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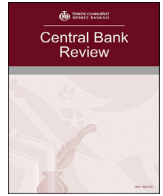
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Revisiting super-cycles in commodity prices



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ABSTRACT

It is argued that business cycles have been moderating. However, there are a limited number of studies in the literature analyzing the cyclical behaviour of commodity prices in the last decades. This paper attempts to fill this gap by investigating the super-cycles in oil prices. In addition, interdependence between cycles in GDP and oil prices and co-movements between cycles in oil and other commodity prices are investigated. Results show that super-cycles in oil prices still exist and are not moderating. The last peak in long-term oil price was observed in 2012 and since then it has been on a downward trend.

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1. Introduction

There has been a debate over the moderation of business cycles, in particular in advanced economies, up until the 2008 Global Financial Crisis, because of the fact that the global economy has shown greater stability compared with earlier periods. This phenomenon is called the “Great Moderation”. Even after 2008, global economic growth has been low but stable around at 3.3 percent,¹ thanks to the unprecedented resilience of emerging markets to global shocks. The general lesson that can be drawn from great moderation literature is that business cycles are not dead, the frequency and severity of the cycles have declined.²

During mid-2008 oil prices reached their second highest level since 1880s in real terms (Fig. 1). Interestingly, the effect of the 2008 Financial Crisis on oil prices did not last long and prices rebounded very quickly. Such a long-lasting rise in oil prices has renewed the interest of academicians, financial market players and policy makers on oil prices and with limited interest on cycles in oil prices.

The literature on long-term cycles (super-cycles) in commodity prices includes analysis based on the definition of long-term cycles of Kondratiev (1925) and Kuznets (1940). Kondratiev (1925) presents long swings of commodity prices, industrial production, interest rate and foreign trade over forty to sixty years. Kuznets (1940) defines long-term cycles of 25 years which reflect the life-cycles of innovations. Radetzki (1974), Grilli and Yang (1988), Cuddington (1992), Pindyck and Rotemberg (1990) and Reinhart and Wickham (1994) are among the early works that examine long-term trends in commodity prices. More recently, Radetzki (2006) analyses the commodity price booms and concludes that there are three commodity booms of the early 1950s, the early to middle 1970s and 2003 onwards. Cuddington and Jerrett (2008) report evidence on the presence of super-cycles in metal prices by using a Christiano-Fitzgerald band pass filter. Moreover, Cuddington and Zellou (2012) investigate the super-cycles and compared them with the super-cycles in other commodity prices. Erten and Ocampo (2013) identify the duration and magnitude of super-cycles in commodity prices including oil. They attribute the last super-cycle in commodity prices to the strong global growth performance by BRIC economies. Jacks (2013) also aims to understand the long-term trend and medium-term cycles in commodity prices. He concludes that both energy and non-energy commodity prices have been on the rise since the 1950s.

In this paper, following the business cycle literature, we retest

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¹ IMF (2016).

² See Goldstein (1997), Bernanke (2004) and IMF (2007).

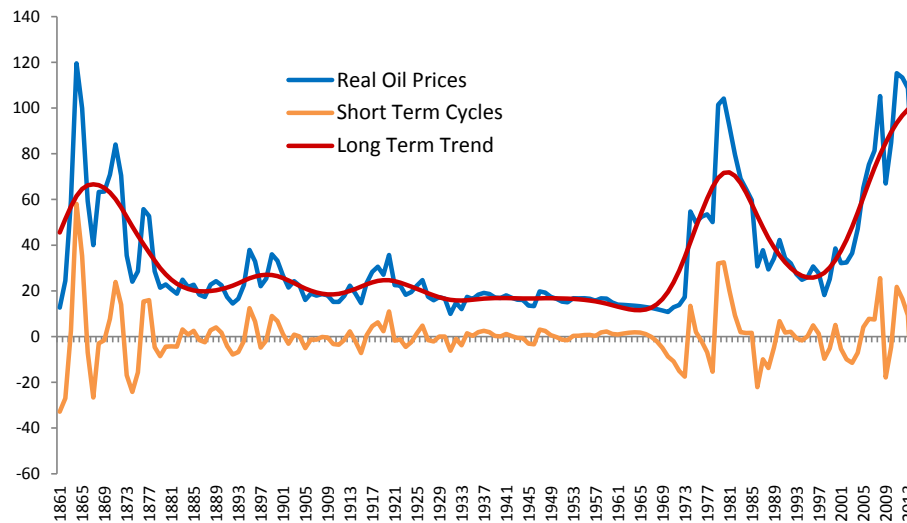


Fig. 1. Super-Cycles in Oil Prices (HP Filtering). Source: BP Statistical Review of World Energy Historical Data. Note: Smoothing parameter is taken as 100.

