Demand Shocks Fuel Commodity Price Booms and Busts

Martin Stuermer, Ph.D.
Senior Research Economist, Federal Reserve Bank of Dallas

Dr. Martin Stuermer, Ph.D., Senior Research Economist, Federal Reserve Bank of Dallas, presenting on what drives commodity price booms and busts at the J.P. Morgan Center for Commodities' (JPMCC's) international commodities symposium, which was held at the University of Colorado Denver Business School from August 10, 2017 through August 11, 2017.

Booms and busts in commodity markets are a particularly important part of the global economy. They affect inflation and consumer spending, and determine investment and welfare in producing nations. They also influence growth-enhancing institutions and may even lead to civil unrest.

Understanding which shocks drive these low-frequency price movements and how long they persist is important in formulating environmental and resource policies, for the conduct of macroeconomic policy,

and, most importantly, for investment decisions involving extractive and agricultural sectors of the economy.

Commodity prices are driven by shocks in supply and/or demand. For example, a commodity supply shock is an unexpected decline in crop yield due to adverse weather, which shifts the supply curve inward and increases prices.

An aggregate commodity demand shock changes the demand for all commodities at the same time. For example, China's rapid industrialization led to stronger-than-expected increases in the demand for a broad variety of commodities such as copper, oil and wheat over the past decade.[1]

Thus, examining the effects of shocks on commodity prices is an intriguing avenue of research.[2] While the literature on modeling oil markets has examined only a handful of boom-and-bust phases since the early 1970s, this analysis of commodity markets is based on a new dataset of price and output levels for 12 agricultural, metal and soft commodities for the period, 1870 to 2013.

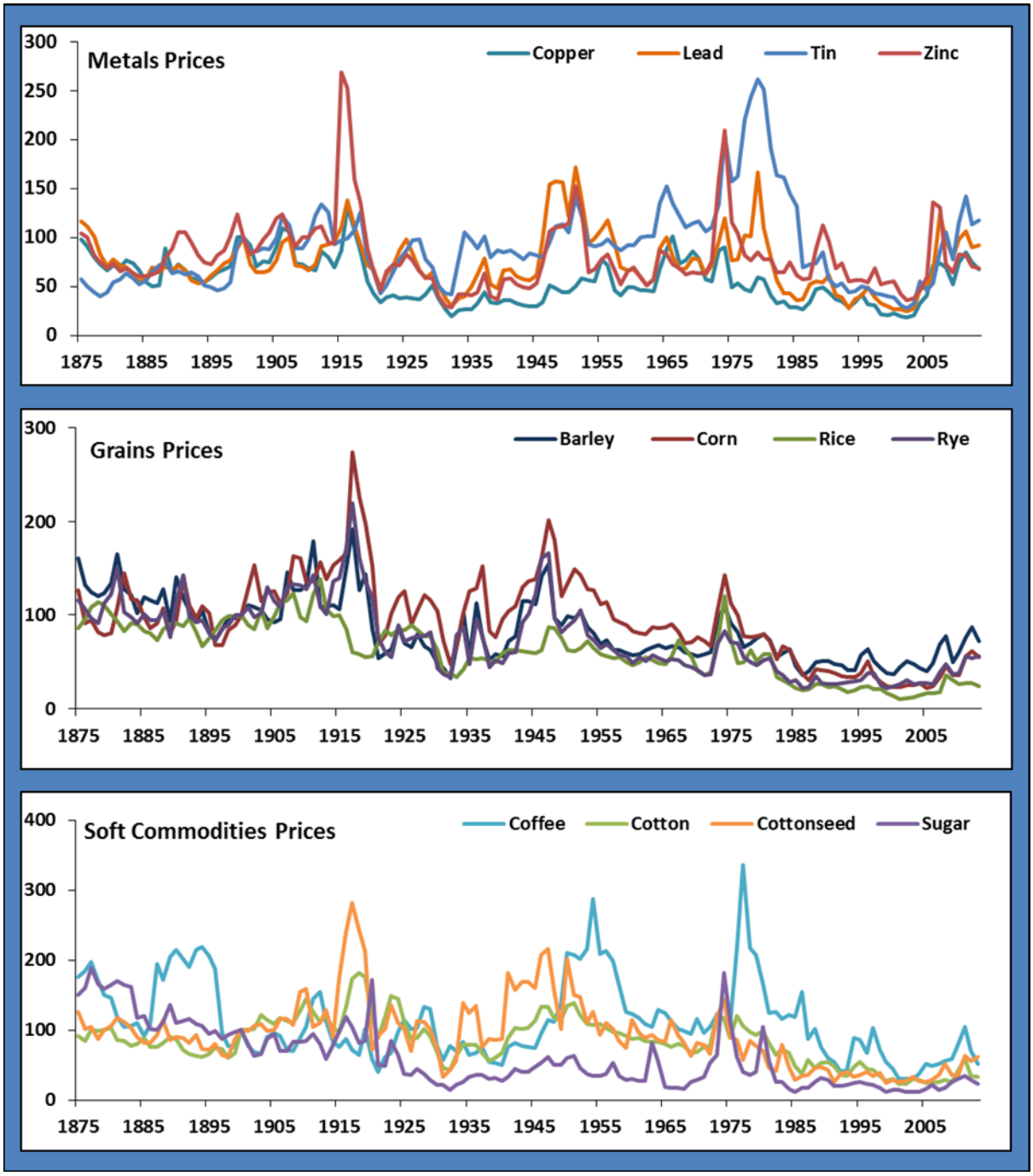
China's effect on commodity markets is not a new phenomenon. Throughout history, demand shocks due to rapid industrialization have driven commodity price booms.

