How Super is the Commodity Cycle?

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Introduction

To borrow a phrase once used about business cycles, it can be said that "*the study of [super] cycles necessarily begins with the measurement of [super] cycles*" (adapted from Baxter and King, 1999). This was the lead quote in a 2008 International Monetary Fund journal article introducing the concept of statistically measuring super cycles. Dr. John Cuddington[1] and Dr. Daniel Jerrett utilized band-pass filters to isolate cycles in commodity prices at varying frequencies. With the current re-emergence of the super-cycle discussion, it seems timely to revisit and update the analysis to help inform the current conversation.

Defining Super Cycles

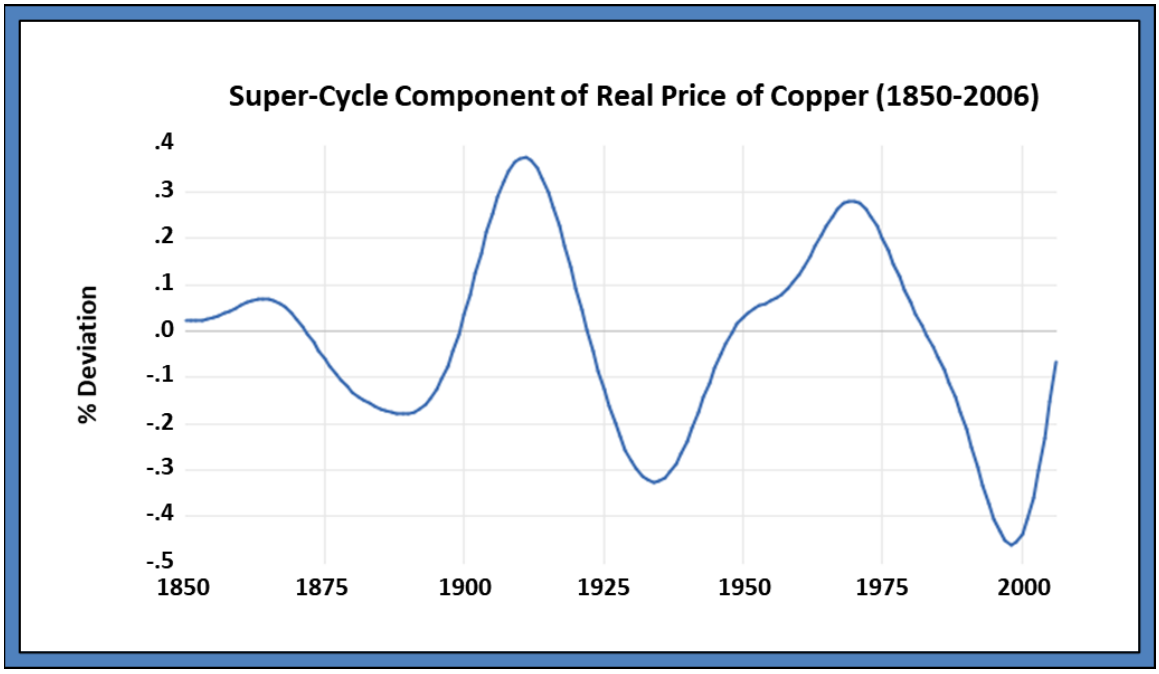
In early 2005, former Citigroup Director, Alan Heap, declared that "a super cycle is underway, driven by material intensive economic growth in China" (Heap, 2005). Heap's analysis suggested that super cycles have two unique features: 1. Prolonged cycles with expansions of roughly 10-35 years (suggesting full cycles of 20-70 years) and 2. Broad-based, affecting a wide range of commodities. Heap said that there had been three super cycles since the late 1800s occurring during the U.S. industrialization, post-war reconstruction in Europe followed by Japan, and the industrialization and urbanization of China beginning in the early 2000s. All were demand driven.

It is well known that short-to-medium run supply conditions in commodity markets can be quite constrained due to capacity and time to bring new deposits online. Therefore, it should be evident that a large demand shock such as above-trend economic growth in China could create a supply-demand imbalance that results in large, sustained price increases as seen in the early 2000s.

Measuring Super Cycles

Cuddington and Jerrett (2008) took an agnostic view of super cycles and used a series of statistical techniques to document facts around commodity price behavior. The super cycle, as defined by Heap, had a complete cyclical frequency of 20-70 years. Band-pass filters were used to extract cyclical components as well as the long-run trend from a 150-year dataset of real metals prices. The filtering technique found evidence supporting the hypothesis that three super cycles had occurred over the past 150 years and the amplitude of the super cycles was large with variations of 20 to 40 percent above and below the long-run trends. Figure 1 shows the super-cycle component for the real price of copper from the original 2008 analysis.

Figure 1



In addition to extracting the super-cycle component of copper, the analysis was performed on a broader group of metals. Simple correlations of the super-cycle components were large and statistically significant in most cases. Principal component analysis (PCA) was used to measure the amount of co-movement in the group of metals. If a super cycle is being driven by broad-based economic growth, one would expect to see commodity prices moving together. PCA can be used to measure the importance of unobservable common factors affecting the super-cycle components. The first principal component explained 66 percent of the overall joint co-variation in the six metal super-cycle components. It is left to the analyst to then correlate the unobserved factor with something that could be driving prices. In this case, it was assumed that the first principal component was highly correlated with global real GDP, supporting Heap's hypothesis that super-cycles are driven, in part, by periods of above-trend economic growth and industrialization and urbanization.

