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"Power Play in the natural gas market. An analysis of the geopolitics leading to the "Turkish Stream" project and its implications on the natural gas market between Europe and Russia in the future"

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Alberty Pit

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1. Introduction

The 1st December 2014, President Putin announced that the South Stream project was cancelled. Instead of this project, Russia and Turkey planned the new Turkish Stream project. The main, but by far not the only, reason behind the change from the South Stream project to the Turkish Stream project was that Russia didn't want the Ukraine to be involved anymore. This turnaround of events came unexpected and asked for a deeper discussion about this subject.

In order to do so, this paper takes at first a look at the structure of the European natural gas market. Therefor the GASMOD model will be analyzed. The model compares three different market outcomes and tries to find out which one of these three outcomes is the nearest to the prevailing market structure. The model uses therefor economic factors. The results of the model discussed in this paper show that economic factors can't explain the natural gas market by themselves, but that other factors should also be taken into consideration. These other factors are geographic and political factors, or just geopolitical factors, as they should be considered together.
The GASMOD model delivers a good way to understand the natural gas market and its results lead to the conclusion that geopolitics have to be considered in greater detail during the rest of this paper. This should eventually make Russia's motivation to change to the Turkish Stream project clearer.

To get a more precise picture of the European natural gas market, the paper focuses in its next part on natural gas statistics. They describe best the effects that the financial and economic crisis of 2008 had on the natural gas market and they show also that the natural gas market hasn't fully recovered from this crisis. The attention of the reader should especially be put on the natural gas supplies, as these constitute the link to Russia. It is important to know how future demand for natural gas will evolve in order to prepare for new situations. New infrastructures, new partnerships, new contracts, …, everything depends on the development of the demand for natural gas.
As with the first part of the paper, it also becomes obvious in the second part, that focusing on economic factors isn't enough. Here Russia plays again an important role for

Europe in its decisions concerning the natural gas market. These statistics should also give an insight in how connected Europe and Russia are in the natural gas market.

The first two chapters show that the European gas market is heavily linked to Russia and they both lead to the conclusion that the paper should therefore analyze the relationship between these two countries in more detail. In order to do so, the next part concentrates on the relationship between Europe and Russia concerning gas, beginning with how they each handle their energy sector. There exists a huge difference, which already shows how difficult their relationship is. The ideas of using competition or monopoly power are colliding here and these different approaches have a big influence on the relationship.

Europe doesn't use a common voice concerning its energy sector and so the different countries of Europe have different approaches towards Russia. Alleged risks of the relationship with Russia are mentioned in this part of the paper as well as the possible responses to these risks. The information of the first parts of this paper is designed to help and understand the (inter)dependent relationship between Russia and Europe. The fact that Europe needs Russia and vice-versa leads to this interdependence. The reasons for this interdependence are described here, going from economic factors to geopolitical factors and explaining the concept of asymmetric interdependence.

The transportation system for natural gas is a key factor in this asymmetric interdependence and shows again how locked in Europe and Russia are in their relationship. The transportation system leads to the concept of transit states, which is also being described in this part. Here it shows that geopolitics have to be considered together with economic factors in order to understand the natural gas market and the relationship of two major players in this field, namely Europe and Russia.

The concept of transit states has been described earlier in the paper in order to lead to the next part, which concentrates on transit games. The reason why transit games arise is being described here, as well as different types of transit games. The main part of this section however is built by two case studies on transit games.

The first case study is about the transit game between Russia and Ukraine. At first the paper takes a look at the history preceding this transit game. Then it describes the model for this transit game, which uses economic factors. The model concentrates on the losses and the profits that arise from the transit game.

The difference to the next case study is that Ukraine is a net gas importer, whereas Turkmenistan (next case study) is a net gas exporter. Another difference is that geopolitics has become more important than economics in this case study. The paper takes a look at the emergence of the transit game, before describing the model. The model considers several problems.

These two case studies lead to the next part of the paper, the new Turkish Stream project. The history describing the events before the decision to build the new pipeline is being described here, before mentioning the details of the Turkish Stream. Then the paper takes a closer look at the profits that Turkey and Russia can make with the Turkish Stream, by describing three different scenarios. This transit game is modeled for a net gas importer, so there are similarities with the case study of Ukraine and therefore this part compares the profits from the different formulas with one another. Europe is indirectly affected by this transit game and possible repercussions for Europe are also being discussed.

