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Abstract. Using a sample of 828 oil-user firms from 14 net oil-producing countries, spanning from Jan 2004 to Dec 2015, we show that stock returns of oil-user companies increase with lagged oil price returns and decrease with lagged oil price volatility. Furthermore, the evidence suggests that oil-user stocks operating in countries with larger fuel subsidies tend to be more exposed to oil returns but not oil volatility. Intuitively, when the oil price increases (decreases), oil-user stocks that operate in countries with larger oil subsidies gain (lose) more than oil-user stocks in countries with smaller fuel subsidies. However, both types of stocks experience losses when the oil market becomes more volatile, with no statistically significant difference between their losses. Our evidence implies a diversification benefit for international investors to reduce their exposure to oil risk. Our results are robust because of the use of alternative proxies, econometric methodologies, and model specifications.

Keywords: Oil price risk, Oil-producing countries, Oil subsidies, Stock performance
JEL Codes: G1; G2; Q3 ;Q4

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1. Introduction

The benefits of international diversification in equity markets are well documented. Among many explanations suggested in the literature, the country effect is often suggested to be the source of these benefits. That is, if an investor invests in the same industry but in two different countries that are somehow affected differently by a set of risk factors, she/he may benefit from doing so (Griffin and Karolyi, 1998). The aim of this paper is to provide evidence of this claim by investigating the hypothesis that oil prices, as a risk factor, have an asymmetric effect on stock markets across countries with different levels of crude oil subsidies provided by governments.

It has been shown empirically that the movement and volatility of oil prices is a priced factor in asset pricing – see, for example, Kilian and Park (2009) for a discussion on how oil price shocks affect individual asset prices; Chen et al. (2010) for a link between oil prices and exchange rates and Ferraro et al. (2015) for an empirical analysis on the predictive power of commodity prices for commodity currency. In other words, investors are compensated for taking the risk of the uncertainty of oil prices when investing in the stock market. There now exists a very large body of literature focusing on both unconditional and conditional risk factors to investigate the relationship between oil price risk and stock returns, along with other priced factors such as market and exchange rate risks (e.g. Huang et al., 1996; Jones and Kaul, 1996; Basher and Sadorsky, 2006; Basher et al., 2012; Elyasiani et al., 2011; Degiannakis et al., 2013). For a recent survey on the complex relationships between oil prices and stock market activity, see Degiannakis et al. (2017).

The question arises as to how this risk factor exposure varies among countries. Additionally, can an investor exploit these variations to reduce his/her exposure to this risk? One documented fact that is a major motivation for this study is the supportive role that oil-producer countries play in oil-user sectors in providing special treatment for their home firms. It is fair to say that oil-user companies in such countries have a competitive advantage over their international rivals.[1] They face a relatively small and perhaps fixed input (oil) price in production, guaranteed by the government, to help maintain their profitability and market share. In support of this argument, Gupta et al. (2002) found that in most major oil-exporter countries, governments kept domestic prices below the free-market level, which resulted in implicit subsidies that, on average, equaled 3% of gross domestic product (GDP) in 1999. More recently, Coady et al. (2017) projected global energy subsidies to reach $5.3 trillion in 2015 (equivalent to 6.5% of world GDP)[2], which is more than what governments across the world spend on healthcare. Clearly, firms operating in such subsidized markets are better off with high oil prices that will help maintain their competitive advantage over their rivals. Ideally, when oil prices go down, one would expect this competitive edge to lose its significance, which may lead to a decline in market share and an adverse effect on earnings and market prices.

In this study, we use a sample of oil-user firms that use oil as an important input to production. We select these companies from 14 net oil-producing countries to estimate the impact of oil subsidies on firms' oil risk exposure. We construct country-based portfolios to study the impact of oil risk on excess oil-user stock returns. We utilize the energy subsidies data used in Coady et al. (2017) to construct our crude oil subsidies variables. Following Elyasiani et

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[1] Recent allegations of unfair competition between Gulf airline carriers (particularly Emirates, Etihad, and Qatar Airways) and their rivals in Europe and America, where the former have long been accused of receiving government subsidies, is a case in point. See the Economist (2015) for further details.

[2] Coady et al. (2017) use a broader notion of energy subsidy, dubbed as "post-tax subsidies", which is appropriate when consumer prices are below supply costs plus a "Pigouvian" tax to reflect environmental damage and general consumer taxes. For further clarification, interested readers are referred to Coady et al. (2017), particularly Apendix 1 and 3.

al. (2011), we consider oil volatility as well as oil returns[3] when estimating oil risk exposure. We also assume that oil price returns follow an AR(1) and GARCH(1,1) composite process and compute the conditional variance and use it as a proxy for oil volatility risk.

GARCH models have been used in previous studies to explore volatility in time series such as stock price returns and foreign currencies and to examine different hypotheses. For example, Day and Lewis (1992) investigated the impact of implied volatilities from the prices of call options on the S&P 100 index by including implied volatilities as an exogenous variable in the conditional variance equation of GARCH and EGARCH models. Using a bivariate GARCH model, Karolyi (1995) examined the international transmissions of stock returns and volatility between the U.S. and Canadian markets. He considered the conditional variance of the excess stock market returns of foreign countries as an exogenous variable in the conditional variance equation of the excess market returns of the countries of origin. More recently, Elyasiani et al. (2011) studied the effect of oil price returns and volatility on excess stock returns across industries. To capture the effect of oil volatility on excess stock returns volatility, they included the lagged conditional variance of oil futures returns in the conditional variance equation. They found that oil price fluctuations constitute a systematic asset price risk at the sector level.

Our paper follows the framework of Elyasiani et al. (2011) closely, yet our analysis differs from theirs in several important ways. First, we use a large cross-country sample, which allows us to disaggregate firms by the nature of the countries from which they operate so that we can observe whether they are impacted by oil price risk asymmetrically and whether the government oil subsidies capture this asymmetry. Our analysis thus complements the evidence provided by

[3] Throughout the paper, 'oil price returns' and 'oil returns' are used interchangeable. Oil price return is defined as log difference of oil price.

previous studies that also examined asymmetric exposure to oil risk across countries (e.g. Park and Ratti, 2008; Degiannakis et al., 2013). Second, we estimate the impact direction of the oil price risk and how it is affected by a government's decision to provide fuel subsidies to local firms, based on a risk factor loading framework. Finally, previous studies that compared the effect of the oil market on stock markets tend to investigate the causal relationship at the market level rather than the industry level. In contrast, we pose a more pointed question: mainly, we ask whether the documented government subsidies to oil-user companies that operate in oil-producing countries, could influence the effect of oil risk on stock returns. As a result, these subsidies could create a diversification benefit for international investors.

Using a sample of 828 oil-user firms from 14 net oil-producing countries, spanning from Jan 2004 to Dec 2015, we find results that were consistent with our expectations. Our findings suggest that oil-user returns increase with lagged oil price returns and decrease with lagged oil price volatility.[4] Furthermore, our results conclude that stocks of oil-user firms operating in countries with generous oil subsidies tend to be more exposed to oil returns but not oil volatility. Intuitively, when the oil price increases (decreases), oil-user stocks that operate in countries with larger oil subsidies gain (lose) more than oil-user stocks in countries with smaller fuel subsidies. However, both types of stocks experience losses with higher oil volatility, with no statistically significant difference between their losses.

The rest of the paper is organized as follows. Section 2 provides a brief review of the literature on international diversification and oil prices as a risk factor in asset pricing. Section 3 discusses the data and the construction of variables. Section 4 outlines the econometric methodology used to test the hypotheses. Section 5 reports the main findings of our analysis.

[4] When equations are estimated for each country separately, there are very few exceptions.

Section 6 conducts some additional analyses and tests more hypotheses as a check of the robustness of our primary results. Finally, Section 7 concludes the paper.

2. Literature Review

2.1. International diversification benefits

Previous literature has documented that investors benefit from international diversification by holding securities from markets that are weakly correlated. However, the interesting question that has been extensively posed and investigated in the literature is what causes these gains. Early work by Grubel (1968), Levy and Sarnat (1970), and Adler and Solnik (1974) document weak correlations in stock returns across countries and argue that the gains from investing internationally are greater than the costs involved. Some common explanations that have been provided are differences in monetary and fiscal policies, movements in interest rates, budget deficits, and national growth rates. However, others have argued that the gains are caused by the diversity of industrial structures across countries (e.g. Roll, 1992; Baca et al., 2000).

The industrial composition of a country has been argued to cause the weak correlation between returns across countries. An early work by Lessard (1974) was the first to consider this explanation for why returns vary across countries. Following Lessard (1974), Roll (1992), Heston and Rouwenhorst (1994), and Griffin and Karolyi (1998) examined this issue in more detail. Roll (1992) used daily country index returns and found that industry (exchange rate) factors explain 40% (23%) of the variations in stock returns. He assumed that each country has seven industries and used the Fama and MacBeth (1973) regressions to estimate the industry factors. Heston and Rouwenhorst (1994) reinvestigated the issue using a different sample. They showed that the industry factors used by Roll (1992) included country effects, which made them overstated. They used monthly stocks in seven industries and 12 European countries and showed that industry factors explained less than 1% of the variation. Griffin and Karolyi (1998) provided support for the findings of Heston and Rouwenhorst (1994). Using a relatively new dataset (the Dow Jones World Stock Index), they were able to cover 25 countries and 66 industries. Their conclusion suggested that industrial composition explains less than 4% of the variation in country index returns. On the other hand, Baca et al. (2000) argued that the relative importance of industry factors in stock variations across countries is growing and is expected to grow more with the increasing geographical integration of capital markets. Their results undermined the findings of previous studies that commonly found country effects to mostly dominate industry effects.

