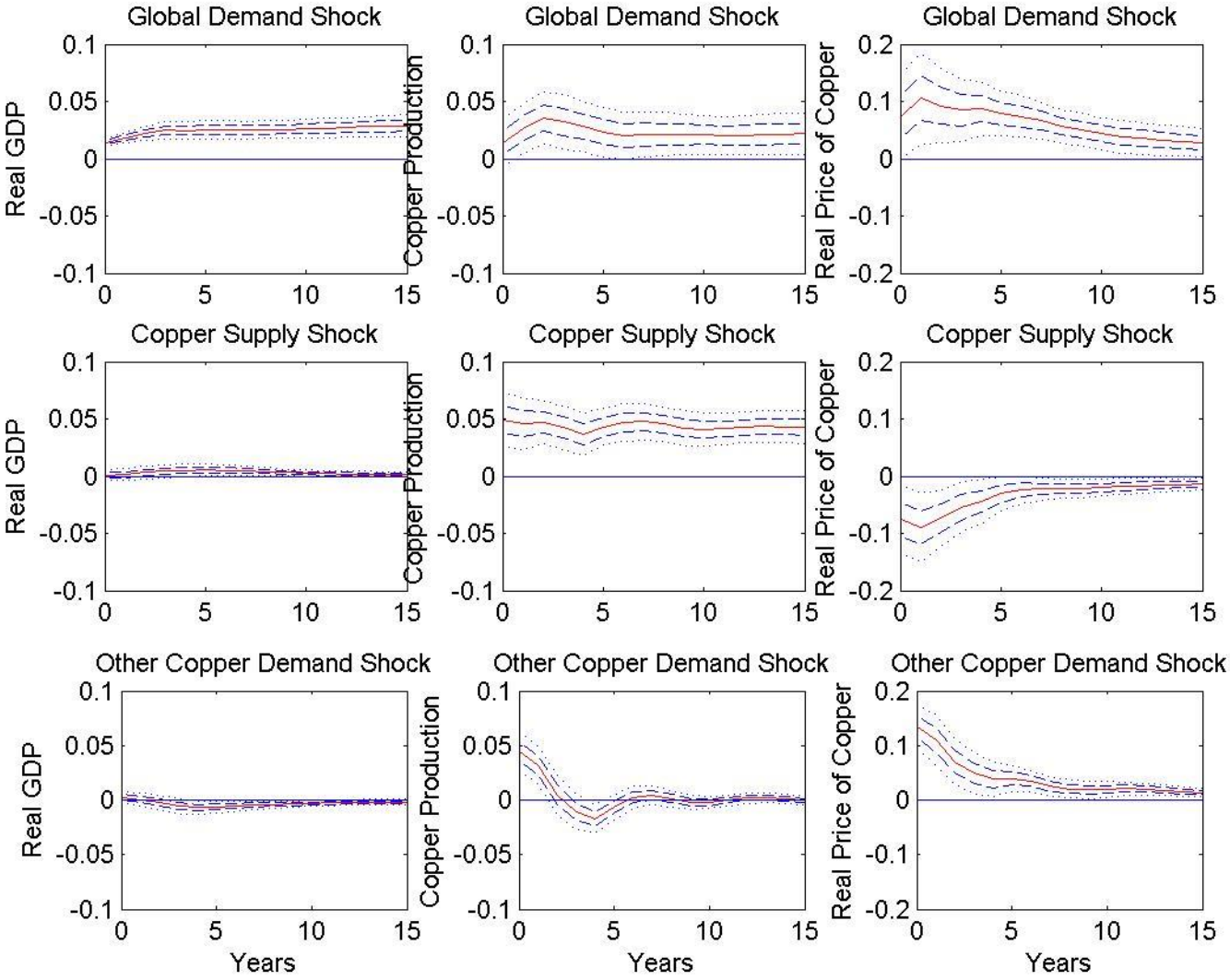
Production: drawn historically from national statistics and presently from industry groups.

Global GDP: Maddison (2010) with updates from the Conference Board (2014).


World GDP (percentage change)
0.1
0.05
0
-0.05
-0.1
1860
1880
1900
1920
1940
1960
1980
2000
World Copper production (percentage change)
0.5
0
-0.5
1860
1880
1900
1920
1940
1960
1980
2000
Real Price of Copper (log)
8
6
4
2
1860
1880
1900
1920
1940
1960
1980
2000

To check our method, we consider accumulated impulse response functions for shocks and whether these match with reasonable priors:

