BUFFER VS. SPECULATION: A REVIEW ON THE ROLE OF CRUDE OIL INVENTORY

Soohyeon Kim, Seoul National University, Phone +82 2 880 8284, E-mail: kimssoo@snu.ac.kr
Eunnyeong Heo, Seoul National University, Phone +82 2 880 8323, E-mail: heoe@snu.ac.kr

Introduction

This study aims to identify the double-facedness of oil inventory between a speculation and a buffer. It will be unveiled whether inventory owners react to a shock by hoarding up/selling off it with speculative incentive or by releasing/absorbing oil with buffer motivation. We considered two episodes: the increasing oil prices (Jan. 2003–Jun. 2008) and the decreasing oil prices (Jul. 2009–Feb. 2016). Our empirical analysis utilizes Structural Vector Auto Regressive (SVAR) model to identify the response of oil inventory to oil market shocks.

Although there has been ample research on oil inventory, the studies seem to be biased to either speculation (Kilina and Murphy, 2014; Kaufmann, 2011) or buffer (Teisberg, 1981; Cho and McDougall, 1990; Kim et al., 2014). Little research has been conducted to disentangle the buffer and speculative behaviors of the oil inventory despite its ambiguous identity between buffer and speculation. Table 1 shows representative studies selected on each side, and entire previous study will be presented at the conference.

Table 1. Confrontation of previous studies between buffer and speculation

Speculation		Buffer	
Research	Methodology	Research	Methodology
Kilian and Murphy (2014)	Time series analysis (SVAR)	Teisberg (1981)	Dynamic programming
Kaufmann (2011)	Time series analysis (Cointegrating test)	Cho and McDougall (1990)	Time series analysis (Regression)

The rest of the paper is organized as follows. The second section notes the major issues regarding the speculative and buffer behavior of inventory in detail. In the third section, an econometric model is introduced which is designed to capture the response of inventory to the shocks. The results of the analysis are described in the fourth section. Finally, the fifth section summarizes the findings and provides a brief discussion concerning contribution and future research.

Buffer vs. speculation

To disentangle buffer and speculative behaviors, we need to visualize the response of oil inventory to the shock with appropriate quantitative ways. In our analysis, the buffer and speculation are characterized by opposite signs. We defined that for a positive supply shock (e.g. an unexpected oversupply) if the inventory decreases (-), the inventory is a speculation, while if it increases (+), it is a buffer. For a positive demand shock (e.g., an unexpected demand rise), if the inventory increases (+), the inventory is a speculation, while if it decreases (-), it is a buffer. Table 2 summarizes the signs for the inventory responses to shocks.

Table 2. Signs of speculative and buffer responses to positive supply and demand shocks

Inventory response	Speculation	Buffer
Supply shock	(−)	(+)
Demand shock	(+)	(−)

We can unwind the ambivalent characteristic based on timing. Speculators would be active at the moment or right after the shocks since they pursue arbitrage profit with their timely information about the market. As the heated expectation for the arbitrage opportunity weakens over time, the inventory would begin to offer a buffer, and the buffer behavior would last long until the market imbalance would be alleviated.

Model

This study employs a Structural Vector Autoregressive (SVAR) since it not only estimate contemporaneous coefficients but also orthogonalize shocks independently, thus allowing structural economic interpretation. Also, as it does not depend on the ordering, the impulse response function (IRF) and variance decompositions through SVAR can provide stable results. Especially, we used a sign restriction method proposed by Uhlig (2005).

The SVAR model takes the form:

$$\mathrm{A_0 y_t} = \sum_{\mathrm{i}=1}^{\mathrm{p}} \mathrm{A_i y_{t-i}} + \mathrm{B}\varepsilon_\mathrm{t}, \quad \varepsilon_\mathrm{t} \sim \mathrm{N}(0, \Sigma_\varepsilon), \tag{1}$$

where $\mathrm{y_t}$ is a vector of endogenous variables, including world crude oil production, economic activity, crude oil inventory, and a oil price. The matrix $\mathrm{A_0}$ represents contemporaneous structural relations. The matrix $\mathrm{A_i}$ consists of dynamic structural parameters at time i. The ε_t is a vector of orthonormal structural shocks, and the matrix B is scale matrix for ε_t to have unit variance. The detailed estimation process will be presented at the conference.