More recently, Bekaert et al. (2009) revisited the issue using a risk-based model rather than the dummy variable model commonly used in previous studies. They found that the increasing relative importance of industry effects was temporary and that country effects dominate industry effects in explaining variations in global stock markets, which is consistent with Heston and Rouwenhorst (1994).

2.2. Oil prices as a risk factor

Early studies analyzing oil have established oil to have a significant effect on many macroeconomic variables, including economic growth and stability. Many studies, including Hamilton (1983), Gilbert and Mork (1984), Chen et al. (1986), and others, have provided empirical evidence for these hypotheses. Moreover, in recent studies, oil has been shown to play a significant role in financial markets. Huang et al. (1996) argued that a decrease in stock prices is initially caused by the effect of oil on real gross national product, which results in a decline in the earnings of companies for which oil is an input for operation. Let use define the price of a stock price as follows:

$$P = \frac{E(CF)}{E(r)}, \tag{1}$$

where *P* is the stock price, *CF* is the cash flow of the company, and *r* is the discount rate. Equation (1) defines stock prices as the discounted value of the company's cash flows. From this, realized stock returns (*R*) can be expressed as Equation (2):

$$R = dP = \frac{d(E(CF))}{E(CF)} - \frac{d(E(r))}{E(r)} \tag{2}$$

Equation (2) implies that a realized stock return is a function of systematic changes in the expected cash flow and discount rates. Huang et al. (1996) claimed that these two factors are very likely to be affected by oil prices. For instance, they argued that oil is a primary resource in the production process that companies are likely to be involved in. Therefore, changes in oil prices may alter the stream of cash inflows and outflows. In addition, oil prices can directly affect the main two components of expected discount rates: expected real interest rates (because oil is a major resource in the economy) and expected inflation rates (because oil is a commodity).[5]

Huang et al. (1996) also argued that the impact of oil price movements into stock prices can arrive from two different sources: effects that can appear in the returns and effects that may be present in the volatility of returns. In their study, they used the vector autoregressive (VAR) approach to investigate the relationship between stock returns and oil prices. Their results suggested that oil future returns are not correlated with stock market returns except in the case of

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[5] See Degiannakis et al. (2017) and the references therein for further clarifications.

oil company returns and the petroleum stock index, where the correlation of the latter lacked some economic significance (i.e., the size of the estimated correlation coefficient) even though the relationship was statistically significant.

A similar relationship was also found for the volatility of returns. To examine the volatility of oil measured by the shock on stock returns and return volatility, Jones and Kaul (1996) used the Iraq–Iran war as an event study, examining the oil shock experienced in their sample period. Their results showed that changes in oil prices during the postwar period that Granger-preceded most economic series had a damaging effect on output and real stock returns in the U.S., Canada, Japan, and the United Kingdom.

More recent studies have looked at the relationship between oil prices and stock returns using samples from emerging markets. Basher and Sadorsky (2006) used an international multi-factor model to assess the relationship between oil price risk and emerging stock market returns using a sample from 21 emerging markets. Their most important conclusion was that oil price risk impacts stock price returns in emerging markets. Basher et al. (2012), however, used a different approach to investigate the relationship between oil prices and emerging market returns. They used the structural VAR approach to examine the dynamic relationship among oil prices, exchange rates, and stock returns. Their main results suggested that positive shocks to oil prices tended to negatively affect emerging market stock prices and U.S. dollar exchange rates in the short run. Kang et al. (2015) also investigate how structural oil price shocks the contemporaneous stock market return and volatility relationship. Similar to Basher et al. (2012), they find that a positive shock to oil price negatively affects the stock market return and volatility in the United States.

A different approach was used by Elyasiani et al. (2011) to examine the relationship of oil prices and stock returns and volatility in the U.S. market. They studied 13 U.S. industries and found evidence supporting of the hypothesis that oil price fluctuations constitute a systematic asset pricing risk at the industry level, as 9 of the 13 sectors analyzed showed statistically significant relationships between the oil price return and industry excess returns. Their model constructed the industry returns as functions of multiple variables, including lagged oil price returns and the lag of the conditional variance of oil price returns, which represented the shocks from oil price returns and were obtained by assuming that oil price returns follow a GARCH(1,1) process. We mainly use their framework in our study to examine the effect of oil on oil-user stocks. However, instead of using a single market, we use a sample from net oil-producing countries and we distinguish between them by their level of oil government subsidies.

Looking at 10 European sectors, Degiannakis et al. (2013) investigated a similar hypothesis and provided evidence on the relationship between oil prices and stock returns. They used a time-varying multivariate heteroskedastic framework to test the time-varying correlation between the two variables. They concluded that the link between the returns of oil prices and industrial sector indices is significantly influenced by the origin of the oil price shock. Specifically, supply-side oil price shocks resulted in low to moderate positive correlation levels, precautionary demand oil price shocks led to almost zero correlation levels, and aggregate demand oil price shocks generated significant changes in the correlation levels.

One last set of studies analyzed the effect of oil on firms from oil-producing countries compared with oil-consuming countries. Only a few papers have examined the asymmetric effect of oil prices when considering the nature of the country a firm belongs to. Degiannakis et al. (2011) examined the time-varying correlation between stock market prices and oil prices for oil-importing and oil-exporting countries, using the DCC-GARCH-GJR approach to investigate data from six countries divided into net oil-exporting and net oil-importing groups. Their results show that time-varying correlations did not differ for oil-importing and oil-exporting economies. However, the correlation increased positively in response to important aggregate demand-side oil price shocks, whereas supply-side oil price shocks did not influence the relationship between the two markets. Additionally, the lagged correlation results showed that oil prices had a negative effect on all stock markets, regardless of the origin of the oil price shock. A similar study by Park and Ratti (2008), using a sample of 13 European countries and the U.S., showed that Norway, as an oil exporter, had a statistically significant positive response of real stock returns to an oil price increase. Furthermore, for many European countries – but not for the U.S. – increased volatility of oil prices significantly decreased real stock returns. Finally, they suggested that there was no evidence of asymmetric effects on the real stock returns of positive and negative oil price shocks for any of the European countries.

Gupta (2016) undertakes a comprehensive analysis using firm-level data from 70 countries spanning three decades to examine the effect of country-level determinants, competition, and asymmetrical relationship in affecting the oil and gas stock returns. Among other results, he finds that firms located in oil-rich countries are more sensitive to oil price fluctuations. Further, firms that operate in a less competitive environment are less sensitive to oil price changes.

3. Data and Variable Construction

We obtained daily price data from Global Compustat[6] for a total of 828 firms from seven oil-user industries and 14 net oil-producing countries, spanning from Jan 2004 to Dec 2015. We

[6] www.crsp.com

picked the firms in our sample from seven oil-user industries, following Elyasiani et al. (2011), which include building (SIC15), chemicals (SIC28), plastic and rubber (SIC30), metal (SIC33), industrial machinery (SIC35), transport equipment (SIC37), and air transportation (SIC45). We used the data from Coady et al. (2017) to construct proxies for crude oil subsidies. Coady et al. (2017) found that the regions that provided the highest oil subsidies as a percentage of GDP were the Middle East, North Africa, and Pakistan. Their oil subsidies are roughly 8% of their GDP. The countries of the Commonwealth of Independent States (CIS) come next with oil subsidies that are roughly 5% of their GDP (Coady et al. 2017). On the other hand, the Advanced Economies and Emerging Europe groups have the smallest oil subsidies as a percentage of GDP.[7] We included all net oil-producing countries whose firms have complete data available in Global Compustat, which have at least one firm in the seven oil-user industries, and which have available data on government subsidies.

We calculate all prices in U.S. dollars. We use the monthly and annually averaged exchange rates obtained from the Federal Reserve Economic Data (FRED) and the World Bank to convert prices to U.S. dollars. Our analysis includes four key variables: risk-free rate, excess market returns, changes in exchange rate, and oil price returns. We use daily 1-month Treasury bill rates obtained from the FRED to proxy for daily risk-free returns, which were used to calculate excess returns. Following Ferson and Harvey (1994) and Basher and Sadorsky (2006), we use the trade-weighted U.S. dollar index: broad, obtained from the FRED, as our single-variable proxy for exchange rate risk. Following previous literature (e.g. Amihud et al., 2015), we use daily data from Morgan Stanley Capital International (MSCI), obtained from Bloomberg, as a proxy for global market returns. We define the excess market return (*MKT*) as the global market returns

[7] See Coady et al. (2017)'s Appendix 2 for regional classifications and figure 8 for energy subsidies by region

minus the daily 1-month Treasury bill rate. For oil data, we use daily data of the 1-month crude oil futures traded on the New York Mercantile Exchange as a proxy for oil risk. We use the 1-month futures prices following Sadorsky (2001), who showed that spot prices are more heavily affected by temporary random noise than futures prices[8]. We obtain the daily oil price data from the U.S. Energy Information Administration. We calculate the returns of oil prices (*ROIL*) as the log difference of the oil price variable. On the basis of the Akaike Information Criterion and the Bayesian Information Criterion, we find that the AR(1)-GARCH(1) process is the most appropriate model for oil price returns. We consider the conditional variance of this process as a proxy for oil volatility. For an alternative model, we obtain daily global Fama–French Factors from Kenneth French's website.[9]

To account for home currency inflationary effects, we begin by converting prices in the local currency to U.S. dollars and computing daily total returns. According to the Global Compustat manual, adjusted prices are equal to unadjusted prices multiplied by the daily dividend factor and divided by the daily adjusted factor. To calculate the total return, we take the log difference of adjusted price at periods t and $t - 1$. Following previous studies on international data, we only include the most traded securities for each firm and observations with the most currency traded, and we screen for non-trading days and firms for each country (e.g. Karolyi et al., 2012). To avoid outliers, we winsorize the daily observations within a country for each year at 1 percentile for each tail.

