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Firm return volatility and economic gains: The role of oil prices

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ABSTRACT

In this paper we investigate whether the oil price contributes to stock return volatility for 560 firms listed on the NYSE. Using daily data, we find that the oil price is a significant determinant and predictor of firm return variance. We devise trading strategies based on forecasts of firm return variance using the oil prices and historical averages. We find that investors can make substantial gains in returns by using the oil price in forecasting firm return variances.

1. Introduction

1.1. Background

The literature on the effect of the oil price on firm returns is large and growing; for an influential list of studies, see Chen et al. (1986), Driesprong et al. (2008), Jones and Kaul (1996), and Narayan and Sharma (2011). There is another branch of this literature which focuses not on firm returns but on market and industry returns (see Cologni and Manera, 2008; Nandha and Faff, 2008; Park and Ratti, 2008; among others). A feature of both these groups of studies is that the oil price has a statistically significant effect on returns. We take this literature forward in a novel way. Despite the plethora of studies investigating the effects of the oil price on returns, two questions remain. First, does an increase in the oil price contribute to stock return volatility? Second, does a statistically significant relationship between oil price and stock return volatility translate to economic significance? The literature alluded to above has generally ignored exploring the economic significance of the oil price–stock returns relationship.

We attempt to answer these questions for 560 firms listed on the NYSE, using time series daily data for the period 2000 to 2008. That the oil price affects firm returns implies that it should affect firm return volatility. Marquering and Verbeek (2004), for instance, argue that factors that impact the first moment of returns should also impact the second moment. Moreover, Christoffersen and Diebold (2000) argue that if volatility fluctuates in a forecastable way, volatility forecasts are useful for risk management. Given the importance of firm return volatility forecasts in risk management, what remains of interest, and has not been considered previously, are: (1) the magnitude of the effect of an oil price rise on firm return volatility; (2) the heterogeneous effects of the oil price on firm return volatility; and (3) whether investors can devise profitable trading strategies based on forecasting firm return variance with the oil price.

1.2. Motivation

There are three motivations for why we investigate the relevance of the oil price in influencing firm return volatility. Our first motivation comes from a recent study by Narayan and Sharma (2011), which established a number of empirical facts about the oil price and firm return relationship on the NYSE. Narayan and Sharma (2011) show that firms on the NYSE are heterogeneous based on the evidence that: (a) the oil price has different effects on firm returns depending on sectoral location of firms; (b) the oil price has different effects on firm returns depending on the size of firms — that is, small size firms are differently impacted by the oil price compared to large size firms; (c) the oil price has a nonlinear effect on firm returns not for all firms, but for specific firms depending on their sectoral location; and (d) the oil price has different degrees of persistent effects depending on the sector to which firms belong to. In sum, the Narayan and Sharma (2011) study proffers an important message regarding the oil price–firm returns relationship: that the effect of the oil price on firm returns is both sector-specific and firm-specific. This finding has implications for our research question. Given their findings, there is no reason to believe that the oil price will not have a heterogeneous effect on firm return volatility. We explore this further and provide new empirical evidence. Our approach to modelling the effects of the oil price on firm return volatility is similar to Narayan and Sharma (2011), in that we divide the 560 firms into 14 different sectors. More specifically, we have the following sectors: energy, electricity, supply, manufacturing, food, general services, chemical, medical, engineering, computer, transportation, banking, financial, and real estate.

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Our second motivation for a firm-level return volatility analysis is rooted in the work of Campbell et al. (2001), who argue that many investors tend to hold significant individual stocks such that changes in industry-level and idiosyncratic volatility matter.[1] While this fact is now well understood, the sources of firm-level volatility are relatively less understood.

The third motivation is that there is lack of knowledge on the economic significance of the oil price for investors. For example, Narayan and Sharma (2011) do not show how investors can profit by using information contained in the oil price. And, while Driesprong et al. (2008) do, their focus is on the first moment of return. Therefore, our approach of understanding the role of the oil price on firm return volatility and subsequently on profitable trading strategies is new.

1.3. Summary

Foreshadowing our main results, we find that the oil price is a significant determinant of stock return volatility. Generally, the effect (in terms of sign) of the oil price on stock return volatility is mixed; but for the bulk of the firms the oil price reduces stock return volatility. We show that in 13 of the 14 sectors the oil price reduces stock return volatility. The only exception is banking sector firms, for which the oil price has a positive effect on stock return volatility. We attribute this to some of the salient features of banking sector firms, such as the higher systematic risk of firms in the sector. Our results also reveal that the oil price has a persistent effect on stock return volatility and the effect differs by sector. We also find that the oil price affects return volatility of different sizes of firms differently. Taken together while our results suggest that the oil price has a heterogeneous effect on stock return volatility, they also confirm the relevance (at least from a statistical point of view) of the oil price in influencing stock return volatility. Motivated by this finding, we then investigate potential economic gains that investors can make by devising trading strategies based on models where the oil price is used to forecast stock return volatility. We compare trading strategies based on the oil price with those from historical averages and find on average across all 14 sectors investors can improve returns by around 5% if they were to use a model of the oil price to forecast firm return variance as opposed to using historical averages. We also show that the improvements in returns from an oil price based model are heterogeneous in that investors in certain sectors, such as financial and manufacturing, can potentially gain by over 11% while investors in some sectors, such as general services and medical, gain by less than 1% per annum.

