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Quantifying the speculative component in the real price of oil: The role of global oil inventories

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A B S T R A C T

One of the central questions of policy interest in recent years has been how many dollars of the inflation-adjusted price of oil must be attributed to speculative demand for oil stocks at each point in time. We develop statistical tools that allow us to address this question, and we use these tools to explore how the use of two alternative proxies for global crude oil inventories affects the empirical evidence for speculation. Notwithstanding some differences, overall these inventory proxies yield similar results. While there is evidence of speculative demand raising the price in mid-2008 by between 5 and 14 dollars, depending on the inventory specification, there is no evidence of speculative demand pressures between early 2003 and early 2008. As a result, current policy efforts aimed at tightening the regulation of oil derivatives markets cannot be expected to lower the real price of oil in the physical market. We also provide evidence that the Libyan crisis in 2011 shifted expectations in oil markets, resulting in a price increase of between 3 and 13 dollars, depending on the inventory specification. With regard to tensions with Iran in 2012, the implied price premium ranges from 0 to 9 dollars.

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1. Introduction

The real price of crude oil depends on shocks to the flow supply of oil (defined as the amount of oil being pumped out of the ground), on shocks to the flow demand for crude oil that reflect the state of the global business cycle, on shocks to the speculative demand for oil stocks above the ground, and on other more idiosyncratic oil demand shocks. Especially, the quantification of speculative oil demand shocks has long eluded researchers because it raises difficult problems of identification. A speculator is someone who buys crude oil with the intent of storing it for future use in anticipation of rising oil prices. Such forward-looking behavior invalidates standard econometric oil market models if speculators respond to information not available to the econometrician attempting to disentangle demand and supply shocks based on historical data.

Recent theoretical and empirical work by Alquist and Kilian (2010), Kilian and Murphy (2013), and Baumeister and Kilian (2012a) made considerable strides in addressing these problems within a framework that is theoretically sound and empirically tractable.[1] These studies generalized the structural oil markets models pioneered by Kilian (2009), Baumeister and Peersman (2013), and Kilian and Murphy (2012) to examine the role of speculation and forward-looking behavior with careful attention to the role of spot and futures prices.

The key insight on which the Kilian and Murphy (2013) model builds is that otherwise unobservable shifts in expectations about future oil demand and supply conditions must be reflected in shifts in the demand for above-ground crude oil inventories. Shocks to this expectations-driven or speculative component of inventory demand may be identified and estimated jointly with all other shocks within the context of a fully specified structural vector autoregressive model. This fact allows one to assess how quantitatively important the speculative component in the real price of oil has been at each point in time from the late 1970s until today. The latter question has been of central policy interest since 2003 when oil prices began to surge to unprecedented levels, raising the question of how policy makers should respond to rising oil prices (see, e.g., Fattouh et al., 2012).

Models aimed at quantifying the speculative component in the real price of oil depend crucially on the quality of the oil inventory data. There are no readily available data for global crude oil inventories. Kilian and Murphy (2013) instead relied on a proxy constructed from publicly available U.S. Energy Information Administration (EIA) data. The objective of this paper is to explore how sensitive the conclusions reached by Kilian and Murphy are to the use of an alternative proxy compiled by the *Energy Intelligence Group* (EIG), a private sector company which provides detailed accounts of crude oil inventory stocks by region as well as oil at sea and oil in transit. We examine how the use of this alternative proxy affects our assessment of the causes of the oil price surge from 2003 to mid-2008 and of the subsequent collapse and partial recovery of the real price of oil. We also examine for the first time the role of speculative demand during the Libyan Revolution, the Arab Spring, and recent tensions with Iran ranging from the Iranian nuclear threat to the EU's decision in early 2012 to impose an oil import embargo on Iran. These recent episodes are of particular interest both because they provide additional evidence about the role of expectations shifts and because many pundits have conjectured that rising oil prices in recent years may be attributed to these events. Our focus throughout the paper is on providing results in a format that is immediately useful for policy makers. For this purpose, we design two new presentation tools that summarize – at each point in time – how many dollars of the inflation-adjusted price of oil must be attributed to which demand or supply shock in the global market for crude oil.

The remainder of the paper is organized as follows. Section 2 reviews the structure and identifying assumptions of the vector autoregressive model to be used throughout this paper. Section 3 compares the two alternative proxies for changes in global above-ground crude oil inventories. In Section 4, we re-estimate the Kilian-Murphy model using these alternative proxies on data extending to 2012.5. We quantify the effects of speculative demand using measures of their cumulative effects as well as counterfactuals for the real price of oil. The conclusion in Section 5 links our discussion of speculation

[1] There has been renewed interest in theoretical models of the relationship between oil inventories and oil prices in recent years. Other examples include Hamilton (2009), Dvir and Rogoff (2010), Arseneau and Leduc (2012), and Unalmis et al. (2012).

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