Can Accounting Inventory Data Shed Light on Physical Oil Market Speculation?

By Ivan Diaz-Rainey, Helen Roberts and David Lont

The oil spike of 2008 has generated intense academic and policy debate. Specifically, researchers have sought to ascertain what role, if any, speculation played in causing this spike. The majority of these studies have explored what impact financial institutions (non-commercial speculators) have had on price dynamics in the oil derivatives markets (principally oil futures).

Another less prominent concern in the oil price spike debate is what impact 'speculation' in the physical oil market had on prices. Consequently a number of papers have explored the relationship between physical inventories and oil prices (Hamilton, 2009; Kaufmann, 2011; Kilian and Murphy, 2013; Singleton, 2014). However, these efforts have relied on two aggregate data sources (OECD inventories from the IEA and US inventories from the EIA).

By way of contrast our paper (see Diaz-Rainey et al. 2016), uses an alternative data source, namely the companies' own financial accounts, and asks the following research question: Can we infer from accounting inventory numbers whether companies involved in the physical oil market have been speculating in the run-up to 2008?

Our contributions relative to the existing work using inventories are twofold: (1) we use an alternative data source that is more global and covers "oil at sea" (unlike IEA and EIA datasets), and (2) we explore individual company data and, therefore, can explore the heterogeneity of company behavior. The former is important, since both the IEA and EIA datasets do not capture emerging markets and do not cover 'oil at sea', which is critical since physical speculation in oil often involves holding positions in oil tankers. The latter is also important because past research on inventories has not been able to explore individual company behaviors, and thus our results challenge anecdotal and research-based conclusions drawn from aggregate data that suggested either all companies or none were involved in speculation. The reality is more nuanced; the evidence we find is consistent with some companies speculating and others not.

More specifically, using quarterly inventory data over the period 1990Q4 to 2012Q1 and an initial sample of 15 of the largest listed oil companies in the world, we derive an Index of Scaled Physical Inventories (ISPI). We employ three methods to expore the research question: (1) a descriptive evolution of ISPI over time; (2) statistical structural break tests on individual company time series (a positive structural breaks during the 'speculation period' would be suggestive of speculative activity) and econometric models of operating profit using estimates of barrels of oil as an explanatory variable.

We hypothesize a state dependent relationship between inventory, oil prices and, in turn, the operating profitability of commercial traders. Intuitively, if oil prices are rising and are expected to continue to rise ($E(P_{t+n}) > P_t$), momentum trades holding physical inventory will be profitable, so long as capital gains are greater than the cost of carry (s), hence $(E(P_{t+n}) - P_t) - s > 0$. This trade is, however, risky since prices may not in fact rise. Alternatively, traders can make a riskless profit through the contango and carry trade. Expectation of rising prices are likely reflected in a futures contango market, whereby futures prices are higher than spot prices (i.e., $F_{t,T} > P_t$). Traders can buy spot oil and sell it into the future instantly and make a riskless profit, so long as the capital gain is greater than the cost of carry, that is, $(F_{t,T} - P_t) - s > 0$. Indeed, Singleton (2014) finds evidence of the inventory and price relationship switching from negative to positive in 2004 when the oil market had considerable momentum and just before the market moved towards contango in 2005.

The ISPI measure ± 1 standard deviation using the inventory to sales measure (left axis) together with the Brent crude oil price (right axis) is shown in Figure 1. ISPI declines until the turn of the century. The declining standard deviation suggests a drive for efficiency shared by most industry participants (homogeneity in behavior). However, this changes as the Brent crude oil price starts to increase after Q3 in 2003 and continues to rise up to a maximum in Q2 of 2008. The one-standard-deviation band around the ISPI measure begins to widen at the turn of the century. The greater standard deviation supports heterogeneity of inventory behaviors among the companies included in the ISPI. This is consistent with more variation in decisions concerning the amount of inventory being held by each firm as the market enters a momentum phase.

