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Lost in Transmission? Stock Market Impacts of the 2006 European Gas Crisis

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Lost in Transmission? Stock Market Impacts of the 2006 European Gas Crisis

Abstract

Around the turn of the year 2005/2006, the Russian freezing of natural gas exports to the Ukraine led to a European gas crisis. Using event study techniques, we first investigate whether the Russian suspension of gas deliveries, the announcement of this suspension as well as its withdrawal had an effect on *unsystematic volatility* of European energy stocks. Second, we measure event effects on *stock returns*, taking volatility (GARCH effects) and especially possible firm-specific, event-induced volatility into account. We get – at a first glance – counterintuitive results suggesting that the definite announcement of the crisis and therefore a rise of Western Europe’s energy risk tended to increase market expectations with respect to energy-related firms. In contrast, market uncertainty increased the day when Russia reopened its valves. One reason for these findings could be windfall profits of energy-related companies due to increasing resource and electricity prices. The existence of event-induced volatility at a between-firm level confirms the choice of our flexible abnormal returns methodology

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Keywords: Energy security, event study, gas crisis.

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1. Introduction

Recently, energy security in Western Europe seems to be at risk. Around the turn of the year 2005/2006, the Russian freezings of natural gas exports to the Ukraine led to a European gas crisis. This triggered off intensive debates about energy security all over Europe (see e.g. Economist, 2006).

Apart from this singular gas transmission crisis, ongoing political interventions in the Russian energy sector and general political instability in the Ukraine constantly give reason for serious concerns about energy security in Western Europe (Helm, 2005). The relevance of this issue for Europe is apparent in the light of the striking energy dependence on Russian gas.¹ In 2005, 20 per cent of the gas consumed in Western Europe stemmed from Russia *and* was transmitted across the Ukraine. Additionally, the global rise in energy demand due to the fast economic growth in Asia makes energy security an essential challenge for Western Europe (Correljé and van der Linde, 2006). What is more, the current period is shaped by the rise in importance of gas as the main source of new electricity-generation capacity (cp. Foss, 2005).

In the past decades, the scientific debate about energy security focused on possible implications for competitiveness at an economy-wide level as well as for politics (see e.g. Toman, 1993, Zweifel and Bonomo, 1995, LaCasse and Plourde, 1995, and Helm, 2005). Less discussed in academic contributions, however, is the question of whether energy security has an impact on single sectors or companies that depend on a stable and secure resource supply. In this respect, it is straightforward to ask how utilities and companies operating or

¹ This also holds for Russian oil. Relatively similar to the gas crisis of 2006, concerns about a stable oil supply were especially put forward by the Russian suspension of oil deliveries to Western Europe via Belarus in early 2007.

trading with natural gas are affected by changes in the environment of energy security. For this group, effects have not yet been theoretically explored and empirically analyzed. Obviously, as this natural resource is the foundation of energy-related companies' business, supply crises should have a negative effect on their business prospects.

Using an event-study approach, we assess whether or not the crisis implied (a) uncertainty for and (b) generally abnormal returns of West European utilities as well as oil and gas companies. Besides the intention of setting the phenomenon of energy security on the agenda of economists dealing with financial markets, this paper contributes to the methodological enhancements of event studies in the field of resource, energy and environmental economics. To our knowledge, this is the first paper to assess event impacts on *unsystematic return volatility*². However, it is obvious that volatility is an important issue in financial markets and, to be precise, in stock attractiveness for potential investors (see e.g. Engle, 2004). Given a certain return level, risk-averse investors will prefer the equity with lowest volatility. Furthermore, we are not familiar with any event study in this field that generally considers autoregressive conditional heteroskedasticity – although the GARCH-class has become standard in financial econometrics subsequent to Bollerslev's (1986) seminal paper – or even event-induced volatility (and, what is more, security-specific volatility effects) for the calculation and significance testing of abnormal *returns*. This analysis aims at starting to fill this gap.

The remainder of this paper is structured as follows: Section 2 gives an overview over the 2006 European Gas Crisis, the event to be analysed in this study. Section 3 introduces the methodological approach chosen. In Section 4, we review the related literature and in Section

² Systematic volatility is the volatility that is common to the entire market, whereas unsystematic volatility is the volatility induced by idiosyncratic behaviour of single stocks.