We construct daily value-weighted and equally-weighted oil-user portfolios for each country. We calculate the daily excess return for each portfolio return as the portfolio return minus the

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[8] For a robustness check, we use the spot crude oil prices instead of oil futures and repeat all our analyses. The results are qualitatively similar.
[9] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

daily 1-month treasury bill rate. In Table 1, we list the definitions and sources of each variable included in our analysis.

[Insert Table 1 here]

In Table 2, we show the descriptive statistics for each country. We report the start date, the number of firms and observations included, GDP, oil subsidies, government subsidy ratios (GSub), and the means and standard deviations of oil-user portfolio returns. The sample includes 828 firms with about 1.5 million observations. The maximum number of daily return observations included in our regression analyses is about 33,000. All countries have data that start in Jan 2004, except for Qatar, which has complete data only from March 2014. The country with the largest number of firms is Malaysia with 252 firms, followed by Canada with 207 firms. The country with the smallest number of firms is Qatar with only one firm, followed by the United Arab Emirates with only seven firms. The largest oil subsidies are attributed to Russia and Saudi Arabia, with oil subsidies worth of 114.33 U.S. billion Dollars and 67.61 U.S. billion Dollars, respectively. However, the countries with the largest oil subsidies as percentage of GDP are Saudi Arabia and Egypt, with ratios of 11.56% and 11.02%, respectively. On the other hand, Norway and Nigeria have the smallest oil subsidies scaled by GDP, with ratios of 0.56% and 1.01%, respectively. In addition, Table 3 shows the pairwise correlation matrix for the variables included in our regression analyses. As a preliminary result, the correlations of portfolio returns with the market returns or with the oil price returns are positive, and with exchange rate changes but the correlation negative, as expected. These correlation coefficients are statistically significant at the 1% level. Finally, the correlation coefficients between the control variables show no implications for possible multicollinearity issues.

[Insert Table 2 here]

[Insert Table 3 here]

4. Model Specifications

Here, we identify the testing approach of the key questions in this paper. First, we introduce the basic models to establish the association between the returns of our country-based portfolios and oil risk. next, we modify the models by incorporating government oil subsidies to test their impact on the relationship between returns and oil risk.

To measure the exposure of the country-based portfolio returns to the oil price risk, we estimate a multi-factor model that assumes the variation in excess returns is explained by the market risk, the exchange rates risk, the oil risk, and other unobserved factors that are uncorrelated with the three independent factors. Because of the lack of evidence for the Purchasing Power Parity, we follow Solnik (1974)'s international version of CAPM (ICAPM) and include the exchange rate risk to capture the heterogenous evaluations of stock returns across countries. Lastly, we augment the ICAPM model to include oil risk factors (augmented-ICAPM) The estimated equation is,

$$PR_{c,i} = \alpha + \beta_{c,m}\, MKT + \beta_{c,ex}\, RBEX + \beta_{c,oil}\, OIL_{i-1} + \beta_{c,voil}\, VOIL_{i-1} + \varepsilon_{c,i}, \tag{3}$$

where *PR* is the country-based portfolio excess returns, *MKT* is the excess market returns, *RBEX* is the change in exchange rates, *OIL* is oil price returns, and *VOIL* is oil price volatility. The subscripts *c* and *i* indicate country *c* and day *i*, respectively. $\varepsilon_{c,i}$ is an unobserved factor with a mean of zero and a constant variance. We estimate Equation (3) by using value-weighted portfolios formed from a set of oil-user stocks for each country, separately.

To more rigorously account for risk exposures that are not captured by Equation (3) but are possibly correlated with those included, we modify the equation and include two additional factors that capture size and growth effects. Specifically, we include the global versions of 'small minus big' (SMB) and 'high minus low' (HML) factors introduced in Fama and French (1996).[10] The estimated equation is altered to the form,

$$PR_{c,i} = \alpha + \beta_{c,m}\, MKT + \beta_{c,ex}\, RBEX + \beta_{c,smb}\, SMB + \beta_{c,hml}\, HML + \beta_{c,oil}\, OIL_{i-1} + \beta_{c,voil}\, VOIL_{i-1} + \varepsilon_{c,i}. \quad (4)$$

As pointed out earlier, we expect a positive association between oil-user portfolio returns and oil price returns and a negative association with oil volatility. The intuition simply is that stocks operating in a net oil-producing country benefit from higher oil prices because their competitive advantage over their international rivals peaks. On the other hand, during volatile oil market, they are expected to suffer from high uncertainty in the key variable in their production functions. Namely, we expect $\beta_{c,oil}$ to be positive and $\beta_{c,voil}$ to be negative.

Next, we attempt to investigate how oil subsidies impact the relationship between oil-user stock returns and oil risk. We test our second hypothesis by using two alternative econometric approaches. In the first approach, we estimate the relation by using country-quarter separate regressions[11]. Specifically, we run time-series regressions of Equations (3) and (4) for each country-quarter combination. We require at least 24 observations to estimate the coefficients in a country-quarter regression to avoid small sample bias. For each country, this creates a set of estimates for each quarter. We then average quarterly estimated coefficients across two groups: high-subsidy and low-subsidy countries. This creates a quarterly time series for each coefficient

[10] Unlike the relevant risk factor such as oil price, both SMB and HML serve proxy for yet-unknown more fundamental variables. According to Fama and French (2012), "firms with high ratios of book-to-market value are more likely to be in financial distress and that small stocks may be more sensitive to changes in business conditions" (Bodie et al., 2014, p. 341).

11 We closely follow Loughran and Schultz (2005)'s approach used to investigate asymmetry in the systematic turnover in rural and urban stocks.

for each of these two groups. To test the null hypothesis that an averaged coefficient in one group is different from zero, we use Newey–West standard errors to correct for possible autocorrelation. More importantly, we perform a two-sample t-test to determine whether oil risk is relatively more influential in countries with relatively larger oil subsidies. A drawback of this approach is that we average the estimated coefficients across a small number of countries, which may violate the assumption of normality. To address this issue, we report the medians for each estimated coefficient and use the Wilcoxon rank-sum test to test the equality of the estimated coefficients across the two groups.

In the second approach, we use a panel regression framework inspired by Henry (2002). Specifically, we run the regression equation on pooled data while controlling for time and cross-sectional fixed effects. We use two alternative proxies for oil subsidies for robustness. In one case, we use the ratio of a country's oil subsidies to its GDP as an indicator of how much a country provides oil subsidies. Since this ratio is calculated on an annual basis while the dependent variable is on a daily basis, this approach may suffer from a continuity issue. Therefore, as our second proxy, we introduce a dummy independent variable that takes 1 if a country's ratio is above the median of oil subsidies ratios in a year and 0 otherwise. We modify Equation (3) to fit the nature of our second hypothesis:

$$PR_{c,i} = \alpha + \beta_{c,m}\, MKT + \beta_{c,ex}\, RBEX + \beta_{c,oil}\, OIL_{i-1} + \beta_{c,o\_g}\, OIL_{i-1} * GSubs + \beta_{c,voil}\, VOIL_{i-1} + \beta_{c,v\_g}\, VOIL_{i-1} * GSubs + \beta_{c,g}\, GSubs + \varepsilon_{c,i}, \qquad (5)$$

where GSub is one of the proxies discussed above[12]. Similarly, we modify Equation (4) as follows:

[12] We include the variable *GSubs* along with the interaction terms since it is time-varying even though its time variation is very low, which explains why its coefficient is statistically insignificant across all specifications.

$$PR_{c,i} = \alpha + \beta_{c,m}\, MKT + \beta_{c,ex}\, RBEX + \beta_{c,smb}\, SMB + \beta_{c,hml}\, HML + \beta_{c,oil}\, OIL_{i-1} \quad (6)$$

$$+ \beta_{c,o\_g}\, OIL_{i-1} * GSubs + \beta_{c,voil}\, VOIL_{i-1} + \beta_{c,v\_g}\, VOIL_{i-1} * GSubs$$

$$+ \beta_{c,g}\, GSubs + \varepsilon_{c,i}$$

We estimate Equations (5) and (6) with country-fixed effects to account for heterogeneity across the countries in the sample. In addition, we add year dummies to the regression equations to account for business cycle effects (Lang et al., 1996). The parameters of interest in Equations (5) and (6) are β_{c,o_g} and β_{c,v_g}. As argued earlier, the profits from rising oil prices generated by oil-user firms operating in net oil-producing countries are caused by the potential competitive advantage these firms have over their rivals, which might be triggered by government oil subsidies. Thus we expect firms operating in a country that provides larger subsidies of oil to benefit more from rising oil prices. That is, we expect the interaction terms in Equations (5) and (6) to have positive and statistically significant coefficients. For the impact of oil volatility on excess returns, firms are expected to be less sensitive to uncertainty in the oil market if they operate in a country that provides relatively larger subsidies to their local firms.

5. Empirical Results

In Table 4, we show the results of the country-by-country regressions of Equation 3. Except in Nigeria, the coefficients of excess market return are positive, representing the exposure of these portfolios to systematic market risk. In most cases, this positive association has a high t-stat score, indicating statistical significance. Except in three countries, the coefficients of the exchange rate risk (*RBEX*) are negative and which is mostly statistically significant, consistent with Ferson and Harvey (1994), who found that the U.S. equity market returns are negatively associated with the exchange rate risk, proxied by the log difference in the trade-weighted U.S. price of the currencies of 10 industrialized countries, and that all 17 remaining countries' equity market returns are positively associated with exchange rate risk. This is to be expected since the returns here are calculated in U.S. dollars and therefore, an increase in our exchange rate risk variable means a depreciation in U.S. dollars.