2. GASMOD

The structure of the European natural gas market constitutes a good tool to understand in what ways Russia and Europe differ concerning their gas market. In order to see the differences, this paper takes a look at the structure of the European gas market and later on shows how Russia and Europe are linked in the natural gas market. Therefore the GASMOD model will be discussed hereafter as it tried to represent the structure of the European gas market.

GASMOD is a quasi-static model as it only regards one time period. The European natural gas market is structured as a two-stage-game of successive imports to Europe (first stage, upstream market) and wholesale trade within Europe (downstream market). It compares three possible market outcomes: Cournot competition, ‘’an economic model that describes an industry structure in which competing firms that make the same homogeneous and undifferentiated product choose a quantity to

produce independently and simultaneously''[1], in both markets, perfect competition in both markets and perfect competition in the downstream with Cournot competition in the upstream market. It also treats gas demand endogenously and explicitly includes infrastructure capacities.[2]

2.1 Data and Model

Data is used for the base year 2003. Implicitly it is assumed that the market in Europe is a liberalized, but oligopolistic one and that there is no vertical integration between the two stages. The oligopolistic structure helps to represent the problem of double marginalization. Also complete and perfect information is assumed, which means that the producers in the first stage have perfect information about the demand situation in the second stage and decide on their production quantities by taking into account the downstream market situation. Backwards induction is being used for determining equilibrium prices and quantities.[3]

2.1.1 Upstream export market

The constraints for the upstream exporter apply to the transport infrastructure: the export capacity of each exporter f (cap_f^{exp}) and the capacity of each bilateral relation between an exporter and a wholesale trader r ($cap_{f,r}^{trade}$). Considering these constraints, the optimization program for the exporter is:

$$\max_{x_{f,r}} .\Pi(x_{f,r}, p_r) = (p_r(X_r) - c_f(x_{f,r}) - tc_{f,r}(x_{f,r})) * x_{f,r}$$
$$\text{s.t.} \sum_{r \in R} x_{f,r} \leq \text{cap}_f^{\text{exp}}$$
$$x_{f,r} \leq \text{cap}_{f,r}^{\text{trade}}$$
$$x_{f,r} \geq 0$$

where $x_{f,r}$ is the supply by exporter f to wholesale trader r. $p_r(X_r)$ is the inverse demand function of each wholesale trader r with $X_r = \Sigma_{f \in F} x_{f,r} + x_r^{dom}$. $c_r(x_{f,r})$ is the production cost

[1] Investopedia (2015) : Cournot competition, http://www.investopedia.com/terms/c/cournotcompetition.asp, 17.04.2015
[2] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.767-773
[3] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.771-773

function of producer f and $tc_{f,r}(x_{f,r})$ is his transport cost function for delivering to trader r.

The simplified Karush-Kuhn-Tucker (KKT) conditions, due to Cournot competition, for this optimization problem are:

$$0 \leq p_r(X_r) - mc_f - t_{f,r} + \frac{\partial p_r(X_r)}{\partial x_{f,r}} \cdot \frac{\partial X_r}{\partial X_r} \cdot \frac{p_r(X_r)}{p_r(X_r)} \cdot \frac{X_r}{X_r} \cdot x_{f,r} - \lambda_f^{\text{exp}} - \lambda_{f,r}^{\text{trade}} \perp x_{f,r} \geq 0$$

$$mc_f + t_{f,r} \leq p_r(X_r) \cdot \left(1 + \alpha \cdot \frac{\theta_{f,r}}{\sigma_r}\right) - \lambda_f^{\text{exp}} - \lambda_{f,r}^{\text{trade}} \perp x_{f,r} \geq 0$$

$$0 \leq \text{cap}_f^{\text{exp}} - \sum_{r \in R} x_{f,r} \perp \lambda_f^{\text{exp}} \geq 0$$

$$0 \leq \text{cap}_{f,r}^{\text{trade}} - x_{f,r} \perp \lambda_{f,r}^{\text{trade}} \geq 0$$

where $\frac{\theta f,r}{\sigma r}$ is the price margin obtained by the oligopolistic supplier. In case of perfect competition, this margin is equal to zero. These conditions are sufficient for optimality.[4]

2.1.2 Domestic production

Domestic producers are restricted to the wholesale traders r in the same country and decide about their production quantities. They try to optimize their profits under a restriction of production capacity.

