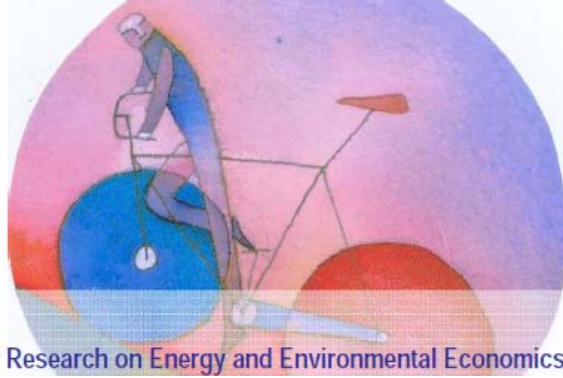


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**How much do the neighbors pay?
Economic costs of international gas disputes**

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How much do the neighbors pay? Economic costs of international gas disputes

Olha Zadorozhna¹

09 February 2012

The paper analyzes financial performance of European companies during Ukrainian-Russian gas disputes in January 2006 and 2009. Investors' reaction to the gas disputes is estimated for companies listed on the European stock exchanges and for which natural gas is the main factor of production. Economic costs of the gas cut-offs are estimated using event study methodology. It is found that the most severe decline in value due to the gas disputes was for companies located in the CEE states that are heavily dependent on Russian gas supply. The paper also contributes to the literature on the bargaining power of states, providing an empirical investigation of how much costs bears a party with less bargaining power in the dispute.

JEL classification: G14, G15, Q34, Q41.

Key words: Natural gas, gas dispute, security of supply, bargaining power, CEE, EU.

Lately there has been a rising concern in the EU about the dependence of member-states on Russian natural gas supplies. Russia's share of EU-27 imports of natural gas has been around 30 % for the last couple of years², which made Russia the single biggest natural gas exporter to the EU, and 80% of that amount was transported through Ukraine³. Recent disputes between Russia and Ukraine over the price of natural gas and the price of transit through the territory of Ukraine have had a huge impact on supply and consumption of energy in the European Union. In January 2006 (for the period of 3 days) and in January 2009 (for the period of 22 days) the transit of natural gas through Ukraine to the EU was stopped which caused disruptions in the production cycles of the most gas-dependent industries in the European Union, specifically electricity generation and gas industries.

The research explores financial performance of companies operating in the EU as a reaction to events related to two most severe Ukrainian-Russian gas disputes in January 2006 and 2009. The interest lies in evaluating the cost (or benefit) of Ukrainian-Russian gas disputes for companies listed on the European stock exchanges and that perform their

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² Eurostat (2010). See Appendix 1 and 2 for more details.

³ Energy Information Administration (2005), Chow and Elkind (2009).

operations in the EU. Estimation is performed for the universe of companies for which natural gas is the main factor of production, for example electricity generating firms that are main consumers of natural gas (see Appendix 3), as well as for companies from gas and oil&gas sectors. The gas conflict between Ukraine and Russia is an interesting case for an event study that allows assessing investors' reaction to a political energy-related conflict that occurred between partner countries outside the EU, but had major economic consequences for European member-states. The paper also provides evidences and economic evaluation of the outcomes of unequal distribution of bargaining power between the parties to the dispute. The EU, being dependent on Russian gas supplies and Ukrainian transit services, has suffered major losses due to gas cut-offs; Russia, on the other hand, being a stronger party in the dispute, was able to achieve some political and economic concessions, specifically, an increase in the price of gas paid by Ukraine.

From the methodological point of view, the event study proposed is interesting as the gas cut-offs had a high degree of unexpectedness (especially in 2006, to a lesser extent in 2009), due to the low credibility of Russian threats to stop gas transit through Ukraine among investors. The low credibility stems from the fact that Ukrainian-Russian negotiations over the price of natural gas for Ukraine and the price if its transit through its territory happen basically every year since 2004, but it has been only in 2006 when Ukraine halted the transit of Russian gas to Europe⁴, and in 2009 when Gazprom, Russia's state-owned gas monopoly, followed through on threats to turn off the taps.

The paper relates to a strand of literature concerned with political event studies that examine the effects of political conflicts on economic and financial variables. Empirical results of the paper by Kim and Mei (2001) show that political developments in Hong Kong have significant impact on volatility and returns of the stock market. The papers by Venieris and Gupta (1986) and Alesina and Perotti (1996) concluded that political instability is inversely correlated with investment and savings. Barro (1991), Mauro (1995), and Alesina et al. (1996) have argued that political instability impacts negatively the economic growth of the countries. Abadie and Gardeazabal (2003) showed that stocks of firms located in the Basque Country had a positive relative performance when the Basque terrorists announced the truce, while Guidolin and La Ferrara (2007) found a negative reaction of the diamond industry investors in Angola to the end of the civil conflict. Hence, there exists a growing

⁴ In January 2006 Russia did not cut off gas supply to the EU through the territory of Ukraine. What happened was that Russia stopped supplying gas to Ukraine and the latter diverted portion of gas meant for European consumers in order to satisfy its own demand.

evidence that political events are reflected in the performance of the stock markets. This research differs from the existing papers as its main goal is to understand and quantify the consequences of the political disputes in the partner countries outside the EU on industries located in the home countries within the EU, and *not* to assess the effects of home countries political events and conflicts. The endogeneity issues that arise from the ambiguity of whether political events (that lead to instability) are a cause or an effect of financial and economic variables fluctuations are mitigated in the proposed research. That is because economic and financial conditions of the European Union are unlikely to have had impacted the cut-offs of the transit of Russian natural gas through Ukraine in 2006 and 2009.

