



## Oil price shocks and transportation firm asset prices

Raj Aggarwal <sup>a,\*</sup>, Aigbe Akhigbe <sup>b</sup>, Sunil K. Mohanty <sup>c</sup>

<sup>a</sup> Sullivan Professor of Finance, College of Business Administration, University of Akron, Akron, OH 44325, United States

<sup>b</sup> Department of Finance, College of Business Administration, University of Akron, Akron, OH 44325, United States

<sup>c</sup> Department of Finance, Opus College of Business, University of St. Thomas, Minneapolis, MN 55403, United States

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### ABSTRACT

The transportation sector is a major user of oil-based energy. Even as oil prices continue to fluctuate greatly, the impact of oil price changes on transportation firms has heretofore not been adequately examined. This paper fills this gap, documenting important new findings based on analysis of over two decades of daily data on large changes in oil prices (oil price shocks). First, while transportation firm returns are influenced negatively by oil price increases, risks are increased more by oil price declines. Second, firm characteristics are important with the market-to-book ratio being the most important firm characteristic, and ROA, firm size, and the prior run up in prices are also important in influencing oil price related returns, betas, variances, and trading volumes. Third, in the S&P transportation sub-sector, industry concentration is negatively related to returns, oil price risk, and trading volume, and asymmetrically related to returns and market betas. These new findings enhance our understanding of the asset price impact of oil price shocks and should be of much interest to scholars, corporate executives, money managers, regulators, and policy makers.

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### 1. Introduction

A major user of energy, especially oil-based energy, is the transport sector. However, the past decades have seen unprecedented swings in the price of oil and in the resulting demand for oil especially from the transport sector (Larsson and Nossman, 2011). Oil price rises, often dramatic, have also led to many policy developments and innovations in the use of energy for transport (e.g., rising manufacturer fuel economy standards). Further, oil prices are important for national economies and asset markets as they influence both significantly (He et al., 2010; Jones et al., 2004). The costs of oil-based fuels are especially important for the transport sector, and it seems that oil prices change frequently and dramatically. These oil price shocks are important for the economy and especially for energy usage in the transport sector.

Many studies have documented that the impact of oil price shocks on an economy is significant (e.g., Hamilton, 1983, 2003; Kilian, 2008; Mork, 1994).<sup>1</sup> In addition, changes in the price of crude oil have also long been considered an important factor affecting stock prices. Indeed, a large body of literature examines the impact of oil shocks

on stock market returns at both the country and industry levels.<sup>2</sup> For example, Driesprong et al. (2008) and Jones and Kaul (1996) find oil prices impact stock returns negatively.<sup>3</sup> In contrast, Chen et al. (1986) conclude that changes in oil price have no incremental explanatory effect on asset pricing, and similarly, Huang et al. (1996) also find no significant relation between stock returns and changes in the price of oil futures.

In addition, it has been noted that the direction of impact of oil shocks on stock returns at the industry level may vary from one industry to the other depending on a number of factors. For example, it depends on whether an industry is a net producer or net consumer of oil

<sup>2</sup> The business and popular press certainly believe that oil prices influence stock prices. For instance, the *Financial Times* on August 21, 2006 reported that U.S. stock prices declined due to an increase in crude oil prices caused by geopolitical risk in the Middle East (including the Iranian nuclear program and terrorist attacks by Islamic militants). The same newspaper on October 12, 2006 attributed the strong rally in global equity markets to a slide in crude oil prices. Similarly, the *Wall Street Journal* on May 2, 2007 reported that "A big drop in crude-oil prices also helped stocks, which generally benefit from signs that consumers' pocket books won't be sapped by higher pump prices." In fact, during the years 2005 and 2006, oil prices figured in the headlines of the *Wall Street Journal* on 204 days and most of these reports suggest that returns on stock markets are sensitive to oil price changes (the search term used are "oil prices", "oil price", "oil prices and stocks", and "oil price and stocks").

<sup>3</sup> Other studies examine the link between the change in oil prices and stock returns at the country level include Ferson and Harvey (1991) and Hamao (1989). Similarly, industry level studies include Faff and Brailsford (1999), Hammoudeh and Li (2005), Kilian and Park (2009), Nandha and Faff (2008) and Sadorsky (2001).

\* Corresponding author.

E-mail address: [aggarwa@uakron.edu](mailto:aggarwa@uakron.edu) (R. Aggarwal).

<sup>1</sup> Hamilton (1985) provides an excellent discussion on this issue. Also see, for example, Yakov and Wohl (2003).

(e.g., Hammoudeh and Li, 2005; Nandha and Brooks, 2009; Nandha and Faff, 2008), or depending on an industry's cost-side and demand-side dependence on oil (e.g., Gogineni, 2010). For example, the oil and gas industry may have a positive exposure to a change in price (net producer and/or demand-side dependence on oil), while the transportation industry may have a negative exposure to a change in oil price (net consumer and/or cost-side dependence on oil).

Further, Hou and Robinson (2006) show that the structure of product markets also affects stock returns. In general, Hou and Robinson (2006) argue that firms make operating decisions based on strategic interactions between market participants which, in turn, may affect the riskiness of their cash flows and rates of return. Thus, firms in less concentrated industries are likely to behave differently from those that operate in more concentrated industries where barriers to entry are high and the competition is low.