the long-term cycle phenomena in oil prices by using two main stream filtering techniques to map if oil prices have been in a new super-cycle since the early 2000s. After identifying the super-cycles, we discuss peak and trough points of these cycles and point out the current state of oil prices. Further, we check the connection between business cycles in GDP and oil price cycles. Lastly, comovements between oil and other commodity prices are investigated.

Our results show that oil prices still show cyclical behaviour and reached their last peak around 2012. In addition, while oil price cycles led business cycles during the 1970s, business cycles have led oil price cycles in the last decade. Lastly, there is a strong co-movement between oil prices and other commodity prices starting in the second half of the 1990s. We argue that this result is due to the fact that commodity price cycles are mainly driven by business cycles during this period along with financialization of commodities.

The remainder of this paper is organized as follows. In Section 2 identification of long-term cycles, known as super-cycles, in oil prices is presented. In addition, turning points in oil prices and the linkage between business cycles, and comovements between oil and other commodity prices are examined. Section 3 concludes.

2. Super-cycles in oil prices, business cycles and comovements between commodity prices

2.1. Identifying super-cycles since 1861

In this section we address two questions: First, do oil prices present super-cycle behaviour? Second, if super-cycles exist, is it possible to identify which phase of the cycle oil prices are in?

2.1.1. Data and methodology

In the literature, short-term cycles are defined as movements with periods between 2 and 8 years; medium-term cycles are defined as movements with periods between 8 and 20 years and long-term cycles, super-cycles, are defined as movements with periods between 20 and 70 years.³ To decompose super-cycles, we

use long-term oil price series which are obtained from the 2014 BP Statistical Review of World Energy. Oil price data starting from 1861 and end in 2014 and frequency is annual. Historical series are constructed by using average US crude oil prices from 1861 to 1944, Arabian light prices from 1945 to 1983 and Brent oil prices since 1984.⁴

Two different filtering techniques are used to identify super-cycles. First, the Hodrick-Prescott (HP) filtering methodology, commonly used in studies of cycle analysis, is used. However, there are two well-known drawbacks to the HP filtering technique, sensitivity of results to the choice of smoothing parameter and end-point bias. In order to overcome such drawbacks of the HP filtering technique, band-pass (BP) filtering, which has more robust features, is also used. We follow Christiano and Fitzgerald (2003) approach in BP filtering which allows us to decompose the cycle component within a specified window or various frequencies. Lower and upper bounds of the periods of the cycles are taken as 20–70 years to identify the super-cycles. BP filters are explained in the literature as sophisticated two sided moving averages,⁵ hence they differ from standard moving averages techniques as frequency filters are used in terms of time rather than frequency domain.⁶ We also prefer to use symmetric filters to prevent phase shifts in the filtered series.

2.1.2. Results

In Fig. 1, behaviours of short-term cycles and the long-term trend of the real oil price are shown after filtering with HP methodology. In Fig. 2, long-term cycles in the same data series are extracted by using the BP method.⁷ These two filtering techniques suggest that there are three super-cycles in oil prices since 1861. The first super-cycle begins in 1861, peaks around 1867 and ends around 1882. The beginning of this cycle coincides with the commercialization of the oil around 1860. Later on, the early industrialization process in the USA and Europe shaped the cycle

⁴ Oil price data for 2014 is derived by using the growth rate of Brent oil prices obtained from the Energy Information Administration (EIA). In analysis logarithmic forms of real oil prices are used.

⁵ Baxter and King (1999).

⁶ Both symmetric and asymmetric BP filtering can be computed.

⁷ The filter developed by Christiano and Fitzgerald (2003) is used by taking different lead and lag lengths. Cycle periods are taken between 20 and 70 years.

³ Cuddington and Jerrett (2008) and Cuddington and Zellou (2012) studies were based on same definition for the long-term cycles and used BP filter methodology. Erten and Ocampo (2013) also accept the time span of super-cycles between 20 and 70 years.

