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Measuring Global Real Economic Activity: Do Recent Critiques Hold Up to Scrutiny?

Abstract

Hamilton (2018) suggests that the Kilian (2009) index of global real economic activity is misleading and calls for alternative measures. The problem documented by Hamilton is a consequence of a coding mistake. Specifically, the index of nominal freight rates underlying the Kilian index was accidentally logged twice. Once this coding error is corrected by removing one of the log transformations, none of the concerns raised by Hamilton remains valid and the index may be used as originally intended. Moreover, it can be shown that the corrected index differs only slightly from the original index and that the key empirical results in Kilian (2009) and related studies remain unchanged when replacing the index.

JEL-Codes: Q310, Q430.

Keywords: global business cycle, shipping, commodity market, oil, log transformation.

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1. Introduction

A central question in international economics is how to measure the global business cycle. Kilian and Zhou (2018) compared several measures of global real economic activity used in modeling industrial commodity markets and showed that traditional proxies for global real GDP and global industrial production are less suited for modeling industrial commodity prices than the global real activity index constructed by Kilian (2009) from ocean bulk dry cargo freight rates. Hamilton (2018) recently questioned this conclusion. He observed that the Kilian (2009) index of global real economic activity depends on a normalization that has substantive consequences, of which users of the index must be aware. Specifically, Hamilton cautioned that this widely used index is sensitive to the base period chosen in constructing the nominal freight rate index. On this basis, he strongly argued against the use of the Kilian index in applied work.

This note clarifies that the problem documented by Hamilton is a consequence of a coding mistake in Kilian's analysis. Specifically, the index of nominal freight rates underlying the Kilian (2009) index was unintentionally logged twice, and this coding error was preserved in subsequent updates of the series. Once this coding error is corrected by removing one of the log transformations, none of the concerns raised by Hamilton remains valid and the description of the construction of the index matches exactly the discussion in Kilian (2009). The corrected index is invariant to the normalization of the base period. For example, it is invariant to whether we normalize the nominal freight index to a value of 1 in January 1968, as in Kilian (2009) or in January 1973, as in Hamilton (2018).[1]

Of course, finding a coding error could be potentially important if it changed the substance of the conclusions of earlier studies. This note shows that it does not. Although the

[1] The corrected index data are available at: http://www-personal.umich.edu/~lkilian/paperlinks.html.

correction of this coding error affects the numerical values of the index, the evolution of the index remains largely the same. The original index somewhat understates the economic boom between 2004 and mid-2008 and slightly overstates the decline in the index in early 2016, but the pattern is the same (see Figure 1). The timing of the global economic contractions and expansions remain unchanged, as does the evidence of the global economic slowdown between 2011 and 2015 and the ability of the model to match what we know about the global business cycle from survey data and other sources. The only noteworthy difference is that the magnitude of the decline in the Kilian index in early 2016 compared with late 2008 diminishes, alleviating Hamilton's main substantive concern.

Not only does the corrected index look broadly similar, but it can also be shown that the empirical results in Kilian (2009) and related studies about the historical evolution of global oil demand and oil supply shocks, about the responses of the real price of oil to these shocks, about the determinants of the real price of oil, and about the effects of global oil demand and oil supply shocks on U.S. real GDP and inflation are extremely robust to correcting the index.

The remainder of this note elaborates on these points and examines more closely the claims made by Hamilton (2018). Section 2 illustrates the robustness of the conclusions of Kilian (2009) and related studies. Section 3 addresses Hamilton's other concerns about the conceptual invalidity of the Kilian (2009) index. Section 4 discusses whether global industrial production is a suitable alternative to the Kilian index. Section 5 concludes.

2. How robust are earlier empirical results to the correction of the index?

It is straightforward to examine the robustness of the conclusions of Kilian (2009) to correcting the coding error in the construction of the global real activity index. It can be shown that all substantive results in that article are unaffected by this change. Figure 2 illustrates this point by

comparing the responses of the real price of oil to oil demand and oil supply shocks. There are no substantive differences across specifications. Likewise, the historical decompositions of the real price of oil in Figure 3 are hardly affected by this change. Nothing in the interpretation of the historical evolution of the real price of oil changes. The same is true for all figures shown in Kilian (2009) including the structural shock series and the responses of U.S. real GDP and inflation to oil demand and oil supply shocks.