Another strand of literature that the paper relates to is on bargaining power and trade relations between states. This topic has been discussed widely in theories of labour and international economics, trade and politics⁵. According to Hirschman (1945), a party in a trade dispute is considered stronger if it values gains from trade less than a counter side; and if it can credibly threaten the other party to interrupt their trade relations. Therefore, bargaining power arises when there is an unequal distribution of losses as a consequence of interrupted trade between the parties. That is one of the states engaged in a trade dispute suffers higher losses relatively to the other state. In case of Ukrainian-Russian gas dispute, low elasticity of the natural gas supply and demand in Ukraine and the European Union as well as the lack of alternative suppliers of gas, have given Russia relatively higher bargaining power in the dispute. The objective of the paper is to analyze and evaluate economic consequences of the dispute with unequal distribution of the bargaining power between the parties. This study contributes to the existing research on bargaining power as it is an empirical investigation of a particular political conflict between two states (i. e. Russia and Ukraine) and its impact on the third party, not involved in the conflict (i. e. the EU).

Main finding of the paper are that CEE states within the EU as well as Germany and France suffered greatest losses due to the gas cut offs of 2006 and 2009. These countries should try to diversify portfolios of their gas suppliers in order to protect themselves from further costs connected with Ukrainian-Russian disputes in the energy sector. The findings are consistent with a priory expectations and provide a good empirical example of the situation when party with less bargaining power in the dispute (i. e. CEE states) bears

⁵ See Crawford (1982) and Wagner (1988).

economic costs higher than those borne by the party that is less dependent on Russian gas supply (other EU member-states).

The paper is organized in the following way. First, the history of the Ukrainian-Russian gas relations is discussed, as well as the timelines of 2006 and 2009 gas disputes. Then methodology used in the paper is presented together with the description of the data. In the last section main empirical results are outlined. And, finally, conclusions are made.

History and timeline of Ukrainian-Russian gas disputes

The history of Ukrainian-Russian gas relationships goes far back to the Soviet Union times when there was one single Soviet gas system with its abundant natural gas deposits located in Russia and pipelines connecting western Siberia and Europe that passed through the territory of Ukraine⁶. After the dissolution of the Soviet Union, formerly single gas transportation system was split up between the different countries. Ukraine inherited all of the pipelines within its borders and became the western-most transit country⁷ responsible for the delivery of Russian gas to the CEE⁸ and Europe. Ukraine itself became heavily dependent on Russian natural gas supplies, producing only around 30% of its own natural gas consumption and importing the rest⁹. Throughout the 1990s Ukraine and Russia were engaged in negotiations concerning the price of gas for Ukraine and the price of its transit for Russia. Up until 1997 the gas trade between the two countries was based on the barter relationships, where Ukraine paid lower-than market prices for Russian gas and Russia enjoyed much lower-than prevalent European prices for Ukrainian transit services and underground gas storage. However, even though the price of gas for Ukraine was much below market, it accumulated huge debts to Russia and was accused on several occasions by Russian officials of stealing the gas from the transit system (Balmaceda, 2009).

Heat up by the 1998 economic crisis, Russia started to demand from Ukraine to pay back its gas debt which has reached USD 2.8 billion at the time (according to Gazprom claims¹⁰). The debt issue was settled only in 2001 when the parties signed the intergovernmental agreement on “Additional Measures Regarding the Provision of Transit of Russian Natural

⁶ Map of gas pipeline system connecting Russia and Europe is in Appendix 4.

⁷ Together with Belarus.

⁸ Central and Eastern European states.

⁹ Ministry of Energy and Coal Industry of Ukraine, 2011.

¹⁰ IEA, 2006, p. 220.

Gas on the Territory of Ukraine” which was further amended in July 2004. According to it, Ukraine was supposed to transit approximately 19.2 bcm¹¹ per year of Russian gas and receive as an in-kind payment for its services of around 5 bcm per year of gas during 2005-2009.

In order to cope with gas deficit generated by the 2001/2004 agreement, Ukraine sought renegotiation to its terms at the beginning of 2005¹², trying to get more gas for its transit services. In March 2005 Gazprom responded saying that it was unable to provide in 2006 more gas than agreed, unless Ukraine would pay a market price for gas of USD 160-230 per thousand cubic meters. For the rest of 2005 no agreement was reached. On December 13, 2005 Gazprom’s CEO, Alexei Miller, announced¹³ that it would cut off natural gas supply to Ukraine starting from January 1, 2006 if the compromise was not reached by that time. He also said that the Gazprom was ready to create a joint venture that would own and operate Ukrainian gas transit pipelines in order to settle the dispute. Ukraine refused.

On December 26, 2005 Ukrainian Prime Minister announced¹⁴ that Ukraine had a right for 15% of the Russian gas meant for European consumers and transiting through Ukraine. This statement was a response to Gazprom officials threatening to resort to international arbitration if Ukraine tried to withdraw some of the transit gas. The conflict reached its peak when on January 1, 2006 Russia started to reduce pressure in the pipeline system¹⁵. As a consequence, Ukraine and a number of European countries suffered a decrease in their gas supply:

¹¹ Billion cubic meters.

¹² According to 2001/2004 agreement, Ukraine and Russia were supposed to sign annual intergovernmental protocols on gas transit and gas supply by the end of the first half of each year. This has made possible annual renegotiations of the terms of the initial agreement.

¹³ Grib, 2005.

¹⁴ Forbes, 2005.

¹⁵ Finn, 2006.

Table 1. Decrease in Russian natural gas supply in the EU as of January 2, 2006.

Country	Decrease in gas supply by, %
Hungary	40
Austria	33
Slovakia	33
Slovenia	33
France	25-30
Italy	24
Romania	20
Poland	14
Germany	Unspecified

Source: BBC News (2006)

Having met strong reaction from the EU countries, Ukraine and Russia ended the dispute on January 4, 2006 signing a 5-year contract and fixing prices for the next half a year.