[Insert Table 4 here]

Consistent with our expectation, the estimated coefficients of *OIL* are positive in all countries except for Denmark. This validates our hypothesis that oil-user stocks operating in oil subsidizing countries benefit from rising oil prices. Later, we also explore whether oil subsidies are the reason for this clearly positive association. For oil volatility, except in two markets, the results show that country-based portfolios of oil-user stocks seem to suffer from higher volatility in the oil market. This suggests that even though the local firms included in our sample may receive special treatment through receiving government oil subsidies, they do not seem to be immune from the uncertainty risk imposed by a more volatile oil market.

[Insert Table 5 here]

In Table 5, we show the results of a similar analysis; however, we control for two additional risk factors (i.e. SMB and HML in the augmented-I-3-FF model). The results are quantitively similar to those shown in Table 4, which reduce the issue of possible omitted bias. We plot the cross-country coefficients of *OIL* from the augmented-ICAPM model and the augmented-I-3-FF model in Figure 1 and Figure 2, respectively. Along with the estimates, we plot the oil subsidy ratios (*GSub*) to investigate whether there is a certain pattern. In both figures, we can see consistency between a country's exposure to oil risk and its oil subsidy ratio. Of course, this preliminary finding needs further investigation, as it only indicates a correlation pattern and thus we do not attempt to draw any major conclusions at this point.

[Insert Figure 1 here]

[Insert Figure 2 here]

In Figures 3 and 4, we show the time path of the cross-sectional averaged coefficients of oil risk (*OIL*) along with the oil subsidy ratios (*GSub*). The figures show two clear surges in the level of oil risk exposure. In fact, these two incidents reflect two oil shock episodes, namely the decline in oil demand during the financial crisis of 2008 and the oil price drop that started in June 2014, which was triggered by a combination of supply and demand factors. In addition, Figures 3 and 4 show that oil subsidy ratios vary little over time. The maximum averaged oil subsidy ratio was 5.77% in 2004; the minimum was 3.56% in 2015.

[Insert Figure 3 here]

[Insert Figure 4 here]

Table 6 shows the results of the quarterly time series regressions performed for each country. Average and medians of β across different groups are presented along with the results from the statistical significance tests. Consistent with our prior results, the market risk and the exchange risk have statistically significant coefficients with the expected signs in both models. More importantly, the results show that the median oil risk (*OIL*) is positive and that this average is statistically different from zero. Interestingly, when the country-based portfolios are split between countries with high and low oil subsidies, oil risk seem to be stronger for high-subsidy countries and very weak for low-subsidy countries. In fact, the time series average of the coefficient of oil risk is statistically insignificant ($p = 0.903$) in the low-subsidy group. We perform a coefficient equality test for the mean (using a two-sample *t*-test) and the median (using the Wilcoxon rank-sum test). The results indicate a statistically significant difference in oil risk exposure between the two groups at the 1% statistical significance level. For oil volatility (*VOIL*), on the other hand, the results seem to be vague and mixed. However, in most cases, the coefficient of *VOIL* is statistically insignificant. We revisit the oil volatility effect later and overcome this lack of evidence in the panel regression results, where we provide results that are consistent with our initial findings.

[Insert Table 6 here]

Table 7 shows the results from the panel regressions using the augmented-ICAPM model. The results for market risk and exchange rates are in line with what we found initially. We consider two alternative measures of oil subsidy ratios (GSub). We use the actual ratio in Model 1 and an indicator variable in Model 2. Consistent with our hypothesis, across all models and specifications, the results suggest that the portfolio excess returns are positively associated with oil returns and negatively associated with oil volatility. The negative association between stock returns with oil volatility is consistent with the findings of Elyasiani et al. (2011).

More interestingly, the interaction term of oil risk (*OIL*) and oil subsidies (*GSub*) is positive and statistically significant across all models and specifications. This indicates that oil risk is an increasing function of how much a government subsidizes oil for local companies. In other words, companies operating in a high-subsidy country gain more when oil prices rise. For oil volatility, the results show that the native impact of oil volatility on oil-user portfolios is higher in high-subsidy countries. However, in all cases, this difference is statistically insignificant. Overall, although our findings hint at the significant role that oil subsidies play in the oil risk effect, we do not believe that oil subsidies influence the impact of oil volatility on oil-user stocks.

For robustness, we perform the same analysis on two sub-periods. We split the sample into two periods: before the 2008 financial crisis and after it. The results are shown in Table 7 and are quantitatively similar to the results from the whole sample. In Table 8, we also report the results from a similar analysis using the augmented-I-3-FF model. The results reported in Table 8 are also quantitively similar to those in Table 7.

Our findings are consistent with our main argument that because of the government subsidies documented in the literature, international investors can reduce but not totally prevent their exposure to oil risk factors. The rationale behind this is to take advantage of the government subsidies that are provided to firms in oil-subsidizing countries, which changes the exposure of their domestic firms to oil price return movements. Therefore, one may consider a diversification strategy and invest in two oil-user firms from two different countries and benefit from the asymmetric exposure to oil risk. However, if the government effect is held constant, we expect to have a more symmetric effect of oil price return movements on all oil-user stocks in the global market.

6. Robustness Check

In this section, we modify the choices made earlier to see whether our results are sensitive to them. First, we constructed our country-based portfolios based on value-weighted averages. This procedure gives more weight to large firms, which may impose a bias in our results. This issue is especially present when a few firms in a country are very large but the majority of firms are much smaller. The results would be biased toward the large firms, which do not represent the total population. To address this issue, we repeat all of our analyses using equally weighted portfolios and the results, though not reported, are qualitatively similar and consistent with our initial findings.

Additionally, we repeat our analysis using local returns instead of U.S. dollar returns, and using oil spot prices instead of oil futures. In all cases, the results are qualitatively similar and confirm our conclusions.

7. Conclusions

A firm that largely uses oil in its operations is expected to be negatively affected by an increase in oil prices because of resulting increases in its operating costs. However, we argue that oil-user firms that operate in an oil-producing country and receive implicit government subsidies in various forms experience the opposite effect. This argument is motivated by Gupta et al. (2002), who found that in most major oil-exporting countries, governments keep domestic prices below free market levels. Further evidence by Coady et al. (2017) highlighting the projected energy subsidies (oil, gas, and coal) at $5.3 trillion in 2015 (equivalent to 6.5% of global GDP) bolstered this conviction.

In this paper, we used a sample of 828 oil-user stocks drawn from 14 net oil-producing countries, spanning from Jan 2004 to Dec 2015. We found that country-based portfolios formed from oil-user stock returns increased with lagged oil price returns and decreased with lagged oil price volatility. In addition, we found strong evidence that oil-user stocks domiciled in countries with large oil subsidies tend to be more exposed to oil return movement but only weak evidence for the effect of oil volatility. These findings are in line with our expectation that oil-user stocks that operate in countries with larger oil subsidies gain when oil prices increase more than those operating in countries with relatively smaller oil subsidies. On the other hand, the evidence suggests that this is not the case for oil volatility. Regardless of oil subsidy levels, all the country-based portfolios formed from oil-user stocks experience losses when the oil market becomes more volatile, with no disparities. This may be caused by elevated uncertainty in oil prices, which reflect a temporary drop in stock prices but a higher return in the next period. These results are robust to using alternative proxies for excess returns, oil prices, and government oil subsidies, and to considering alternative econometric approaches, model specifications, and subsample periods.

The key implication of our analysis is for international investors. International investors investing in oil-user stocks may choose to implement a diversification strategy that invests in stocks in countries with different oil subsidy levels and thus eventually reducing their exposure to oil risk. For example, Arouri et al. (2012) demonstrate an effective strategy to hedge the oil risk exposure, which is also pertinent to our analysis. According to their results, an "one dollar long in oil asset should be hedged with a short position of less than 1 and 18 cents in *Financials* and *Utilities* sector stocks respectively" (p. 617). However, particularly for oil and gas companies, basis risk[13] remains an important concern for hedging many different types of exposures effectively (Haushalter, 2000). In this regard, the development of currency futures markets in Middle East and Africa is essential. Based on the evidence presented here, we expect that if we control for government subsidies, the extent of the international diversification benefit will decrease, if not completely disappear.

[13] Basis risk refers to the price differential between the price of the asset being hedged (oil) and the asset underlying the hedging instrument (oil futures). The higher the price difference, the greater the basis risk a firm faces.

References

Adler, M. and Solnik, B.H. (1974). The international pricing of risk: An empirical investigation of the world capital market structure. Journal of Finance 29, 365-378.

Amihud, Y., Hameed, A., Kang, W. and Zhang, H. (2015). The illiquidity premium: International evidence. Journal of Financial Economics 117, 350-368.

Arouri, M.E.H., Jouini, J. and Nguyen, D.K. (2012). On the impacts of oil price fluctuations on European equity markets: Volatility spillover and hedging effectiveness. Energy Economics 34, 611-617.

Baca, S.P., Garbe, B.L. and Weiss, R.A. (2000). The rise of sector effects in major equity markets. Financial Analysts Journal 56, 34-40.

Basher, S.A. and Sadorsky, P. (2006). Oil price risk and emerging stock markets. Global Finance Journal 17, 224-251.

Basher, S.A., Haug, A.A. and Sadorsky, P. (2012). Oil prices, exchange rates and emerging stock markets. Energy Economics 34, 227-240.

Bekaert, G., Hodrick, R.J. and Zhang, X. (2009). International stock return comovements. Journal of Finance 64, 2591-2626.

Bodie, Z., Kane, A. and Marcus, A.J. (2014). Investments. McGraw Hill, Tenth Edition, New York.

Chen, N. F., Roll, R. and Ross, S.A. (1986). Economic forces and the stock market. Journal of Business 59, 383-403.

Chen, Y., Rogoff, K.S. and Rossi, B. (2010). Can exchange rate forecast commodity prices? Quarterly Journal of Economics 125, 1145-1194.