An important industry where a significant and important part of input costs are dependent on oil prices is the transportation industry. This is an important industry and for instance, since the second half of the 20th century, the transportation industry has been the largest sector of petroleum consumption in the U.S. According to the U.S. Department of Energy, 14 million barrels/day of petroleum products were consumed for transportation purposes in 2006, accounting for 66% of all U.S. petroleum product consumption. However, somewhat surprisingly, prior studies have not examined the impact of oil price changes on stock returns in the transportation industry. Specifically, in this paper we analyze the wealth effects of large oil price changes (oil price shocks) on equity returns for firms in the U.S. transportation industry.

Using over two decades of daily data on oil prices and returns for 71 companies in the S&P transportation index, our study addresses the following heretofore neglected questions: 1) What is the exposure of firms in the transportation industry to oil price shocks? 2) Are there any asymmetric effects of oil price shocks on stock returns and risk? In other words, is the impact of a positive change in oil price on a firm's returns and risk different from the impact of a negative change in oil price on stock returns and risk? 3) Are firm-specific factors and industry characteristics including structure of product markets within a sector (e.g. airline industry and railroad industry) related to a firm's returns, market exposure (market beta), oil price exposure (oil beta), variance of returns, and trading volumes? 4) Do oil price shocks have the same or different impact on returns and risk of firms across various sectors within the transportation industry (e.g., air freight and logistics, airlines, marine transportation, railroads, trucking, and transportation infrastructure services)? Specifically, we analyze the asymmetric effects of large oil price changes (shocks) on stock returns, market risk, oil beta, stock return volatilities, and trading volumes for U.S. transportation firms. Further, the event study methodology used here has not been used in this context previously but it allows us to ask important and interesting questions that illuminate and extend in important ways our understanding of the asset price impact of oil price changes.

We document that transportation firm return and risk exposures to oil price changes are asymmetric and while returns are influenced significantly by oil price increases, risks are influenced more by oil price declines. In addition, these impacts often differ based on firm characteristics and the structure of the product markets within a sector (industry concentration). The market-to-book ratio (MBR) is the most important firm characteristic followed by firm size and the prior run up in prices in influencing oil price related returns, betas, variances, or trading volumes. The firm ROA influences oil price beta, return variances, and trading volumes while firm leverage does not seem to influence much except, as expected, market beta. Returns of transportation firms in more concentrated sectors are significantly negatively influenced by oil price increases. These results should be of much interest to scholars, corporate executives, money managers, regulators, and policy makers.

The rest of this paper is organized as follows. In Section 2, we align our work with the relevant literature. Section 3 presents our data sources, research methodology, and hypotheses development. In Section 4, we present our empirical findings. Section 5 concludes the paper.

## 2. Economic importance of oil price changes

### 2.1. Oil price changes and stock returns

The impact of oil price changes on equity prices has long been of interest and, as briefly indicated, early studies examined the impact on national stock prices documenting a general negative impact of rising oil prices on stock markets (e.g., Driesprong et al., 2008; Jones and Kaul, 1996; Lee, Ni, and Ratti 1995; Sadorsky, 1999). Using quarterly data for the U.S. (1947–1991), Canada (1960–1991), Japan (1970–1991), and the U.K. (1962–1991), Jones and Kaul (1996) document a uniformly negative effect of oil prices on stock returns in these countries. Sadorsky (1999) estimates a vector auto-regression model to study the relation between oil price changes and stock returns in the U.S. and finds that both oil price changes have a significant negative impact on stock returns. Using country-level data for 48 different countries (both developed and emerging economies), Driesprong et al. (2008) also find that changes in oil prices can have a significant negative impact on stock market returns worldwide.

While the association between changes in oil prices and overall equity prices seems negative, the impact of oil prices on stock prices at the industry level is likely to differ depending on the type of industry. For example, industries may differ with regard to the impact of oil prices on the inputs and on the outputs of various industries. Industries would also differ in their ability to pass on oil price related price increases either because of competitive reasons or because of regulation (e.g., as in the transportation sector). Industries may differ with regard to the impact of oil prices on the demand for their outputs. Oil prices might also influence financial markets directly via shocks to discount rates (i.e., expected return), and through their influence on monetary and other government policies.

In some countries, industry reaction may also differ depending on the nature and level of subsidy provided to fuel prices. Additionally, the postponement of investments and the reallocation costs induced by oil shocks could also result in reduction in expected future cash flows leading to a negative impact on equity returns of such oil-sensitive firms (e.g., Pindyck, 1991).<sup>4</sup> Finally, industries may differ with regard to the structure of product markets within the industry (i.e., industry concentration) which serves as a measure of barriers to entry. Barriers to entry may affect how firms optimally make operating decisions in response to aggregate demand shocks due to change in oil prices (Hou and Robinson, 2006). Therefore, we hypothesize that the degree of industry concentration is likely to have a significant impact on how stock returns of individual firms react to oil prices. Overall, the impact of oil prices on various industries can be expected to vary considerably.

Indeed, Gogineni (2010) examines the impact of daily oil price changes on the stock returns of a wide array of industries. He finds evidence that impact of daily oil price changes on equity returns varies across industries. Using industry-level data, Kilian and Park (2009) analyze the response of industry-specific stock returns to oil shocks. Their study finds that stock returns of oil and gas, and gold and silver mining industries are significantly positive in response to an increase in oil price, while the stock returns of automobile industry and retail sector are significantly negative in response to oil price shocks.

<sup>4</sup> Huang et al. (1996) suggests that, if oil plays an important role in an economy, one would expect changes in oil price to be correlated with changes in stock prices.

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