In sum, 2006 Ukrainian-Russian gas dispute had an impact on the European gas supply for 4 days, from January 1st to January 4th. However some sources claim (Gelb, 2006; Chow and Elkind, 2009) that Gazprom restored gas flows to the EU already on January 3rd in order to avoid sanctions from the West. Also according to Stern (2006) and Pirani et al. (2009), European consumers of gas were affected to a small degree, feeling just a minor inconvenience, because supplies were not cut off completely during the conflict. Therefore, it is not expected ex-ante to find a significant impact of the 2006 Ukrainian-Russian gas dispute on financial performance of European companies under consideration. Moreover, as most of the stock exchanges located in the EU were on holidays during January 1st and 2nd, it would be difficult detect and untangle the reaction of the listed companies to the gas dispute in question from post-holidays rush¹⁶.

After the 2006 gas crisis, Russia and Ukraine were almost constantly disputing and renegotiating their gas contracts and pricing all throughout 2007 and 2008. In October 2008

¹⁶ According to Saunders (1993), a stock market usually shows an upward movement in January as investors' activity increases due to holiday rush. Higher financial performance of the listed companies in January might also be explained by the fact that at the end of a tax year (December) prices tend to decrease, but then rise again during the first month of a new year (Al-Khazali et al., 2008).

Prime Ministers of both countries managed to sign an agreement according to which gas prices for Ukraine and transit tariffs for Russia were to rise to market levels within three years¹⁷. The only thing left was to establish actual gas prices and transit tariffs to be paid. However, it appeared to be not an easy thing to do. Not being able to reach a compromise during November and December 2008, the parties again engaged in mutual accusations and threatening as it was in 2005 right before the 2006 cut-off crisis. Gazprom warned Ukraine that gas supplies would be cut-off if the agreement was not reached; Ukraine, on the other hand, was saying that it would not be able to guarantee transit of the full volumes of gas to the EU if Russia turned off the taps. At the time, there was no official response to these threats from the EU, except for the statement from the Energy Charter Secretariat issued on December 23rd reminding Ukraine of the principle of uninterrupted transit¹⁸¹⁹. Nevertheless, no agreement was reached and on January 1, 2009 Russia stopped natural gas supplies to Ukraine. The outline of the events that followed can be found in Table 2 below.

Table 2. Main events of the Ukrainian-Russian gas dispute in January 2009.

Date	Event
1 January	Russia cuts off supplies to Ukraine; supplies to the EU continue
4 January	First reports of falling supplies to the EU
5 January	Public agreement between the Russian Prime Minister and Gazprom's CEO to reduce gas flows to the EU via Ukraine
6 January	Russian gas supplies to the EU reduced significantly
7 January	Russian gas supplies to the EU cut off completely
11-12 January	EU monitoring deployed
13-17 January	Gazprom accused Ukraine of "blocking" the supplies of gas
18-19 January	Ukraine and Russia reached an agreement and signed the 10-year supply and transit contracts
20 January	Supplies of Russian gas restarted
22 January	Supplies of Russian gas to the EU back to normal levels

Source: Pirani et al. (2009); BBC News (2009); Reuters (2009a)

In total, the 2009 gas conflict between Ukraine and Russia lasted for 22 days. European countries were affected by it during 15 days, from the 6th January up until 20th January when the Russian gas supplies were restarted. EU member-states that suffered the most from this

¹⁷ UNIAN, 2008.

¹⁸ The Energy Charter Treaty (2004), Article 7.5, ratified by Ukraine, states that “Contracting Parties shall ... secure established flows of Energy materials and Products to, from or between the Areas of other Contracting Parties” securing in this way transit flows and preventing “non-transit related issues from having a negative impact on transit volumes”.

¹⁹ ECS, 2008.

dispute were Bulgaria, Romania and Slovakia. Some important industrial plants in Bulgaria and Romania had to stop production, while Slovakia declared a state of emergency²⁰. The situation there was worsened by the cold winter temperatures faced by these countries. According to the official statement of the Gas Coordination Group (2009), the following countries were affected by the cut-off of Russian gas supplies through Ukraine:

Table 2. Member State general situation according to the significance of impact.

Country	Cut	Diversification	Gas storage	Alternative fuel
Bulgaria	100%	No diversification	Gas storage for 2-3 days, covering 35% of gas demand	Alternative fuel for 20 days
Slovakia	97%	No diversification	Gas storage for several weeks, covering 76% of gas demand	Alternative fuel for 1 month
Greece	80%	Only LNG terminal, fully capable, booked more ships	Only in LNG terminal	One gas power plant switched to oil, sufficient till end of January Yes
Austria	66%	Increased import from Norway and Germany	Gas in storage for several weeks	Not used now, could be coal and oil
Czech Republic	71%	Increased import by 8mcm from Norway, and via Yamal/Germany	Gas from storage 40 days, 15% increase of domestic production	Yes
Slovenia	50%	Gas from Algeria via Italy, and from Austria, but not increased amount	Little gas storage in Austria then decrease of supply by 20%	Yes
Hungary	45%	Increased gas from Norway by 5%	Gas storage for 45 days	Alternative fuel – crude 90 days, fuel oil 30 days
Poland	33%	Half of the cut covered by Yamal, more gas from Norway	Gas storage for several weeks	Yes
Romania	34%	No diversification	Increased domestic production (60%) and withdrawal from storage	Yes
Germany	10%	20 mcm receiving from Yamal, more from Norway and Netherlands	Gas storage for several weeks	Not used now
Italy	25%	Increased import from Libya, Norway and Netherlands	79% full, covers 50% of demand	Not used now
France	15%	Industry covered	80% full	Not used now

