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OPEC and Venezuelan oil production: Evidence against a cartel hypothesis

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ABSTRACT

This study revisits the OPEC cartel hypothesis using a case study. A test is conducted to see if Venezuela has its production Granger cause its OPEC quota or whether the OPEC quota for Venezuela Granger causes Venezuelan production. The results show both occur at different times. In the short run, OPEC's oil production quota for Venezuela Granger causes Venezuelan production. However, shortly after cuts, Venezuela cheats on agreements, suggesting a tit-for-tat oligopoly game, which is not anti-competitive. In the long run, we show that Venezuelan oil production Granger causes OPEC's quota for Venezuela, but not vice versa. Having Venezuelan oil production Granger cause OPEC quotas for Venezuela in the long run suggests OPEC does not coordinate outputs as much as it reacts to them. The evidence suggests Venezuela is not a part of an OPEC anti-competitive syndicate even though we show that Venezuelan oil production is low. An alternative explanation for why Venezuela and possibly other OPEC members have low oil production outputs is that institutions and risk aversion, not cartel participation, is the cause. A vector error correction model shows that there is no tendency for Venezuelan oil production to converge to OPEC's quota for Venezuela.

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1. Introduction

Ever since the first oil price shocks of 1973, OPEC has been accused of operating as a cartel. However, with ten or more members making up OPEC's producers, it is normally difficult for such an organization of independent players to maintain agreements. Van Huyck et al. (1990) and other game analyses suggest agents playing cooperative games have a difficult time trusting each other especially if any uncertainty is involved, which is the case for OPEC. Furthermore, as Adelman (1986b) implies, OPEC members face the risk of losing oil value due to oil substitution technology making oil's value decline should OPEC attempt to refrain from production now and produce more oil later. Therefore, due to the potential competition, the future risk of technological substitutes for oil, and the difficulty of coordinating in a game, there should be little if any supply reductions by OPEC members. This suggests OPEC is not a cartel.

However, Kaufmann et al. (2004) and Loderer (1985) do show that oil prices have been affected by OPEC actions, although Loderer shows that the amount the price of oil increases due to OPEC decisions and the length of the time oil prices stay high are small, and Kaufman et al. show that cheating by OPEC members has nearly an exact counter neutralizing effect on quota induced price increases, suggesting a near competitive outcome not worthy of the term cartel. Nevertheless, Adelman (1986a) shows

that there is less investment in Saudi Arabia and Kuwait than what would normally be the case in the United States, which suggests an effort to reduce output. What's more, there was less investment in Saudi Arabia after 1973 than what was normal for it before 1973, although, if OPEC is affecting the market price, it is still unclear what market manipulating model—cartel, price leader or some form of oligopoly—best represents OPEC.

However, changes in production by OPEC members can be caused by other factors than cartel agreements such as internal oil producer institutions. See Reynolds and Kolodziej (2007, 2009). Therefore, a necessary and sufficient condition for a cartel or syndicate to be operating effectively is that it has a tool, and it is actively using that tool and that members are adhering to the tool. The only tool OPEC has to raise price is its quota system, and as Loderer shows that tool was not in use in the 1970s, and so therefore OPEC cannot have been a cartel or syndicate in the 1970s. But what about after 1981? In order to determine if OPEC worked coherently as a cartel or an anti-competitive syndicate then Granger causality (Granger, 1969) should determine if members are adhering to the quota tool or not. If the OPEC quota does not Granger cause the member's production and if a member's production increases before its OPEC quota is increased, then OPEC's quotas are not working. The only way to assume that a member is adhering to some form of price manipulation in that case is to assume internal or secret agreements are occurring outside of the public view, which requires further proof.

In this paper, Venezuelan oil production in comparison to OPEC's stated quota for Venezuela is looked at. A test is conducted to see if Venezuelan production Granger causes the OPEC quota

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for Venezuela or vice versa. The results show both occur but at different lags. However, it is apparent based on the results that we can reject the non-causality that Venezuela production does not Granger cause the OPEC quota in the long run which is a rejection of the OPEC collusion hypothesis at least for Venezuela. However, by rejecting such collusion for Venezuela, then such collusive hypotheses have to be questioned for other OPEC members as well, although that would require a more detailed analysis of each member's institutions, which is research for the future.

Nevertheless, the evidence suggests that it is not OPEC's quotas that are affecting Venezuelan production in the long run, but rather Venezuela's own internal decision making that is affecting its production. For example, during the 1970s when there was no OPEC quota for Venezuela, Venezuelan oil production declined even as prices compared to the 1960s were twice as high. When world oil prices were low in the late 1980s and 1990s, Venezuelan production increased opposite what a competitive supplier normally would do. Venezuela also kept pushing its production well above stated OPEC quotas in the 1990s making Venezuela a poor cartel or syndicate participant at best. This puts into question the entire cartel or syndicate hypothesis. A more plausible reason for the Venezuelan production decline during the 1970s was because Venezuela had nationalized its oil production, which created risk aversion to investment. Venezuelan production increased during the 1990s because it put competitive institutions in place such as production sharing arrangements (PSAs), but oil production decreased again when Venezuela nullified many of its competitive contracts around 2000. A Cautious Shift Model is developed that may better explain Venezuelan and OPEC member oil production history.