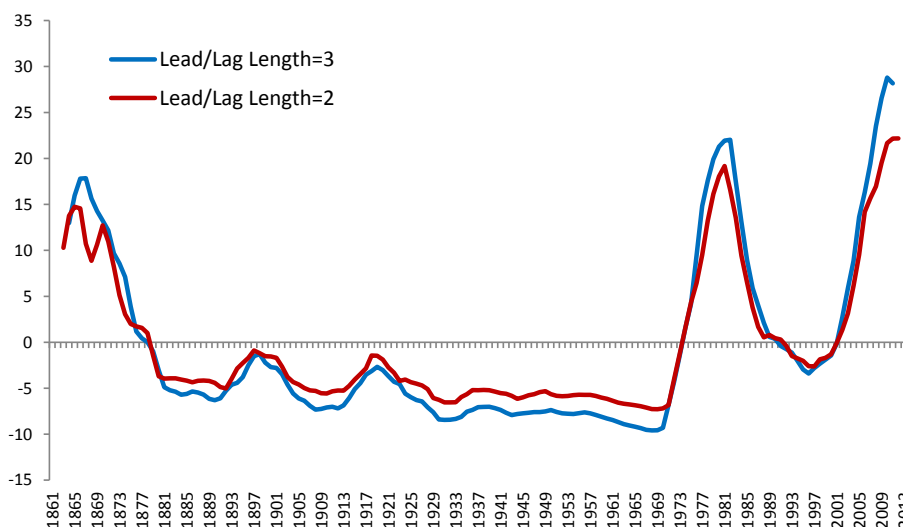


Fig. 2. Super-Cycles in Oil Prices (BP Filtering). Source: BP Statistical Review of World Energy Historical Data. Note: Low frequency = 20 and high frequency = 70.

until 1882.⁸ Oil prices were stable over the period of 1885–1966. As Cuddington and Zellou (2012) state this period is harder to interpret due to: (i) oil was economically less important for the industrialization of Europe and the USA and (ii) price controls. The second super-cycle begins in 1966 and ends around 1996. The beginning of the cycle overlaps with the establishment of OPEC while reconstruction of Europe and Japan in the aftermath of World War II gave to the cycle its shape.

The last super-cycle starts around 1996.⁹ The rapid industrialization of China together with fast economic growth in other emerging market economies fuelled the demand not only for oil but also for other commodities. Therefore, evolution of the last super-cycle could be attributable to the high growth rates in major emerging market economies. There are a number of studies that associate the early phase of super-cycle expansion with the industrial development and urbanization in emerging market economies such as Heap (2005), Radetzki (2006), Cuddington and Zellou (2012), Erten and Ocampo (2013). Farooki (2009) also mention that the global growth performance has been the most important driver of commodity markets, in particular for metals. There is another strand of literature arguing that the increase in global liquidity and financialization of commodities also have important roles on rising commodity oil prices over the last cycle¹⁰. The 2008 financial crisis has created a large swing in oil prices yet cycle has continued up until mid-2014, supporting our empirical findings for the last super-cycle that oil prices were in the expansion phase until 2012 and have been in a contraction period since then.

Our findings suggest that the previous super-cycles in oil prices lasted around 25–30 years, thus the expansion period of the cycle has already been completed and the cycle will be in the contraction phase for a while. The decline in oil prices, starting in mid-2014, coincides with the slowdown of the growth rate of emerging market economies, especially China. Accordingly, the last super-cycle has entered a contraction phase partly due to the slowdown in emerging market economies and how long that downward phase lasts is expected to be determined by the global economic outlook.

2.2. Turning points in oil prices and the linkage between growth cycles and oil price cycles

Empirical findings indicate the existence of super-cycles in real oil prices. The relation between oil price cycles and business cycles in economic activity is yet to be answered. Therefore, in this section the co-movement between growth cycles and cycles in oil prices is examined.