$$\max_{x_r^{\text{dom}}} . \Pi(x_r^{\text{dom}}, p_r) = (p_r(X_r) - c_r^{\text{dom}}(x_r^{\text{dom}})) * x_r^{\text{dom}}$$
$$\text{s.t.} \sum_{r \in R} x_r^{\text{dom}} \leq \text{cap}_r^{\text{dom}}$$
$$x_r^{dom} \geq 0$$

The KKT conditions that are sufficient for optimality (assuming unit costs, a concave demand function and having a linear constraint) are:

$$mc_r^{\text{dom}} \leq p_r(X_r) \cdot \left(1 + \alpha \cdot \frac{\theta_r^{\text{dom}}}{\sigma_r}\right) - \lambda_r^{\text{dom}} \perp x_r^{\text{dom}} \geq 0$$

$$0 \leq \text{cap}_r^{\text{dom}} - \sum_{r \in R} x_r^{\text{dom}} \perp \lambda_r^{\text{dom}} \geq 0$$

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[4] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.773-775

2.1.3 Downstream wholesale trade market

The wholesale traders are maximizing their profits that are determined by their revenues from sales minus the costs of purchasing and transporting gas and again given certain capacity constraints. The optimization problem can be written as:

$$\max_{y_{r,m}} .\Pi(y_{r,m}, p_m) = (p_m(Y_m) - p_r(X_r) - tc_{r,m}^{\mathrm{EU}}) * y_{r,m}$$
$$\text{s.t.} 0 \leq cap_{r,m}^{\mathrm{EU}} - y_{r,m}$$
$$y_{r,m} \geq 0$$

where p_r is the local price, $tc_{r,m}^{EU}$ are the intra-European transport costs, $y_{r,m}$ is the supply by each trader r to each end-market m, $cap_{r,m}^{EU}$ is the intra-European transport capacity of the pipeline grid between the trader and each end-market m, and $Y_m = \Sigma_m \in_M y_{r,m}$ with $p_m(Y_m)$ as the local price of gas in each end-market m.
The KKT conditions for the wholesale trader with marginal transport costs $t_{r,m}^{EU}$ are:

$$p_r \leq p_m(Y_m) \cdot \left(1 + \alpha \cdot \frac{\theta_{r,m}}{\sigma_m}\right) - t_{r,m}^{\mathrm{EU}} - \lambda_{r,m}^{\mathrm{EU}} \perp y_{r,m} \geq 0$$

$$p_r \leq p_m^0 \cdot \left(\frac{Y_m}{Y_m^0}\right)^{\frac{1}{\sigma_m}} \cdot \left(1 + \alpha \cdot \frac{\theta_{r,m}}{\sigma_m}\right) - t_{r,m}^{\mathrm{EU}} - \lambda_{r,m}^{\mathrm{EU}} \perp y_m \geq 0$$

$$0 \leq cap_{r,m}^{\mathrm{EU}} - y_{r,m} \quad \perp \lambda_{r,m}^{\mathrm{EU}} \geq 0$$

where Y_m and $p_m(Y_m)$ are the actual quantities and prices and Y_m^0 and p_m^0 are the reference demand and reference price in the market m in the base year.[6]

2.1.4 Market equilibrium

The market balance is given by the following equality, which must be verified for each market r:

$$\sum_m y_{r,m} = \sum_f x_{f,r} + x_r^{\mathrm{dom}}, \qquad \forall r \in R$$

[5] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.775
[6] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.776-777

The equilibrium solution is unique, due to a strictly decreasing demand function for each market and convex optimization problems with non-decreasing production functions resulting from constant (unit) costs.[7]

2.2 Results

As mentioned before, this model compares three scenarios. To conclude about the prevailing market structure in 2003, one has to compare the results of the model to the original data. Conclusions can then be derived due to the proximity of these numbers.

Figure 1 shows the results for exports in the first stage. It can be seen that, in the Cournot scenario, some traditional suppliers (Algeria, Russia) lose market shares, whereas newly emerging exporters (Middle East, Nigeria) gain market shares. Norway, the Netherlands and UK remain at a high level due to their cost advantage in production and transport costs.

In the Cournot scenario there is also strategic withholding of quantities compared with the perfect competition scenario. Of course this leads to higher prices in the Cournot scenario. In the perfect competition scenario Russia and Egypt, higher cost producers, gain market shares, because lower cost producers like the UK, the Netherlands and Norway reach their capacity limits.