5, we present our data basis and important features of our analysis. Section 6 reports the results, section 7 concludes.

2. The 2006 European Gas Crisis – An Overview

The Russian gas monopoly Gazprom³ is an all-important supplier, owning 17 percent of the world-wide gas resources. In 2005, it provided for about 50 per cent of Ukrainian gas consumption. Besides, 25 per cent of the West European gas demand is supported by the Russian supplier Gazprom. 80 per cent of these imports (have to) be transmitted via the Ukraine.⁴ As other former member states of the USSR, the Ukraine received Russian gas deliveries for a price that was well below the price level of the world market. While this level was about 230 dollars per 1000 cubic meters of gas in December 2005, the price the Ukraine had to pay did not even amount to 50 dollars.

In a situation of deteriorated Russo-Ukrainian relations and rising oil and gas prices in late 2005, Gazprom together with the Russian government announced the suspension of this discount on gas deliveries. Gazprom consequently announced a price increase of more than 350 per cent starting from January 1, 2006.⁵ As the Ukraine rejected this claim, a gas supply crisis ensued on December 27, 2005, when Gazprom decisively announced a suspension of gas transmissions for the case that the Ukraine would not accept the Russian price increase.⁶ This suspension was scheduled for January 1, 2006. In the following days, no agreement between the Russian and the Ukrainian side was reached, although international and

³ The official company name of the cooperation is OAO Gasprom.

⁴ Von Hirschhausen et al. (2005) develop an interesting model (subsequently, they calibrate numerical results and run simulations) that takes into account different options of transporting Russian gas to Western Europe.

⁵ Alternatively to this price increase, Gazprom demanded the licence for an equity stake in the Ukrainian transit pipeline network (Stern, 2006b).

⁶ Already before December 27, 2005, there were threats by Gazprom to cut gas supply as well as Ukrainian claims that such steps would violate past contracts. The crisis came to a head only in late December, however.

especially European politicians had appealed for a negotiated resolution of the problem. Therefore, Gazprom followed through with its threat and suspended gas deliveries on New Year's Day, 2006. The same day, the Ukrainian utility MOT declared that Russian deliveries had decreased by 25 per cent. In Central and West European countries, gas deliveries declined consequently, emphasizing the overall European dimension of the gas crisis.

On January 2, 11 European countries reported a cutback of gas deliveries due to reduced feeding-in from Russia. The drop was not negligible, amounting to losses of about one third of usual deliveries in Austria, 25 percent in France and Italy, as well as of unknown size in Germany, the largest European economy (Stern, 2006b). At the APX, London, gas prices rose by more than 10 per cent. On January 3, a normalization of Russian gas deliveries was still not reached. While the gas price at the APX did not stop rising, the cutback of gas supply had consequences for trading of resources other than gas, for example oil, and of electricity at West European exchanges as well: The price of WTI rose by about 3 per cent; Brent prices reached their 3-month peak. Furthermore, German electricity prices at the EEX, Leipzig, were by about 50 per cent higher than at the turn of the year. Moreover, the Gazprom share reached a record high, when the Russian stock market reopened, indicating that Gazprom-investors appreciated the crises (Stern, 2006a).

However, in the course of January 3, Russia turned back on the supply to the Ukraine. Consequently, the gas shortages in Western Europe were removed. A legal (preliminary) compromise in the conflict was reached on January 4. The agreement set the price for Russian gas deliveries that the Ukraine had to face from 2006 on at 95 dollars, the transit price for Russian gas through the Ukraine rose from 1.09 to 1.65 dollars. Resource prices at the international exchanges, as well as European electricity prices remained at a high level, though.

3. Methodology

In this article, we want to analyze the impact of the 2006 European gas crisis on West European utilities from a stock market perspective using event-study techniques. This is a very reliable approach for measuring impacts on utilities' business prospects since, given the existence of efficient financial markets, stock prices constitute the best possible estimate of the net present value of discounted cash flows (Fama, 1970). Furthermore, measuring the impact of such a short-dated crisis is very difficult if the analysis is not based on daily data. For indicators of business prospects other than stock prices or returns, such as exports, sales, Tobin's Q, or return on assets, daily data are hardly available. As indicated in the introduction, we pursue two different approaches in this paper: First, we seek to analyse if the Russian suspension of gas deliveries, the announcement of this suspension as well as its withdrawal had an effect on *unsystematic volatility* of European energy stocks. Second, we seek to measure event effects on *stock returns*, taking volatility and especially possible event-induced volatility into account.