Aggregate demand shocks strongly predominate over supply shocks as drivers of price booms across a broad variety of commodities. Demand shocks strongly affect prices for about 10 years, while commodity supply shocks impact prices for roughly five years. As periods of industrialization lose steam and supply catches up, busts follow. Prices return to their stable or declining trends.

Commodities Dataset Created

A dataset encompassing global output and prices for 12 commodities – barley, corn, rice, rye, coffee, cotton, cottonseed, sugar, copper, lead, tin and zinc – was assembled covering the 143-year study period (Figure 1).

Figure 1
Booms, Busts Not a New Phenomenon
Annual Real Price Indexes for 12 Commodities, 1900=100



Source: Jacks and Stuermer (2018).

The commodity markets selected exhibit characteristics that make a long-run analysis feasible. Specifically, there is longstanding evidence of an integrated world market; there is no strong indication

of sudden change in how the commodity is used, and there is a high degree of product homogeneity. Thus, the 12 commodities selected have long-term characteristics that mineral commodities such as iron ore or crude oil only gained relatively recently.

Identifying Price Shocks

Shocks are unexpected shifts in the supply or demand curves of a commodity market. An underlying idea is that firms do not anticipate these shocks. Because it's not easy for supply or demand to fully respond, there are either supply shortfalls or oversupply, leading to price increases or decreases as firms discover they are either underinvested or overinvested.

The econometric model employed here allows identification of the contribution of three types of shocks to each commodity price. The "aggregate demand shock" (for example, unexpected increase in commodity demand due to rapid industrialization) is based on the assumption that this shock can trigger investment and innovation, and subsequent long-run effects on overall output.[3]