Finally, the scenario ''EU liberalization'' leads to higher demand in the downstream market, because lower (competitive) prices generate higher exports.[8]

[7] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.777

[8] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.777-779

Figure 1: Exports

Export quantities and market share (as percentage of total exports to Europe)

Exporter	Cournot competition		Perfect competition		EU liberalization		Reference exports to Europe 2003 [a]	Reference market share 2003
	Exports (bcm/year)	Market share	Exports (bcm/year)	Market share	Exports (bcm/year)	Market share		
Algeria	14.7	4.4%	66.0	14.6%	66.0	11.9%	57.0	17.6%
Libya	4.8	1.4%	14.5	3.2%	14.5	2.6%	0.8	0.2%
Egypt	5.0	1.5%	11.9	2.6%	11.9	2.2%	0	0.0%
Iran	0.0	0.0%	10.0	2.2%	10.0	1.8%	3.5	1.1%
Middle East	13.3	4.0%	26.6	5.9%	26.6	4.8%	2.4	0.7%
Russia	58.8	17.7%	196.0	43.3%	134.4	24.3%	131.8	40.1%
Norway	86.0	25.8%	86.0	19.0%	86.0	15.6%	68.4	20.8%
Netherlands [b]	66.6	20.0%	0.0	0.0%	80.4	14.6%	42.2	12.8%
UK [b]	59.4	17.8%	0.0	0.0%	81.5	14.7%	11.5	3.5%
Nigeria	12.6	3.8%	22.7	5.0%	22.7	4.1%	10.4	3.2%
Trinidad	12.0	3.6%	18.7	4.1%	18.7	3.4%	0	0.0%
Total	333.1	100.0%	452.4 [c]	100.0%	552.6 [c]	100.0%	328.7	100.0%

[a] *Source*: BP (2004).

[b] The Netherlands and UK are considered as exporters and as importers. In this table we have removed the exports to the traders in the Netherlands and UK. However, these quantities are available for re-export (including domestic consumption) in the 2nd stage.

[c] Excluding own domestic consumption in UK and the Netherlands. If domestic consumption is included, total "exports" are higher in the perfect competition than in the EU liberalization scenario as intuition suggests.

Source: Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.778

Figure 2 shows the quantities and market shares of domestic production. Domestic production is part of the supply portfolio in more countries in the perfect competition and EU liberalization scenarios than in the Cournot scenario, due to the higher demand triggered by the lower prices. This means that there is a higher demand, which needs to be satisfied under the perfect competition assumption. That is why domestic production is generally higher for both scenarios than observed in the reference data. Congested trade capacities also lead domestic production to serve the demand.[9]

[9] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.779

Figure 2: Domestic production

Domestic production quantities and market shares of the domestic producers in the upstream market

Domestic producer	Cournot competition		Perfect competition		EU liberalization		Domestic production 2003 in bcm (IEA, 2004b)
	Domestic production (bcm/year)	Part of the supply in the same country	Domestic production (bcm/year)	Part of the supply in the same country	Domestic production (bcm/year)	Part of the supply in the same country	
UK [a]	27.4	35.9%	120.0	100.0%	38.5	42.2%	108.4 [a]
Netherlands [a]	23.4	42.1%	90.0	80.7%	9.6	32.9%	73.1 [a]
Spain/Portugal			0.3	0.7%	0.3	0.7%	0.2
France			1.9	3.2%	1.9	2.9%	1.6
Italy/Switzerland			16.3	19.4%	16.3	13.4%	13.6
Belgium/ Luxembourg							0
Germany			13.2	21.5%	26.7	21.1%	22.2
Denmark	1.0	44.7%	8.5	100.0%	9.6	86.4%	8.0
Sweden/Finland							0
Austria							2.1
Poland	6.0	27.8%	6.8	38.3%	6.8	32.7%	5.6
CSH	3.9	14.7%	3.9	3.5%	3.9	15.3%	3.3
Balkan			4.1	100.0%	4.1	28.9%	3.4
Romania/Bulgaria			17.5	49.8%	17.5	69.3%	14.6
Baltic							0
Greece					0.03	0.9%	0.03
Turkey							0.6

[a] Here we report *exports* from the UK or the Netherlands to the trader in the same country.