First, we employ the approach formulated by Hilliard and Savickas (2003) to test for event-induced, abnormal unsystematic volatility in the stock returns. The authors use a standard GARCH(1,1) (market) model as a baseline. Models of the GARCH class (Bollerslev, 1986) are very appealing approaches for the analysis of high-frequency time series in financial markets. The reason for this is that they, in contrast to linear estimation techniques, address the so-called "volatility clustering", the tendency that current volatility of asset prices tends to be positively correlated with its past values. Amongst those approaches, the use of the GARCH(1,1) model is widespread as it generally sufficiently explains systematic variation of asset price volatility (Akgiray, 1989, Andersen and Bollerslev, 1998, Engle, 2001), although

numerous modifications have been proposed in the meantime. The GARCH(1,1) model can be formulated as

$$(1) r_{i,t} = \alpha + \beta r_{m,t} + \varepsilon_{i,t} \text{ with}$$

$$(2) h_{i,t} = a + bh_{i,t-1} + c\varepsilon_{i,t-1}^2,$$

where $r_{i,t}$ is the stock return for firm i in the period t , and $r_{m,t}$ is the return of the market portfolio, respectively. The error term $\varepsilon_{i,t}$ is assumed to be conditionally normally distributed with zero mean and variance $h_{i,t}$ ($N(0, h_{i,t})$). α and β are the parameters of the mean equation, a , b , and c are the parameters of the variance equation.

At an event day t , two different types of factors may determine the level of unsystematic volatility: security specific factors that are captured by the model formulated above as well as event specific factors that are ignored here. Their impact, however, can be measured by the ratio λ of the cross-sectional variance the estimated residuals of the market model and its conditional variance implied by the GARCH process. The parameter λ that is positive as a rule measures the event effect on volatility in a manner that it indicates the multiple by which the unsystematic volatility increases from its no-event level, i.e. $\lambda = 1$ indicates that the event has no effect while for $\lambda = 2$, unsystematic volatility has doubled. If the volatility of the event day significantly exceeds the one implied by the model dynamics, an event impact on unsystematic volatility is observed. λ is calculated as follows,

$$(3) \hat{\lambda}_t = \frac{1}{N-1} \sum_{i=1}^N \frac{\left(\hat{\varepsilon}_{i,t} - \frac{1}{N} \sum_{j=1}^N \hat{\varepsilon}_{j,t} \right)^2}{\frac{N-2}{N} \hat{h}_{i,t} + \frac{1}{N^2} \sum_{j=1}^N \hat{h}_{j,t}},$$

with N denominating the number of assets analysed. The $\hat{\varepsilon}_{i,t}$ s and the $\hat{h}_{i,t}$ s are taken from the estimation of equation (1) and (2) for the respective firm i . Under the null hypothesis of $\lambda_i = 1$ the test statistic

$$(4) s_i = (N - 1)\hat{\lambda}_i$$

is asymptotically χ^2 -distributed with $N - 1$ degrees of freedom.

In order to assess whether the gas crisis had an impact on stock returns, i.e. if abnormal returns occurred due to this event, we use the approach suggested by Savickas (2003). Given the fact that it addresses both conditionally heteroskedastic behaviour of volatility as well as possible event induced variance increases, it is a very robust method. Furthermore, it does not require the conditional volatility to be the same across firms analysed. These are very appealing features, making Savickas' approach superior to the well-established methods proposed by Fama et al. (1969, re-examined by Brown and Warner, 1980 and 1985) and Boehmer et al. (1991). The advantages of Savickas' approach are emphasized by the results obtained by Babalan and Constantinou (2005). In the existing event studies in energy and environmental economics, this approach has not yet been employed. Moreover, to our knowledge, there is no event study available in this discipline that takes conditional heteroskedasticity into account, although approaches of the GARCH class have become standard in financial economics.

