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Stock price synchronicity to oil shocks across quantiles: Evidence from Chinese oil firms

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ABSTRACT

This paper investigates behaviour of stock price synchronicity to oil shocks across quantiles for Chinese oil firms. The spillover effects of the oil market on a firm are segregated into firm-specific and market-wide information. First, our results report a higher level of synchronicity by dynamic conditional correlations than by R-square since the former better captures dynamic linear dependence. Second, we find strong evidence of size effect. In particular, stock price synchronicity is generally higher in large-cap firms than in small-cap ones. Oil shocks affect synchronicity in the upper quantiles differently based on firm size. Third, we also find that synchronicity responds to oil shocks significantly in extreme low quantiles, implying that shocks in the oil market are transmitted to Chinese oil firms via firm-specific information. Finally, we determine that oil shocks have little or no immediate impact on stock price synchronicity; instead, cumulative lagged effect is evident. This evidence highlights the lagging effect of spillover of oil shocks on Chinese oil firms.

1. Introduction

A considerable volume of work has shown that oil prices play an important role in explaining stock price movement (see, for example, Jones and Kaul, 1996; Kilian and Park, 2009; Aloui et al., 2012; Basher et al., 2012; Kang et al., 2015). A common feature of the empirical evidence on the response of stock markets to oil shocks is that they focus on the aggregate market and its industry perspective. For instance, Arouri (2011) investigates the responses of European sector stock markets to oil price changes. Moya-Martínez et al. (2014) examines the sensitivity of the Spanish stock markets at the industry level to movements in oil prices. Martín-Barragán et al. (2013) investigates the impact of oil shocks and stock market crashes on correlations between oil and stock markets of Germany, Japan, UK and US. In other words, these studies take a macro perspective in analysing the role of oil price in determining stock returns. However, there is little analysis of this linkage at the micro-level, especially for Chinese stock market, and our focus is to investigate the spillover from the oil market to individual firms.

Theoretically, the value of a firm is the present value of future cash flow, that is, the stock price of individual firms reflects both firm-specific information (such as, future cash flow) and market-wide information (such as, discount rate) in accordance with Chan and Hameed (2006), Xing and Anderson (2011) and Boubaker et al. (2014). Oil shocks can affect the stock price of a firm by influencing firm-specific information or market-wide information. For example, rising oil prices negatively (positively) affect the future cash flows of an oil-consuming (-producing) firm that reflects the significant reaction of firm-specific information to oil shocks. In addition, rising oil prices also increase interest rates in the economy by inflation and monetary policy. This reflects market-wide information. Unlike the firm-specific information, the change of market-wide information may result in a stock price change in the overall stock market. This raises an interesting and meaningful question for a firm: How do we know which of the two information flows responds significantly to oil shocks? This paper seeks to answer the question by examining the impact of oil shocks on stock price synchronicity across extreme quantiles.

Stock price synchronicity is a measurement of how individual stock prices co-move with the market, and it reflects the proportion of systematic volatility relative to the total volatility or idiosyncratic volatility. In line with prior literature, such as Morck et al. (2000), Chan and Hameed (2006) and Douch et al. (2015), a relatively lower level of stock price synchronicity indicates that the stock price variation is more likely to be caused by firm-specific information, while a relatively higher level indicates that market-wide information plays a leading role, i.e., the stock prices of an individual firm follows changes in the market. Intuitively, the foregoing characteristics of stock price synchronicity provide a practical approach for the identification

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problem, and this motivates us to explore the impact of oil shocks on stock price synchronicity in the quantile-regression framework. In particular, oil shocks are regressed against synchronicities of a firm across tail-quantiles. The significant coefficients in lower quantiles imply that firm-specific factors change with oil shocks, so that spillover effects of oil shocks are firm-specific information. Those of upper quantiles indicate that oil shocks drive the changes of stock prices via market-wide factors, thus the spillover effects of oil shocks are market-wide information.

The primary purpose of this research is to extract information intertwined in oil and stock markets. It will not focus on the relationship between oil and stock returns, but will analyse the impact of oil shocks on stock price synchronicity of a firm to extract useful information and determine features that detect whether spillover effects from the oil market to the stock market are firm-specific or market-wide information for an individual firm.

The study contributes to the literature on this topic in three ways. First, this is the first study to determine whether oil shocks affect stock prices by the influence of firm-specified or market-wide information. Second, we show that the dynamic conditional correlations (DCC) of stock prices between an individual firm and the market are a reasonable substitute for R-square to measure synchronicity. A large (small) absolute value of correlation also means a high (low) level of R-square and synchronicity. In contrast to R-square based synchronicity (Chan and Hameed, 2006; Chan and Chan, 2014; Douch et al., 2015), DCC based measurement is better able to capture the dynamic linear dependence of price variations between an individual firm and the stock market. Third, we analyse impacts of oil price shocks on stock price synchronicity[1] in the short and long run across extreme quantiles where the infinite distributed lag models are expanded into quantile regression. In this way, the impact of oil shocks on stock synchronicity over any time interval can be analysed instead of using averaging data in a series of regression models.