While South-Eastern Europe was suffering from the undersupply of Russian gas, North-Western Europe did not feel much of an impact of the gas crisis. On the contrary, according to Westphal (2009), Russian gas cut-off was even profitable to some of the European countries that had huge amounts of gas left in storage because they could sell it at much higher prices and then buy it back later on in the year when the prices would fall down. Here, the crucial moment was that industrial demand for gas had fallen sharply at the time due to the economic downturn of 2008-2009 and, hence, gas storages of many

²⁰ Reuters (2009b).

countries were full of gas (Pirani et al., 2009). This has made possible for some countries in the EU to help out others with the gas supply:

- Germany supplied gas to Slovakia through Czech Republic, and also to Hungary, Slovenia, and other Balkan countries;
- Hungary helped out Serbia;
- Domestic gas and LNG²¹ supplies were increased where possible.

Therefore, ex-ante it is expected to find a negative reaction to the Ukrainian-Russian gas dispute of 2009 in the stock markets of South-Eastern and Central Europe and none or even maybe positive performance of the companies under consideration in this study listed on the stock exchanges of North-Western Europe.

The issue whether Ukrainian-Russian gas conflicts of 2006 and 2009 were political, economic or both was widely debated in press and by researchers (see for example, Pirani et al., 2009; Elder, 2009; Wingfield-Hayes, 2009; Gelb et al., 2006; etc). The reason for the political context of the disputes is that right before Russia started to demand an increase in the price of gas for Ukraine in 2005, the Orange Revolution of 2004 resulted in the dismissal of the pro-Russian leadership in Ukraine and an appointment of a new pro-Western President - Viktor Yushchenko. Many analysts argue that Russian officials still would like to be able to exercise a suzerain power over Ukraine and do not like the idea of Ukraine being closer to the EU than to Russia in political and economic sense (Gelb et al., 2006). Some also presume that the main objective that Russia pursued in the gas conflicts was to discredit Ukraine in the eyes of the EU and to hamper its membership in NATO (Boyes, 2009; Milov, 2008 cited in Mesterhazy, 2008; Volker, 2009 cited in Watson, 2009). Using its gas abundance as a leverage, Russia wanted to affect politics in Ukraine.

Pirani et al. (2009), however, argue that the main incentive that pushed Gazprom to initiate the conflicts was of economic nature and not political. Being caught in the middle of the financial crisis, Russia had no other choice but to rethink its gas supply contracts with Ukraine which were highly unprofitable for the former. Nevertheless, authors stress in their report that the 2009 gas dispute "may have reflected Prime Minister Putin's anger and frustration, and been aimed at punishing Ukraine for its repeated threats to disrupt transit" (Pirani et al., 2009, p. 60).

²¹ Liquefied natural gas.

Methodology

Methodology used in this research is the one described by Campbell, Lo and MacKinlay (1997) and used by Guidolin and La Ferrara (2007, 2010) and Abadie and Gardeazabal (2003). The main argument of the model is that an efficient stock market reacts to new information. Therefore, impact of expected or predicted events should be captured by the market and its reaction should be reflected in the movements of stock prices. Everything else is captured by the unexplained residual of the market model, called abnormal returns:

$$r_t = \alpha + \beta r_t^M + e_t \quad (1)$$

where r_t is the daily stock return, r_t^M is the market portfolio return, e_t is the abnormal return. According to (1), stock returns conditional on a particular event of interest (in this case, Ukrainian-Russian gas disputes and gas cut-offs) are predicted by the expected returns unconditional on the event of interest but conditional on other information ($\alpha + \beta r_t^M$) and abnormal returns (e_t).

Assessment of the impact of the Ukrainian-Russian gas disputes and gas supply cut-offs is performed by examining the cumulative abnormal returns (CAR) in the event window that is an interval around the event date over which markets are expected to adjust to this event. In this research, the event is the gas cut-offs of 2006 and 2009. Several event windows are defined. Estimation window is an intervals before the event window over which the parameters of the market model ($\hat{\alpha}, \hat{\beta}$) are estimated.

Table 3. Event and estimation windows.

Gas cut-off date		Event window		Estimational window	
Start	End	Start	End	Start	End
1 Jan 2006	4 Jan 2006	Last trading day* of 2005		4 Jan 2006	23 Dec 2004** 23 Dec 2005
		2 Jan 2006	3 Jan 2006		
		2 Jan 2006	4 Jan 2006		
		2 Jan 2006	2 Jan 2006		
1 Jan 2009	22 Jan 2009	6 Jan 2009	6 Jan 2009	23 Dec 2007 23 Dec 2007	
		7 Jan 2009	7 Jan 2009		
		2 Jan 2009	9 Jan 2009		
		5 Jan 2009	8 Jan 2009		
		6 Jan 2009	7 Jan 2009		

* Different European stock exchanges have different trading calendars.

** For Bulgaria estimation window starts on 22 Feb 2005 due to the lack of trading data.

Event study methodology is performed in a sequence of steps. First, the parameters of the market model $(\hat{\alpha}, \hat{\beta})$ are estimated in the estimation window. Then, e_t is predicted in the event window:

$$e_t = r_t - \hat{\alpha} - \hat{\beta}r_t^M$$

Finally, CAR is calculated:

$$CAR_t = \sum_{j=t_0}^t e_j$$

If CAR_t is positive (negative), it suggests that the gas cut-offs have had a positive (negative) impact on abnormal returns. If CAR_t is equal to zero, then the gas cut-offs have had no effect on stock prices of the companies under consideration.