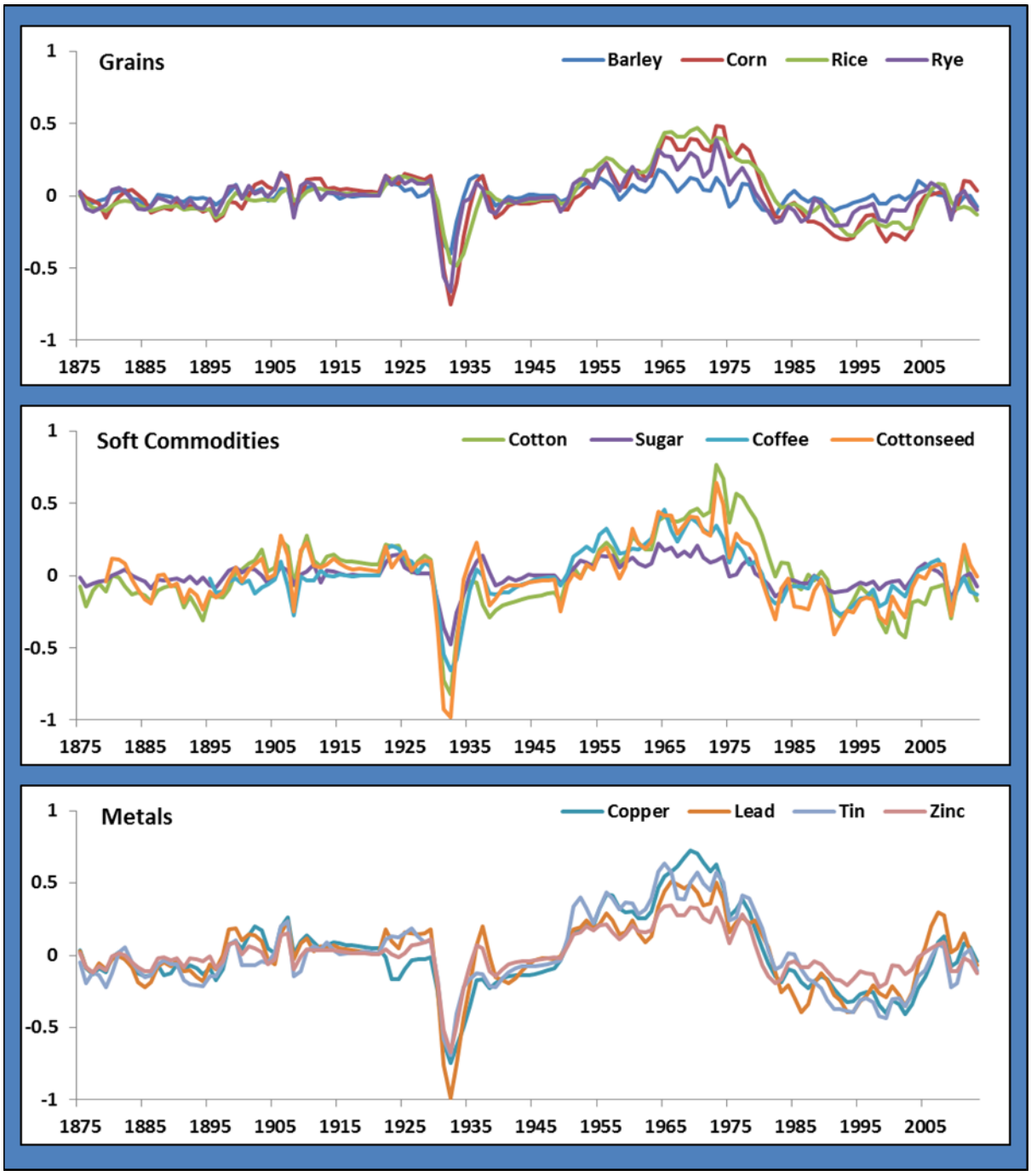
By comparison, it is assumed that a "commodity supply shock" – such as cartel action or the weather – only affects global gross domestic product (GDP) for a couple of years. This is consistent with evidence that oil supply shocks have had short-lived effects on U.S. GDP.[4]

Any residual shock – or one that isn't attributable to an aggregate shock or a commodity supply shock – is a "commodity market-specific demand shock." This type of shock is assumed to only affect capacity utilization and poses no long-run effects on global GDP or commodity production.

Booms, Busts Explained

Econometric modeling allows assessment of the contribution of each type of shock to commodity prices over time. Figure 2 represents a counterfactual simulation of what the prices of specific commodities would have been solely in the presence of aggregate commodity demand shocks.

Figure 2
Commodity Prices React to Demand Shocks Simultaneously



Source: Jacks and Stuermer (2018).

Note: Charts show a counterfactual simulation of what the prices of specific commodities would have been solely in the presence of aggregate commodity demand shocks.

The collective story that emerges suggests that although the proportional contribution of the aggregate commodity demand shocks naturally varies across the different commodities, the accumulated effects broadly follow the same pattern. Thus, while aggregate commodity demand shocks affect prices to different degrees, they affect the real commodity prices at the same time. These results then suggest that aggregate commodity demand shocks have a common source.

This interpretation of aggregate commodity demand shocks is in line with what economic history suggests about global output fluctuations. Historical decompositions start in 1875, when prices were depressed due to the negative accumulated effects of aggregate commodity demand shocks on prices during the first – but somewhat forgotten – Great Depression.

The effects of subsequent aggregate commodity demand shocks are in line with historical occurrences of business cycles in major economies. For example, the effects of the large negative aggregate commodity demand shock in 1907 can be associated with the so-called Panic of 1907. Likewise, in the early 1930s, real prices plummeted as the (second) Great Depression reduced global demand for commodities.

After World War II, positive aggregate commodity demand shocks led to increases in real commodity prices as re-industrialization and re-urbanization in much of Europe and Japan proceeded, followed by the economic transformation of the East Asian Tigers (following Japan's lead.)

Negative aggregate commodity demand shocks are evident in the late 1970s, the early 1980s and the late 1990s, respectively corresponding to the global recessions of 1974 and 1981 and the Asian financial crisis of 1997. These are followed by a series of positive aggregate commodity demand shocks emerging from the late 1990s and early 2000s due to unexpectedly strong global growth, driven by the industrialization and urbanization of China.