Coady, D., Parry, I., Sear, L. and Shang, B. (2017). How large are global fossil fuel subsidies? World Development 91, 11-27.

Day, T.E. and Lewis, C.M. (1992). Stock market volatility and the information content of stock index options. Journal of Econometrics 52, 267-287.

Degiannakis, S., Filis, G. and Floros, C. (2013). Oil and stock returns: Evidence from European industrial sector indices in a time-varying environment. Journal of International Financial Markets, Institutions and Money 26, 175-191.

Degiannakis, S., Filis, G. and Arora, V. (2017). Oil prices and stock markets. Working Paper, U.S. Energy Information Administration. Downloadable from https://www.eia.gov/workingpapers/pdf/oil_prices_stockmarkets.pdf

Elyasiani, E., Mansur, I. and Odusami, B. (2011). Oil price shocks and industry stock returns. Energy Economics 33, 966-974.

Fama, E.F. and MacBeth, J.D. (1973). Risk, return, and equilibrium: Empirical tests. Journal of Political Economy 81, 607-636.

Fama, E.F. and French, K.R. (1996). Multifactor explanations of asset pricing anomalies. Journal of Finance 51, 55-84.

Ferraro, D., Rogoff, K. and Rossi, B. (2015). Can oil price forecast exchange rates? An empirical analysis of the relationship between commodity prices and exchange rates. Journal of International Money and Finance 54, 116-141.

Ferson, W.E. and Harvey, C.R. (1994). Sources of risk and expected returns in global equity markets. Journal of Banking & Finance 18, 775-803.

Gilbert, R.J. and Mork, K.A. (1984). Will oil markets tighten again? A survey of policies to manage possible oil supply disruptions. Journal of Policy Modeling 6, 111-142.

Griffin, J.M. and Karolyi, G.A. (1998). Another look at the role of the industrial structure of markets for international diversification strategies. Journal of Financial Economics 50, 351-373.

Grubel, H.G. (1968). Internationally diversified portfolios: Welfare gains and capital flows. American Economic Review 58, 1299-1314.

Gupta, S., Clements, B.J., Fletcher, K.T. and Inchauste, G. (2002). Issues in domestic petroleum pricing in oil-producing countries. IMF Working Paper No. 02-140. International Monetary Fund, Washington DC.

Gupta, K. (2016). Oil price shocks, competition, and oil & gas stock returns – Global evidence. Energy Economics 57, 140-153.

Hamilton, J.D. (1983). Oil and the macroeconomy since World War II. Journal of Political Economy 91, 228-248.

Haushalter, G.D. (2000). Financing policy, basis risk, and corporate hedging: Evidence from oil and gas producers. Journal of Finance LV, 107-152.

Henry, P.B. (2002). Is disinflation good for the stock market? Journal of Finance 57, 1617-1648.

Heston, S.L. and Rouwenhorst, K.G. (1994). Does industrial structure explain the benefits of international diversification? Journal of Financial Economics 36, 3-27.

Huang, R.D., Masulis, R.W. and Stoll, H.R. (1996). Energy shocks and financial markets. Journal of Futures Markets 16, 1-27.

Jones, C.M. and Kaul, G. (1996). Oil and the stock markets. Journal of Finance 51, 463-491.

Kang, W., Ratti, R.A., and Yoon, K.W. (2015). The impact of oil price shocks on the stock market return and volatility relationship. Journal of International Financial Markets, Institutions & Money 34, 41-54.

Karolyi, G.A. (1995). A multivariate GARCH model of international transmissions of stock returns and volatility: The case of the United States and Canada. Journal of Business & Economic Statistics 13, 11-25.

Karolyi, G.A., Lee, K.H. and Van Dijk, M.A. (2012). Understanding commonality in liquidity around the world. Journal of Financial Economics 105, 82-112.

Kilian, L. and Park, C. (2009). The impact of oil price shocks on the U.S. stock market. International Economic Review 50, 1267-1287.

Lang, L., Ofek, E. and Stulz, R. (1996). Leverage, investment, and firm growth. Journal of Financial Economics 40, 3-29.

Lessard, D.R. (1974). World, national, and industry factors in equity returns. Journal of Finance 29, 379-391.

Levy, H. and Sarnat, M. (1970). International diversification of investment portfolios. American Economic Review 60, 668-675.

Loughran, T. and Schultz, P. (2005). Liquidity: Urban versus rural firms. Journal of Financial Economics 78, 341-374.

Park, J. and Ratti, R.A. (2008). Oil price shocks and stock markets in the US and 13 European countries. Energy Economics 30, 2587-2608.

Roll, R. (1992). Industrial structure and the comparative behavior of international stock market indices. Journal of Finance 47, 3-41.

Sadorsky, P. (2001). Risk factors in stock returns of Canadian oil and gas companies. Energy Economics 23, 17-28.

Solnik, B.H. (1974). An equilibrium model of the international capital market. Journal of Economic Theory 8, 500-524.

The Economist. (2015). Airline subsidies in the Gulf: Feeling the heat. March 6, 2015. https://www.economist.com/blogs/gulliver/2015/03/airline-subsidies-gulf

Table 1: Description and sources of main variables.
This table provides brief descriptions and the sources of the key variables in this study.

Variable	Description
GSubs	Total petroleum post-tax subsidies as a percentage of GDP. Data are on an annual basis, obtained from Coady et al. (2017).
EW	The returns of country-based equally weighted portfolios of oil-user stocks. Returns are in U.S. dollars and in excess of the U.S. 1-month Treasury bill rate. Oil-user stocks are those classified as building (SIC15), chemicals (SIC28), plastic and rubber (SIC30), metal (SIC33), industrial machinery (SIC35), transport equipment (SIC37), and air transportation (SIC45). Our source for daily prices is Global Compustat.
VW	The returns of country-based value-weighted portfolios of oil-user stocks. Returns are in U.S. dollars and in excess of the U.S. 1-month Treasury bill rate. Oil-user stocks are those classified as building (SIC15), chemicals (SIC28), plastic and rubber (SIC30), metal (SIC33), industrial machinery (SIC35), transport equipment (SIC37), and air transportation (SIC45). Our source for daily prices is Global Compustat.
MKT	The return of the Global MSCI index in excess of the U.S. 1-month Treasury bill rate. This variable is obtained from www.msci.com.
RBEX	The change in the broad trade-weighted U.S. dollar index. This variable is obtained from the Federal Reserve Bank of St. Louis.
SMB	The equal-weight average of the returns on the three small-stock global portfolios minus the average of the returns on the three big-stock global portfolios. This variable is obtained from the website of Kenneth French.
HML	The equal-weight average of the returns for the two high B/M global portfolios minus the average of the returns for the two low B/M global portfolios. This variable is obtained from the website of Kenneth French.
OIL	The return of the 1-month crude oil futures traded on the New York Mercantile Exchange. This variable is obtained from the U.S. Energy Information Administration.
VOIL	The conditional variance of daily oil price returns (oil) from an AR(1)-GARCH(1,1) process.

Table 2: Summary statistics by country.

This table shows some descriptive statistics of each country in our sample. It reports the first month (Start Date), number of firms (No. Firm), number of total observations (No. Firm Obs.), number of daily country observations (No. Day Obs.), GDP levels in U.S. billion dollars, oil subsidies in U.S. billion dollars, and the ratio of the oil subsidies to the GDP levels (GSub). The table also reports the means and standard deviations of the country-based portfolios formed from the equally weighted average (EW) and value-weighted average (VW) of oil-user firms in each country. Oil-user firms are those in building (SIC15), chemicals (SIC28), plastic and rubber (SIC30), metal (SIC33), industrial machinery (SIC35), transport equipment (SIC37), and air transportation (SIC45).

								EW Portfolio		***VW Portfolio***	
Country	**Start Date**	**No. Firms**	**No. Firm Obs.**	**No. Day Obs.**	**GDP ($B)**	**Oil Subsidies ($B)**	**GSubs (%)**	**Return (%)**	**STDEV (%)**	**Return (%)**	**STDEV (%)**
Saudi Arabia	2004 01	22	48,825	1627	584.59	67.61	11.56	-0.0545	2.0963	0.0261	2.0725
Nigeria	2004 01	39	34,154	2166	410.12	4.15	1.01	0.0395	1.2787	0.0290	1.7256
Kuwait	2004 01	13	19,706	1818	139.41	9.63	6.91	-0.0102	1.2990	0.0318	1.3389
United Arab Emirates	2004 01	7	13,400	2124	314.70	7.69	2.44	0.0673	1.8601	0.1084	2.0481
Qatar	2014 03	1	459	357	137.44	5.44	3.96	-0.0694	1.6290	-0.0694	1.6290
Norway	2004 01	51	76,361	2941	424.13	2.38	0.56	-0.0337	1.3172	0.0814	1.9213
Russia	2004 01	46	32,030	2730	1587.67	114.33	7.20	0.0187	2.4095	0.0664	2.5135
Mexico	2004 01	24	38,646	2945	1081.27	38.26	3.54	0.0500	1.2915	0.0761	1.5685
Malaysia	2004 01	252	523,482	2879	243.80	14.53	5.96	-0.0205	1.0284	0.0448	1.1020
Egypt	2004 01	34	63,060	2290	196.19	21.62	11.02	0.0419	1.4475	0.1074	1.5805
Argentina	2004 01	18	29,281	2863	423.58	9.15	2.16	0.0309	1.5016	0.0612	1.9490
Canada	2004 01	207	358,298	2842	1547.72	22.10	1.43	-0.0523	1.0200	0.2421	1.7934
Indonesia	2004 01	77	126,465	2836	621.88	49.85	8.02	0.0331	1.4659	0.0903	1.6181
Denmark	2004 01	37	75,391	2925	311.97	3.37	1.08	-0.0214	1.0935	0.0843	1.3511
Total		**828**	**1,439,558**	**33,343**		**370.1**					

Table 3. Pairwise Correlation Matrix.