The same conclusion was reached by Zhou (2018) who reexamined the conclusions of the extended global oil market model of Kilian and Murphy (2014). The impulse responses and historical decompositions in that paper are equally unaffected by using the corrected index of global real economic activity. The same result also holds for the model in Kilian (2017), which used a slightly different econometric methodology. Thus, one can say with confidence that the coding error highlighted by Hamilton (2018) is inconsequential.

3. Is the Kilian (2009) index of global real economic activity conceptually flawed?

In addition, Hamilton (2018) argues that the Kilian index is conceptually flawed, even after correcting the redundant log transformation. As this section shows, none of his arguments holds up to scrutiny.

First, Hamilton (2018) presents a review of global bulk dry cargo shipping markets, which is intended to cast doubt on the use of indices derived from bulk dry cargo shipping rate data. His analysis, however, misrepresents the economic model discussed in Kilian (2009) and Kilian and Zhou (2018). For example, increases in bulk dry cargo shipping capacity occur in response to shifts in the demand for bulk dry cargoes that drive up real shipping rates (see Stopford 1997; Greenwood and Hanson 2015). They typically do not represent exogenous shifts in the static supply curve, as claimed by Hamilton, but are part of the dynamic propagation of

shipping demand shocks. Hence, the assertion that declines in the Kilian index represent the causal effect of exogenous increases in shipping capacity and productivity is not correct. In fact, Kilian and Zhou (2018) explicitly refuted this hypothesis on empirical grounds.

Second, Hamilton raises the concern that the linear trend estimate removed from the real shipping rates evolves over time, as more data become available. This is simply a generic feature of linear detrending. More data allow more precise estimates. Hamilton (2018) instead proposes to express the real bulk dry cargo freight rates underlying the Kilian (2009) index as 24-month cumulative growth rates. The resulting time series in his Figure 4, however, implies a recession in 2005, when the global economy was booming and a protracted recession after 2009, when real commodity prices recovered sharply. Similar concerns apply to the daily version of this index suggested by Hamilton.[2]

Third, Hamilton (2018, p. 2) suggests that changes in potential real GDP are reflected in linear trends in real bulk dry cargo shipping rates. In fact, there is no a priori reason to expect a systematic relationship between fluctuations in global real GDP and changes in the volume of bulk dry cargo ocean shipping, as discussed in Kilian and Zhou (2018). The Kilian index was not designed to capture the cyclical component of global real GDP, but to help identify demand shifts in global commodity markets. Moreover, the global industrial production measure favored by Hamilton (2018) and discussed in the next section, does not in general reflect changes in global real GDP either (see Kilian and Zhou 2018).

4. Is global industrial production a suitable alternative to the Kilian index?

Hamilton (2018) then proceeds to argue that the Kilian index is empirically implausible because

[2] It should be noted that the idea of extending the Kilian (2009) index to daily data is not new (see, e.g., Bruno, Büyüksahin and Robe 2017).

it differs from his preferred measure of global industrial production. The problem with this argument is that global industrial production is a flawed measure of global real activity, as discussed in a recent comprehensive study of the merits of alternative measures of global real economic activity for modeling industrial commodity prices by Kilian and Zhou (2018).

Specifically, the concern is that industrial raw materials are ordered in advance of an increase in industrial output. Thus, we need a leading indicator for industrial output rather than a coincident indicator when modeling real industrial commodity prices. Such a leading indicator is by construction driven by expected rather than actual industrial output, which makes both its timing and amplitude potentially different from global industrial production indices. Moreover, in evaluating the global business cycle, Hamilton superimposes U.S. recession dates on the measure of global real activity, ignoring that the United States is not the world (see, e.g., Kilian and Hicks 2013; Kilian and Zhou 2018).

There is also the question of how to detrend global industrial production. Linear detrending may not be appropriate for real output series.[3] Month-to-month growth rates tend to downplay long cycles in the data. Finally, expressing global industrial production in 24-month cumulative growth rates, as suggested by Hamilton (2018), generates implausible results. For example, it implies a higher business cycle peak in 2011 than in mid-2008. It also implies that the highest business cycle peak ever occurred in 1960, which is hard to reconcile with the stylized facts about commodity booms. Moreover, the resulting business cycle is not mean zero in the long run, which is not consistent with standard trend-cycle decompositions.