Event study estimation is performed for the universe of companies for which natural gas is the main factor of production. Portfolios of electricity generating firms, gas, and oil&gas companies are constructed for each member-state of the EU. Then, the impact of the gas cut-offs is assessed for each portfolio within an industry by estimating CAR_t .

Data

In order to perform an event study of the Ukrainian-Russian gas disputes, it is used stock data for companies trading on the stock exchanges of the EU member-states²², plus Switzerland and Norway. In total, there are 20 countries for which estimation is performed. Stock prices of the universe of companies used in the paper and of market indices are taken from Bloomberg database. Sample periods that cover the time before and during disputes of interest are:

- from 24 December 2004 until 6 January 2006 (for 2006 gas dispute);
- from 24 December 2007 until 23 January 2009 (for 2009 gas dispute).

²² Malta, Cyprus, Ireland, Estonia, Slovakia, Denmark and Luxembourg are not included in the study due to either the lack of stock market data for these countries or the absence of listed companies from the defined sectors with a trading history over the defined periods.

In order to be included into the universe of companies under study, a stock has to satisfy a range of criteria. Specifically, a company should:

- be from a sector that uses gas intensively: electricity generating firms, gas and oil&gas, companies;
- operate²³ in a country under consideration (i.e. EU member-state) and be incorporated there;
- start trading history at least 200 trading days before the event (i.e. January 1st, 2006 and January 1st, 2009);
- not be thinly trading²⁴, that is it has to have at least 200 trade quotes in the last year prior to the event.

Description of the composition of a portfolio for each of the countries is in the Appendix 5.

Results

In this section results of the OLS estimation of CAR are presented for both disputes of 2006 and 2009. As a robustness check GARCH estimation²⁵ is also performed, however, results are similar to those of OLS. Estimation results of CAR during alternative event windows described in Table 3 is not presented in the text as all of them resemble and are consistent with the results of Table 4 and 5 below.

Table 4 below presents CAR results of the 2006 gas dispute during the event window of [02 Jan; 04 Jan]. *Diff* is the difference between CAR at the beginning of the event window and CAR at the end, formally:

$$Diff = CAR_{04\ Jan} - CAR_{02\ Jan}$$

²³ Companies that perform majority of their operations internationally (like for example, Royal Dutch Shell or British Petroleum) are excluded from the analysis as it would be too hard to disentangle the effect of the Ukrainian-Russian gas disputes from other events that happened in different countries simultaneously and affected these companies.

²⁴ As discussed by Heinkel and Kraus (1988) and Guidolin and La Ferrara (2007), it is difficult to perform an event study with thinly trading stocks (i.e. stocks that are being exchanged in low volumes and frequency).

²⁵ Some authors (Engle, 2001; Chang et al., 2006) argue that GARCH may give better results than OLS when working with stock market data as it may exhibit heteroscedasticity and be characterized by volatility clustering.

Table 4. CAR estimation results for 2006 dispute. Event window [02 Jan; 04 Jan].

Country	CAR results											
	Electricity			Alternative electricity			Gas			Oil&Gas		
	Diff	02 Jan	04 Jan	Diff	02 Jan	04 Jan	Diff	02 Jan	04 Jan	Diff	02 Jan	04 Jan
Austria	0.035	0.001	0.036							-0.009	-0.010	-0.019
Belgium							0.029	-0.003	0.026			
Great Britain	0.014	-0.001	0.013	-0.057	-0.001	-0.058	-0.019	0.0002	-0.019			
Czech Republic	-0.004	-0.004	-0.008				-0.002	-0.001	-0.003	-0.003	-0.010	-0.013
Finland	0.018	0.003	0.021									
France	-0.009	0.009	0.000	-0.019	0.017	-0.001	0.002	-0.009	-0.007	-0.0003	-0.005	-0.005
Germany	-0.006	-0.008	-0.013	0.030	0.039	0.069	-0.002	-0.016	-0.018	0.009	-0.016	-0.007
Greece	-0.003	0.024	0.021							-0.005	-0.011	-0.016
Hungary	-0.012	0.015	0.003							0.011	-0.011	0.001
Italy	-0.0001	-0.003	-0.003	0.025	0.019	0.044	0.028	0.024	0.052	-0.011	0.005	-0.006
Latvia							0.011	-0.010	0.001	-0.046	0.051	0.005
Lithuania	0.025	0.001	0.026				0.003	0.001	0.003			
Norway	-0.009	0.012	0.004									
Poland	-0.005	-0.016	-0.021							0.010	-0.003	0.007
Portugal	0.006	0.002	0.009									
Romania										0.017	-0.0002	0.017
Spain	-0.012	-0.017	-0.029				-0.012	0.006	-0.006	0.006	0.009	0.015
Sweden	0.027	-0.028	-0.001							0.036	0.0005	0.036
Switzerland	0.017	-0.0004	0.017							0.037	-0.002	0.035

Diff is a difference between CAR results on the Jan 4th and 2nd.
Coefficients in blue and bold are statistically significant at 5% level.

Diff captures the evolution of CAR within the event window and shows how much a portfolio of stocks has gained or lost over the period of time when the event took place.

A test of significance of CAR and AR is performed for each portfolio, testing whether CAR/AR is statistically different from zero and whether the event has had a statistically significant impact on a portfolio's performance.

According to Table 4, half of the countries in the sample have been affected by the Ukrainian-Russian gas dispute of 2006. It seems like electricity generation industry has been impacted the most by the conflict: statistically significant effect of the event on the CAR of producers of electricity is observed for 6 countries. Cumulative abnormal returns of electricity generating industry in Germany fell by almost 0.6 percentage points as a consequence of the conflict. Czech electricity companies suffered 0.4 percentage points decrease in CAR, Spanish – 1.2 percentage points and Italian – 0.01 percentage points decrease over the event window.

