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Risk factors and value at risk in publicly traded companies of the nonrenewable energy sector☆

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ABSTRACT

We analyze a sample of 64 oil and gas companies of the nonrenewable energy sector from 24 countries using daily observations on return on stock from July 15, 2003 to August 14, 2012.
We show that specific and common risk factors are priced. Specific risk factors including company size and leverage are important in explaining returns of energy companies and those companies became more exposed to credit concerns after the financial crisis of 2008. Common risk factors including the U.S. Dow Jones market excess return, the VIX, the WTI price of crude oil, and the FX of the Euro, Chinese yuan, Brazilian real, Japanese yen and British pound vis-à-vis the U.S. dollar are also important in explaining energy company returns. The foreign exchange effect accounts for the fact that many companies in the sector receive revenues denominated in domestic currency while their costs are in foreign currency.

1. Introduction

In the last few years, the U.S. has been moving towards energy self-sufficiency and, in December 2013, the nation produced more oil than it imported for the first time in nearly two decades. At the same time period, states in the union have implemented policies promoting alternative renewable energy uses and sources. The debate regarding the merits of nonrenewable versus renewable sources of energy in policy circles can potentially spillover on the financial returns of nonrenewable energy companies.[2] This paper studies how common factors and specific factors affect equity returns for publicly traded nonrenewable energy sector companies and their effect on value at risk for those companies. Our sample is in the realm of global capital markets. We set out to measure and analyze the exposure of the nominal equity returns of a company denominated in the currency of the stock exchange of the country of origin. Those nominal returns may or may not be exposed to company specific and/or common risk factors.

From a theoretical perspective, if we assume complete global financial markets, the conditional CAPM implies that specific idiosyncratic factors are fully diversified and only global risk is priced. On the other extreme of full absence of international risk sharing, specific idiosyncratic risk is fully priced and non-diversified. The potential for an in-between case of partial risk sharing is plausible under the common assumptions of information asymmetries. In this case, equity returns are exposed to both global risks and specific risks and our main objective is to measure and price those risks.

The core of our empirical methodology is as follows. First, we use conditional heteroskedasticity methods applied to the panel. Second, we use multivariate conditional heteroskedastic and dynamic conditional correlation methods applied to each company. While the full panel assumes homogeneity of the factor loadings, we estimate the model to better understand, on average, the key common and specific factors that affect returns. We then use the multivariate models by company to uncover heterogeneity across companies.

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[2] See e.g. the review of Xie (2013).

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Table 1
Key codes of companies in the sample.[a]

Code	Full name	Country	Code	Full name	Country
AOIL_SS_Equity	Alliance Oil Company	Russia	LUPE_SS_Equity	Lundin Petroleum	Sweden
1605_JT_Equity	International Petroleum Exploration Corp.	Japan	MUR	Murphy Oil Corporation	U.S.
3_HK_Equity	Hong Kong and China Gas Co Limited	China	NES1V_FH_Equity	Neste Oil	Finland
386_HK_Equity	China National Petroleum Corporation	China	NG_LN_Equity	National Grid PLC	UK
6_HK_Equity	Power Assets Holdings Limited	China	OGXP3_BZ_Equity	OGX Petróleo e Gás Participações S.A.	Brazil
857_HK_Equity	PetroChina Company Limited	China	OINL_IN_Equity	Oil India Limited	India
883_HK_Equity	China National Offshore Oil Corporation	China	OMV_AV_Equity	Österreichische Mineralölverwaltung	Austria
APA	Apache Corporation	U.S.	OPHR_LN_Equity	Ophir Energy PLC	UK
BANE_RU_EQUITY	Bashneft	Russia	OXY	Occidental Petroleum Corporation	U.S.
BG_LN_Equity	BG Group	UK	PCG	Pacific Gas And Electric Company	U.S.
BP_LN_Equity	British Petroleum	UK	PEG	Public Service Enterprise Group Inc.	U.S.
CNA_LN_Equity	Centrica PLC	UK	PETR3_BZ_Equity	Petróleo Brasileiro S.A.	Brazil
CNE_LN_Equity	Cairn Energy plc	UK	PFC_LN_Equity	Petrofac	U.S.
CNP	CenterPoint Energy	U.S.	PMO_LN_Equity	Premier Oil PLC	UK
CNQ_CN_EQUITY	Canadian Natural Resources Limited	Canada	PRE_CN_Equity	Pacifc Rubiales Energy Corporation	Canada
COP	ConocoPhillips Company	U.S.	QGEP3_BZ_Equity	Grupo Queiroz Galvão S.A.	Brazil
CVE_CN_EQUITY	Cenovus Energy Inc.	Canada	RDSA_NA_Equity	Royal Dutch Shell	UK
CVX	Chevron Corporation	U.S.	REP_SM_EQUITY	Repsol S.A.	Spain
ECOPTL_CB_Equity	Empresa Comlombiana de Petróleos S.A.	Colombia	ROSN_RU_Equity	Rosneft	Russia
ENEL_IM_Equity	Ente Nazionale per l'energia Elettrica	Italy	RWE_GR_Equity	Rheinisch-Westfälisches E. AG	Germany
ENG_SM_Equity	Enagás S.A.	Spain	SBMO_NA_Equity	SBM Offshore N.V.	Holland
EXC	Exelon Corporation	U.S.	SDRL_NO_Equity	Seadrill Limited	Norway
FP_FP_Equity	Total S.A.	France	SOL_SJ_Equity	Sasol Limited	S. Africa
Galp_PL_Equity	Galp energia	Portugal	SPM_IM_EQUITY	Saipem S.p.A.	Italy
GAZP_RU_Equity	Gazprom	Russia	SRG_IM_Equity	Snam Rete Gas S.p.A	Italy
GSZ_FP_Equity	GDF Suez S.A.	France	STL_NO_Equity	Statoil ASA	Norway
HER_IM_Equity	Holding Energia Risorse Ambiente	Italy	SU_CN_EQUITY	Suncor Energy Inc.	Canada
HES	Hess Corporation	U.S.	SUBC_NO_Equity	Subsea UK	UK
HRTP3_BZ_Equity	HRT participações em petroleo	Brazil	TLW_LN_EQUITY	Tullow Oil plc	UK
HTG_LN_Equity	Hunting PLC	UK	UNF_SM_Equity	Unión Fenosa, S.A.	Spain
IBE_SM_Equity	Iberdrola Group	Spain	WMB	Williams Companies, Inc.	U.S.
LKOH_RU_Equity	LUKoil	Russia	XOM	Exxon Mobil Corporation	U.S.