2.2.1. Data and methodology

Following National Bureau of Economic Research (NBER) methodology we consider classical business cycles defined by Burns and Mitchell (1946) and Bry and Boschan (1971). Hence in this section, the relationship between cycles in oil prices and growth cycles of the US economy is investigated. Turning points of the real oil price and US real GDP,¹¹ which is taken as a proxy of global growth cycles, are identified based on the classical business cycles definition.¹² Quarterly data obtained from EIA has been used. Peak and trough points of real oil prices are computed by using BBQ (Bry, Boschan; Quarterly) algorithm introduced by Harding and Pagan (2002). According to the BBQ algorithm, a local peak (through) in y_t occurs at time t if $\{y_t > (<) y_{t-k}\}$ where k is the minimum duration of a phase, $y_t = \ln(Y_t)$ and Y_t . Consistent with Bry and Boschan (1971), the minimum phase duration (k) is taken as two quarters and a complete cycle is assumed lasting at least five quarters. The quarterly series is used over the period from 1946:1 to 2014:4 to evaluate the comovement between NBER cycles and cycles in oil prices.

2.2.2. Results

Table 1 presents the descriptive statistics of the main features of the cycles of oil prices. Descriptive statistics indicate that over the period of 1996–2014, expansion period for oil prices has increased substantially as well as the amplitude of the expansion. On the other hand, the average duration of contractions has decreased but the amplitude of the contraction has increased. Thus, Harding and Pagan (2002) algorithm suggest that oil prices have started to experience much deeper contractions and stronger expansions over the period of the last super-cycle.

⁸ Hamilton (2011).

⁹ Supporting the findings of Cuddington and Zellou (2012) and Erten and Ocampo (2013).