We organise the rest of the paper as follows. In the next section, we discuss the relationship between the oil price and stock return volatility. In Section 3, we discuss the empirical model and results. In Section 4, we provide an explanation for our results. In Section 5, we devise a trading strategy based on forecasting stock return volatility by utilising information in the oil price. We compare the profitability of this model with a historical average based variance forecast model. In the final section, we provide some concluding remarks.

2. Relationship between the oil price and return volatility

Previous studies document various transmission channels through which the oil price has an impact on certain macro-economic variables, such as interest rate, money supply, gross domestic product, and exchange rate (see, for example, Dohner, 1981; Fried and Schultze, 1975; Hotelling, 1931; Mork, 1994; Pierce and Enzler, 1974). According to Fried and Schultze (1975) and Dohner (1981), the wealth transfer effect from the oil price rise emphasizes the shift in purchasing power from oil importing countries to oil exporting countries. As a result, consumer demand for oil importing nations decreases whereas the consumer demand in oil exporting nations increases when the oil price rises. This has implications on the macro-economy. In particular, this leads to a fall in world consumer demand for goods produced in oil importing nations; the resultant is an increase in the world supply of savings. The increasing supply of savings causes real interest rates to increase. Moreover, Hotelling (1931) argues (theoretically) that changes in interest rates will alter oil prices through producer extraction decisions if oil in the ground has value. He also claims that oil in the ground can have value because it is scarce and this can differ from the value it has as a final output (good) or as an input to production above ground.

Given that the interest rate is one of the most important determinants of stock returns and return volatility (or market volatility), an increase in the interest rate raises the required rate of return, and negatively affects the value of assets. This also encourages an investor to change the structure of his/her portfolio in favour of bonds and vice versa, which, to some extent, affects the volatility of the stock market (see, for example, Campbell, 1987; Engle and Rangel, 2005; Fama, 1981; Fama and Schwert, 1977; Ferson, 1989; Shanken, 1990). On the other hand, a decline in the interest rate leads to an increase in the present value of future dividends. Additionally, according to Binder and Merges (2001), the volatility of the terminal value of the market portfolio, which is in the numerator, is a function of aggregate output, the expected price level, and the price level uncertainty. The initial value of the market portfolio is in the denominator of the standard deviation of stock returns. As the initial value of the market index is the discounted value of the future expected cash flow to equity, the same factors that affect equity prices also affect the volatility of the stock market or volatility of returns (see, Marquering and Verbeek, 2004).

Furthermore, Pierce and Enzler (1974) and Mork (1994) document that, according to the real balance effect, an increase in the oil price would lead to an increase in money demand. Thus, if monetary authorities intend to bring changes in money supply to meet the growing money demand, this will affect the stock market volatility through changes in portfolio substitution or inflationary expectations. Fama (1981) states that the inflation rate is positively associated with the money supply growth rate. A negative change in the money supply may cause a decrease in the discount rate and eventually will increase the stock price. Therefore, if the central bank buys or sells bonds to adjust banks reserves and the money supply, the initial impact will be felt on financial markets. This will lead to more market volatility or stock return volatility; for empirical evidence, see Cheng (1995) and Morelli (2002).

In sum, we notice that the transmission mechanism is through the monetary channel. The wealth effect from oil alters the interest rate. Because oil exporting countries gain from oil production and higher oil prices at the expense of oil importing countries, there is a shift in the interest rate, inflation rate, and money supply in both the oil exporting and importing countries which affects economic activities and performance of the stock market. Hamilton (1983), for instance, argues that seven of the eight postwar US recessions had been preceded by a sharp increase in the price of crude oil. Hayat and Narayan (2011) argue that preceding the 2007–2008 global financial crisis, the crude oil price had more than doubled. Moreover, several studies have shown that the oil prices have a statistically significant effect on returns. Equally significantly, a recent study by Narayan and Sharma (2011) shows that the oil price has different effects on firm returns depending on the sector to which firms belong to in the case of firms listed on the NYSE. More specifically, they show that while the oil price generally has a negative effect on firm returns for most sectors, for the energy and transport sectors the oil price has a positive effect on returns. Given this, and consistent with the argument of Marquering and Verbeek (2004), there is no reason to believe that the oil price will not affect firm return volatility.

[1] The relationship between structural breaks and volatility has been identified by Shaffer (1991); however, this relationship is understood at the market-level and not at the firm-level.