Crude oil and stock markets: Stability, instability, and bubbles ☆

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ABSTRACT

We analyze the long-run relationship between the world price of crude oil and international stock markets over 1971:1–2008:3 using a cointegrated vector error correction model with additional regressors. Allowing for endogenously identified breaks in the cointegrating and error correction matrices, we find evidence for breaks after 1980:5, 1988:1, and 1999:9. There is a clear long-run relationship between these series for six OECD countries for 1971:1–1980.5 and 1988:2–1999.9, suggesting that stock market indices respond negatively to increases in the oil price in the long run. During 1980.6–1988.1, we find relationships that are not statistically significantly different from either zero or from the relationships of the previous period. The expected negative long-run relationship appears to disintegrate after 1999.9. This finding supports a conjecture of change in the relationship between real oil price and real stock prices in the last decade compared to earlier years, which may suggest the presence of several stock market bubbles and/or oil price bubbles since the turn of the century.

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1. Introduction

The relationship between oil prices and economic activity has been investigated by a number of researchers. On the issue of the effect of oil price shocks on stock market returns, Jones and Kaul (1996), Sadorsky (1999) and Ciner (2001) report a significant negative connection, while Chen et al. (1986) and Huang et al. (1996) do not. A negative association between oil price shocks and stock market returns has been reported in several recent papers. Nandha and Faff (2008) find oil prices rises have a detrimental effect on stock returns in all sectors except mining and oil and gas industries, O'Neill et al. (2008) find that oil price increases lead to reduced stock returns in the United States, the United Kingdom and France, and Park and Ratti (2008) report that oil price shocks have a statistically significant negative impact on real stock returns in the U.S. and 12 European oil importing countries.[1] In new strands in the literature, Kilian and Park (2007) report that only oil price increases driven by precautionary demand for oil over concern about future oil supplies negatively affect stock prices, and Gogineni

(2007) finds that industry stock price returns depends on demand and cost side reliance on oil and on size of oil price changes.

Research on the effect of oil prices on stock prices parallels a larger literature on the connection of oil price shocks with real activity. Much of this research has been influenced by Hamilton's (1983) connection of oil price shocks with recession in the U.S. Hamilton's finding has been elaborated on and confirmed by Mork (1989), Lee et al. (1995), Hooker (1996), Hamilton (1996, 2003) and Gronwald (2008), among others.[2] The research in the two areas is clearly connected, since oil price shocks influence stock prices through affecting expected cash flows and/or discount rates. Oil price shocks can affect corporate cash flow since oil is an input in production and because oil price changes can influence the demand for output at industry and national levels. Oil price shocks can affect the discount rate for cash flow by influencing the expected rate of inflation and the expected real interest rate. The corporate investment decision can be affected directly by changes in the latter and by changes in stock price relative to book value.

In recent work emphasis has been placed on the changing nature of the connection between oil prices and real activity. Blanchard and Gali (2007) find smaller effects of oil price shocks on macroeconomic

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[1] Nandha and Faff (2008) review work on the effect of oil price on equity prices. Recently papers have focused on the effect of oil price for stock market risk as in Basher and Sadorsky (2006) and Sadorsky (2006).

[2] Cologni and Manera (2008), Kilian (2008a) Jimenez-Rodriguez and Sanchez (2005), Cunado and Perez de Garcia (2005) and Lee et al. (2001) have confirmed a negative link between oil price shocks and aggregate activity for other countries. Huntington (2005), Barsky and Kilian (2004) and Jones et al. (2004) provide reviews on the effect of oil shocks on the aggregate economy.
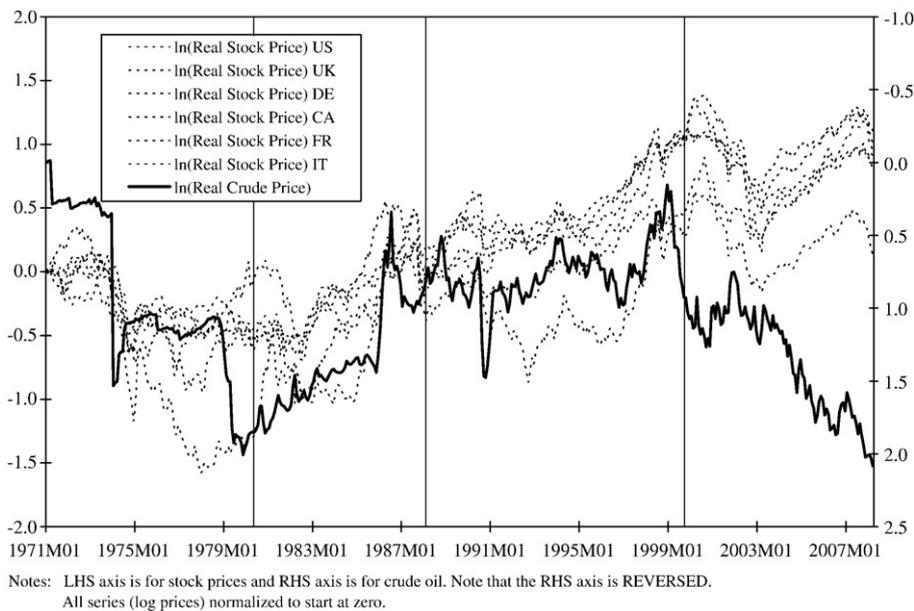
Fig. 1. Stock market prices and the crude oil price (Jan 1971–Mar 2008).

