



OPEC and world oil security

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ABSTRACT

On the margin, the effectiveness of policy to enhance the stability of world oil market oil conditions greatly depends on which countries supply what economists would call the “marginal barrels.” That is, the barrels whose production responds to changes in demand. If the countries dominating the production of the marginal barrels are relatively unstable, policies to reduce world oil consumption or boost oil production from stable suppliers will provide the additional benefit of reducing the contribution of unstable producers to the world oil market. If the countries dominating the marginal barrel are relatively stable, however, policies to reduce world oil consumption or boost oil production from stable suppliers will be less effective in promoting oil market stability.

Typically, we think of the highest cost producers as supplying the marginal barrel of oil, but our assessment finds it quite likely that OPEC dominates production of the marginal barrel of world oil. Moreover, OPEC members have been among the more unstable producers on a historical basis. Hence, reducing world oil consumption and promoting oil production in stable non-OPEC countries will enhance world oil security. Policies to promote stability in OPEC countries also would enhance world oil security.

1. Introduction

Recent declines in the price of oil are thought to fall the hardest on the highest cost oil sources of world oil consumption—such as Canadian tar sands and U.S. shale oil. Because these sources of oil supply are thought to be politically stable, analysts have expressed concern that lower oil prices will gradually reduce the security of world oil supply. Along these lines, we typically think of the highest cost producers as supplying the marginal barrels of world oil consumption—with the marginal barrels referring to the barrels of oil whose production is reduced or increased when demand falls or rises. The sources of the marginal barrels of oil can be important to policy because these sources of oil production most readily respond to changes in demand brought about by changes in policy.

Perhaps contrary to expectations, OPEC's low and relatively constant costs put it in a position where it can make an important contribution to the marginal barrel of world oil production through its exercise of market power.¹ To the extent that OPEC restrains its production to sustain higher world oil prices, it lessens its share of

world oil production relative to competitive conditions. At the same time, OPEC's exercise of market power puts it in a position to contribute a significant portion of the marginal barrel of oil. That is, when confronted with a change in world oil demand, OPEC's exercise of market power provides it with the incentive to change its output—perhaps by more than non-OPEC producers.

Because OPEC members are also among the more unstable suppliers, OPEC's dominance in producing the marginal barrel of oil has important implications for world oil market security. Adelman (2004) suggested that these two seemingly disparate strands of inquiry need to be combined. Nonetheless, to our knowledge, the confluence of these issues has not been well examined or understood in the context of energy security. We find it worthwhile to examine both how OPEC's cost structure and behavior affects its contribution to the marginal barrel of oil, and to assess whether OPEC members have been among the unstable producers.

Our inquiry has important implications for energy policy. In assessing the security of world oil supply, we are concerned with two related issues: 1) Which countries produce the marginal barrels of oil;

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¹ We use the term “OPEC” for any large producing entity with the capacity to exert some degree of market power. It may be one country like Saudi Arabia or many countries like members of the Organization of the Petroleum Exporting Countries. Although defining which players can exercise their market power is critical for oil price projections, our analysis does not require that all OPEC member countries act collectively.

and 2) Are the countries supplying the marginal barrels stable or unstable oil producers? The security of world oil supply and the effectiveness of policies to increase world oil security depend on the answers to these two questions. Policies to increase oil production in stable areas of the world or to reduce world oil consumption will be more effective at enhancing world oil security if they also reduce the production of unstable sources of oil production.

The remainder of the paper is organized as follows: Section 2 examines OPEC's role in global oil market instability. Section 3 examines OPEC's contribution to the marginal barrel of oil—taking into account costs and market structure while utilizing both static and dynamic analysis. Section 4 examines some options for increasing the security of world oil supply. Section 5 pulls these ideas together and examines the policy implications.

2. OPEC and the geopolitical instability of world supply

Brown and Huntington (2013, 2015) argue that global oil security increases when stable sources of world oil supply increase by more than unstable supplies. An increase in stable supplies by itself will not increase global security if its share of total world oil supply does not also increase. The historical record indicates that OPEC has maintained a relatively constant share of the world oil market in recent decades. But if that share should increase, global oil supplies would become more insecure because OPEC oil production appears to be more insecure than non-OPEC oil production in a geopolitical sense.

Evaluation of the historical record by a number of means shows that OPEC members have been among the politically unstable producers. Simple data analysis and an evaluation of oil supply volatility, by means of trend analysis using a Hodrick-Prescott filter, shows OPEC production has been less stable than non-OPEC production. Expert assessments also place OPEC members among the most unstable world oil producers. In addition, concerns about future political instability extend to members of OPEC that have been relatively stable in the past but are beginning to experience increasing political turmoil.