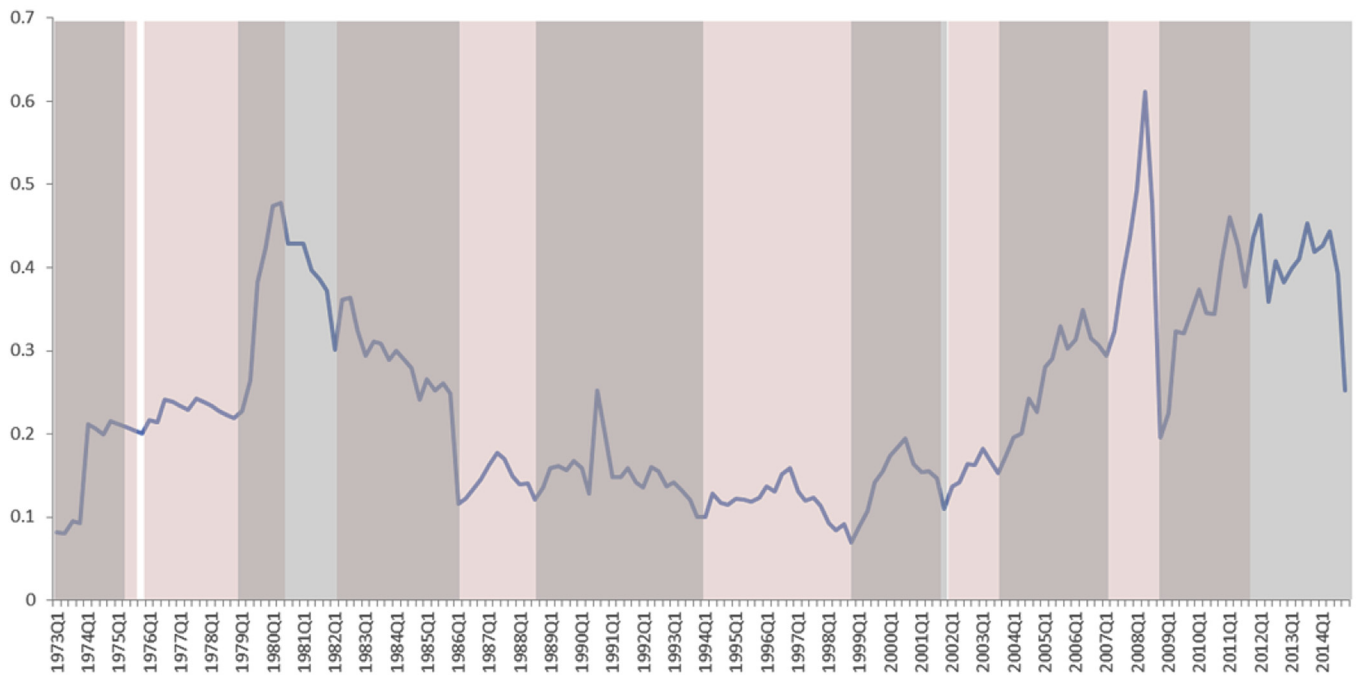
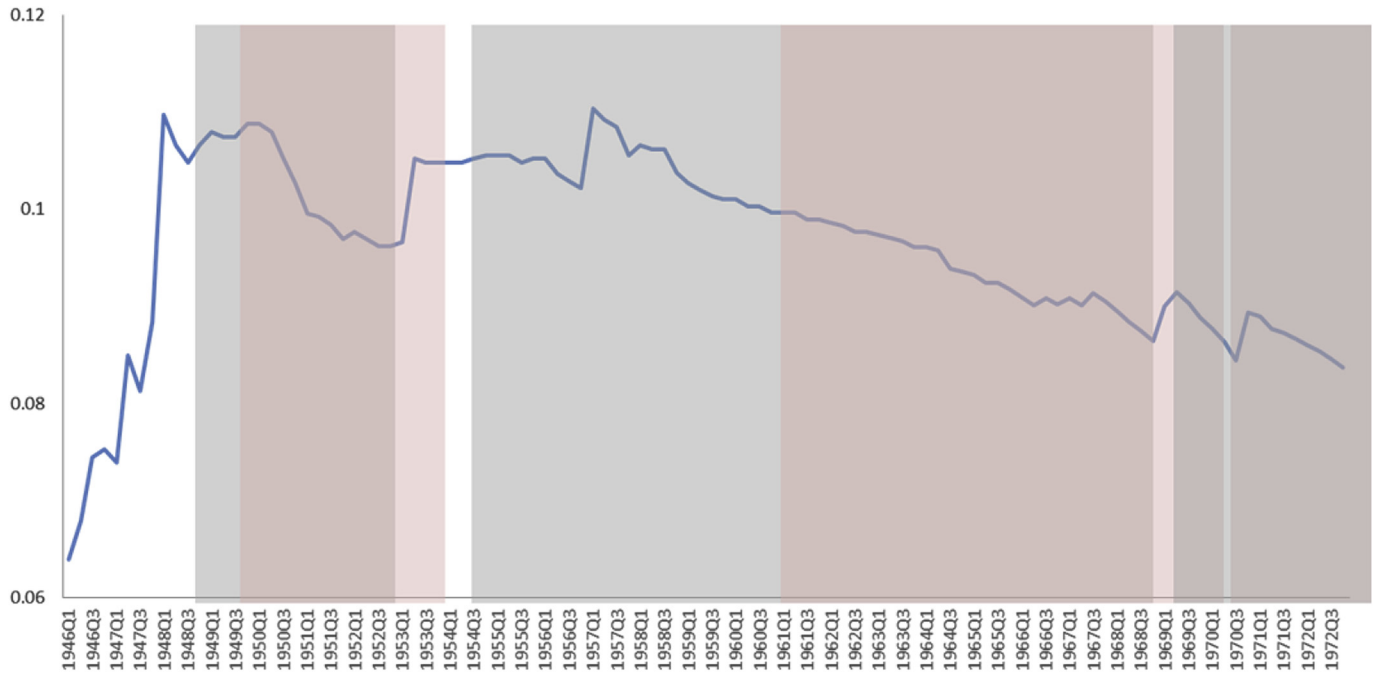
¹⁰ Pollin and Heintz (2011).

¹¹ NBER's dating of US Business Cycles are used for the expansion and contraction points.

¹² Burns and Mitchell (1946), Bry and Boschan (1971).

Table 1
Descriptive statistics of cycles in oil prices.

	Contraction		Expansion	
	Average duration	Average amplitude	Average duration	Average amplitude
1946–1970	17.75	–0.009	4.60	0.013
1971–1995	10.40	–0.090	5.67	0.109
1996–2014	5.17	–0.106	8.20	0.140



Note: Grey areas show the cycles (from trough to trough) for oil prices computed using Harding-Pagan algorithm and red areas show the cycles (from trough to trough) for US economy computed by NBER.

Fig. 3. Real Oil Prices (WTI) and US Business Cycles.