Empirical results

Impulse response function (IRF) shows that during the first episode from January 2003 to June 2008, the demand shock caused the inventory behavior from speculation to buffer, as plotted in Figure 1. On the contrary, the response of oil inventory to supply shock is weaker than to the demand shock.

During the second episode from July 2009 to February 2016, it is shown in Figure 2 that inventory strongly responded to supply shock, behaving as from a speculation to a buffer. The response to the demand shock, however, is weaker than to the supply shock.

Forecast error variance decomposition (FEVD) supports the previous result that the IRF to the demand shock was more dramatic than to the supply shock in the fist episode, and vice versa in the second episode.

Figure 1. Impulse response functions to the supply and demand shock (Episode 1: Jan. 2003–Jun. 2008)

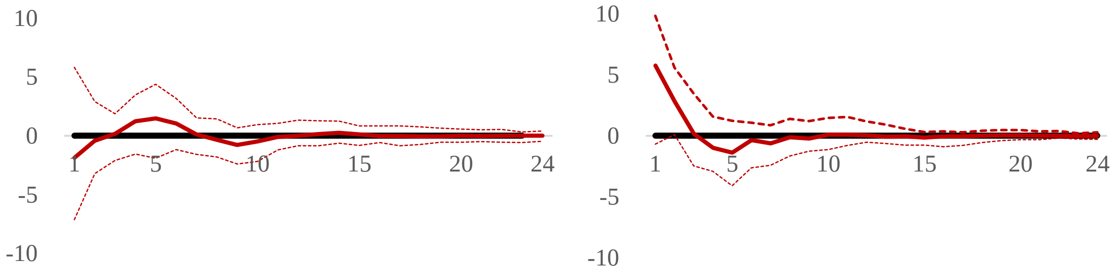
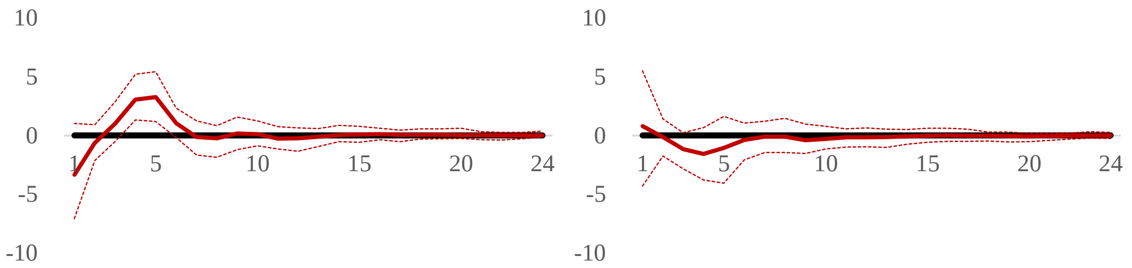


Figure 1. Impulse response functions to the supply and demand shock (Episode 2: Jul. 2009–Feb. 2016)



Note. Values are calculated by multiplying the impulse responses of oil inventories to both shocks multiplied by a thousand.

Concluding remarks

The study reviews questions on the role of crude oil inventory using SVAR. Regardless of the increasing oil prices (Jan. 2003–Jun. 2008) and the decreasing oil prices (Jul. 2009–Feb. 2016), overall tendency shows that inventories respond to oil shocks from a speculation to a buffer. The result implies that oil traders pursue arbitrage profit through speculative trades of oil inventories by taking advantage of oil shocks, but the traders come to adjust the levels of oil inventory to cover the oil shocks. The two episodes, however, show distinguishing differences that during the first episode it was the demand shock that affected inventories, but in contrast, it was the supply shock that drove inventory behaviors.

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