Source: Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.780

The goal of the GASMOD model was to find out which of the three scenarios would be the most representative of the actual (2003) market structure for the European natural gas market. Figure 3 shows that the results for domestic consumption in the Cournot scenario are very close to the actual final consumption. This indicates a proximity to the real world situation and therefore the Cournot scenario is the most realistic representation of the market structure. The exception of the UK can be explained by the more competitive structure in this country compared to continental Europe.

The results of the GASMOD model are driven by economic factors rather than being the consequence of geo-political considerations. As geopolitics is an important factor of the natural gas market, this paper will take a closer look at it later on.[10]

[10] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.779-780

Figure 3: Domestic consumption

Domestic consumption of natural gas in billion cubic meters (bcm) per year

Markets	Cournot competition	Perfect competition	EU liberalization	Consumption 2003
UK	49.5	113.3	95.9	95.4
Netherlands	38.9	69.6	56.9	40.3
Spain/Portugal	27.5	39.8	39.4	26.6
France	50.7	60.2	63.3	43.3
Italy/Switzerland	96.0	115.9	121.1	73.6
Belgium/Luxembourg	16.1	21.3	21.4	16.0
Germany	100.7	147.4	138.3	85.5
Denmark	0	6.2	5.7	5.4
Sweden/Finland	2.0	6.3	2.2	5.3
Austria	11.9	15.5	14.6	9.4
Poland	12.6	17.6	16.2	11.2
Czech/Slovak/Hungary	26.3	41.8	36.4	28.8
Balkan	9.7	10.0	10.5	7.7
Bulgaria/Romania	13.3	29.2	28.9	20.9
Baltic	0	3.3	5.7	5.0
Greece	2.3	3.7	3.6	2.3
Turkey	0	33.6	33.1	20.9
Total	457.6	734.7	693.4	497.6

Source: Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.780

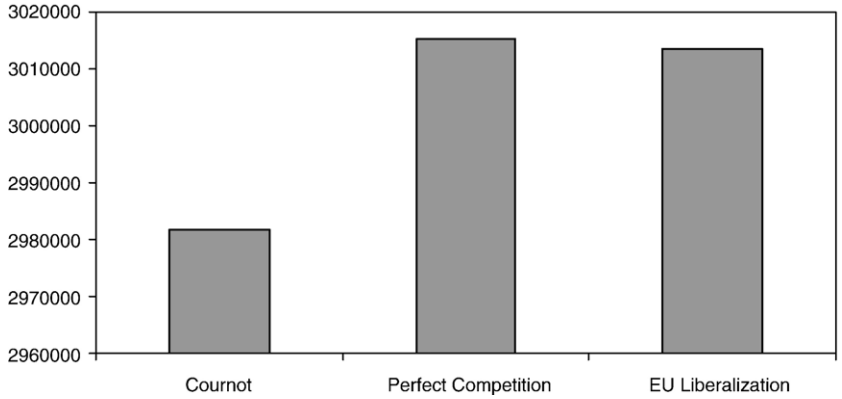
In the Cournot scenario, strategic withholding of production increases prices from one market stage to the next (double marginalization), which is an indication of the effect of market power. Compared to the other two scenarios there is also a large price increase in the Cournot competition and prices are heterogeneously distributed. For the other two scenarios, prices are distributed homogeneously between the countries and they are generally lower. Whereas the difference between prices in the upstream and the downstream market is very high and heterogeneous in the Cournot stage, it equals the assumed intra-country transport costs for the other stages. As mentioned before, prices are generally lower, even in the case of the EU liberalization, where exporters behave strategically.[11]

Keeping the different price margins in mind, Figure 4 shows us the welfare results for the different scenarios and one important finding is that in the EU liberalization scenario the welfare is close to the case of overall perfect competition. Unsurprisingly both welfare results for the perfect competition scenarios are higher than in the double marginalization (Cournot) scenario. This shows that enforcing competition in the European wholesale market is a good step.[12]

[11] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.781-782

[12] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.782-783

Figure 4: Welfare results for all market scenarios, in US-$



Source: Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.783

At last, Figure 5 shows how congested the transport routes are in the upstream market. In the Cournot scenario, the only route that is congested is the Norwegian access to Europe, as Norway is well positioned as a supplier to Europe. In the perfect competition case and similarly in the EU liberalization case, there are many exporters that are bound by their export capacities. This gives an idea of the quantities that could be traded without capacity constraints. The infrastructure capacities between exporters and importers are also an important part for the rest of the paper as geopolitics will also play a significant role in the development of transport infrastructure.[13]