This paper yields some interesting results. Firstly, the stock price synchronicity of the DCC based measurement generally reports a higher level than the R-square based measurement. One possible explanation might be that the latter has poor data fitting to non-normality and heteroscedasticity in financial time series and poor ability to capture dynamic linear dependence. Secondly, stock price synchronicity has significant reaction to oil shocks across the extreme low quantiles that provides strong evidence to support that shocks in the oil market transmitted to Chinese oil firms are firm-specific information. This is consistent with the conclusion that oil shocks have a significant impact on energy-related stock indexes and oil firms (see Cong et al. (2008), Broadstock et al. (2012)). The impacts of oil shock on synchronicity are different based on firm size. The large-cap firms seem to have an insignificant response to oil shocks in the upper quantiles, however, the response of small-cap firms is significant. One possible explanation is that large-cap firms pay lower interest rates and are able to maximize advantages from early payment discounts on trade credit (see Vickery (2008), Narayan and Sharma (2011)). Therefore, shocks in the oil market have limited impact on market-wide factors of large-cap firms. Thirdly, oil shocks have no immediate effect on stock price synchronicity for Chinese oil firms. However, long-run effects are evident. Chen and Lv (2015) noted that Chinese refined oil price reflects only extreme changes in the world crude oil price. Because of the special oil price adjustment mechanism, domestic oil price variations will lag behind changes in international crude oil prices. Another reason may be the proposed under reaction hypothesis (see, for example, Narayan and Sharma, 2011). Short-horizon stock market investors underreact to information while long horizon investors overreact to information, i.e., investors do not respond strongly enough to new information. A strong reaction takes time; hence, the effect of information is felt after some time. Thus, we conclude that the spillover effect of oil shocks is lagging information for Chinese oil firms.

The rest of the paper is organized as follows. Section 2 reviews the literature. Section 3 describes the data and discusses the method for calculating synchronicity. Section 4 introduces the econometric methodology. Section 5 shows the empirical results. Section 6 concludes the paper.

2. Literature review

Given the crucial role of crude oil in the world economy, there is a growing body of research to explore the behaviour of stock price in response to oil shocks. Theoretically, oil shocks can affect stock returns via different channels. For example, Jones and Kaul (1996), based on a standard cash flows/dividends valuation model, found that the oil price shock had a decisive effect on the real stock returns in US, Canada, Japan and England. Huang et al. (1996) noted that oil prices were able to affect specific stock prices by changing future cash flows or discount factors, where the discount factor was composed of the expected inflation rate and the expected interest rate. Narayan and Sharma (2011) adduced the strong evidence of the effects of size on oil price affecting firm returns. In spite of these listed and unlisted paths, we simply classify them as the “firm-specific factors” and “market-wide factors” in accordance with the literature of Morck et al. (2000) and Chan et al. (2013). Our focus is to analyse the quantile behaviour of stock price synchronicity in response to oil shocks. In this way, we will distinguish oil shocks as firm-specific or market-wide information for individual firms.

Studies concerning stock price synchronicity have received increasing attention recently. For instance, Chan and Hameed (2006) examine the relation between the stock price synchronicity and analyst activity in emerging markets. Gul et al. (2010) use Chinese listed firms to analyse the impacts of largest-shareholder ownership concentration, foreign ownership, and audit quality on the amount of firm-specific information incorporated into share prices. Xing and Anderson (2011) research the linkage between stock price synchronicity and public firm-specific information in the United States. Zhang et al. (2016) investigate the ability of R-square and idiosyncratic volatility to capture firm-specific return variation. Feng et al. (2016) investigate the effect of ownership structure and analyst coverage on stock price synchronicity in China. Some other research includes the literature of Chung et al. (2011), Chan et al. (2013), An and Zhang (2013), Devos et al. (2015), Douch et al. (2015), and so on. Differing from their focus on firm characteristics, we investigate the reaction of synchronicity to oil shocks, i.e., cross-market information. More specifically, we propose the following three hypotheses that have not been previously tested:

Hypothesis 1. That oil shocks affect stock price synchronicity differently across the extreme quantiles.[2]

Hypothesis 2. That oil shocks affect stock price synchronicity differently based on firm size.

Hypothesis 3. That there is a lagged effect of oil shocks on stock price synchronicity.

The motivation for testing the above hypotheses comes from discussions concerning the linkages between oil prices and the stock market, such as, the studies about quantile behaviour in Sim and Zhou (2015) and Zhu et al. (2016); the issues related to firm size in Vickery (2008) and Narayan and Sharma (2011); and the question of the lagged effect in Jones and Kaul (1996) and Chang and Yu (2013). Our paper, following this research, tests these hypotheses for Chinese oil firms.

[1] There is a fairly sizable quantity of literature investigating the short- and long-run effects of oil price movements on stock prices. See Apergis and Miller (2009) and Ghosh and Kanjilal (2016) as a simple example.

[2] In fact, the tested procedure for this hypothesis is shown in the following two hypotheses.

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