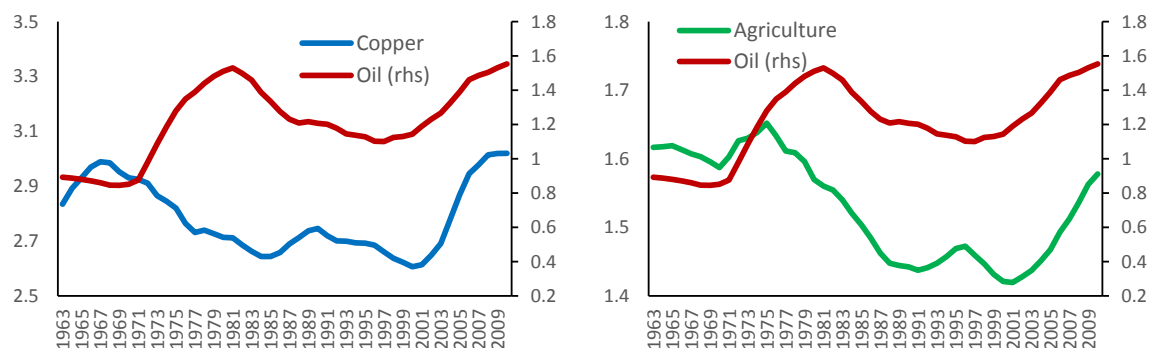


Fig. 4. Super-Cycles in Real Oil, Copper and Agriculture Prices. Source: WB, EIA. Note: BP filter is computed with low frequency = 20 and high frequency = 70.

Cycles in oil prices and business cycles in the US economy from 1946 to 1972 and from 1973 to 2014¹³ are illustrated in panel 1 and panel 2 of Fig. 3 respectively. Visual inspection of the figure shows that business cycles in the US economy appear to follow cycles in oil prices before the 1990s. This result is consistent with Hamilton (1983) argument that post-war US recessions are mainly caused by oil price hikes. Indeed, before the 1990s oil price fluctuations were mainly driven by supply factors. Oil price shocks affected inflation and output directly through cost and aggregate demand channels. However, this explanation reverses after the 1990s. The reason is that fast growing emerging market economies together with asset price booms in advanced economies fuelled demand for oil. As a result oil prices were mainly driven by fluctuations in economic activity in fast growing emerging market economies. Visual inspection of the second panel in Fig. 3 also supports this view.

2.3. The comovement between cycles in oil and in other commodities

The comovement between super-cycles in prices of other commodities, namely copper and agriculture, and prices of oil is examined in this section. Identifying comovements between commodity prices is important both from the perspective of the commodity producers, exporters and financial market players.

2.3.1. Data and methodology

Due to historical data limitations in agricultural and copper prices, data starts from 1960 and ends in 2014 and is obtained from the World Bank (WB). Super-cycles are derived by using BP filter as in Section 2.1. In Fig. 4, super-cycles in oil prices and in other commodities are presented.

2.3.2. Results

Before 1996, there is no clear comovement between super-cycles in oil prices and other commodities' prices. The first super-cycle in copper prices, starting from 1960 and ending around 1990, seems to lead the super-cycle in oil prices. On the other hand, the first super-cycle in agricultural prices and in oil prices roughly corresponds. The last super-cycles in all commodities, starting in the second half of the 1990s, appear to evolve together. This observation supports the view that commodity prices have started to be driven by the global conjuncture along with financialization of commodities. Our findings support the findings of Cuddington and

Jerrett (2008), Cuddington and Zellou (2012), and Erten and Ocampo (2013) that supercycles in oil prices match the timing of super-cycles in metal prices after the 1990s.

3. Conclusion

Following the debate on business cycles this paper revisits three main themes of the cycles in commodity prices. First, super-cycles in oil prices are identified by different filtering techniques. Second, the stability of the relation between business cycles and oil price cycles is investigated. Last but not least, comovement between cycles in oil and other commodity prices is examined. Empirical results indicate that there are three main super-cycles in oil prices and that the last super-cycle, starting at around 1996, reached its long-run peak around 2012 and has been in the contraction phase since then. The evolution of the last super-cycle could be attributable to the high growth rates in major emerging market economies. Moreover, financialization of commodities has also played a significant role on commodity prices over this period. In addition, unlike the pre-1990 period, business cycles lead commodity price cycles in the last two decades which is consistent with the view that the recent super-cycle last as long as the growth boom lasts in major economies, in particular emerging market economies. However, current slowdown in emerging market economies supports the view that last super-cycle has entered the contraction phase. Lastly, co-movement between commodity prices has increased lately mainly driven by demand shocks in the global economy and financialization of commodities.

