Oil price asymmetric effects: Answering the puzzle in international stock markets[☆]

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ABSTRACT

Although studies have found an asymmetric pattern in the response of aggregate output to oil price changes, parallel studies in stock markets have not been conclusive about their existence. This paper finds evidence that effects for oil-importing and oil-exporting countries run in opposite directions. Oil price hikes have a negative effect on the stock markets of oil-importing countries, while the impact is positive for the stock markets of oil-exporting countries. Statistical tests support the presence of asymmetric effects only in oil-importing countries. Oil price volatility has a negative impact in stock markets of oil-importing countries and positive in oil-exporting countries. Moreover, oil volatility seems to be affected asymmetrically by oil price changes. Oil price drops increase oil volatility more than oil price hikes do. Overall, the evidence seems to support that falls in oil prices do not impact stock markets because their positive effects are offset by negative effects of oil price volatility, canceling out effects for oil-importing countries.

1. Introduction

The importance of energy costs to economic growth has motivated research to study the economic impact of oil price changes. In his pioneer work, Hamilton (1983) shows that oil price hikes accounted partially for every U.S. recession after World War II. Bernanke (1983) and Pindyck (1991) models explain that large oil price movements increase uncertainty about future prices, causing delays in business investments. Though oil price rises have negative effects on gross domestic product (GDP), strikingly, drops have not been found to stimulate aggregate output (see, for instance Mork, 1989; Mork et al., 1994), which has been commonly named in the literature as the asymmetric puzzle (see Ferderer, 1996).

Stock markets are commonly seen as bellwethers of the economy anticipating changes in the business activity (Fama, 1990; Schwert, 1990). Thus although studies like Sadorsky (1999), Basher and Sadorsky (2006), Cong et al. (2008), Nandha and Faff (2008), and Park and Ratti (2008) have tried to find a similar asymmetric impact of oil price changes in stock markets, the evidence was mixed.

One shortcoming in the previous literature is a failure to address the role of oil price volatility in stock markets. Yet oil price volatility is likely to affect asymmetry because volatility can be a transmission mechanism itself. Uncertainty in future oil costs causes companies to postpone investments (Bernanke, 1983), because firms are uncertain whether the fall in energy prices is permanent or transitory.[1] Ferderer (1996) adds that the interaction of oil volatility and oil price changes might create offsetting effects. He hypothesizes that if negative oil price changes affect oil price volatility positively, and if oil price volatility has a negative effect on the economy, the effects would offset and create an asymmetric response to oil price changes. Therefore, part of the asymmetric relations between oil price changes and output growth found in macroeconomic studies could be explained by the response of oil price volatility to oil price changes. Moreover, turbulence in oil prices reduces the marginal effect of a given oil price change (see Hamilton, 1996; Lee et al., 1995). Thus, asymmetric effects are likely to be weaker or not significant when oil price volatility is accounted for.

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[1] Hamilton (1996, p. 216) comments that if that is indeed the mechanism by which oil shocks affect the economy, then a decrease in oil prices would not confer a positive effect on the economy that mirrors the negative consequences of an oil price increase.

Our paper addresses this question by analyzing whether oil price volatility has an impact on stock markets, and whether asymmetric effects persist when we account for oil price volatility. Moreover, unlike the previous literature, we distinguish between oil-exporting and oil-importing countries in order to understand whether the transmission effect of oil price changes is different for the stock markets of these two groups. If indeed stock markets mirror the behavior of aggregate output, and if higher oil prices generate additional income to the economy of oil producer countries, then higher oil prices would be expected to foster higher levels of economic activity (Bjørnland, 2000, 2009) and stock markets should anticipate that.

Our study makes a number of contributions. We find that the impact of oil price changes on stock markets runs in different directions for these two groups of countries. Increases in oil prices have a negative impact on the stock market returns of oil-importing countries, while for oil-exporting countries the impact is positive. Oil price drops negatively affect returns of stock market oil-importing countries but have a larger negative impact on the stock markets of oil-exporting countries. The result is consistent with the empirical findings on oil-exporting countries that find that their economies respond positively to oil price changes (Bjørnland, 2000; Jiménez-Rodríguez and Sanchez, 2004). Statistical tests confirm asymmetric effects only for oil-importing countries.

Our results also show that oil price volatility is relevant for stock markets, but again the effects run in different directions for oil-importing and exporting countries. Asymmetric effects do not disappear when we account for volatility, but the coefficient of negative shocks is smaller.

To understand the relationship between oil volatility and oil price variations, we estimate generalized autoregressive conditional heteroscedastic models (GARCH) with exogenous variables related to oil price changes in the conditional variance. The results show that negative oil price changes impact more the conditional variance and consequently oil volatility than positive oil price changes do, also suggesting the existence of asymmetric effects in oil volatility. These results are consistent with the smaller coefficient of negative oil price variations when we account simultaneously for the asymmetric effects of oil and oil volatility.