The analysis was extended to look at iron ore, steel, and molybdenum (Jerrett and Cuddington, 2008) and to oil prices (Zellou and Cuddington, 2012). Super cycles were found to occur during similarly defined time periods in both studies, further supporting the super-cycle hypothesis.

Are All Cycles Super?

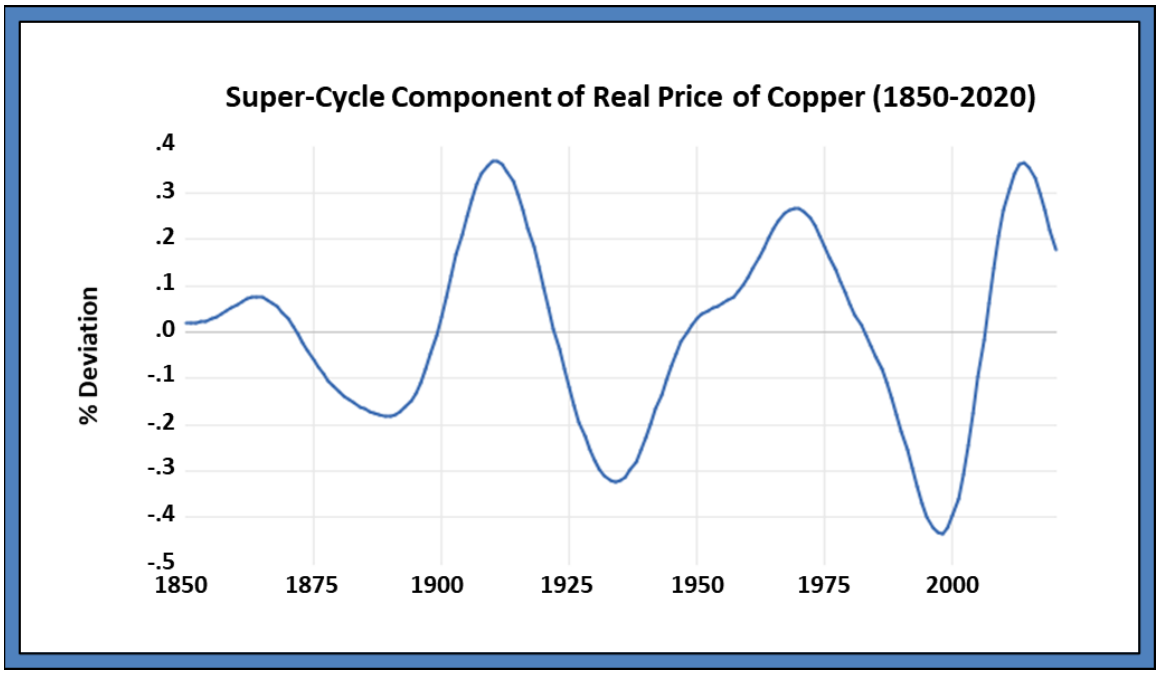
There have been discussions in the past few months regarding commodity prices and the possibility of entering a new super cycle driven, in part, by the ongoing move to green technology as well as supply constraints from a decade of underinvestment in exploration and production. In addition, many commodities have seen recent price increases which could be a combination of economic recovery from the Coronavirus pandemic, current, low inventories in many commodities, and a weak U.S. dollar. The question is, are these current market forces transitory and more importantly, is the forthcoming

technological change a large enough structural driver to affect commodity markets in a similar way to prior super cycles?

No two super cycles are alike, and one could assume that with declining commodity intensity in many countries, the continued energy transition, and demographics becoming a headwind for many parts of the world, the look and feel of super cycles and the associated amplitude may be quite different both across the entire commodity complex and within individual commodities.

The original statistical analysis was updated through 2020 to determine where the current super cycle is relative to long-run trends. This can help inform the current discussion of whether a new super cycle is emerging. Figure 2 shows the super-cycle component of the real price of copper through the end of 2020. The super-cycle component peaked in 2014 but remains above its long-run trend suggesting we may still be in the tail end of the super cycle that began in the early 2000s or possibly a new cycle is emerging without the decline in amplitude seen in past super cycles.