5. Conclusion

The problems with the Kilian (2009) index highlighted by Hamilton (2018) are the consequence

[3] It should be noted that the downward trend in real shipping rates is inherently different from the upward trend in real output. There is no reason for the trends or the appropriate trend models to be the same.

of a simple coding mistake rather than some conceptual flaw in the index. Once this coding error is corrected, this index is a sensible measure of cyclical variation of the global economy, when modeling industrial commodity prices, with strong empirical and conceptual foundations. There is no good reason for relying on measures of global industrial production, as proposed by Hamilton (2018). Indeed, the latter variable systematically mismeasures changes in global real activity relevant for industrial commodity markets and hence cannot be used to evaluate the merits of the Kilian index (see Kilian and Zhou 2018). Nor is there a good case for expressing the data underlying the Kilian index in cumulative changes over two years, as proposed by Hamilton. While this transformation may be used as a descriptive statistic, it does not replicate key features of the global business cycle documented in the literature.

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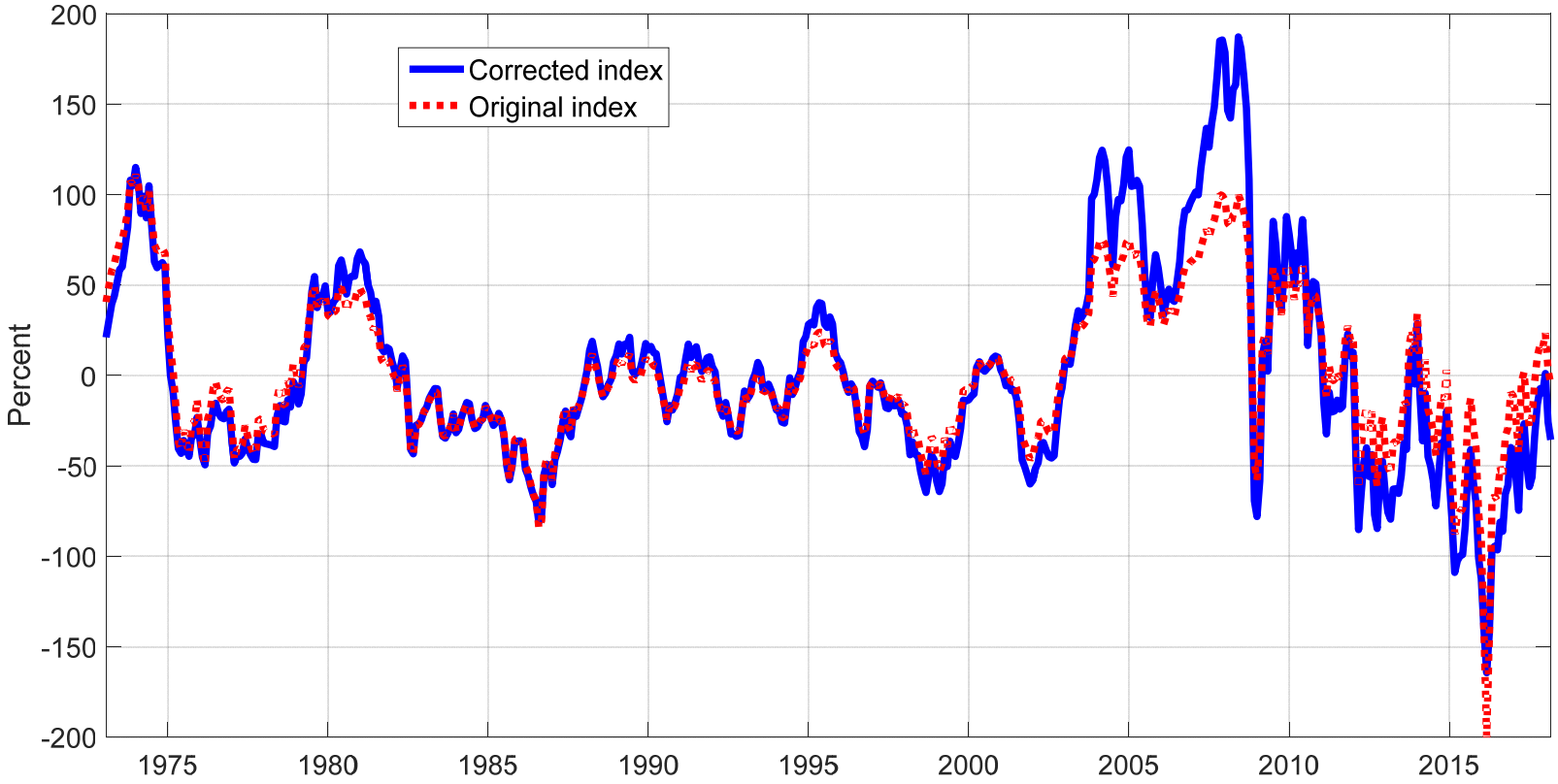
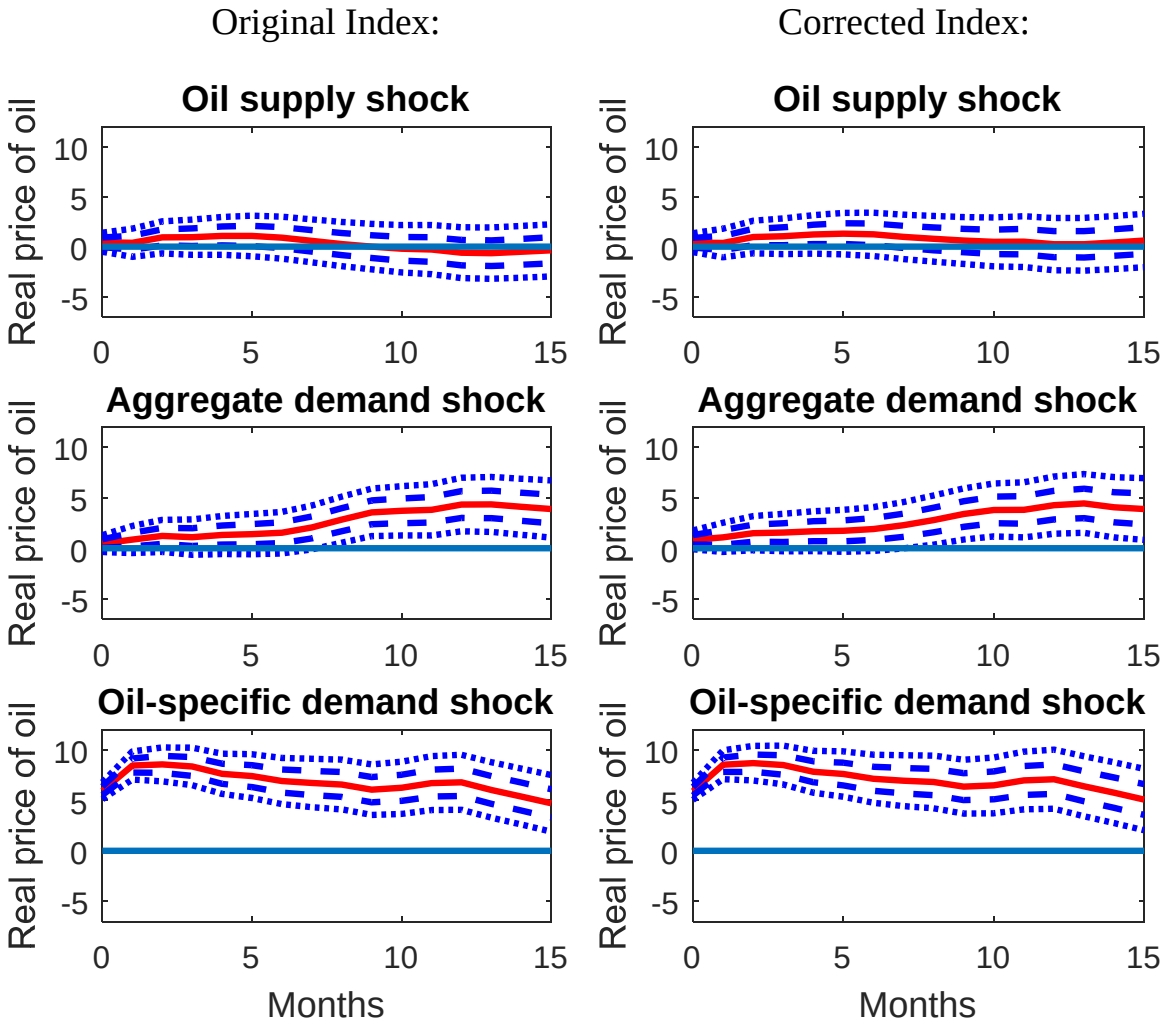
Figure 1: How much of a difference does the correction of the Kilian index make?