Savickas' (2003) test is based on an estimation framework with

$$(5) r_{i,t} = \alpha + \beta r_{m,t} + \gamma_i' D_t \varepsilon_{i,t} \text{ and}$$

$$(6) h_{i,t} = a + bh_{i,t-1} + c\varepsilon_{i,t-1}^2 + dD_t,$$

where D_t is a matrix of dummy variables that equal 1 if for an event day t , and 0 otherwise. Besides the inclusion of this dummy variable(s), the GARCH(1,1) framework is identical to the one used for assessing effects on unsystematic volatility (see equations (1) and (2)).

The cross sectional test statistic θ_t is a refinement of the usual t-statistic which takes intertemporal firm-specific heteroskedasticity into account, and can be calculated according to

$$(7) \theta_t = \frac{\sum_{i=1}^N \frac{S_{i,t}}{N}}{\sqrt{\frac{1}{N(N-1)} \sum_{i=1}^N \left(S_{i,t} - \sum_{j=1}^N \frac{S_{j,t}}{N} \right)^2}}, \text{ with}$$

$$(8) S_{i,t} = \frac{\hat{\gamma}_i}{\sqrt{\hat{h}_{i,t}}}.$$

Being the ratio of the estimated mean of abnormal return for each security and of its estimated standard deviation, $S_{i,t}$ is a measure of abnormal (event-induced) returns that accounts for security-specific, event-induced volatility. Under the null hypothesis of no abnormal return the test statistic θ_t is Student-t distributed with $N-1$ degrees of freedom.

4. Literature Review

Event studies are particularly applied in finance and accounting, for example, to examine the effects of mergers and acquisitions, earnings announcements, or issues of new debt or equity (MacKinley, 1997, Kothari and Warner, 2006). However, they are increasingly used to

analyze news related to resource, energy, and environmental economics. Those studies can roughly be subdivided into three different groups: Event studies considering (1) disclosures of information regarding positive or negative corporate environmental performance (Dasgupta et al., 2001, Gupta and Goldar, 2005, Capelle-Blancard and Laguna, 2006), environmental news which are related to (2) regulations concerning energy and the environment (Lanoie et al., 1998, Karpoff et al., 2005, Dasgupta et al., 2006), and papers (3) trying to directly analyzing the effects of regulation.

Event studies forming this third group are relatively few. This is due to the fact that regulation generally refers more to a process than to a surprising event that may be analysed using the event-study technique. If information had been available before the event, which is often the case, abnormal returns should not occur as the news is already priced in by the financial markets. Many of these studies have important features in common with our own analysis: Electric utility stocks have often been analysed (Butler and McNertney, 1991, Diltz, 2002, Kahn and Knittel, 2003, Oberndorfer and Ziegler, 2006). In addition the studies assess the influence of a general shock related to resource, energy, or environmental economics on stock returns. Results from these papers remain inconclusive, however, indicating that regulation does not affect financial markets as a rule. To our knowledge, there is no event study available that assesses the impact of energy supply shortages on stock returns possibly affected. However, the study of Hayo and Kutan (2005) somehow relates to our paper: They analyze Russian financial markets with one focus, on energy news. They receive mixed evidence for the impact of energy news.

Methodologically, to our knowledge, all event studies in the field of resource, energy, or environmental economics focus on the impacts of the respective event on *stock returns*.

Against this background, to our knowledge, this is the first paper in this field that, besides simply looking at stock returns, assesses event impacts on *unsystematic return volatility*. It is obvious that volatility is an important issue in financial markets and, to be precise, in stock attractiveness for potential investors. Given a certain return level, risk-averse investors will prefer the equity with lowest volatility. Furthermore, we are not familiar with any event study in our field that generally considers autoregressive conditional heteroskedasticity – although the GARCH class has become standard in financial econometrics – or even event-induced volatility (and, what is more, security-specific volatility effects) for the calculation and significance testing of abnormal returns. Using simulation technique, Savickas (2003) shows that traditional tests are misspecified in the presence of event-induced volatility.