variables in recent years. Kilian (2008b) reports that while exogenous oil supply shocks, identified as oil production disruptions, have a significant effect on the economy, their impact on the U.S. economy since the 1970s has been small compared to the impact of other factors. Along similar lines, Cologni and Manera (2009) report that the role of oil shocks in explaining recessions has decreased over time in G7 countries. This change in the relationship between oil prices and real activity in recent years from earlier decades is attributed to several causes including improvements in energy efficiency and in the conduct of monetary and fiscal authorities.

In this paper, we analyze the long-run relationship between the price of crude oil and international stock markets from January 1971 to March 2008 using a vector error correction model (VECM). The basic model we employ includes additional regressors to control for short-run dynamics between stock market prices for six OECD countries and a single international crude oil price and other macroeconomic series. The contribution of this paper is in the analysis of the long-run relationship between oil price and stock prices in a number of major countries jointly while allowing for short-run macroeconomic influences on stock price. This is in contrast to much recent work which has focused on the short-term impact of oil price increases on stock market returns.[3] Moreover, we allow for the possibility of endogenously identified structural breaks in both the long-run and short-run relationships.

We find a clear long-run relationship between these series for six OECD countries from 1971 until May 1980 and again from February 1988 until September 1999, suggesting that stock market indices respond negatively to increases in the oil price. Although we do not find long-run relationships to be statistically significant in the intervening period, they are not statistically significantly different from those in the previous period, either.[4]

The long-run relationship appears to disintegrate and even change signs in some cases after September 1999, based on data through March 2008. Such an empirical finding supports a conjecture, not only of a change in the relationship between oil prices and real variables in recent years from earlier decades, but possibly of several stock market bubbles and/or oil price bubbles since the turn of the century.

The remainder of the paper is structured as follows. In the following section, we provide a non-quantitative motivation for our analysis. Our econometric model and explanations of our estimation technique and breakpoint identification procedure are contained in Section 3. Section 4 discusses specification test results, while Section 5 holds our main empirical results. Section 6 concludes. Data and sources are discussed in Appendix A.

2. Motivation: End of the oil era or beginning of the bubble era?

Fig. 1 shows a simple time series plot of the real stock market prices and real crude oil prices[5] for six countries from January 1971 through March 2008, with crude oil measured on the *reversed* RHS axis. The countries are Canada, France, Germany, Italy, the U.K. and the U.S., designated by CA, FR, DE, IT, UK and US, respectively. The set of countries is chosen because they represent the major developed countries over a sample starting in 1971 and real stock prices and real crude oil price share a single stochastic trend. Japan is not included because the real stock price for Japan does not share this single stochastic trend. Up until about December 1998, the plot clearly indicates the presence of long-run relationships, with one or more common stochastic trends. Since the crude oil axis is reversed, such relationships imply that long run decreases in the price of oil correspond to long-run increases in stock market prices around the world, and vice versa.

After December 1998, when the oil price reached its historic low since the early 1970s, this price began to climb. Since early 2003, the climb in the real oil price has been steady and rapid. Unlike the early 1970s, stock market prices continued to climb – rather than decline as

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[3] The impact of oil price increases on stock market returns (and analysis of short-run effects) has been considered by Nandha and Faff (2008), O'Neill et al. (2008), Park and Ratti (2008), Ciner (2001) and Sadorsky (1999), as noted earlier. In other work, for example, Sadorsky (2001) and Boyer and Filion (2007) find that positive oil price shocks significantly raise stocks returns for Canadian oil and gas companies, El-Sharif et al. (2005) report a similar result for U.K. oil and gas companies, and Papapetrou (2001) reports that positive oil price shocks significantly reduce stock returns in Greece.

[4] In fact, if we omit the break in either 1980 or 1988, we find statistically significant negative relationships from January 1971 until January 1988 or from June 1980 until September 1999, respectively. The likelihood function is increased by including these breaks, but at the expense of statistical significance over the intervening period.

[5] The plot in Fig. 1 shows the natural logarithm of these prices with each series normalized so that the first observation is zero. Throughout the remainder of the paper, we refer to these transformed series without further reference to the transformation. Data are discussed further in Appendix A.