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OPEC and non-OPEC oil production and the global economy[☆]

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ABSTRACT

Hamilton identifies 1973 to 1996 as “the age of OPEC” and 1997 to the present as “a new industrial age.” During 1974–1996 growth in non-OPEC oil production Granger causes growth in OPEC oil production. OPEC oil production decreases significantly with positive shocks to non-OPEC oil production in the earlier period, but does not do so in the “new industrial age”. In the “new industrial age” OPEC oil production rises significantly with an increase in oil prices, unlike during “the age of OPEC” period. OPEC oil production responds significantly to positive innovations in global GDP throughout. Over 1997:Q1–2012:Q4 the negative effect on real oil price of positive shocks to non-OPEC oil production is larger in absolute value than that of positive shocks to OPEC oil production. The cumulative effects of structural shocks to non-OPEC oil production and to real oil price on OPEC oil production are large. The cumulative effects of structural shocks to OPEC production and real oil price on non-OPEC production are small. Results are robust to changes in model specification. An econometric technique to predict growth in OPEC oil production provides support for the results from the SVAR analysis. Results are consistent with important changes in the global oil market.

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1. Introduction

Hamilton (2013) identifies five main periods associated with significant changes in the price of oil; 1859–1899, 1900–1945, 1946–1972, 1973–1996 and 1997–present. Hamilton (2013) describes the latter two periods as “The age of OPEC” and “A new industrial age”, respectively. Hamilton associates the “The age of OPEC” with the move to a higher average real oil price, the change in the focus of the global oil market from North America to the Persian Gulf, and with assertive behavior by OPEC. “A new industrial age” is connected with the tremendous economic growth in the major emerging economies, particularly China and India. Hamilton (2013) notes that the recently industrialized economies have absorbed over two-thirds of the increase in world oil consumption since 1998 and that this pattern of absorption of oil resources is likely to continue into the future. Kilian and Hicks (2013) show that rapid growth in emerging economies drove the rise in real oil price over 2003–2008.

In this paper we model the behavior of real oil price and OPEC and non-OPEC production behavior during the “The age of OPEC” from

1973 to 1996 and “A new industrial age” from 1997 to the present. The behavior of the two types of producers has been differentiated in the literature and their behavior has changed over time. Dées et al. (2007) report policy simulations indicating that non-OPEC production is inelastic to changes in price and that OPEC decisions about production impact oil prices. Barros et al. (2011) find that shocks affecting the structure of OPEC oil production are highly persistent. Kaufmann et al. (2008) find that real prices generally have a positive effect on production by OPEC members.² Lin (2009) identifies 1990–2006 to be a time of a largely competitive oil market, with the periods 1973–1981 and 1981–1990 having the market strongly influenced by OPEC. Huppmann and Holz (2012) argue that there has been a change in behavior in the crude oil market since 2008 with OPEC having less

² Analysis of OPEC behavior has focused on models of production for oil producers. Lin (2009) provides a review of work on the world oil market based on optimal non-renewable resource extraction models. Huntington (1994) shows that intertemporal optimization models did not function as well as predicting the world oil market as recursive simulation models. Ramcharan (2002) estimates a negative and significant price elasticity of supply for OPEC. Kaufmann et al. (2004) find that OPEC influences real oil prices and that models not allowing for the endogeneity of oil price cannot provide tests of competing models of production behavior. Gately (2007) observes that in discussing OPEC oil output relative to non-OPEC output in the composition of global oil production it is important to recognize that oil consumption in OPEC countries is rising rapidly. Gately et al. (2013) point out that OPEC’s domestic oil consumption has risen steeply since the 1970s and that collectively in recent years OPEC oil consumption approaches that of China.

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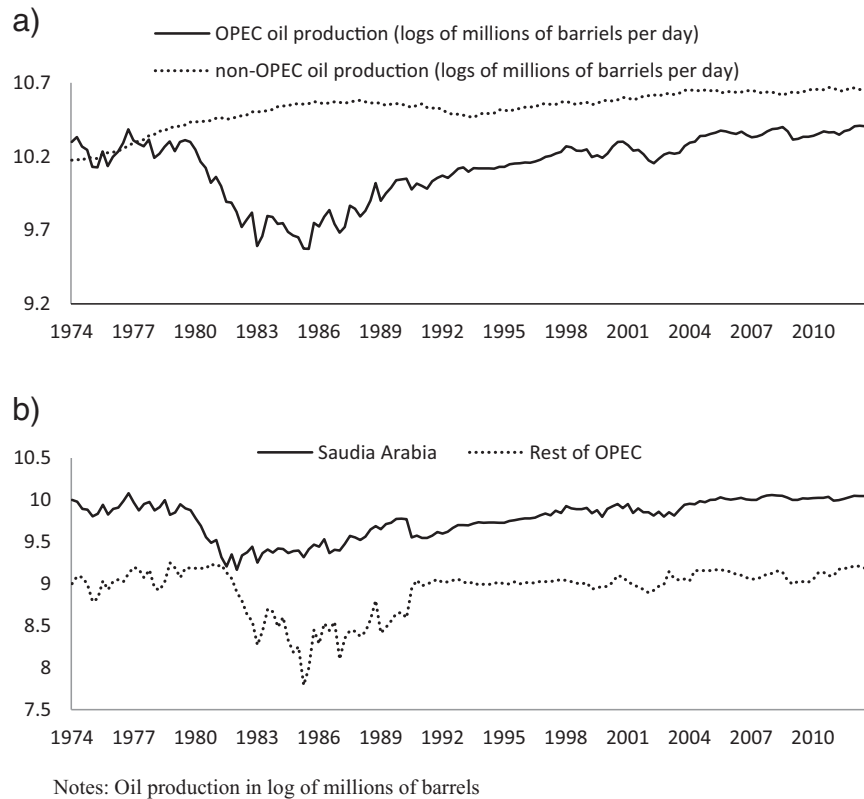