The descriptive evolution of ISPI illustrates declining ISPI during the pre-speculation period (1990Q4

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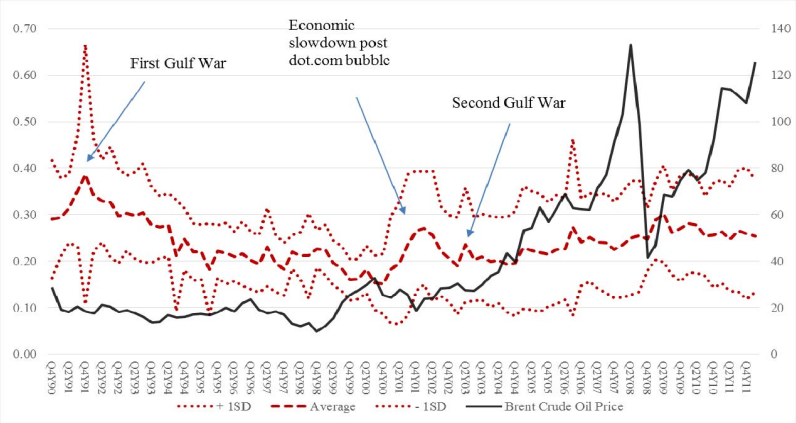

Figure 1: Descriptive Results for ISPI ± 1 SD Measured by Inventory Scaled by Sales

to 2004Q3) and an increasing ISPI during the speculation period (2004Q4 to 2007Q4). This evidence is broadly consistent with the evidence presented by Kaufmann (2011) and Singleton (2014) for the US, namely that the momentum market in oil prices between 2003 and 2008 was associated with rising inventories. As such, we add global evidence to their US findings. Further, the ± 1 standard deviation of ISPI highlights the heterogeneity of oil company behavior in the period leading up to A further examination of the heterogeneous behavior of oil companies based on the Bai-Perron structural break tests shows that nine of the 12 companies tested experience a structural break during the speculation period. British Petroleum, Royal Dutch Shell, Statoil, Total, Gazprom and Lukoil all have significant, positive structural breaks during the speculation period (see Diaz-Rainey et al. 2016 for further details). Conoco, Mobil Exxon and Petrobras experience negative structural breaks in the speculation period, while Chevron, Eni, Valero, China, Sasol and Repsol show no evidence of structural breaks. Evidence of a positive structural break in inventory as oil prices increase is suggestive of commercial traders speculating though it is not the only possible explanation for a positive break (see below). Conversely, negative or no structural breaks during the speculation period is consistent with non-speculative behavior.

We also examine the relationship between changes in operating earnings before depreciation and amortization to changes in oil inventory over the pre-speculation and speculation period. The latter is defined by structural breaks in the oil price. We report some evidence of switching in the coefficients for the change in the quantity of inventory variable over the two periods. There is also consistent but statistically insignificant sign changes in the sensitivity of the quantity of oil held by firms to changes in operating profitability. This is consistent with evidence reported by Singleton (2014). The conclusion based on these models is that switching has not materially affected performance, save for the cases of Royal Dutch Shell, Total and Gazprom (see Diaz-Rainey et al. 2016 for further details).

Overall, our evidence is strongly suggestive that at least some oil companies were involved in speculative activity, though this does not represent 'smoking gun' unassailable proof that they did so – the possibility remains that other factors caused individual inventory numbers to increase. For instance lengthening supply chains could be a plausible alternative explanation and it would seem this might explain the positive structural break for Statoil whom started delivering oil beyond Europe in the relevant period. However, it seems unlikely that all positive breaks can be explained by a third factor. Overall, our results are highly consistent with the evidence presented in Kaufmann (2011) and thereby add to the 'smell test' that physical markets speculation could have contributed to the run-up in prices between 2004 and 2008.

References

Diaz-Rainey, I, Roberts, H & Lont, D (2016) 'Crude Inventory Accounting and Speculation in the Physical Oil Market', working paper. Available at SSRN & ResearchGate

Hamilton, J. D., 2009. Causes and consequences of the oil shock of 2007 – 2008. Brookings Papers on Economic Activity, (Spring) 215-283.

Kaufmann, R. K., 2011. The role of market fundamentals and speculation in recent price changes for crude oil. Energy Policy, 39, 105-115.

Kilian, L. & Murphy, D., 2013. The role of inventories and speculative trading in the global m arket for crude oil. Journal of Applied Econometrics, 29(3), 454-478.

Singleton, K. J., 2014. Investor flows and the 2008 boom/bust in oil prices. Management Science, 60(2), 300-318.