Portuguese and Finnish electricity generating firms, however, reacted to the gas cut off of 2006 positively. The overall impact on CAR of Portuguese generators after the 3 days of dispute is 0.6 percentage points, while it is 1.8 percentage points for Finnish companies. Positive perception of the event by Portuguese market is not surprising as the country does not depend on Russian gas supply. Therefore, for Portuguese electricity producers the lack of gas supply to the rest of the EU meant they could profit by selling their electricity at higher prices to other countries in need and buying it back later on when electricity prices would fall. As for the Finnish electricity generating portfolio, the positive perception of the gas dispute is driven by the results for Fortum. This company generates electricity not only using conventional energy sources, but also is engaged in hydro and nuclear power generation. Therefore, lack of supplies of Russian gas was not perceived as a bad news due to the availability of alternative means of electricity generation.

German generators of electricity from alternative sources were affected by the 2006 dispute positively and experienced 3 percentage points increase in CAR over the period of 3 days during the Ukrainian-Russian gas conflict. This is significant at 5 % level. This result means that CAR of the German portfolio increased by 3 percentage points in excess of what was predicted by the underlying market dynamics. This result can be explained by the little

dependence of generators of electricity from alternative sources from gas in general and from Russian gas supply in particular. Moreover, these companies could have profited from the dispute in question by selling electricity at higher prices during the crises.

Positive increase in CAR over the event window is also observed for the portfolio of Italian gas companies. Their CAR increased by 2.8 percentage points during the event in excess of what was predicted by the market dynamics. The same positive result is observed for Spanish oil&gas portfolio with 0.6 percentage points increase in CAR during the dispute.

Table 5 below presents CAR estimation results for 2009 Ukrainian-Russian gas dispute which was much longer and more severe than the 2006 one. The *Diff* variable in the table is defined as:

$$Diff = CAR_{06\ Jan} - CAR_{07\ Jan}$$

Table 5 contains results of estimation for the event window of [06 Jan;07 Jan] 2009. 7 out of 20 electricity portfolios in the sample exhibit negative reaction to the cut off of Russian gas supply. Over the period of 2 days of the dispute CAR decreased for electricity generating companies in Austria, Belgium, Czech Republic, Finland, Germany, Hungary and Portugal. In Hungary, for example, CAR fell by 0.6 percentage points as a result of the event in excess of what was expected by the market. Investors of electricity generators in Switzerland, however, reacted to the dispute positively and CAR of the portfolio of these companies increased by 3.3 percentage points during the two trading days when the conflict between Ukraine and Russia reached Europe. Such a positive perception is not surprising as Switzerland does not buy Russian gas and in the situation when the EU countries were in need of natural gas and other complementary goods, Switzerland could provide them at obviously higher prices.

German electricity generators from alternative sources again show positive increase in CAR during the event window in 2009 similarly to the results of 2006. This time German alternative electricity portfolio rose by 1.3 percentage points. The same positive result is observed for British and French alternative electricity portfolios.

Table 5. CAR estimation results for 2009 dispute. Event window [06 Jan; 07 Jan].

Country	CAR results											
	Electricity			Alternative electricity			Gas			Oil&Gas		
	Diff	06 Jan	07 Jan	Diff	06 Jan	07 Jan	Diff	06 Jan	07 Jan	Diff	06 Jan	07 Jan
Austria*			-0.002									0.006
Belgium	-0.009	-0.010	-0.018				0.034	0.002	0.036			
Great Britain	0.059	0.039	0.098	0.013	0.046	0.060	-0.022	0.006	-0.015			
Bulgaria										0.157	-0.037	0.120
Czech Republic	-0.004	0.015	0.011				-0.006	0.017	0.011	0.017	-0.013	0.004
Finland*			-0.0004									0.005
France	0.022	-0.009	0.012	0.010	0.023	0.033	-0.010	-0.025	-0.035	0.014	0.001	0.015
Germany	-0.0003	-0.002	-0.002	0.013	0.030	0.043	-0.009	0.0003	-0.008	0.022	-0.009	0.013
Greece*			0.024			0.005						0.010
Hungary	-0.006	-0.013	-0.018							-0.041	0.038	-0.003
Italy	-0.016	-0.008	-0.024	-0.027	0.022	-0.004	-0.001	0.001	0.0001	-0.005	0.010	0.005
Latvia							-0.099	0.004	-0.096	0.064	0.005	0.069
Lithuania	-0.014	0.025	0.012				-0.010	-0.007	-0.017			
Norway	0.038	-0.040	-0.002							-0.019	0.024	0.005
Poland	0.004	0.023	0.027	-0.004	0.065	0.061	-0.021	-0.044	-0.065	-0.010	0.035	0.025
Portugal	-0.014	-0.021	-0.035							-0.033	0.005	-0.028
Romania	0.031	0.000	0.031				0.122	0.003	0.125	0.016	0.022	0.038
Spain	0.008	-0.017	-0.009	-0.013	-0.007	-0.020	0.021	0.015	0.036	-0.007	0.009	0.002
Sweden*												0.091
Switzerland	0.033	0.041	0.073	-0.014	0.059	0.046				-0.005	0.009	0.004

Diff is a difference between CAR results on the Jan 7th and 6th.

Coefficients in blue and bold are statistically significant at 5% level.

* Countries in which 06 Jan was not a trading day.

As for the gas portfolios, Czech, French, Lithuanian and Polish portfolios experience statistically significant fall in CAR due to the event. CAR of Polish gas portfolio decreased by 2.1 percentage points during the first two days of cut off, the CAR of French and Lithuanian portfolios fell by 1 percentage point, while the CAR of Czech gas companies exhibited 0.6 percentage points decrease.

