

BUBBLES IN OIL PRICES – EVIDENCE AND IMPLICATIONS

Marc Gronwald, ifo Institute, Phone +49 89 9224 1400, e-mail: gronwald@ifo.de

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Oil Prices, Rational Bubbles, Resource Extraction Models, Green Paradox

Overview

This paper investigates whether or not rational bubbles are present in oil prices. It applies a recursive test procedure recently proposed by Phillips et al. (2011) which allows one to test for the existence of periodically collapsing bubbles. Furthermore, the date-stamping procedure inherent in this test allows one to identify origination and collapse date of oil price bubbles. The issue whether or not fundamental factors are able to explain the most recent oil price movements is currently debated in a large number of papers, see e.g. Miller and Ratti (2008) or Kaufmann and Ullman (2008).

The paper contributes to the literature in two distinct ways. It, first, helps to deepen the understanding of long run behaviour of oil prices and, thus, stands in the tradition of papers such as Slade (1982) and Lee et al. (2006). Based on this empirical exercise, second, it discusses possible consequences of the behaviour of oil prices on economic decisions. Oil is still an important input factor to various kinds of processes and, furthermore, also a carbon resource. Therefore, the decision when to extract the resource not only affects the economic performance of firms but has also implications for the global climate.

Daily, monthly as well as annual oil price data for different sample periods is used in this study. In general, a rational bubble is said to exist when the observed price of an asset differs from its underlying fundamental value. Traditional tests of rational bubbles examine whether or not the price series and the fundamental value have the same statistical properties. In particular, the variables are tested for stationarity, non-stationarity and explosiveness. These empirical methods are based on standard unit root tests such as augmented Dickey Fuller tests. This procedure goes back to Diba and Grossmann (1988); the test applied in this paper overcomes weaknesses of other existing rational bubble tests. It should be noted that the issue of the fundamental value is less straightforward for the case of oil prices – for asset prices it is assumed that the fundamental value is represented by the present value of the flow of expected future dividends. Therefore, one focus here is to investigate whether or not the statistical behaviour of oil prices changes over time. It is, however, also attempted to explain these changes by using the following proxies for oil price fundamentals : Kilian's (2008) OPEC supply shock series, Kilian's (2009) measure of global economic activity as well as US petroleum stocks.

In a second step, the results of the empirical section are discussed against the backdrop of the theoretical framework put forward by Harold Hotelling which is still predominantly used when it comes to modelling the decision when to extract an exhaustible resource. According to the famous Hotelling rule, the price of such a resource grows, in optimum, at the rate of interest. While initially not much attention has been paid to that paper, during the 1970s various extensions of Hotelling's original framework have been proposed. The motivation in many cases was that the oil crises vividly illustrated that oil is actually a scarce resource. In a number of recent papers, however, the fact that oil is also a carbonic resource gained centre stage. Sinn's (2008) discovery of the Green Paradox sparked enormous research efforts. Sinn (2008) extends Hotelling's (1931) framework by considering the issue of global warming and shows that ignoring this issue leads to a current over-extraction of oil. Holland (2008), moreover, shows that the oil price is the better scarcity indicator than oil production is. This finding is of particular importance for the decision when to switch to alternative technologies.

Methods

Recursive test procedure on the existence of rational bubbles proposed by Phillips et al. (2011).

Results

The application of the Phillips et al (2011) shows that explosive behavior of oil prices is evident only in very few periods, in particular 2007-2008. In this period, global economic activity was on a level never seen before. Moreover, US petroleum stocks were declining rather than increasing over time. These results suggest that this oil price surge was driven by fundamental factors and not by speculation.

Conclusions

The extraction decision as well as that regarding the switch to alternative technologies is certainly based on signals provided by oil prices. If now rational bubbles are present and, thus, expectations regarding the future development of oil prices are more difficult to form, finding both optimal extraction paths and the optimal decision regarding the transition to alternative technologies is compromised. In consequence, theoretical models as well as climate policy evaluating studies need to adequately account for the behaviour of oil prices.

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