Finally, the lingering effects of the global financial crisis are also clearly visible.

Demand Dominates Supply

From 1871 to 2013, aggregate commodity demand shocks explained 32-38 percent of the variation in real commodity prices (across the three types of commodities examined here), while commodity market-specific demand shocks explained 42-50 percent (Table 1A). These two types of shocks, thus, caused an appreciable portion – 74-88 percent – of medium- and long-run fluctuations in real commodity prices.

Table 1
Different Types of Shocks Explain Commodity Price Booms, Busts

Percentage share of each type of shock that explains commodity price fluctuations

Panel A: 1871-2013

	Aggregate commodity demand shock	Commodity supply shock	Commodity-specific demand shock
Grains	32%	18%	50%
Metals	38%	20%	42%
Softs	34%	20%	44%
Total	35%	20%	46%

Panel B: 1871-1913

	Aggregate commodity demand shock	Commodity supply shock	Commodity-specific demand shock
Grains	26%	23%	52%
Metals	33%	24%	44%
Softs	27%	24%	48%
Total	29%	24%	47%

Panel C: 1919-1939

	Aggregate commodity demand shock	Commodity supply shock	Commodity-specific demand shock
Grains	32%	19%	49%
Metals	34%	27%	38%
Softs	35%	19%	46%
Total	34%	23%	45%

Panel D: 1949-2013

	Aggregate commodity demand shock	Commodity supply shock	Commodity-specific demand shock
Grains	37%	16%	47%
Metals	42%	16%	42%
Softs	38%	18%	45%
Total	38%	16%	46%

Source: Jacks and Stuermer (2018).

Conversely, commodity supply shocks played a rather secondary and transient role, explaining only 18-20 percent of the variation. This result is fairly consistent across agricultural, mineral and soft commodities.

Averages for three subperiods based on the full sample (Table 1B-D) show that commodity supply shocks have lost importance over time, as their average share declined from 24 percent in the period before World War I to 23 percent during the interwar period and fell further to 16 percent in the period after World War II.

At the same time, the average share of aggregate commodity demand shocks has increased from 29 percent in the pre-World War I period to 34 percent during the interwar period and up to 38 percent in the post-World War II period.

On average, the effects of aggregate commodity demand shocks are the most persistent, with effects lingering up to 10 years. Commodity market-specific demand shocks are slightly less persistent but with effects also lasting up to 10 years in some cases. Finally, effects of commodity supply shocks, for the most part, are insignificant. The sugar and tin markets are exceptions to this generality, with significant effects lasting up to five years.

Persistent, Low Prices

After examining the drivers of real commodity prices in the long run among different types of commodities, aggregate commodity demand shocks and commodity market-specific demand shocks appear to strongly dominate over commodity supply shocks in driving fluctuations of real commodity prices over a long period of time.

The results suggest that the price effects of the large commodity demand shocks attributable to China in 2003-07 and 2009-11 will dissipate. In the absence of additional positive commodity demand shocks, it appears that current prices may stay low while abundant supplies are consumed. Commodity exporters should, thus, prepare for a prolonged period of depressed commodity prices.

Endnotes

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Dr. Stuermer presented on this article's topic at the JPMCC's August 2017 international commodity symposium, which took the place of the JPMCC's annual Research Council meeting. The views expressed here are those of the author and do not represent the views of the Federal Reserve Bank of Dallas or the Federal Reserve System.

1 See Stuermer (2017) for an empirical exploration of the relationship between industrialization and mineral commodities.

2 For details on the data, methodology and results, see Stuermer (2018) and Jacks and Stuermer (2018).

3 For each commodity market, a Structural Vector Autoregressive Model with long-run restrictions is used. It includes three endogenous variables—global gross domestic product (%), global commodity production (%) and world commodity price (ln). The model also controls for constant, linear trends and the world war periods.

4 See Kilian (2009).

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Author Biography

MARTIN STUERMER, Ph.D.
Senior Research Economist, Federal Reserve Bank of Dallas

Dr. Martin Stuermer is a senior research economist at the Federal Reserve Bank of Dallas. His research interests are macroeconomics with a focus on energy, commodities and natural resources. He studies the fluctuations and trends in energy and mineral commodity markets from a long-run perspective by using time-series econometrics and growth models. In his position he briefs the Bank's president on energy for Federal Open Market Committee meetings. He joined the Dallas Fed in July 2014 and holds a Ph.D. in economics from the University of Bonn.