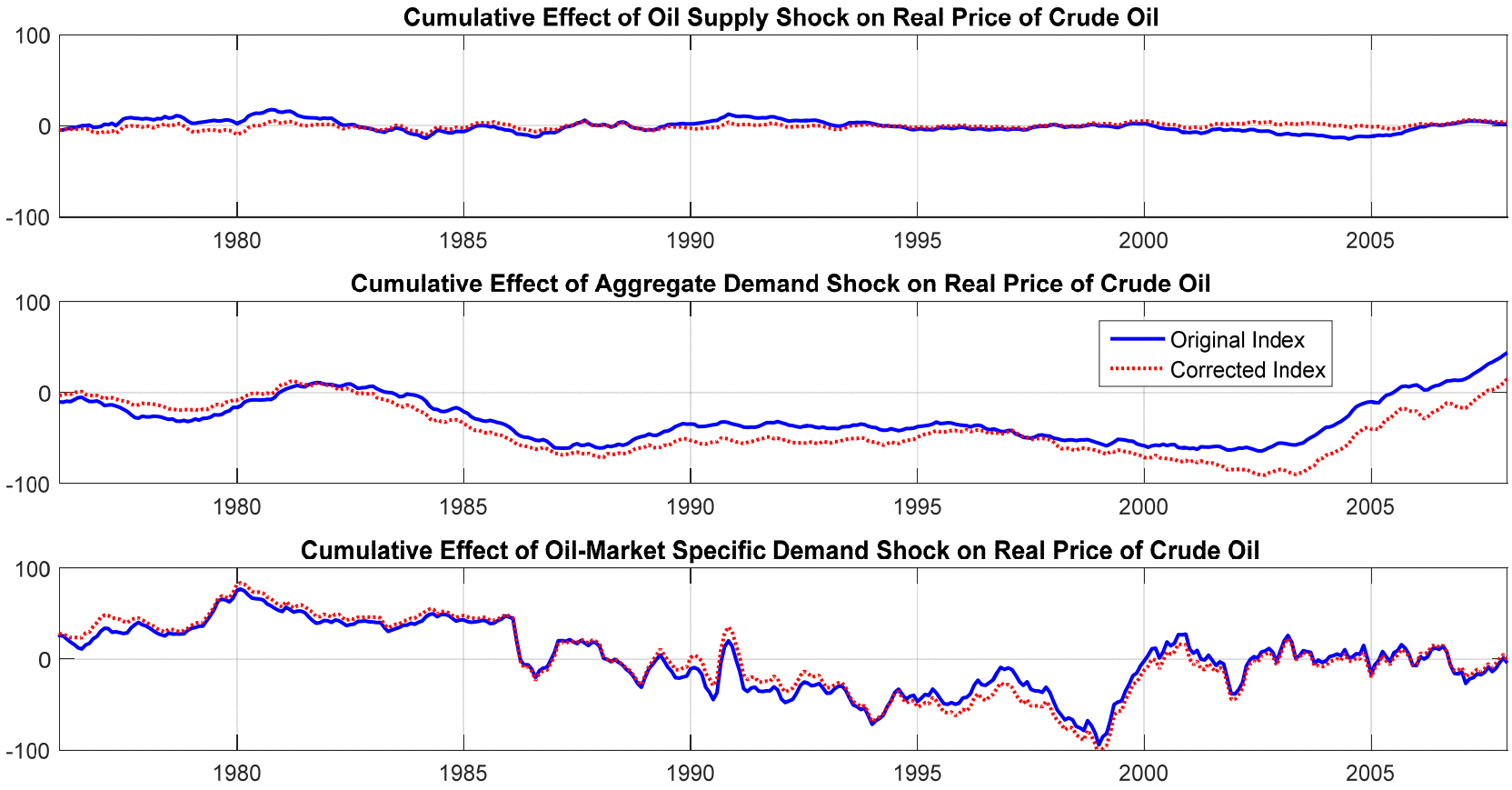
NOTES: Without loss of generality, the original index above has been scaled by 1.5 to make the magnitudes compatible with the corrected index. This facilitates the visual comparison without affecting the interpretation of the index.

Figure 2: Responses of the Real Price of Oil in the Kilian (2009) Model



NOTES: The plot shows point estimates and bootstrap confidence bands computed using the original code.

Figure 3: Historical Decomposition of the Real Price of Oil in the Kilian (2009) Model



NOTES: The plot shows historical decompositions of the real price of oil for the original and the corrected version of the Kilian (2009) index of global real economic activity, computed using the original code.