5. Data and Details of the Event Study

As outlined in the introduction, we test whether or not the 2006 European gas crisis implied higher unsystematic volatility for and abnormal returns of West European utilities as well as oil and gas companies. Therefore, we analyze stocks of two different groups of companies: First, we use the Dow Jones Stoxx 600 Utilities companies, second, the Dow Jones Stoxx 600 Oil & Gas firms (all as of September 30, 2006). Finally, our analysis includes the full sample, i.e. both groups of companies.

From the Dow Jones Stoxx 600 Utilities index, for 32 (out of 35) firms sufficient data was available to include them in our study.⁷ For Dow Jones Stoxx 600 Oil & Gas, 26 firms (out of

⁷ These are AEM, British Energy Group, Centrica, Edison, EDP, Enagas, Endesa, ENEL, EON, Fortum, Iberdrola, International Power, Kelda, Northumbrian, Public Power Corporation, RED, RWE, Scottish & Southern Energy, Severn Trent, SNAM, Solarworld, Terna, Union Fenosa, United Utilities, Veolia, Verbund, and Viridian.

27) were analyzed.⁸ All in all, our (full) sample comprises 58 firms. Log returns have been calculated for all time series used. As the market return, we have chosen the Dow Jones Stoxx 50. All series have been checked for splits and outliers.

For both event study approaches used in this paper, we use 280 observations for each firm. This should yield reliable parameter estimates. Our estimations start January 12, 2005, and end February, 10, 2006. Therefore, to our understanding, we do not only consider a sufficient number of observations *before* our event window. The event days as well as 25 observations *after* the event are included in this estimation window. In contrast to most conventional event study techniques, the approaches used here allow for this.

6. Results

Before proceeding to the event study methods presented in chapter 3, we briefly checked the adequacy of our approaches in testing to see if autoregressive conditional heteroskedasticity and therefore so-called volatility clustering is present in our data set. In order to do this, we employed the common ARCH-LM test. Our assumption is that given that autoregressive conditional heteroskedasticity can be found, our GARCH (1,1) framework should sufficiently capture this phenomenon (see Chapter 3). Our results are quite clear and suggest that in the great majority of the return series analyzed, volatility clustering occurs. In about 70 per cent of our series, ARCH effects are even highly significant at the 1% level. For nearly all of the stock returns of our sample, ignoring ARCH effects would imply at least inefficient parameter estimation.⁹

⁸ The firms analyzed are Acergy, Aker, BG Group, Bourbon, BP, Burren, CIA, ENA, ENI, Fugro, Maurel, Norsk, OMV, Petroleum, Repsol, Saipem, Shell, Statoil, Technip, Total, Tullow, Lundin, and SBM.

⁹ The results of the ARCH-LM tests are available on request.

For the full sample, the approach formulated by Hilliard and Savickas (2003) that tests for event-induced, abnormal unsystematic volatility in the stock returns shows a (highly) significant event impact on one day inside of our event window (see Table 1). On January 3, 2006, abnormal unsystematic volatility differs significantly at the 1%-level from its no-event level. Compared with this baseline, abnormal unsystematic volatility rises by 73 per cent.

Table 1 Abnormal unsystematic volatility in the full sample, for utilities and for oil & gas companies

Analyzed on:	#	58	#	32	#	26
	Full Sample		Utility		Oil & Gas	
	λ	P-value	λ	P-value	λ	P-value
27.12.2005	0,41	1,00	0,37	1,00	0,39	1,00
28.12.2005	0,48	1,00	0,51	0,99	0,46	0,99
29.12.2005	0,32	1,00	0,35	1,00	0,30	1,00
30.12.2005	0,48	1,00	0,23	1,00	0,72	0,85
02.01.2006	0,94	0,61	1,14	0,28	0,64	0,91
03.01.2006	1,73***	0,00	1,69***	0,01	1,58**	0,03
04.01.2006	0,88	0,72	1,06	0,38	0,65	0,91
05.01.2006	1,04	0,40	1,61**	0,02	0,33	1,00

If we distinguish utilities from oil and gas stocks, we can show that abnormal unsystematic volatility is quite homogeneous over the two groups of stocks. For both utilities as well as oil and gas stocks, on January 3, highly significant abnormal unsystematic volatility with a rise of 69 and 58 per cent occurs. There are sector-specific effects on January 5, however. Only for the utilities stocks, can a highly significant impact be observed on January 5. Here, compared with the baseline of no event effect, abnormal unsystematic volatility rises by 61 per cent.