References

- Baxter, M., King, R.G., 1999. Measuring business cycles: approximate band-pass filters for economic time series. *Rev. Econ. Stat.* 81 (4), 575–593.
- Bry, G., Boschan, C., 1971. *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs*. NBER, New York.
- Bernanke, B.S., 2004. The great moderation. In: *Remarks at the Meetings of the Eastern Economic Association*, Washington, DC.
- BP, British Petroleum. "BP Statistical Review." <http://www.bp.com/statisticalreview>. 2014.
- Burns, A.F., Mitchell, W.C., 1946. *Measuring Business Cycles*. NBER.
- Christiano, L.J., Fitzgerald, T.J., 2003. The band pass filter. *Int. Econ. Rev.* 44 (2), 435–465. Department of Economics, University of Pennsylvania and Osaka University Institute of Social and Economic Research Association.
- Cuddington, J.T., 1992. Long-run trends in 26 primary commodity prices: a disaggregated look at the prebisch-singer hypothesis. *J. Dev. Econ.* 39, 207–227.
- Cuddington, J.T., Jerrett, D., 2008. Super-cycles in real metal prices? *IMF Staff Pap.* 55 (4), 541–565.
- Cuddington, J.T., Zellou, A., 2012. Is there evidence of super-cycles in crude oil prices? *SPE Econ. Manag.* 4 (3), 171–181.
- Erten, B., Ocampo, J.A., 2013. Super-cycles of commodity prices since the mid-nineteenth century. *World Dev.* 44, 14–30.
- Farooki, M., 2009. China's structural demand and the commodity super-cycle: implications for Africa. In: *Research Workshop China-Africa Development Relations*, Leeds University (UK).

¹³ Cycles (from trough to trough) that ends at least 4 years are presented in the graph over the period 1946–1972. Since cycles in the oil prices are detected more frequently over the period 1973–2014 cycles over 3 years are also presented in the second panel of Fig. 3.

- Goldstein, J.P., 1997. Is the endogenous business cycle dead? *South. Econ. J.* 63 (4), 962–977.
- Grilli, E.R., Yang, M.C., 1988. Primary commodity prices, manufactured goods prices, and the terms of trade of developing countries: what long run shows? *World Bank Econ. Rev.* 2 (1), 1–47.
- Harding, D., Pagan, A., 2002. Dissecting the cycle: a methodological investigation. *J. Monetary Econ.* 49, 365–381.
- Hamilton, J.D., 1983. Oil and the macroeconomy since World War II. *J. Political Econ.* 91 (2), 228–248.
- Hamilton, James D., 2011. Historical Oil Shocks. National Bureau of Economic Research Working Paper Series, No. 16790.
- Equities Research: Global. In: Heap, A. (Ed.), 2005. *China - the Engine of a Commodities Super Cycle*. Citigroup Smith Barney, New York City.
- IMF, 2007. *World Economic Outlook*, October. In: Chapter 5 on “The Changing Dynamics of the Global Business Cycle”.
- IMF, 2016. *World Economic Outlook*, Statistical Appendix, April.
- Jacks, D.S., 2013. From Boom to Bust: a Typology of Real Commodity Prices in the Long Run. National Bureau of Economic Research Working Paper Series, No. 18874.
- Kondratiev, N.D., 1925. *The Major Economic Cycles* (in Russian). Moscow. Translated and published as *The Long Wave Cycle* by Richardson & Snyder, New York, 1984.
- Kuznets, S.S., 1940. Schumpeter's business cycles. *Am. Econ. Rev.* 30, 262–263.
- Pindyck, Robert S., Rotemberg, J.J., 1990. The excess Co-Movement of commodity prices. *Econ. J.* 100 (403), 1173–1189.
- Pollin, R., Heintz, J., 2011. How Wall Street Speculation Is Driving up Gasoline Prices Today. PERI Research Brief, June.
- Radetzki, M., 1974. Commodity Prices during Two Booms. *SkandEnskilda Bank Quarterly Review*, 4.
- Radetzki, M., 2006. The anatomy of three commodity booms. *Resour. Policy* 36, 56–64.
- Reinhart, C., Wickham, P., 1994. Non-oil Commodity Prices: Cyclical Weakness Secular Decline? MPRA Paper 13871 University Library of Munich, Germany.