2.1. Historical data

When we look at raw data, OPEC production levels are substantially more volatile than for its non-OPEC counterpart. The most direct approach for evaluating this issue is to convert both OPEC and non-OPEC production to logarithms and calculate their first differences to derive annual growth rates.² The top set of results in Table 1 summarizes the variability of each group's annual production growth rate for the 1965–2013 period based upon annual data from the BP Review of Energy Statistics (British Petroleum 2014). Although each group's production grows by equal amounts (2.0% annually), OPEC's standard deviation of 7.5% greatly exceeds non-OPEC's standard deviation of 2.4%. The third column also confirms this finding by reporting normalized standard deviations, where the deviation in the second column is deflated by the mean in the first column. OPEC's production appears to be more than three times more volatile than non-OPEC's production.

This finding is also supported when the two series for production levels (rather than changes) are detrended to abstract from long-term trends. After detrending OPEC and non-OPEC oil production with a Hodrick-Prescott (1997) filter, we are able to express the variation (known as the cyclical effect within the context of the filter) as a percentage of the trended value. Actual and trended values for annual OPEC production are plotted in Fig. 1 and for annual non-OPEC production in Fig. 2. OPEC's normalized cyclical effect is 0.037, which is considerably higher than the 0.008 for non-OPEC. We applied the

² In these computations, non-OPEC includes former Soviet Union areas, although excluding these regions does not change the conclusions.

Table 1

Volatility in oil production growth rates for various periods. Sources: Authors' calculations based on annual data from BP Review of Energy Statistics and monthly data from U.S. Energy Information Administration.

	Mean	Std. Dev.	Normalized St. Dev.
1965–2013, Annual Data ^a			
OPEC	2.03%	7.52%	3.71
Non-OPEC	2.04%	2.36%	1.16
HP Trend ^b			
OPEC	26933	986	0.037
Non-OPEC	38780	324	0.008
1994–2013, Annual Data ^a			
OPEC	1.71%	3.84%	2.25
Non-OPEC	1.14%	1.08%	0.95
1994–2015, Monthly Data ^c (at annualized rates)			
OPEC	1.49%	19.33%	12.95
Non-OPEC	1.52%	10.45%	6.89

Notes:

^a Annual data are first differences of natural logarithms expressed as a percentage.

^b Cyclical variation from Hodrick-Prescott trend using levels data; mean production level is reported.

^c Annual rate = $((1 + \text{monthly rate})^{12}) - 1$, where the monthly rate is expressed in its decimal form.

default Ravn–Uhlig rule for annual data to set the smoothing parameter. These estimates suggest that the volatility of OPEC production is more dramatic than for non-OPEC.

The third set of results in this table repeat the same computations but restrict the analysis to the period beginning in 1994. These annual results cover the same period that will be evaluated with monthly data below. OPEC's production varies by almost four times more than non-OPEC's production, but it grows on average by more (1.7% per year rather than 1.1%). However, normalized standard deviation for OPEC production remains well more than twice that for non-OPEC production. For either period, OPEC's production appears to be much more volatile than that of its non-OPEC counterpart.

The last set of rows in Table 1 repeats the same computations for monthly data (from U.S. Energy Information Administration) over the period from January 1994 to February 2015 where the monthly estimates have been converted to annual rates. Once again, the average annual growth rates based upon the monthly data are very similar between the two groups, but OPEC's standard deviation is almost twice as large as that of non-OPEC. This finding also appears in the normalized standard deviations shown in the third column. Although the normalized standard deviations are much higher for the monthly than the annual data, the principal findings are the same. OPEC's production appears much more volatile than non-OPEC's.

2.2. Expert assessments

These empirical findings are supported by expert assessments. A study by the Council on Foreign Relations (2006) generally concluded that the greater political risks to world oil production lie in countries that are OPEC members. In addition, when geopolitical and military experts evaluated oil disruption risks for an Energy Modeling Forum study (Beccue and Huntington, 2016), they focused on Persian Gulf and other OPEC members in addition to Russia and some Caspian states. The primary motivation for restricting their focus to these producing areas is that most past oil supply disruptions have been caused by internal misgovernance (“failed states”) or conflicts within or across OPEC nations.

The empirical results are further supported by analysis by the International Energy Agency (IEA, 2014), which concludes that major geopolitical and economic events in OPEC countries have been the source of most of the significant supply disruptions over the past seven decades. As shown in Table 2, the International Energy Agency

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