The structure of the paper is as follows. Section 2 reviews the literature. Section 3 presents the research design and describes the data. Section 4 describes the methodology. Section 5 presents the estimation results of asymmetric effects in oil-importing and oil-exporting countries, including the relation between asymmetric effects and oil price volatility. Section 6 provides a series of robustness tests of the analysis, and Section 7 concludes.

2. Literature review

Energy is an important and perversive input for all economic activity. Rises in oil prices increase the costs of running a business, dampen margins, profits, and cash flows (the key drivers of stock prices), and reduce company market value. One might expect that oil price drops have the inverse effect, increasing stock returns, but earlier studies did not find an impact on stock markets (see Chen et al., 1986; Ferson and Harvey, 1994a; Huang et al., 1996). The exception is Jones and Kaul (1996) that find evidence that aggregate stock market returns in the U.S., Canada, Japan, and the U.K. react negatively to the adverse impact of oil price shocks on their economies.

Because stock markets mirror the behavior of aggregate output, some authors have examined whether the oil price asymmetric effects noted in aggregate output (Mork et al., 1994) have parallel in stock market returns, but the evidence is not conclusive. Sadorsky (1999) and Basher and Sadorsky (2006) find evidence of asymmetric oil price effects, whereas Cong et al. (2008), Nandha and Faff (2008), and Park and Ratti (2008) do not.

The effects of oil shocks on the real economy have been differentiated for oil-producing and importing countries.[2] Both Bjørnland (2000) and Jiménez-Rodríguez and Sanchez (2004) find a different impact for Norway, an oil-exporting country.[3]

But the evidence on the effects of oil price changes on stock markets of oil-exporting stock markets countries is scarce. Park and Ratti (2008) analyze a sample of 14 countries and find that the impact of oil price changes for Norway is different from that of other countries, consistent with the explanations that oil price hikes generate additional income and wealth across oil producers. Bjørnland (2009) analyzes the effects of oil price shocks on Norwegian stock market and advocates that if oil income is transmitted back to an economy, then higher oil prices would be expected to lead to higher levels of economic activity. Consistent with her hypothesis, she found that a 10% increase in oil prices leads to an increase of 2.5% in stock returns, which supports the aggregate wealth and demand transmission channel.[4] A recent paper by Aloui et al. (2012) focuses on the effects of oil price changes in emerging oil-dependent and oil-exporting markets.

The lack of analysis on the role of oil price volatility and asymmetric effects has been a gap in the literature, but there is a strong reason to consider it. Lee et al. (1995) correct oil changes by oil price volatility, arguing that the turbulence in oil prices reduces the marginal effect of any given oil price change. An oil price shock variable reflecting both the unanticipated component and the time-varying conditional variance of oil price change (forecasts) is constructed and found to be highly significant in explaining economic growth across different sample periods, even when matched against various economic variables and other functions of oil price. They find that positive normalized shocks have a powerful effect on growth while negative normalized shocks do not. Ferderer (1996) puts forward an offsetting mechanism based on the interaction of oil price volatility and oil price changes that can create the asymmetric effects found in the literature. He states that the two necessary conditions for explaining the mechanism that creates the asymmetric effects are (1) that oil price changes, whether positive or negative, positively affect oil price volatility, and (2) that oil price volatility (uncertainty) negatively affects the economy. Thus, oil price declines increase oil price volatility, which in turn leads to negative effects on the economy and therefore the positive effects generated by oil price declines are canceled out. Globally, oil price declines have no effect on an economy, while soaring oil prices affect it negatively, and these negative effects are reinforced by the negative effects created by oil price volatility. He tests this hypothesis and finds that when controlling for oil volatility, coefficients of oil price increases and decreases are no longer statistically significant. On the empirical side, studies have tested whether oil price volatility affects stock returns. Among empirical studies, Sadorsky (1999) finds that either an oil price change or its volatility has an impact on real stock returns, Sadorsky (2003) finds an impact of oil volatility on technology stocks and Oberndorfer (2009) on energy stock returns.

3. Data

3.1. Country data

To investigate the differences in the impact of oil prices in oil-importing and oil-exporting stock markets, we select a set of countries that are heavily dependent on oil imports and a set of countries

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[2] Studies by Mork et al. (1994); Bjørnland (2000); Cuñado and Garcia (2003); Jiménez-Rodríguez and Sanchez (2004) analyze the effect of oil changes on the GDP of oil producing countries.

[3] Jones and Kaul (1996, p. 468) suggest that the effects of oil shocks should vary considerably across different countries depending on their production and consumption of oil reserves.

[4] For a detailed explanation of how an oil shock can affect an oil producing country we refer to Bjørnland (2009).