The paper is organized as follows. In the next section, we go over a literature review of various anti-competitive hypotheses for OPEC. In Section 3, we develop the cautious shift model that better explains OPEC behavior. In Section 2, we look at how external factors can enhance the cautious shift model, which explains the dichotomy between the 1970s and the 1980s for Venezuela and OPEC. We then explain the quadratic Hubbert model—an indexed Hubbert curve—as a method of comparing various oil production regions to the United States, a good free market example. In Section VI, Venezuela is compared to the US using the Hubbert index to show how and why Venezuelan oil production changed. In Section VII, a test of Granger causality is conducted to see if OPEC Granger causes changes to Venezuelan production or vice versa. The results show that Venezuela is causing OPEC's long run quota to change contrary to a cartel or syndicate hypothesis. In the short run, Venezuela does sometimes follow OPEC directives indicative of a tit-for-tat game. The last section gives concluding remarks.

2. Literature review

A number of models explaining OPEC behavior have been proposed, such as a low discount theory (Johany, 1980), target revenue models (Ezzati, 1976; Cremer and Salehi-Isfahani, 1991; Teece, 1982), political models (Moran, 1982; Adelman, 1993), collusion models (Griffin, 1985; Al-Sultan, 1993), and Hotelling (1931) models (Pindyck, 1978). Attempts to verify these models are shown in Griffin (1985), Green (1988), Jones (1990), Dahl and Yucel (1991), Griffin and Nielson (1994), Gulen (1996), Alhajji and Huettner (2000a, 2000b), Spolimbergo (2001), and Ramcharran (2002). Smith (2005) shows evidence that none of these hypotheses are correct, although he does hypothesize an alternative: that OPEC is a *bureaucratic production syndicate* that allocates quotas but which faces high costs in deciding on those quotas. However, as far as collusive quotas are concerned, Gault

et al. (1999) could not firmly establish a single statistically significant model for how the assignment of quotas is done within OPEC.

If OPEC is a cartel or a syndicate, then it has to have a tool to use to carry out its market manipulation. Clearly OPEC has only one single tool to use: its production levels, i.e. quotas. Therefore, there has to be quotas for all periods when oil prices are considered to be abnormally high and OPEC members have to be shown to be following those quotas or very quickly adhering to the quotas in order for OPEC to be an effective cartel or syndicate. However, no quotas existed for OPEC members in the 1970s (OPEC, 2008). It may be true that OPEC members saw a reduction in their oil outputs right around the 1973 oil price shock making it look as if OPEC was actively engaging in production cutbacks, but because there is no tool that OPEC used in the 1970s; then there can have been no cartel or syndicate. Other than the Arab embargo months from October 1973 to January 1974, general OPEC member reductions or plateaus in supplies were not OPEC directed. Indeed Loderer shows agreements in the 1970s had no effect and that OPEC agreements in the 1970s were to lower oil prices not raise them, implying OPEC agreements to raise outputs not lower them, which is completely counter to cartel or syndicate theory.

However, other reasons for a supply reduction are possible. From 1972 to 1974 the equity interest of oil producing operations by governments in the Middle East increased by an average of 10–75% (Exxon, 1984). Since Middle Eastern governments suddenly became the owners of their own oil reserves, Johanny suggests that OPEC member governments had alternative social discount rates that induced lower production levels. Another more practical possibility is that the take-over and nationalization of oil and gas assets that took place around 1973 included putting in place new, local and possibly inexperienced managers to run the world's great oil fields, which could have affected production, although risk aversion may have a roll. Nevertheless, the owner operator governments would still be competitors with each other.

Looking closely at all the anti-competitive hypotheses surrounding OPEC, if OPEC is a Bertrand Edgeworth Oligopoly, then OPEC agreements have to specify increases in prices, not decreases in prices, in order for OPEC to raise oil prices. However, in the 1970s OPEC agreements were to decrease prices not to increase them. If OPEC exhibits Stackelburg or Cournot behavior, then quotas are not needed and no quotas would be established, but quotas have been established since 1982. In a tit-for-tat game, each OPEC agreement should affect spot prices immediately, but OPEC agreements did not affect spot prices immediately in the 1970s (Loderer). If the Johanny hypothesis of the increase in property rights by a set of low social discount governments is the correct hypothesis for OPEC, then this is counter intuitive to OPEC member actions to invest in US Treasury-bills and international bond and equity markets in order to maximize their wealth. If you want to maximize the present value of your savings, then it only makes sense that you will want to maximize the present value of your oil revenue. Therefore, no model of OPEC consistently works.

Smith does show evidence that OPEC members are not merely free market competitors. Monthly and quarterly production changes for oil producers relative to other OPEC and non-OPEC producers do not exhibit compensating change. If OPEC were a cartel, each member would change outputs to compensate for other OPEC and non-OPEC variations in output more than 50% of the time, but that does not happen. If OPEC members were not complying with any organizational directives at all or were simply participating in a Cournot Oligopoly or in a competitive market, then they would have at least a 50–50 chance of arbitrarily compensating their own production levels vis-à-vis other OPEC and non-OPEC members. That does not happen either.

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