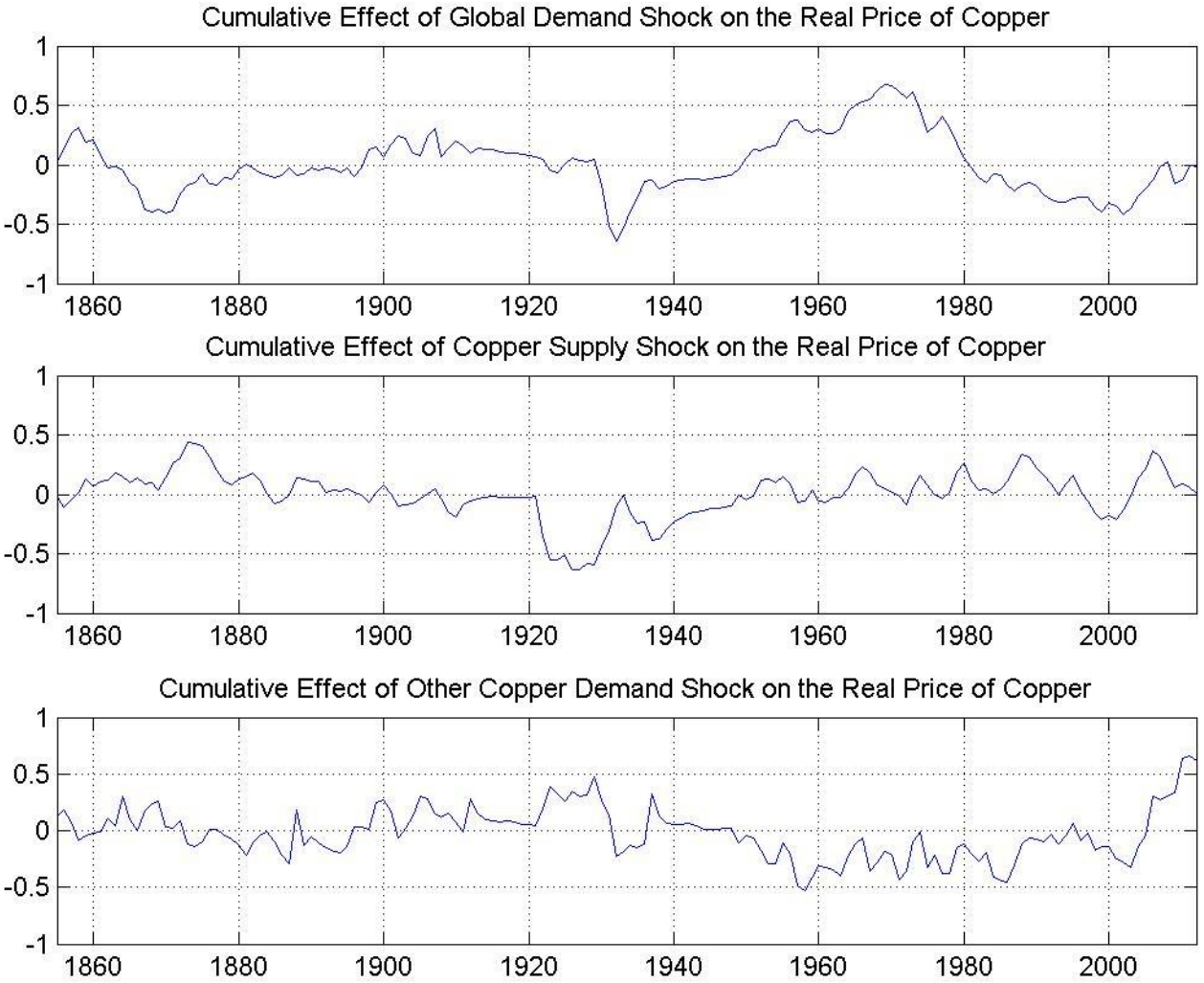
	Global GDP	Production	Price
Global demand	>0	≥ 0	>0
Commodity supply	0	>0	<0
Inventory or other demand	0	0	>0


Global Demand Shock
Global Demand Shock
Global Demand Shock
Copper Supply Shock
Copper Supply Shock
Copper Supply Shock
Other Copper Demand Shock
Other Copper Demand Shock
Other Copper Demand Shock
Real GDP
Copper Production
Real Price of Copper
Years
0.1
0.05
0
-0.05
-0.1
0.2
-0.2
0
5
10
15

Next, we run the horse-race, pitting the various shocks against one another.

Our historical decompositions quantify the shocks' independent contribution relative to a base-line projection.

Intuition: a counter-factual simulation of what the real price of a commodity would have been in the absence of all other shocks.


Cumulative Effect of Global Demand Shock on the Real Price of Copper
1
0.5
0
-0.5
-1
1860
1880
1900
1920
1940
1960
1980
2000
Cumulative Effect of Copper Supply Shock on the Real Price of Copper
1
0.5
0
-0.5
-1
1860
1880
1900
1920
1940
1960
1980
2000
Cumulative Effect of Other Copper Demand Shock on the Real Price of Copper
1
0.5
0
-0.5
-1
1860
1880
1900
1920
1940
1960
1980
2000

Summing up over all commodities, the main findings of the paper are that:

(1) Although contribution of global demand shocks vary, a common pattern w.r.t. timing;
(2) Supply shocks are idiosyncratic in timing, limited in size, and transitory in duration;
(3) Somewhat surprising, inventory or other demand shocks play second largest role, especially for softs.

There still remain a number of tasks, namely:

(1) Exploring characterization of shocks according to commodity categories (in particular, role of fixed costs and IO);

(2) Extending cross-section of commodities, but reducing time-series (equivalent information?);

(3) Unpacking the inventory or other demand shock (gauging relevance versus role as a residual).