Figure 2

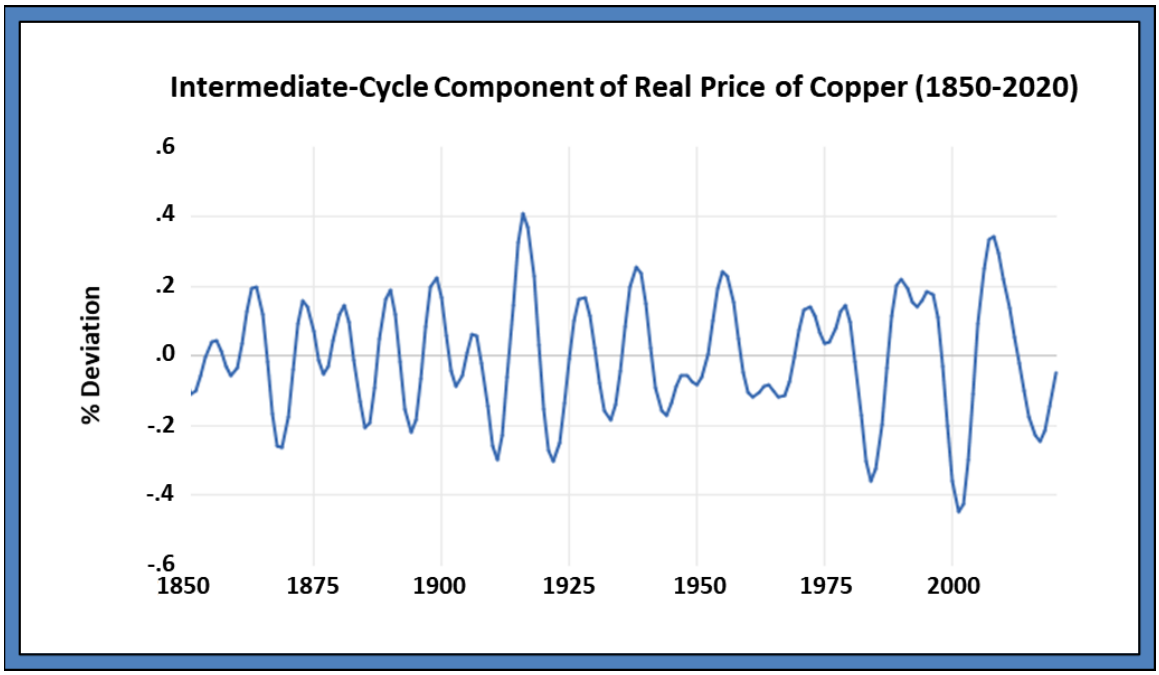


The statistical methodology offers the flexibility to isolate any cyclical frequency from a time series.[2] In addition to isolating the super-cycle component, both the intermediate component (8-20 years) and the business-cycle (2-8 years) component can be extracted using band-pass filters.

The intermediate cycle of 8-20 years correlates well with the investment cycle that many commodities producers experience. The timing of this cycle can have impacts on the super-cycle discussion. Using copper as an example, the super-cycle component is still above trend, albeit declining. The intermediate cycle reached a trough in 2017 after a decade of declining, and subsequently, a decade of little to no

investment in production and exploration. Figure 3 shows the intermediate cycle for the real price of copper.

Figure 3



LME copper inventories in late 2020 were the lowest since 2007.[3] This corresponds to the timing of significant price increases in the fourth quarter of 2020. With China experiencing early signs of an economic recovery, the supply shortage could keep upward pressure on copper prices in the intermediate term. The question is does this represent the emergence of a new super cycle or is this the result of under investment in the industry that will correct in the coming years?

2021 and Beyond

The current discussion of the ongoing transition to green technology does represent a source of continued demand for decades to come. The commitment by many nations to be carbon neutral and less energy intensive by 2050-2060 requires significant infrastructure investment which will be commodity intensive. Structural models of commodity prices have shown that at major stages of economic development including agricultural and industrial, the intensity of use in commodities increases, increasing the likelihood of a super cycle. This is followed by a transition to a period of less-material intensive growth as economies transition to a service-driven economy. The current discussion around green technology raises an interesting question: is the global economy entering a new phase of economic development and technological change unlike any we have seen before that will be material intensive?

Cuddington and Jerrett did not set out to prove or disprove the existence of super cycles in their original 2008 paper. Rather, they wanted to introduce a framework that could inform a broader discussion about

long-run price movements and develop a peer-reviewed, statistical methodology to support it. Before one can conjecture about the existence of any economic phenomenon, one must be able to measure it.

The reemergence of the super-cycle discussion has important implications for the global economy and capital markets. Mineral producers, policymakers, and investment managers are all trying to better understand commodity prices to make more informed, long-term decisions. This statistical methodology is one of many possible tools that could help support the decision-making process and provide a framework to discuss super cycles in commodities and lend itself to other macroeconomic and financial questions.

Endnotes

Of note, this article was cited in Wallace (2021).

1 John T. Cuddington is the former William J. Coulter Professor of Mineral Economics at the Colorado School of Mines.

2 As Christiano and Fitzgerald (2003, p. 1) argue: The theory of the spectral analysis of time series provides a rigorous foundation for the notion that there are different frequency components of the data. An advantage of this theory, relative to other perspectives on decomposing time series, is that it does not require a commitment to any statistical model of the data. Instead, it relies on the Spectral Representation Theorem, according to which any time series within a broad class can be decomposed into different frequency components. The theory also supplies a tool for extracting those components. That tool is the ideal band pass filter.

3 Source of data: https://www.lme.com/en-GB/Market-Data/Reports-and-data/Warehouse-and-stocks-reports.

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