Risk Aversion and OPEC:
An alternative model for OPEC

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Overview

The usual explanation for low oil production capacities among OPEC members is that OPEC operates as a cartel. However, with ten or more members, it is difficult for such a cartel to be successful. Normal characteristics of cartel behavior suggest cheating on agreements as conventional game theory suggest. Van Huyck et. al. (1990) and other game analyses suggest agents playing cooperative games have a difficult time trusting each other especially if a small amount of uncertainty occurs. Based on those games, it should be hard for OPEC to cooperate to change oil prices. Furthermore, as Adelman (1986b) implies, OPEC members face the risk of losing oil value now due to technological innovation should they refrain from production. 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. Yet other evidence suggest that there are supply reductions.

This paper will show evidence for supply reductions. Then it will look at evidence to see if a specific cartel member, in this case Venezuela, Granger causes the OPEC quota's or whether the OPEC quotas granger cause Venezuela's production.

An alternative explanation for the actions of OPEC is then explained introducing the concept of risk aversion. This is not risk aversion to future energy technology in the Adelman (1986b) sense, but risk aversion to exploration results in an option value sense. This analysis relies on Friedman and Savage's (1948) idea of risk in economic models along with Markowitz's (1952) idea of the utility of wealth, as well as Kahneman and Tversky's (2002b) idea of prospect theory. If oil producers are risk averse to exploration and development, then that could induce less exploration and development leading to low oil supplies. Therefore low oil supplies are not caused by OPEC, but by risk aversion.

Methods

The paper will look at the tool (quota system) that OPEC can use to affect prices to see if it is working. It will list a set of quotas by OPEC for one member, Venezuela and see if those quotas affect production. The paper will test to see if OPEC quotas Granger cause production or whether production Granger causes the quota's.

Results

Results of tests show that OPEC quota's neither Granger cause Venezuealan production nor the other way around. Additionaly, OPEC members should expand their oil supply capacities at will in order to better negotiate for higher quotas inside OPEC, or in order to have better bargaining power within a production syndicate or a tit-for-tat game, or even to maximize their oil's value before alternative energy technology takes that value away. Yet the paper shows that OPEC members and even some non-OPEC members seem to have constrained production outputs. Specific examples of OPEC members and some non-members are shown to refrain from expansion of their production, in comparison to the U.S. A cumulative production Hubbert curve index is used to show the differences between the US and OPEC members.

Institutions and risk aversion can cause reductions in oil supplies. Based on such reductions, we can attempt to forecast the Worldwide oil supply. There are three factors that will determine the world's oil supply: the information and depletion effects of the normal Hubbert factory and institutions, which affect how much risk taking occurs. The effect of institutions will be to reduce the Hubbert trend peak to be decidedly lower. Going back to the original quadratic Hubbert curve, the classic Hubbert curve is really a set of mathematical equations called the Richards functional forms.

It is possible that a Richards functional form, which is not always symmetric, may model more closely the worldwide production rate of the past, given the risk averse nature of institutions, and the fact that there is enough information to infer that URR is somewhere in the neighborhood of 3 trillion barrels worldwide. Thus, the world would not normally follow a Hubbert curve like the US Lower 48 quadratic curve that had the luxury of relatively unrestrictive institutions, rather the world should follow a production trend that must endure very restrictive and risk averse institutions, and will look like one of the Richards functions. Therefore, a simple trial and error method of fitting one form of the Richards functions into the world oil supply trend will show that peak oil occurred in 2005.

Conclusions

The paper shows how the economics of the Hubbert curve fit into the broader economics of non-renewable resources and the institutions of OPEC oil producing members. It shows specific examples of the Hubbert curve and of institutional factors that change the Hubbert curve. It shows that OPEC quota's do not Granger cause member production, nor does member production Granger cause quotas. Based on both institutions and the economics of the Hubbert curve, I showed why 2005 was peak oil and why we can expect more high oil and energy prices from here on out.

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