All in all, there is for each group of firms at least one day during the event period where we observe (highly) significant abnormal unsystematic volatility. On the other days analyzed, abnormal unsystematic volatility often noticeably falls below its non-event level. However, this may be due to generally low stock volatility during the weeks following Christmas so that the shocks on abnormal unsystematic volatility observed are even more striking. In any case, from a methodological point of view, the existence of event induced volatility at a between-

firm level confirms our choice of the methodology of Savickas (2003) to test for abnormal returns. As outlined in Section 3 of this paper, this methodology takes into account event induced variance increases and especially volatility effects that differ across the firms analysed.

Table 2 Abnormal returns in the full sample, for utilities and for oil & gas companies

	#	58	#	32	#	26
	Full Sample		Utility		Oil & Gas	
	Abnormal return (mean, in %)	Θ (p-value)	Abnormal return (mean, in %)	Θ (p-value)	Abnormal return (mean, in %)	Θ (p-value)
27.12.2005	-0.19	-1.39 (0.17)	0.02	0.62 (0.54)	-0.45	-2.48** (0.02)
28.12.2005	0.35	3.82*** (0.00)	0.19	2.19** (0.04)	0.56	3.14*** (0.00)
29.12.2005	-0.13	-1.10 (0.28)	-0.04	-0.49 (0.63)	-0.25	-0.90 (0.38)
30.12.2005	0.28	1.43 (0.16)	-0.11	-0.97 (0.34)	0.74	2.40** (0.02)
02.01.2006	0.23	-1.12 (0.27)	0.12	-1.14 (0.26)	0.36	1.01 (0.32)
03.01.2006	0.20	-0.20 (0.84)	0.02	-0.65 (0.52)	0.43	1.70* (0.10)
04.01.2006	0.31	1.83* (0.07)	0.49	1.55 (0.13)	0.10	1.15 (0.26)
05.01.2006	-0.02	-0.50 (0.62)	-0.28	-0.45 (0.66)	0.30	1.26 (0.22)

When abnormal returns of the full sample are analyzed, significant event impacts can be observed for December 28, 2005, as well as for January 4, 2006 (see Table 2). These effects are both positive and significant at the 1-, and 10%-level, respectively. On December 28, we observe (daily) abnormal returns of 0.35 percentage points for the full sample, while for January 4, these abnormal returns are smaller (0.31 percentage points). If we analyze utilities separately, we only get evidence for a significant effect for December 28. The abnormal return calculated is positive as well, but less important than for the full sample (0.19 percentage points), and significant at the 5%-level. For the oil and gas sector, significant positive effects that are stronger than in the full sample are calculated for December 28 and December 30 (0.56 and 0.74 percentage points) and significant at the 1- and 5%-level,

respectively. Furthermore, for this sector we find a significant (5%-level) negative event effect for December 27, of 0.45 percentage points. However, besides that, only significant positive abnormal returns occur in our analysis. The effect for December 28 is robust when the two sectors are analyzed separately.

7. Conclusion

In this article, the impact of the 2006 European gas crisis on West European utilities was measured from a stock market perspective. Using event-study methodology, we assessed whether or not the crisis implied higher unsystematic volatility for and generally abnormal returns of West European energy stocks. In the field of resource, energy and environmental economics, to our knowledge, this is the first paper to measure event impacts on *unsystematic return volatility* as well as generally considering autoregressive conditional heteroskedasticity and event-induced volatility for the calculation and significance testing of abnormal *returns*.

From a methodological point of view, the existence of event induced volatility at a between-firm level confirms our choice of the flexible methodology of Savickas (2003) to test for abnormal returns. We therefore suggest that event-induced volatility should more often be taken into account in event studies in environmental and resource economics. Generally, the existence of significant abnormal returns indicates that the event analyzed in this paper – the European gas crisis – was at least not fully anticipated by financial markets before the day the event window starts. However, it is possible that the event effects we obtain underestimate the effective impact of the crisis as information was available already in early December – although contradictory and highly unconfident – that Russia could suspend gas transmission. Long term effects of an event taking return data from several weeks or even months into account, however, can not accurately be measured, neither with the tests applied in this paper

nor with other “traditional” event study techniques. Methodologically, a further direction for future research would therefore be the application of the relatively recent long-term event study approaches in environmental and resource economics (see Lyon et al., 1999). Up to now, the use of these methods is restricted to management science and financial econometrics.