This table reports the pairwise correlation coefficients for each pair of key variables in the study. EW and VW are country-based portfolios formed from the equally-weighted average (EW) and value-weighted average (VW) of oil-user firms in each country, respectively. EW and VW are daily medians across the 14 countries. GSub is annual medians across the 14 countries. For full definitions of the key variables, refer to Table 1.

	EW	VW	*GSub*	*MKT*	*RBEX*	*SMB*	*HML*	OIL_{t-1}	$VOIL_{t-1}$
EW	1								
VW	0.8483[a]	1							
GSub	-0.0519[a]	-0.003	1						
MKT	0.5954[a]	0.641[a]	-0.0057	1					
RBEX	-0.3897[a]	-0.4072[a]	-0.0032	-0.5486[a]	1				
SMB	-0.1382[a]	-0.2143[a]	-0.0319[c]	-0.5428[a]	0.1222[a]	1			
HML	0.185[a]	0.161[a]	0.0279	0.2749[a]	-0.2118[a]	-0.1555[a]	1		
OIL_{t-1}	0.1006[a]	0.0978[a]	-0.0024	0.0111	-0.081[a]	0.1152[a]	0.0234	1	
$VOIL_{t-1}$	-0.1063[a]	-0.0658[a]	0.0709[a]	-0.0456	0.0446[b]	-0.0052	-0.0405[b]	-0.0192	1

[a, b, c] refer to the 1%, 5%, and 10% statistical significance levels, respectively.

Table 4. Time-series regression results by country (augmented-ICAPM Model).

This table reports the estimated coefficients, number of observations, and R^2 from country-by-country OLS regressions. The dependent variables are the daily returns of country-based value-weighted portfolios of oil-user stocks. Returns are in U.S. dollars and in excess of the U.S. 1-month Treasury bill rate. The independent variables are, the return of the Global MSCI index in excess of the U.S. 1-month Treasury bill rate (*MKT*), the change in the broad trade weighted U.S. dollar index (*RBEX*), the return of the 1-month crude oil futures traded on the New York Mercantile Exchange (*OIL*), and the conditional variance of daily oil price returns (*VOIL*) from an AR(1)-GARCH(1,1) process. Values in parentheses are *t*-statistics scores for each coefficient.

Country	β_{MKT}	β_{RBEX}	β_{OIL}	β_{VOIL}	α	Obs.	R^2
Saudi Arabia	0.524	-0.147	0.089	-1.007	0.001	1627	0.0990
	(9.791)	(-0.809)	(4.232)	(-1.632)	(1.285)		
Nigeria	-0.037	-0.032	0.016	-2.225	0.001	2166	0.0067
	(-0.9)	(-0.238)	(0.962)	(-3.551)	(2.889)		
Kuwait	0.008	-0.322	0.039	-0.741	0.001	1818	0.0158
	(0.252)	(-2.826)	(2.911)	(-1.946)	(2.013)		
United Arab	0.189	-0.507	0.012	-1.268	0.002	2124	0.0303
Emirates	(3.964)	(-3.09)	(0.636)	(-2.226)	(3.27)		
Qatar	0.187	0.111	0.099	-2.29	0.001	357	0.0343
	(1.477)	(0.341)	(2.912)	(-1.376)	(0.65)		
Norway	0.916	-0.415	0.037	0.103	0.001	2941	0.3020
	(27.281)	(-3.801)	(2.902)	(0.256)	(1.659)		
Russia	0.819	-1.23	0.156	-1.718	0.002	2730	0.2495
	(17.752)	(-8.041)	(8.886)	(-3.235)	(3.11)		
Mexico	0.866	-0.2	0.02	-0.429	0.001	2945	0.3696
	(33.207)	(-2.366)	(2.029)	(-1.398)	(3.064)		
Malaysia	0.244	-0.341	0.077	0.145	0	2879	0.1206
	(11.213)	(-4.82)	(9.322)	(0.554)	(1.274)		
Egypt	0.156	-0.194	0.041	-1.238	0.002	2290	0.0258
	(4.306)	(-1.608)	(2.874)	(-2.759)	(4.154)		
Argentina	0.799	-0.143	0.018	-1.243	0.001	2863	0.1978
	(21.219)	(-1.186)	(1.271)	(-2.835)	(3.037)		
Canada	1.102	0.726	0	0.501	0.002	2842	0.3364
	(34.855)	(7.168)	(0.027)	(1.378)	(5.803)		
Indonesia	0.272	-0.258	0.031	-0.168	0.001	2836	0.0467
	(8.006)	(-2.349)	(2.405)	(-0.413)	(2.449)		
Denmark	0.554	0.364	-0.002	-0.097	0.001	2925	0.1545
	(21.261)	(4.28)	(-0.23)	(-0.313)	(2.653)		

Table 5. Time-series regression by country (augmented-I-3-Factor Model)

This table reports the estimated coefficients, number of observations, and R^2 from country-by-country OLS regressions. The dependent variables are the daily returns of country-based value-weighted portfolios of oil-user stocks. Returns are in U.S. dollars and in excess of the U.S. 1-month Treasury bill rate. The independent variables are, the return of the Global MSCI index in excess of the U.S. 1-month Treasury bill rate (*MKT*), the change in the broad trade-weighted U.S. dollar index (*RBEX*), the global versions of the SMB and HML factors of Fama and French (2012), the return of the one-month crude oil futures, traded on the New York Mercantile Exchange (*OIL*), and the conditional variance of daily oil price returns (*VOIL*) from an AR(1)-GARCH(1,1) process. Values in parenthesis are t-stat scores for each coefficient.

Country	β_{MKT}	β_{RBEX}	β_{SMB}	β_{HML}	β_{OIL}	β_{VOIL}	α	Obs.	R^2
Saudi Arabia	0.54	-0.062	0.151	0.329	0.084	-0.983	0.001	1627	0.1021
	(8.121)	(-0.33)	(1.018)	(2.124)	(3.918)	(-1.595)	(1.266)		
Nigeria	-0.009	0.041	0.162	0.298	0.013	-2.173	0.001	2166	0.0101
	(-0.175)	(0.292)	(1.421)	(2.369)	(0.747)	(-3.469)	(2.793)		
Kuwait	0.078	-0.197	0.337	0.23	0.031	-0.709	0.001	1818	0.0256
	(1.877)	(-1.678)	(3.533)	(2.4)	(2.328)	(-1.868)	(1.971)		
United Arab Emirates	0.229	-0.411	0.241	0.285	0.007	-1.226	0.002	2124	0.0335
	(3.861)	(-2.429)	(1.771)	(2.018)	(0.347)	(-2.154)	(3.25)		
Qatar	0.074	-0.089	-0.387	-0.202	0.106	-2.127	0.001	357	0.0388
	(0.471)	(-0.244)	(-1.194)	(-0.654)	(3.081)	(-1.273)	(0.569)		
Norway	0.929	-0.447	-0.027	-0.304	0.038	0.06	0.001	2941	0.3042
	(22.372)	(-3.969)	(-0.283)	(-3.039)	(2.953)	(0.15)	(1.754)		
Russia	0.972	-1.011	0.686	0.321	0.144	-1.591	0.002	2730	0.2585
	(17.074)	(-6.449)	(5.333)	(2.372)	(8.157)	(-3.01)	(2.93)		
Mexico	0.961	-0.094	0.369	-0.021	0.014	-0.372	0.001	2945	0.3751
	(29.938)	(-1.081)	(5.092)	(-0.272)	(1.4)	(-1.214)	(2.913)		
Malaysia	0.451	-0.118	0.784	-0.12	0.064	0.166	0	2879	0.1731
	(17.246)	(-1.663)	(13.316)	(-1.892)	(7.907)	(0.653)	(1.097)		
Egypt	0.263	0.002	0.531	0.385	0.03	-1.196	0.002	2290	0.0416
	(5.837)	(0.016)	(5.114)	(3.53)	(2.104)	(-2.685)	(4.116)		
Argentina	0.861	-0.038	0.318	0.218	0.012	-1.177	0.001	2863	0.2014
	(18.784)	(-0.304)	(3.094)	(1.962)	(0.878)	(-2.688)	(2.89)		
Canada	1.169	0.668	-0.006	-0.905	0	0.408	0.002	2842	0.3583
	(30.67)	(6.511)	(-0.069)	(-9.824)	(0.017)	(1.14)	(6.141)		
Indonesia	0.546	0.06	1.097	-0.01	0.012	-0.115	0.001	2836	0.0923
	(13.404)	(0.538)	(11.912)	(-0.097)	(0.956)	(-0.289)	(2.277)		
Denmark	0.623	0.356	0.126	-0.561	-0.004	-0.148	0.001	2925	0.1708
	(19.511)	(4.094)	(1.756)	(-7.278)	(-0.361)	(-0.48)	(2.826)		