Oil&gas portfolio of only Poland experienced a statistically significant impact of the Ukrainian-Russian gas dispute in 2009. The CAR of Polish oil&gas companies decreased by 1 percentage point during the event.

Overall, mostly CEE states plus Germany and France suffered significant decrease in financial performance of their electricity generating and gas companies. This result is consistent with ex-ante expectations. Countries that heavily use Russian gas are the most vulnerable during crises like those of 2006 and 2009. Also in line with prior expectations, the 2006 gas cut off has affected European countries to a lesser extent than the 2009 gas cut off.

Conclusions and Discussion

This paper analyzes financial performance of companies that operate in the EU as a reaction to events related to two most severe Ukrainian-Russian gas disputes in January 2006 and 2009. Investors' reaction to Ukrainian-Russian gas disputes is estimated for the universe of companies listed on the European stock exchanges for which natural gas is the main factor of production, specifically electricity generating firms, gas and oil&gas companies.

Using event study methodology, abnormal returns and cumulative abnormal returns for portfolios of companies from different industries are calculated. Then the evolution of CAR during the event window is estimated. It is found that CEE countries like Hungary, Poland, Czech Republic as well as France and Germany suffered the greatest economic losses due to the cut offs of Russian gas. For example, Polish gas portfolio decreased by 2.1 percentage points during only 2 days of 2009 dispute in excess to what was predicted by the underlying market dynamics.

The most susceptible industry, according to the estimation results, is electricity generation: in 2009 CAR of 7 out of 17 electricity portfolios decreased (statistically significantly) as a result of the dispute. The same happened to 6 electricity portfolios during the 2006 cut off. This suggests that electricity generating industry of the EU has to seek diversification of their inputs in order to lessen dependence from the natural gas supplies in general and from Russia in particular.

Security of supply implications of this research suggest that the EU and especially Eastern and Central European countries should seriously consider diversifying their portfolio of natural gas suppliers and gradually substituting usage of gas intensive with alternative fuels.

Finally, the research has shown empirically that in cases when there is an uneven distribution of bargaining power between the parties, a more dependent party tends to suffer major losses. In this case EU member states that are less dependent from Russian gas supply did not bear any economic costs due to the Russian gas cut offs; while countries that import Russian gas heavily experienced major economic losses.

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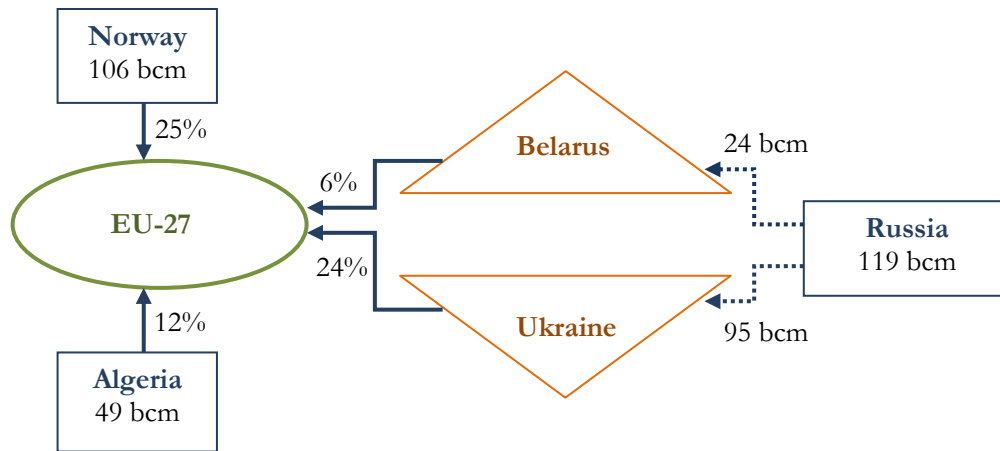
Appendices

Appendix 1. Imports of natural gas from Russia, %.

GEO/TIME	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
EU	29	32	32	33	35	36	37	37	38	40	42	45
Bulgaria	100	100	100	100	100	100	100	100	100	100	100	100
Estonia	100	100	100	100	100	100	100	100	100	100	100	100
Latvia	100	100	100	100	100	100	100	100	100	100	100	100
Lithuania	100	100	100	100	100	100	100	100	100	100	100	100
Finland	100	100	100	100	100	100	100	100	100	100	100	100
Romania	99	97	91	94	100	100	90	100	100	100	100	100
Slovakia	99	100	99	100	100	100	100	100	100	100	100	100
Croatia	96	88	100	100	100	100	100	100	100	100	100	100
Hungary	83	78	75	80	73	81	91	89	88	87	86	81
Poland	82	69	68	69	66	62	79	86	83	81	78	96
Czech Republic	69	78	79	74	76	74	74	73	75	78	82	88
Austria	63	63	57	57	71	73	75	77	79	80	86	88
Greece	50	65	77	81	84	82	76	75	74	74	100	100
Slovenia	49	47	51	51	60	60	60	60	60	60	40	59
Germany	38	44	43	42	42	43	44	41	42	46	45	44
Italy	29	31	31	29	32	35	35	35	36	37	39	39
Luxembourg	24	23	23	0	0	0	0	0	0	0	0	0
France	15	15	13	16	20	21	23	24	25	28	29	28
Netherlands	14	20	18	20	19	0	0	0	0	0	0	0
Belgium	3	5	5	4	5	2	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0	0	0
Spain	0	0	0	0	0	0	0	0	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0
Norway	0	0	0	0	0	0	0	0	0	0	0	0
Switzerland	0	0	0	0	0	0	0	0	0	0	13	13