The significant abnormal returns that occurred in our analysis are almost exclusively positive. This effect is especially robust for December 28, when the crisis emerged and became more concrete. This positive impact over-compensated the (only) significant negative effect observed of December 27 that was limited to the group of oil and gas companies, as well. It seems that these *positive* reactions of financial markets fully anticipated the supply suspension as no abnormal returns can be measured when the withdrawal was implemented – from January 1 to January 2. We observe (highly) *significant abnormal unsystematic volatility* on January 3, 2006, when Russia reopened its valves. This is all the more striking, as low market activity related to Christmas and New Year’s Day, which is not explicitly modelled, should tend to lower estimated volatility. However, oil and gas stocks reacted slightly positively, although significant only at the 10%-level. On January 4, for the whole sample a small positive effect is visible, which can be explained by the legally binding ending of the conflict. This should induce stability. However, positive effects are only significant at the 10%-level.

Summarizing, the definite announcement of the crisis and therefore a rise of Western Europe’s energy risk tended to increase market expectations with respect to energy-related firms while the renewal of gas deliveries increased market uncertainty. This holds not only for oil and gas companies, which directly gain from price increases, but, interestingly, for utilities, as well. One factor behind these counterintuitive findings could be windfall profits of energy-related companies due to increasing resource and electricity prices. The – in general large – oil and gas stocks of the European suppliers are up valued due to the fundamental

resource price increases at the international exchanges. Furthermore, demand elasticities for energy are extremely low as a rule, so that price increases can easily be passed on to consumers. It could well be that energy companies tend to raise their markup in the wake of bad news. Finally, the stock market effect observed may reflect the expectation of energy-related industries that future energy policy, e.g. via competition policy, could increasingly take into account their interests as a reaction to their ostensible dependence or even instability. However, our results suggest that energy policy does not have to bear in mind negative effects for energy-related firms in situations when the security of energy supply is in danger.

References

Akgiray, V. (1989), Conditional Heteroscedasticity in Time Series of Stock Returns: Evidence and Forecasts, *Journal of Business* 62, 55-80.

Andersen, T. G. and T. Bollerslev (1998), Answering the Skeptics: Yes, Standard Volatility Models Do Provide Accurate Forecasts, *International Economic Review* 39, 885-905.

Blacconiere, W. G. and W. D. Northcut (1997), Environmental Information and Market Reactions to Environmental Legislation, *Journal of Accounting, Auditing and Finance* 12, 149-178.

Boehmer, E., J. Musumeci, and A. Poulsen (1991), Event-Study Methodology under Conditions of Event-Induced Variance, *Journal of Financial Economics* 30, 253-272.

Bollerslev, T. (1986), Generalized Autoregressive Conditional Heteroskedasticity, *Journal of Econometrics* 31, 307-327.

Brown, S. J. and J. B. Warner (1980), Measuring Security Price Performance, *Journal of Financial Economics* 8, 205-258.

Brown, S. J. and J. B. Warner (1985), Using Daily Stock Returns: The Case of Event Studies, *Journal of Financial Economics* 14, 3-31.

Butler, M. R. and E. M. McNertney (1991), Election Returns as a Signal of Changing Regulatory Climate, *Energy Economics* 13, 48-54.

Capelle-Blancard, G. and M.-A. Laguna (2006), *How Do Stock Markets React to Industrial Accidents? The Case of Chemical and Oil Industry*, Paper presented at the 21st Annual Congress of the European Economic Association, Vienna.

Correljé, A. and C. van der Linde (2006), Energy Supply Security and Geopolitics: A European Perspective, *Energy Policy* 34, 532-543.

Dasgupta, S., B. Laplante, and M. Nlandu (2001), Pollution and Capital Markets in Developing Countries, *Journal of Environmental Economics and Management* 42, 310-335.