Figure 1. Cross-country β_{OIL} of the augmented-ICAPM model and GSub

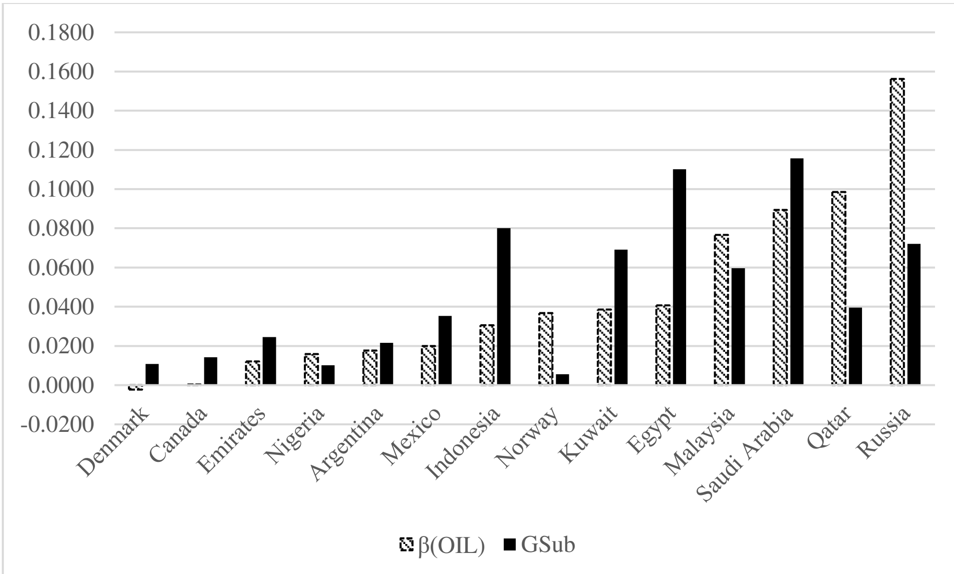

Figure 2. Cross-country β_{OIL} of the augmented-I-3-FF model and GSub

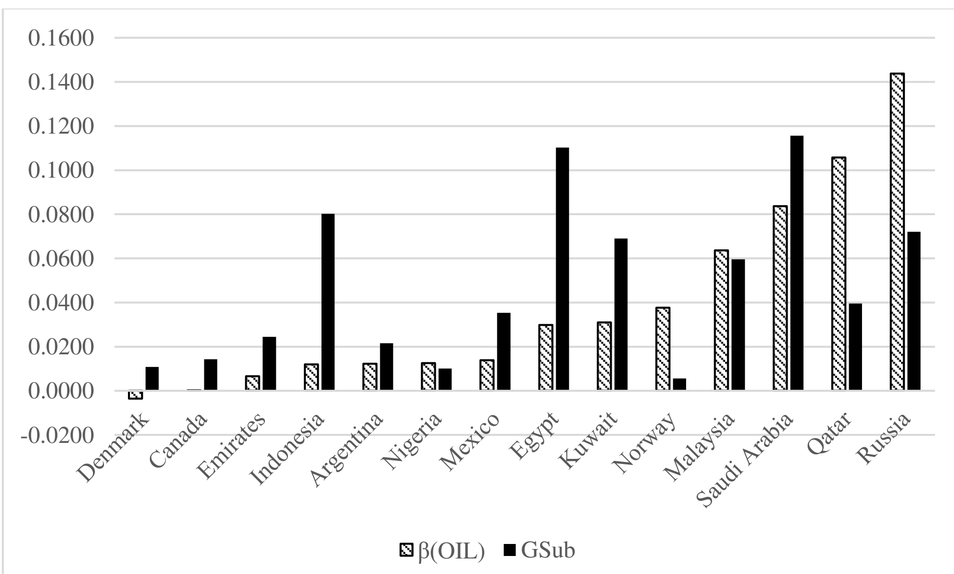

Figure 3. Time path of the averaged β(oil) of the augmented-ICAPM model and GSub

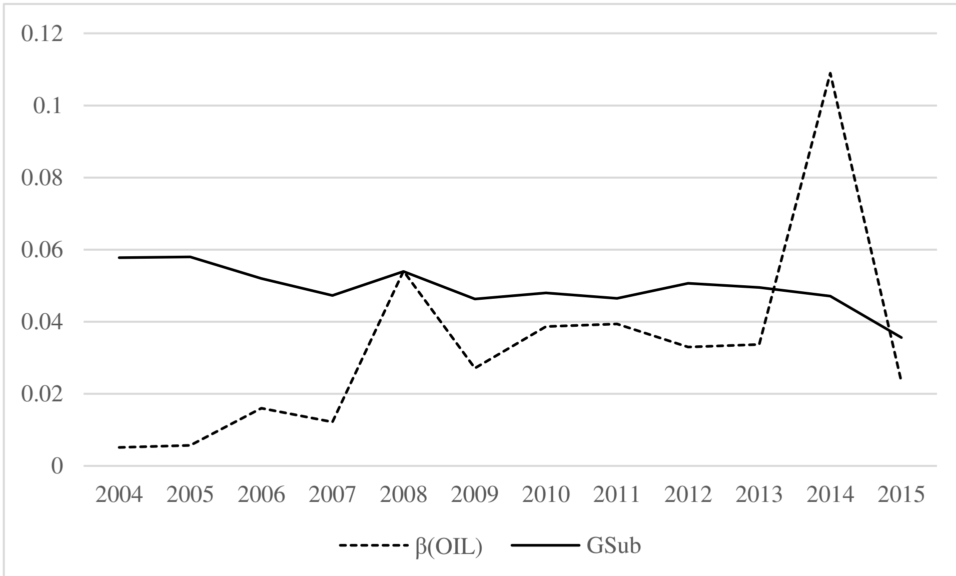

Figure 4. Cross-country β(oil) of the augmented-I-3-FF model and GSub

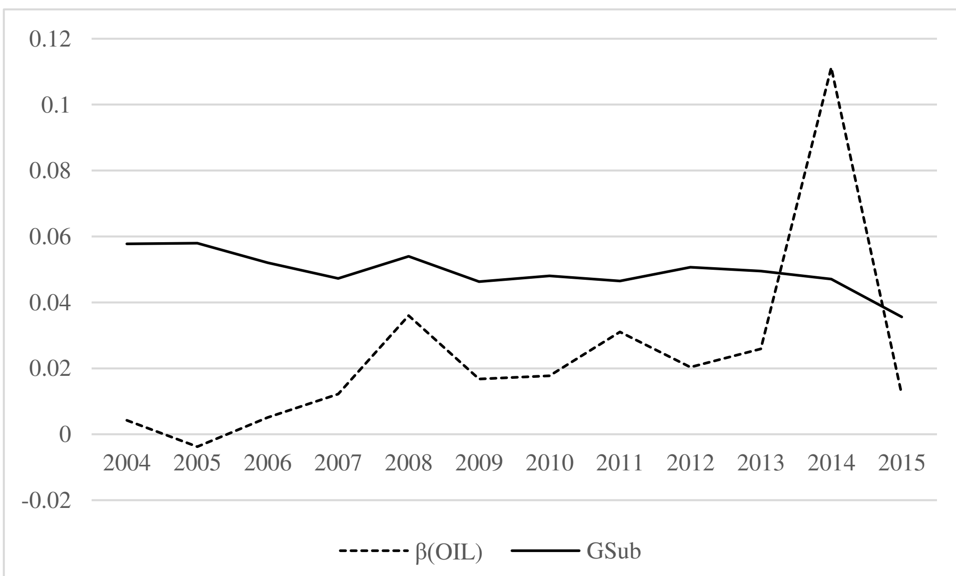

Table 6. Country-Quarter Regressions for High- and Low- Subsidy Countries.
This table presents the results from the country-quarter regressions of the excess returns of country-based portfolios on several risk factors. The dependent variable is the daily returns of country-based value-weighted portfolios of oil-user stocks. Returns are in U.S. dollars and in excess of the U.S. 1-month Treasury bill rate. The independent variables are the return of the Global MSCI index in excess of the U.S. 1- month Treasury bill rate (*MKT*), the change in the broad trade-weighted U.S. dollar index (*RBEX*), the return of the 1-month crude oil futures traded on the New York Mercantile Exchange (*OIL*), and the conditional variance of daily oil price returns (*VOIL*) from an AR(1)-GARCH(1,1) process. In the augmented-I-3-FF Model, the global versions of the SMB and HML factors of Fama and French (2012) are added to the regression equation. In the All column, all portfolios are included in the regressions. In High, only portfolios based on country with higher than the median oil subsidies ratio (GSub) are included. In Low, only portfolios based on countries with lower than or equal the median oil subsidy ratio (GSub) are included. The first row of each variable is the average coefficient, *p*-values are in parentheses (using Newey-West standard errors), and medians are in brackets. In H minus L, the first row is the difference of the average coefficient between the high and low groups, *p*-values of mean coefficient equality are in the second row, and the *p*-values of median coefficient equality from the Wilcoxon rank-sum test are in the third row.

Variables	**Augmented-ICAPM Model**				**Augmented-I-3-FF Model**			
	All	**High**	**Low**	**H minus L**	**All**	**High**	**Low**	**H minus L**
Intercept	-0.0005	-0.0009	-0.0001	0.0008	-0.0002	-0.0005	0.0001	0.0006
	(0.312)	(0.215)	(0.828)	(0.4237)	(0.728)	(0.562)	(0.849)	(0.5365)
	[0.0005]	[0.0005]	[0.0003]	(0.6443)	[0.0001]	[0.0004]	[0.0005]	(0.8951)
MKT	0.4770[a]	0.3207[a]	0.6395[a]	0.3188[a]	0.5145[a]	0.3798[a]	0.6543[a]	0.2745[a]
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
	[0.4388]	[0.2535]	[0.7403]	(0.0000)	[0.5219]	[0.3063]	[0.7219]	(0.0000)
SMB					0.2845[a]	0.4409[a]	0.1267[b]	-0.3142[a]
					(0.0000)	(0.0000)	(0.018)	(0.0016)
					[0.208]	[0.3881]	[-0.0023]	(0.0000)
HML					0.1294[a]	0.2504	0.0048	-0.2456[b]
					(0.057)	(0.003)	(0.953)	(0.0219)
					[0.0954]	[0.2132]	[-0.0026]	(0.0681)
RBEX	-0.0958	-0.3100[a]	0.1314	0.4413[a]	0.0061	-0.1621[c]	0.1868[c]	0.3488[a]
	(0.259)	(0.002)	(0.163)	(0.0004)	(0.94)	(0.069)	(0.061)	(0.0035)
	[-0.03]	[-0.1666]	[0.1157]	(0.003)	[-0.0392]	[-0.1522]	[0.1939]	(0.0091)
OIL_{t-1}	0.0262[a]	0.0504[a]	0.0011	-0.0493[a]	0.0199[a]	0.0391[a]	-0.0006	-0.0397[a]
	(0.0000)	(0.0000)	(0.903)	(0.0001)	(0.004)	(0.0000)	(0.951)	(0.0009)
	[0.0251]	[0.0475]	[0.0061]	(0.003)	[0.0111]	[0.0326]	[0.0011]	(0.0162)
$VOIL_{t-1}$	3.4406	4.6723[c]	2.3017	-2.3707	2.9862	3.7532	2.3321	-1.4211
	(0.103)	(0.094)	(0.265)	(0.4492)	(0.179)	(0.231)	(0.237)	(0.6723)
	[1.0595]	[0.7994]	[1.5534]	(0.3832)	[0.8648]	[0.278]	[1.7006]	(0.2717)
N	48	48	48		48	48	48	
R2	0.2060	0.1763	0.2369		0.2529	0.2326	0.2742	

[a, b, c] refer to the 1%, 5%, and 10% statistical significance levels, respectively.

