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# Causality between oil prices and the stock market in China: The relevance of the reformed oil product pricing mechanism



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## ABSTRACT

The refined oil pricing reform of March 27, 2013, was a major step toward the adoption of market-oriented pricing by making timelier, more frequent adjustments to domestic oil prices in China. However, the prior literature does not consider the impact of this reform in its assessment of the mean and risk dynamics between international oil prices and the Chinese stock market. To address this limitation, this paper employs the cross-correlation function (CCF) approach and reports evidence that this reform has led to a time-varying dimension in the dynamics of the mean and variance linkages between the international oil market and the Chinese stock market. The estimated results indicate that the causality-in-mean between the two markets strengthened after the reform of March 27, 2013, whereas the causality-in-variance almost disappeared after that date. Rigorous robustness analyses confirm these results, which can be useful to both investors and policy-makers.

## 1. Introduction

China has never been more important to the international oil market. With its rapid and persistent growth in crude oil imports, China has become the world's largest net oil importer and the second largest oil consumer (EIA, 2014<sup>1</sup>). At the same time, research on China has become more common in the literature on the oil-stock nexus at both the country and sectoral levels (Broadstock & \$2 Filis, 2014; Broadstock, Cao, & \$2 Zhang, 2012; Caporale, Ali, & \$2 Spagnolo, 2015; Chen & \$2 Lv, 2015; Cong, Wei, & \$2 Jiao, 2008; Fang & \$2 You, 2014; Li, Zhu, & \$2 Yu, 2012; Zhang & \$2 Chen, 2011). In addition to the relationship between oil prices and stock market returns (Broadstock et al., 2012; Chen & \$2 Lv, 2015; Cong et al., 2008; Fang & \$2 You, 2014; Li et al., 2012), the prior literature also examines the risk-spillover effects (Broadstock & \$2 Filis, 2014; Caporale et al., 2015; Zhang & \$2 Chen, 2011).

However, most studies on the oil-stock nexus in China find a positive (or insignificant) relationship (Broadstock et al., 2012; Chen & \$2 Lv, 2015; Cong et al., 2008; Fang & \$2 You, 2014) that is not easily explained by classical economic theory. For example, based on the present value theory, a higher oil price depresses the stock market of an oil-importing country because of a higher input cost and a higher discount rate attributable to inflationary pressure (Basher & \$2 Sadorsky, 2006; Jones & \$2 Kaul, 1996; Kang, Ratti, & \$2 Yoon, 2015; Kilian & \$2 Park, 2009). A few studies have provided some explanations for the positive oil-stock nexus in

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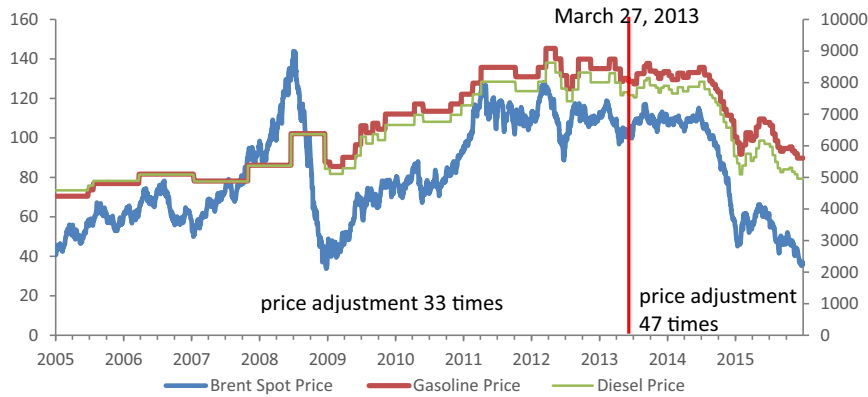
<sup>1</sup> The data are from the EIA website: <http://www.eia.gov/beta/international/country.cfm?iso=CHN>.

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**Fig. 1.** Crude oil price and number of price adjustments of refined oil products. Notes: China's local refined oil price always indicates both gasoline price and diesel price. The data on gasoline price and diesel price are collected from announcements by the National Development and Reform Commission. The Brent spot price data are collected from the website of the US Energy Information Agency (EIA).