Dasgupta, S., J. H. Hong, B. Laplante, and N. Mamingi (2006), Disclosure of Environmental Violations and Stock Market in the Republic of Korea, *Ecological Economics* 58, 759-777.

Diltz, J. D. (2002), US Equity Markets and Environmental Policy: The Case of Electric Utility Investor Behaviour During the Passage of the Clean Air Act Amendments of 1990, *Environmental and Resource Economics* 23, 379-401.

Economist (2006), Special Report: Energy Security, *Economist* 378 (8459), 62.

Engle, R. F. (2001), GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics, *Journal of Economic Perspectives* 15, 157-168.

Engle, R. F. (2004), Nobel Lecture. Risk and Volatility: Econometric Models and Financial Practice, *American Economic Review* 94, 157-168.

Fama, E. F. (1970), Efficient Capital Markets: A Review of Theory and Empirical Work, *Journal of Finance* 25, 383-417.

Foss, M. M. (2005), Global Natural Gas Issues and Challenges: A Commentary, *The Energy Journal* 26, 111-128.

Gupta, S. and B. Goldar (2005), Do Stock Markets Penalise Environment-Unfriendly Behaviour? Evidence from India, *Ecological Economics* 52, 81-95.

Hayo, B. and A. M. Kutan (2005), The Impact of News, Oil Prices, and Global Market Developments on Russian Financial Markets, *Economics of Transition* 13, 373-393.

Helm, D. (2005), The Assessment: The New Energy Paradigm, *Oxford Review of Economic Policy* 21, 1-18.

Hilliard, J. E. and R. Savickas (2003), On the Statistical Significance of Event Effects on Unsystematic Volatility, *Journal of Financial Research* 25, 447-462.

Kahn, S. and C. R. Knittel (2003), *The Impact of the Clean Air Act Amendments of 1990 on Electric Utilities and Coal Mines: Evidence from the Stock Market*, Working Paper, Department of Finance and Economics, Boston University.

Karpoff, J. M., J. R. Lott, and E. W. Wehrly (2005), The Reputational Penalties for Environmental Violations: Empirical Evidence, *Journal of Law and Economics* 48, 653-675.

Kothari, S. P. and J. B. Warner (2006), *Econometrics of Event Studies*, in: Eckbo, B.E. (ed.), *Handbook of Corporate Finance: Empirical Corporate Finance*, Elsevier / North-Holland.

LaCasse, C. and A. Plourde (1995), On the Renewal of Concern for the Security of Oil Supply, *The Energy Journal* 16, 1-23.

Lanoie, P., B. Laplante, and M. Roy (1998), Can Capital Markets Create Incentives for Pollution Control? *Ecological Economics* 26, 31-41.

Lyon, J. D., B. M. Barber, and C.-L. Tsai (1999), Improved Methods for Tests of Long-Run Abnormal Stock Returns, *Journal of Finance* 54, 165-201.

MacKinley, A. C. (1997), Event Studies in Economics and Finance, *Journal of Economic Literature* 35, 13-39.

Oberndorfer, U. und A. Ziegler (2006), *Environmentally Oriented Energy Policy and Stock Returns: An Empirical Analysis*, ZEW Discussion Paper No. 06-079.

Savickas, R. (2003), Event-Induced Volatility and Tests for Abnormal Performance, *Journal of Financial Research* 26, 165-178.

Stern, J. (2006a), *The Russian-Ukrainian Gas Crisis of January 2006*, Comment, Oxford Institute for Energy Studies.

Stern, J. (2006b) Natural Gas Security Problems in Europe: The Russian-Ukrainian Crisis of 2006, *Asia-Pacific Review* 13, 32-59.

Toman, M. A. (1993), *The Economics of Energy Security: Theory, Evidence, Policy*, in: Kneese, A. V. and J.L. Sweeney (eds.), *Handbook of Natural Resource and Energy Economics*, Vol. 3, Chap. 25, 1167-1218.

Von Hirschhausen, C., B. Meinhart, and F. Pavel (2005), Transporting Russian Gas to Western Europe – A Simulation Analysis, *The Energy Journal* 26, 49-68.

Zweifel, P. and S. Bonomo (1995), Energy Security: Coping with Multiple Supply Risks, *Energy Economics* 17, 179-183.

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