Fig. 1. a: Oil production for OPEC and non-OPEC countries (quarterly data):1974:Q1 to 2012:Q4. b: Oil production for Saudi Arabia and for OPEC minus Saudi Arabia (quarterly data):1974:Q1 to 2012:Q4. Notes: Oil production in log of millions of barrels.

market power, in contrast to before 2008 when Saudi Arabia acted as Stackelberg leader with a non-cooperative OPEC. Kolodziej and Kaufmann (2014) argue that failure to model OPEC and non-OPEC oil production separately (and to just focus on aggregate global oil production) will lead to underestimation of the influence of supply shocks on real oil prices.

An increase in economic growth in developing countries may be associated with a higher expected growth for commodity demand than an increase in growth in developed countries. Radetzki (2006) finds that growth in emerging market countries is associated with a relatively greater usage of commodities than in expansion in developed economies.³ Roberts and Rush (2010) report that commodity resources are used relatively intensive in traded goods and that growth in trade is a driving force in the growth of developing countries. Developing Asia grew at an average annual pace of 8.5% over the period between 2003 and 2013. The IMF expects developed economies to grow 2.2% in 2014 and developing economies to grow at almost 6% in 2014.⁴

In this paper we estimate the interrelationship between OPEC oil production, non-OPEC production, global aggregate demand and real oil price with a structural VAR model. Results are consistent with fundamental and related changes in the global oil market, based on strong global demand maintaining real oil price at high levels over most of 1997:Q1–2012:Q4, a steady upward trend in non-OPEC oil production over the last forty years, and a change in the behavior of OPEC from reacting to non-OPEC oil production to responding to higher real oil price.

³ Radetzki (2006) finds that a dollar added to the GDP in developing Asian countries uses more than twice the quantity of commodities as does a dollar added to the GDP in OECD countries. Ratti and Vespignani (2013a) find that liquidity growth in China has a significant effect on crude oil price over 1997–2011.

⁴ IMF Global Prospects and Policies can be found at <http://www.imf.org/external/pubs/ft/weo/2013/01/>.

We find that growth in OPEC oil production moves to offset growth in non-OPEC production during 1974:Q1–1996:Q4, but not during 1997:Q1–2012:Q4. Growth in OPEC oil production is not influenced by oil price during 1974:Q1–1996:Q4, but is influenced during 1997:Q1–2012:Q4. Growth in non-OPEC oil production responds significantly to positive innovations in real oil price over 1974:Q1–1996:Q4. Growth in non-OPEC oil production does not respond significantly to positive innovations in real oil price over 1997:Q1–2012:Q4, possibly because real oil price during this period is above a threshold required for non-OPEC to maximize production.⁵ Over 1997:Q1–2012:Q4 the negative effect on real oil price of positive shocks to growth in non-OPEC oil production is larger in absolute value than that of positive shocks to growth in OPEC oil production. Previously (over 1974:Q1–1996:Q4) growth in non-OPEC production didn't have a statistically significant effect on real oil price (due to offsetting OPEC adjustments).

Shocks to growth in OPEC oil production make large cumulative contribution to real oil price. Shocks to growth in non-OPEC oil production do not. The cumulative contribution to growth in OPEC oil production of real price shocks is large whereas that of growth in non-OPEC oil production is small. There is a large cumulative contribution to growth in OPEC oil production of shocks to growth in non-OPEC oil production, but that reverse does not hold. The effect of shocks to growth in non-OPEC oil production on cumulative growth in OPEC oil production is larger over 1974–1996 than over 1997–2012.

Using an econometric technique to predict growth in OPEC oil production, developed by Lewellen (2004) and Westerlund and Narayan (2012, 2014), we find support for the results from the SVAR analysis. During the first period, growth in OPEC oil production can be predicted by growth in non-OPEC oil production and global GDP

⁵ Ghalib (2004) estimates that among non-OPEC producers, the price ranges from a low of \$12 for Norway to a high of more than \$35 for Mexico that they require to balance the current account of their balance of payments.

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