[a] Company descriptions and additional information are presented in the extended version Table A1 in the Appendix.

We cover 64 companies from the oil and gas sector from 24 countries using daily data from July 15, 2003 to August 14, 2012. While the energy market can be regarded as a sector that supports the entire economy, our focus is on the systematic risk faced by companies in the non-renewable energy sector.[3] Our measurements indicate that specific factors relating to firm size and firm debt-to-equity financial policy are robustly priced factors.[4] In the space of common factors, the market premium of the U.S. Dow Jones industrials, the VIX U.S. S&P500 options volatility index, the price of West Texas Intermediate (WTI) crude oil and several exchange rates relative to the U.S. dollar are robustly priced common factors.

There is a vast literature on the effect of oil prices on energy markets, but our main focus is much broader and includes oil prices as one potential factor among many others.[5] Giovannini et al. (2004) investigate the correlations of volatilities in the stock returns and their determinants for integrated oil companies and find low to extreme interdependence between the volatilities of companies' stock returns and the relevant stock market indexes or crude oil prices. Chiou and Lee (2009) study the relationship of the S&P500 and the WTI oil transactions and find that high fluctuations in oil prices have asymmetric unexpected impacts on S&P500 returns. Elyasiani et al. (2011) examine the impact of changes in the oil returns and oil return volatility on U.S. industries' excess stock returns and return volatilities and find evidence that oil price fluctuations constitute a systematic asset price risk at the industry level. Mohanty and Nandha (2011) estimate oil price risk exposures of the U.S. oil and gas sector using the Fama and French (1992, 1995) framework. They show that the Fama–French factors as well as momentum characteristics of stocks and changes in oil prices are significant determinants of returns for the sector. Lombardi and Ravazzolo (2012) find that the joint modeling of oil and equity prices produces more accurate point and density forecasts for oil prices.[6] Our results regarding the change in oil prices as a common factor confirm the positive effect of WTI crude oil prices on company stock returns under several alternative estimation procedures.

Closer to our analysis is Ramos and Veiga (2011) who also analyze the exposure of the oil and gas industry returns of 34 countries to oil prices using panel data methods. They find that oil price is a globally priced factor for the oil industry. Our main contribution to this strand of the literature is to show that specific factors such as size and leverage and common factors such as the VIX U.S. options' volatility index are important factors that are robustly priced as well. In particular, we find that energy companies in the energy sector became more exposed to credit concerns since the financial crisis of 2008. In addition, we find significant heterogeneity across companies and move beyond the panel data framework.[7]

[3] Ferson and Harvey (1994) study the sources of risk and expected returns in global equity markets, see also Karolyi and Stulz (2003) for a survey. Alternatively, Pierret (2012) studies the systemic risk that emanates from energy markets. Hamilton (1983) is the classic reference on the broad effects of oil on the macroeconomy in the US.

[4] By robust we mean statistically significant across several specifications. Haushalter (2000) shows that the extent of hedging is related to financing costs for oil and gas industry firms and finds that companies with greater financial leverage manage price risks more extensively.

[5] The focus of this paper is on the energy sector (i.e., energy companies).

[6] In addition, several authors study the exposure of Canadian oil and gas companies to risk factors including Sadorsky (2001) and Boyer and Filion (2007).

[7] Our paper also differentiates from Ramos and Veiga (2011) by examining more factors such as the specific factors including firm size and leverage ratio. Related to this strand, Sadorsky (2008) investigates the impact that global oil market risk factors have on the oil price risk of oil company stock prices. He finds that oil prices and market risk are both positive and statistically significantly priced risk factors, and that oil price risk is negatively impacted by increases in oil reserves, is positively impacted by increases in oil production, and is more sensitive to changes in production rates than to changes in reserve addition rates. More recently, Bianconi and Yoshino (2013) apply a variant of the methodology of this paper to a small sample of oil and gas companies in the emerging countries of Brazil, Russia, India, China and South Africa (BRICS).