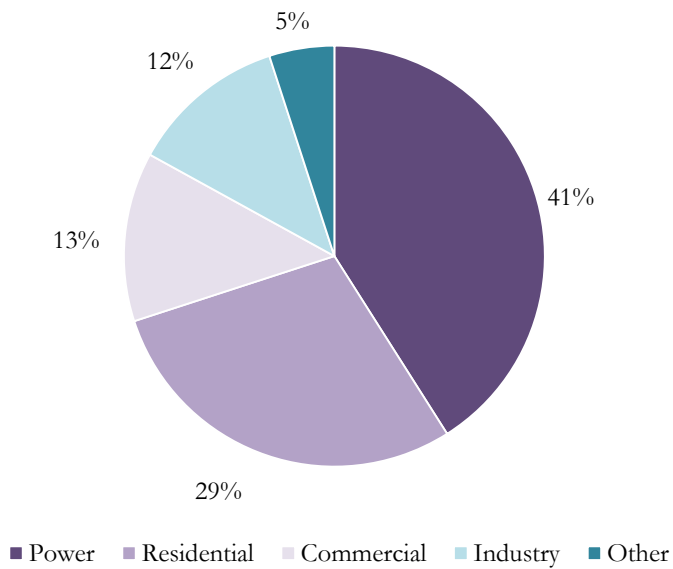
Source: Eurostat, 2011

Appendix 2. Main gas import routes to the EU-27, 2009.



Source: Eurostat, 2011

Appendix 3. Main gas consumers in the EU by industry, 2000-2005.



Source: Global Insight (2006) **European Natural Gas Supply and Demand Report Overview.** Research Report.

Appendix 4. Gas pipeline system between Russia and the EU.



Source: Petroleum Economist (2008) **Gas in the CIS and Europe**. Petroleum Economist Ltd in association with Ruhrgas. London.

Appendix 5. Portfolios composition by sector.

Country	Year	Market Index*	Number of stocks in a portfolio			
			Electricity**	Gas	Oil&Gas	Total
Austria	2006	WBI	2			5
	2009		2		1	5
Belgium	2006	BELPRC		1		5
	2009		1	1		7
Great Britain	2006	UKX	5	2	-	16
	2009		11	2		22
Bulgaria	2006	SOFIX				4
	2009				1	6
Czech Republic	2006	PX	2	2	1	6
	2009		2	2	1	6
Finland	2006	HEX	1			4
	2009		1		1	5
France	2006	CAC	5	1	4	15
	2009		12	2	3	25
Germany	2006	DAX	10	1	2	26
	2009		18	1	3	37
Greece	2006	ASE	1		2	14
	2009		2		2	16
Hungary	2006	BUX	2		1	4
	2009		2		1	4
Italy	2006	ITLMS	12	2	2	19
	2009		12	4	3	22
Latvia	2006	RIGSE		1	1	3
	2009			1	1	3
Lithuania	2006	VILSE	2	1		4
	2009		1	1		3
Netherlands	2006	AEX				2
	2009					2
Norway	2006	OBX	1			2
	2009		1		8	10
Poland	2006	WIG	1		1	6
	2009		2	1	4	16
Portugal	2006	BVLX	1			1
	2009		2		1	3
Romania	2006	BET			1	4
	2009		2	1	7	30
Slovenia	2006	SBITOP	-	-	-	-
	2009					1
Spain	2006	IBEX	4	2	2	12
	2009		6	2	2	13
Sweden	2006	SAX	1		3	5
	2009				7	9
Switzerland	2006	SMI	9		2	17
	2009		10		5	21

* Description of indices can be found in Appendix 6.

** Comprises Electricity and Alternative Electricity portfolios together.

Appendix 6. Description of indices.

Name	Description
AEX	A free-float adjusted market capitalization weighted index of the leading stocks traded on Amsterdam SE
ASE	A capitalization-weighted index of Greek stocks listed on the Athens SE
BELPRC	A capitalization-weighted index of Euronext Brussels
BET	A capitalization weighted index, comprised of the most liquid 10 stocks listed on the BSE tier 1
BUX	The official index of blue-chip shares listed on the Budapest SE
BVLX	The all-share market index that reproduces the total return of the main Portuguese market
CAC	A narrow-based, modified capitalization-weighted index of 40 companies listed on the Paris Bourse
DAX	A total return index of 30 selected German blue chip stocks traded on the Frankfurt SE
HEX	A capitalization-weighted index consisting of all the stocks traded on the Helsinki SE
IBEX	The official index of the Spanish Continuous Market. It is comprised of the 35 most liquid stocks
ITLMS	A free float capitalization weighted index of Italian stock market
KAX	A capitalization-weighted index of the all stocks traded on the Copenhagen SE
OBX	A capitalization-weighted index of the largest companies traded on the Oslo SE
PX	The official index of the Prague SE
RIGSE	An all-share index consisting of all the shares listed on the Main & Secondary lists on the Riga SE
SAX	Includes all the shares listed on OMX Nordic Exchange Stockholm
SBITOP	A free float capitalisation weighted index comprising the most liquid shares traded at Ljubljana SE
SMI	A capitalization-weighted index of the 20 largest and most liquid stocks of the SPI universe
SOFIX	A free float market capitalization weighted index of the most liquid companies listed on the Sofia SE
UKX	A capitalization-weighted index of the 100 most highly capitalized companies traded on the London SE
VILSE	A total return index which includes all the shares listed on the Main & Secondary lists on the Vilnius SE
WBI	A capitalization-weighted index that represents approximately 60% of Austrian stock trade
WIG	A total return index which includes all companies listed on the main market of Warsaw SE

Source: Bloomberg, web-sites of corresponding stock exchanges.