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Does OPEC act as a cartel? Empirical investigation of coordination behavior

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HIGHLIGHTS

- I test if OPEC acts as a cartel; it affects oil prices through members' coordination.
- I use cointegration to examine long run relation between OPEC production and member's production.
- I test causality between the OPEC production and oil prices.
- The findings show no evidence of cointegration indicating no cartel behavior exists.
- The results show OPEC production does not cause oil prices; rather it is the other way around.

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ABSTRACT

In this paper I use quarterly and monthly data from 1994 to 2014 to test if OPEC acts as a cartel, and therefore, it affects oil prices through members' coordination. I use Engle and Granger two-step approach, Johansen cointegration test and Autoregressive Distributed Lag (ARDL) bounds testing approach of cointegration to examine the long-run relation between OPEC production and each member's production as an evidence of coordination. Besides, I apply Granger causality and Toda and Yamamoto tests to check the direction of causality between the OPEC production and oil prices (U.K. Brent and Dubai Fateh). The findings show no evidence of cointegration between the production of the members and that of OPEC, indicating no cartel behavior exists. Moreover, the results show that OPEC production does not cause oil prices; rather it is the other way around.

1. Introduction

Since the first oil price shock after the Arab embargo in 1973 followed in 1978 by another upset in oil production when the Iranian regime changed, the interest in oil market modeling developed rapidly where various models were elaborated in the past four decades to examine OPEC behavior and its capability to affect oil prices. The question of whether OPEC is a cartel or not remains strongly debated. Theoretically, a cartel represents few competing firms unite together through a formal agreement by way of which they work for the benefit of each other and will not harm one another for the purpose of boosting the profit maximization. Cartel members allocate the market share for each member and they fix the market share associated with every member in terms of territory. In this way they control or manipulate the prices of the product in the market. Any standard economics textbook uses OPEC as an example of a profit-maximizing cartel, showing that as a cartel it forms quotas, splits the market, and protects prices.

OPEC was established in 1960 by Iran, Iraq, Kuwait, Saudi Arabia and Venezuela. Later the organization was joined by Qatar, Indonesia (suspended its membership from January 2009–December 2015), Libya, United Arab Emirates, Algeria, Nigeria, Ecuador (suspended its membership from December 1992–October 2007), Angola and Gabon (1975–1994). According to OPEC statutes, the organization is dedicated to co-ordinate and unify petroleum policies among Member Countries, in order to secure fair and stable prices for petroleum producers; an efficient, economic and regular supply of petroleum to consuming nations; and a fair return on capital to those investing in the industry. This can be inferred as that the organization is dedicated to acquire a stable stream of income for its members by targeting the oil prices as well as setting total production. In spite of this goal, the history of crude oil prices since the formation of OPEC suggests to some that prices are instead determined in a competitive market, perhaps interspersed by occasional attempts to restrict output that invariably unravel. That is to say that, as a cartel, OPEC has not been successful in controlling oil prices. Indeed, there appears to be no

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clear consensus in the empirical literature regarding OPEC's stability as a cartel or its ability to influence prices (Almoguera et al., 2011).

Aside from the substantial amount of tests and empirical analysis attempted to model OPEC behavior in the last four decades, the literature as a whole remains inconclusive regarding OPEC is a cartel or not, and whether a coordination behavior among the members takes place to control production as a tool to put pressures on the oil market price. Through tracing the trend of oil prices over the past 40 years, one argument in the literature is that OPEC is responsible for most of these increases due to their production cuts and market power. Another believes that OPEC is not to be blamed for the price increases, since OPEC's ability to control the price of oil diminished somewhat after the 1973 oil crisis, due to the subsequent discovery and development of large oil reserves in the Gulf of Mexico and the North Sea, the opening up of Russia, and market modernization (Kisswani, 2014). Gulen (1996) reports that OPEC in the 1980s failed to stop deterioration in oil prices although it embraced production control in 1982 raising questions about the ability of the organization to act as a cartel and whether OPEC is just benefiting from higher oil prices.