China. [Chen and Lv \(2015\)](#) suggest that China's non-market pricing of refined oil, which was adopted in 1998, has distorted the transition mechanism between oil prices and the local stock market to create this positive nexus.

China took a unique path to the reform of its refined oil pricing mechanism. However, other than [Chen and Lv \(2015\)](#), no research has assessed the impact of this mechanism on the relationship between international oil prices and the local stock market returns in China. Before 1998, the Chinese central government controlled the price of refined oil, setting that price lower than in the global markets. However, the continued growth in oil consumption and oil imports has pushed China's central government to relax price controls five times since 1998, making China's oil price much more responsive to the changes in international oil prices,<sup>2</sup> especially the most recent market-oriented reform of March 27, 2013. This reform was a major step in the market-oriented pricing for refined oil, reducing reduced the price adjustment cycle from 22 working days to 10 working days and cancelling the 4% world oil-price-fluctuation trigger point.<sup>3</sup> Therefore, the persistence period of refined oil prices was significantly decreased from more than one month (or even four to five months) to approximately 10 or 20 days after the reform. Additionally, China's refined oil price changed 33 times from 2005 to 2012, whereas it changed approximately 47 times from March 27, 2013 to December 30, 2015,<sup>4</sup> as shown in [Fig. 1](#). Given the higher frequency and number of adjustments in the refined oil price, China's oil price and the world oil price are much more closely connected than before, and their trends are now quite similar, as can also be seen in [Fig. 1](#).

Overall, the market-oriented reform of March 27, 2013, appears to be a milestone in the history of China's reform of its oil pricing mechanism and motivates us to examine whether this reform has caused a structural break in the relationship between the Chinese stock market and the world oil market. Intuitively, we expect that the reform of March 27, 2013, has strengthened the connection between China's refined oil prices and the international crude oil price, leading to both Chinese companies' stronger sensitivity to international oil prices and closer relationships between the stock prices of Chinese listed companies and international oil prices after March 27, 2013.

However, from another perspective, the cancellation of regulation "22+4%" may have reduced the uncertainty that surrounds China's oil price adjustments in response to changes in international oil prices. Before the reform, China's domestic oil price would make an adjustment only when the cumulated changes in the world oil price within 22 days was at least 4%. Under this system, the prediction of China's oil price adjustment based on the information from the world oil price was complicated because of the requirements related to the time period and the magnitude of change. For example, when there is a large fluctuation above 4% in the world oil price in the first few days, it is difficult to predict whether the fluctuation will continue, stop or reverse before the end of the 22-day window. Therefore, it is difficult to forecast whether there will be an adjustment in China's domestic oil price. After the reform, the adjustment time period was much shorter, so it became relatively easier to predict the adjustment in China's domestic oil price once the trend in international oil prices has been observed. Intuitively, therefore, China's domestic oil prices are expected to have a closer link with international oil prices in both level and variation following the reform, but the unexpected fluctuation in China's domestic oil price that is caused by changes in the international oil market actually decreased because of the relaxation of the regulations on the adjustment in China's oil price. In this paper, we use a standardized residual after an estimation of an ARMA-GARCH model to represent the unexpected shock in the adjustment of China's domestic oil prices. In this sense, we expect that a weaker causality-in-variance between international oil and the Chinese stock markets will lead to a decrease after March 27, 2013, that is, weaker risk-spillover effects.

Additionally, given firms' different attributes, all equity sectors cannot be affected equally by oil prices and/or volatility shocks. One would expect that the sectors that are strongly related to oil, such as the energy and industrial sectors, are affected by the

<sup>2</sup> [Chen and Lv \(2015\)](#) list the contents of dynamic market-oriented reforms in China's refined oil pricing mechanism.

<sup>3</sup> The regulation of China's refined oil pricing mechanism before March 27, 2013 is referred to as "22+4%."

<sup>4</sup> The data were obtained from announcements by China's National Development and Reform Commission.

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