Table 7. Panel regressions using the augmented-ICAPM model.

This table presents the results from panel regressions of the excess returns of country-based portfolios on several risk factors. The dependent variable is the daily returns of country-based value-weighted portfolios of oil-user stocks. Returns are in U.S. dollars and in excess of the U.S. 1-month Treasury bill rate. The independent variables are the return of the Global MSCI index in excess of the U.S. 1-month Treasury bill rate (*MKT*), the change in the broad trade-weighted U.S. dollar index (*RBEX*), the return of the 1-month crude oil futures traded on the New York Mercantile Exchange (*OIL*), and the conditional variance of daily oil price returns (*VOIL*) from an AR(1)-GARCH(1,1) process. In Model A, GSub is the ratio of a country's oil subsidies to its GDP. In Model B, GSub is a dummy variable that takes one if a country's oil subsidy ratio is above the median oil subsidy ratio in a year and zero otherwise. In All Years, all daily observations are considered in the regressions. In Sub-periods, two separate regressions are performed on daily observations that are split into two periods. In Specifications A, B, and C, the regression results are based on pooled OLS, year fixed effects, and both year and country fixed effects, respectively. Intercepts are suppressed to conserve space. Standard errors are Huber-white corrected for heteroscedasticity and *p*-values are reported in parentheses.

Variables	**Model 1**					**Model 2**				
	All Years			**Sub-periods**		**All Years**			**Sub-periods**	
	A	**B**	**C**	**2004–2009**	**2010–2015**	**A**	**B**	**C**	**2004–2009**	**2010–2015**
GSub	-0.0001	-0.0011	0.0052	0.0241[c]	-0.0099	-0.0004	-0.0004	-0.0001	0.0001	0.0013[c]
	(0.97)	(0.762)	(0.516)	(0.091)	(0.469)	(0.169)	(0.152)	(0.808)	(0.907)	(0.066)
MKT	0.5194[a]	0.5162[a]	0.5163[a]	0.5266[a]	0.4958[a]	0.5196[a]	0.5163[a]	0.5164[a]	0.5271[a]	0.4961[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RBEX	-0.207[a]	-0.2001[a]	-0.2002[a]	-0.3437[a]	-0.0366	-0.2066[a]	-0.1999[a]	-0.2[a]	-0.3425[a]	-0.0359
	(0.000)	(0.000)	(0.000)	(0.000)	(0.458)	(0.000)	(0.000)	(0.000)	(0.000)	(0.467)
OIL_{t-1}	0.0127	0.0112	0.0112	0.0049	0.0196[b]	0.0138[b]	0.0123[a]	0.0123[c]	0.006	0.0213[b]
	(0.105)	(0.154)	(0.153)	(0.667)	(0.048)	(0.049)	(0.08)	(0.079)	(0.553)	(0.014)
$OIL_{t-1} \times GSubs$	0.6103[a]	0.6096[a]	0.609[a]	0.6494[a]	0.5433[a]	0.0556[a]	0.0555[a]	0.0554[a]	0.0634[a]	0.0424[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$VOIL_{t-1}$	-0.4207	-0.5885	-0.6041	-0.6689	0.7352	-0.5862[c]	-0.7395[b]	-0.7442[b]	-0.7588[b]	0.3065
	(0.243)	(0.132)	(0.123)	(0.137)	(0.211)	(0.056)	(0.029)	(0.027)	(0.046)	(0.568)
$VOIL_{t-1} \times GSubs$	-5.0078	-4.0637	-3.748	-3.6144	-11.8201	-0.1222	-0.0739	-0.0662	-0.1472	-0.098
	(0.45)	(0.541)	(0.573)	(0.638)	(0.238)	(0.794)	(0.874)	(0.887)	(0.787)	(0.866)
Year fixed effects	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Country fixed effects	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Observations	33343	33343	33343	15470	17873	33343	33343	33343	15470	17873
R^2	0.1202	0.1225	0.1234	0.1343	0.1093	0.1206	0.1229	0.1237	0.1347	0.1095

[a, b, c] refer to the 1%, 5%, and 10% statistical significance levels, respectively.

Table 8. Panel regressions using the augmented-I-3-FF model.

This table presents the results from panel regressions of the excess returns of country-based portfolios on several risk factors. The dependent variable is the daily returns of country-based value-weighted portfolios of oil-user stocks. Returns are in U.S. dollars and in excess of the U.S. 1-month Treasury bill rate. The independent variables are the return of Global MSCI index in excess of the U.S. 1-month Treasury bill rate (*MKT*), the change in the broad trade-weighted U.S. dollar index (*RBEX*), the global versions of the SMB and HML factors of Fama and French (2012), the return of the 1-month crude oil futures traded on the New York Mercantile Exchange (*OIL*), and the conditional variance of daily oil price returns (*VOIL*) from an AR(1)-GARCH(1,1) process. In Model A, GSub is the ratio of a country's oil subsidy to its GDP. In Model B, GSub is a dummy variable that takes one if a country's oil subsidy ratio is above the median oil subsidy ratios in a year and zero otherwise. In All Years, all daily observations are considered in the regressions. In Sub-periods, two separate regressions are performed on daily observations that are split into two periods. In Specifications A, B, and C, the regression results are based on pooled OLS, year fixed effect, and both year and country fixed effects, respectively. Standard errors used are Huber-white corrected for heteroscedasticity and p-values are reported in parenthesis.

	Model 1					**Model 2**				
Variables	**All Years**			**Sub-periods**		**All Years**			**Sub-periods**	
	A	**B**	**C**	**2004-2009**	**2010-2015**	**A**	**B**	**C**	**2004-2009**	**2010-2015**
GSub	0.0002	-0.0007	0.0053	0.0244[c]	-0.0101	-0.0003	-0.0004	-0.0001	0.0001	0.0013[c]
	(0.96)	(0.841)	(0.511)	(0.085)	(0.458)	(0.209)	(0.179)	(0.856)	(0.851)	(0.063)
MKT	0.6136[a]	0.608[a]	0.6081[a]	0.6516[a]	0.5515[a]	0.6136[a]	0.6079[a]	0.608[a]	0.6518[a]	0.5522[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RBEX	-0.0984[b]	-0.0938[b]	-0.0939[b]	-0.2062[a]	0.0386	-0.0982[b]	-0.0938[b]	-0.094[b]	-0.2054[a]	0.0396
	(0.033)	(0.042)	(0.042)	(0.004)	(0.447)	(0.033)	(0.042)	(0.042)	(0.004)	(0.435)
SMB	0.37[a]	0.3584[a]	0.3582[a]	0.4515[a]	0.2552[a]	0.3693[a]	0.3577[a]	0.3576[a]	0.4502[a]	0.2566[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HML	-0.0088	-0.0066	-0.0066	-0.0178	0.0291	-0.0095	-0.0071	-0.0071	-0.0187	0.0286
	(0.837)	(0.876)	(0.877)	(0.799)	(0.489)	(0.824)	(0.868)	(0.868)	(0.789)	(0.497)
OIL_{t-1}	0.0062	0.005	0.005	-0.0014	0.0144	0.0074	0.0062	0.0062	0	0.0157[c]
	(0.432)	(0.53)	(0.529)	(0.905)	(0.146)	(0.296)	(0.384)	(0.38)	(0.997)	(0.072)
$OIL_{t-1} \times GSubs$	0.6106[a]	0.6102[a]	0.6098[a]	0.6486[a]	0.5359[a]	0.0554[a]	0.0554[a]	0.0553[a]	0.063[a]	0.0425[a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$VOIL_{t-1}$	-0.3721	-0.5239	-0.5393	-0.5556	0.7244	-0.5371[c]	-0.6807[b]	-0.6854[b]	-0.6586[c]	0.299
	(0.303)	(0.181)	(0.169)	(0.218)	(0.219)	(0.081)	(0.045)	(0.043)	(0.084)	(0.579)
$VOIL_{t-1} \times GSubs$	-5.2122	-4.4217	-4.11	-4.2956	-11.5831	-0.1434	-0.0966	-0.0889	-0.1873	-0.0858
	(0.431)	(0.505)	(0.535)	(0.575)	(0.247)	(0.759)	(0.836)	(0.849)	(0.731)	(0.882)
Time fixed effects	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Country fixed effects	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
N	33343	33343	33343	15470	17873	33343	33343	33343	15470	17873
R^2	0.1246	0.1266	0.1275	0.1403	0.1117	0.1251	0.1271	0.1278	0.1406	0.112

a, b, c refer to the 1%, 5%, and 10% statistical significance levels, respectively.