The first systematic test of OPEC behavior started by Griffin (1985) seminal work when he examined, at country level, different hypotheses of market structure in regard to OPEC behavior using single-equation approach for the period 1971–1983. His findings supported a partial market-sharing cartel model for OPEC, which was also supported by Jones (1990) using same model with extended data dates (1983–1988). On the other hand, Loderer (1985) show that OPEC was capable of affecting oil prices only for the beginning of the 1980s (1981–1983), and the organization was able to act as a cartel during this period. Dahl and Yücel (1991) tested competing hypotheses for production decisions for both OPEC and non-OPEC producers on quarterly data between 1971 and 1987. Using cointegration tests, they were unable to find formal evidence of coordination in the form of strict cartel behavior or swing production among OPEC countries. Gulen (1996) investigated, for the period 1965–1993, whether OPEC is a cartel whose members are committed to the output quota system allocated by the organization, besides testing the ability OPEC to alter the market oil price by changing and modifying its production and supply. Using cointegration analysis and causality tests he finds evidence of output coordination among OPEC members, especially in the output rationing period (1982–1993). Furthermore, he shows a statistically significant causality from OPEC production to oil price. Smith (2005) believes that OPEC's market structure is between a cartel and a non-cooperative oligopoly. Spilimbergo (2001), on the other hand, find no support for the hypothesis that OPEC was a market sharing cartel during the period 1983–1991. Likewise, Griffin and Xiog (1997) show that it is more profitable for some OPEC members to cheat on their assigned quota, raising doubts about the ability of the members to successfully coordinate and OPEC to act as a cartel. Alhajji and Huettner (2000) show that OPEC can't be considered as a dominant producer, indicating that it does not act as a cartel. However, to a certain extent, Saudi Arabia acts as the dominant firm and the other members are the competitive fringe. Similar findings are reported by Colgan (2014) where he shows that economists have wrong idea about OPEC acting as a cartel; on the contrary, the organization has no power to manipulate oil prices. Bremond et al. (2012) investigate whether production decisions of OPEC members are coordinated and therefore affect oil prices. The findings show that the influence of OPEC was strong only in periods after oil shocks, while the organization acts as price take most of the time since 1973. Kisswani (2014) tests the hypothesis that OPEC considers political interests in its decisions regarding oil production by adding a "harm function" as part of a profit maximization function using optimal control theory. He shows that OPEC does not follow strict profit maximization; it also pursues political support among the public of OPEC members whom frequently express anti-Western sentiments. For this reason, OPEC members may take production decisions to gain such support in need of popular domestic support. Where such kind of approach diverges from the cartel concept of cutting production to control prices.

To this end, this brief look at the literature shows the controversy regarding the cartel behavior of OPEC and that no conclusive evidence about production behavior exists. In the light of this controversy, our objective is to revisit the production behavior of OPEC and examine the theory that the organization acts as cartel, using time series cointegration techniques. This is done by following Dahl and Yücel (1991); Gulen (1996) in testing whether the production decisions of OPEC members are coordinated and whether they have any impact on oil prices. I use monthly and quarterly data for the period between 1994 and 2014. I apply three different cointegration tests to examine if a long run relation between the production of each member and that of the OPEC exists. I then utilize causality tests for OPEC production and oil prices to see any evidence of cartel behavior. The major contribution of this paper comes from the fact that I use more recent data and longer time series. I also apply three different cointegration tests (Engle and Granger, Johansen Cointegration tests, and Autoregressive Distributed Lag (ARDL) bounds testing approach of cointegration) besides using Toda and Yamamoto (1995) causality test as well as Granger (1969) causality as compared to previous studies that used Granger causality only. Giving the empirical outcomes, I found that OPEC does not act as a cartel where the cointegration findings do not support coordination argument among the members, and therefore, no evidence to support the cartel behavior. Furthermore, these findings are backed by the causality tests, where OPEC production does not Granger cause oil prices; rather, it is oil prices that Granger cause the organization production.

The rest of the paper proceeds as follows. The next section discusses the model and the theoretical framework, besides describing the data used. In Section 3, results and findings are reported. Finally, Section 4 provides some concluding remarks.

2. Data and methodology

In this paper I follow and adopt the structure of Dahl and Yücel (1991); Gulen (1996) in testing the cartel behavior, if any, among OPEC members by examining whether the production decisions of those members are coordinated or no. The relation between the production of each OPEC member and total OPEC production can be described as:

$$Q_{it} = \alpha_i Q_t \tag{1}$$

where Q_{it} is the ith member's production and Q_t is total production of OPEC, both at time t. α_i is the production share of the ith member of the cartel, which is assigned usually during OPEC meetings. Testing for the existence of cartel behavior is simply done by testing for cointegration between Q_{it} and Q_t. If members do follow the quota policy and do cooperate as a cartel to control the production and therefore the oil price, then one would expect to find a long run equilibrium relationship between Q_{it} and Q_t, that is Q_{it} and Q_t are cointegrated. This suggests that the variables are involved in a stable long-run (equilibrium) relation and any departure from this relation indicated short-run (transient) disequilibria. On the other hand, the rejection of cointegration between Q_{it} and Q_t might imply a lack of coordination between that member and the organization, or consistent cheating by that