Figure 5: Export capacity utilization

Export capacity utilization of each exporter

Exporters	Cournot competition	Perfect competition	EU liberalization
Algeria	22%	100%	100%
Libya	33%	100%	100%
Egypt	43%	100%	100%
Iran	0%	100%	100%
Middle East	50%	100%	100%
Russia	30%	100%	69%
Norway	100%	100%	100%
Netherlands	74%	0%	89%
UK	50%	0%	68%
Nigeria	55%	100%	100%
Trinidad	64%	100%	100%

Note that in addition to export capacity restrictions we have also introduced import capacity and bilateral trade restrictions. Whereas import capacity of European traders generally is not binding, bilateral trade capacity quite often is but with a structure similar to the export capacity utilization.

Source: Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.783

[13] Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.783-785

3. Natural gas statistics

The GASMOD model is an attempt to model the market structure, and it has done so by finding out that for the year 2003 the Cournot competition was the best scenario to describe the market structure. The next part of the paper will now take a look at the more recent years of the natural gas market, showing with the help of statistical reports how demand for natural gas evolved.

Natural gas has to be seen as part of the energy mix, which can be described like this: "To meet its energy needs, each country uses the energy available to it, in different proportions."[14] This means that the energy mix varies between countries and it plays a big factor in the development of natural gas demand.
Natural gas can be considered as a success story since its development in the 1960s. Growing demand for natural gas was expected for the years to come, until the 2000s and the development of low carbon policies. Slow but steady changes occurred in the energy mix without people and governments noticing them, because they were blinded by the growing demand for energy, which left enough room for gas even in a growing competitive environment. The major shock was felt in the years 2008-2009, the years of the financial and economic crisis. As a result many factories in the industry either closed or reduced output. Industrial production is an important sector for natural gas consumption and due to the crisis, industrial gas demand decreased and hasn't reached its pre-crisis levels. Not just the industry sector, but also the energy sector was affected by the economic downturn and gas demand in OECD Europe declined by 5.67% in 2009. Gas demand levels are still below those of 2008, especially for major markets like France, Germany, Spain, UK and Italy. One non-European country for which this isn't true is Turkey, where demand grew about 24% from 2008 to 2013. The situation of Turkey will be discussed in more detail later in this paper. The decline in natural gas demand can also be partly explained by the emergence of renewable energy. This impact can be seen especially in the electricity generation mix, where gas lost a lot of its shares to renewable energy.[15]

[14] Planète energies (2015): About the Energy Mix, http://www.planete-energies.com/en/medias/explanations/about-energy-mix, 21.04.2015
[15] Anouk Honoré (2014) : The Outlook for Natural Gas Demand in Europe. The Oxford Institute For Energy Studies, p.13-21

3.1 Primary energy consumption and natural gas supplies

Taking a look at the year 2013, Figure 6 shows the primary energy consumption for the EU-28, Switzerland and Turkey. The primary energy consumption of a country can be defined "as the total gross energy supply (indigenous production plus net imports) before any conversion of primary energy into final energy forms has taken place".[16] Here it can be seen that for the EU-28, the consumption of natural gas decreased by 1.5% from 2012-2103.[17]

Figure 6: Primary energy consumption by fuel in the EU-28, Switzerland and Turkey 2013

Mtoe	Oil	Solid fossil fuels	Natural gas	Nuclear electricity	Hydro	Other renewables	Electricity net imports	Others	TOTAL	% CHANGE 2013/2012
AUSTRIA	12.3	3.3	7.0	0.0	3.6	6.5	0.6	0.7	34.1	0.4%
BELGIUM	22.0	2.6	14.2	11.1	0.0	5.4	0.8	0.1	56.1	0.3%
BULGARIA	4.1	5.9	2.3	3.2	0.9	0.6	0.0	0.0	17.0	-5.8%
CROATIA	3.1	0.7	2.3	0.0	0.7	0.6	0.4	0.0	7.7	-2.5%
CYPRUS	1.9	0.0	0.0	0.0	0.0	0.1	0.0	0.0	2.1	-6.8%
CZECH REPUBLIC	8.8	18.3	6.8	8.0	3.2	0.2	-1.5	0.0	44.0	0.3%
DENMARK	6.1	3.1	2.8	0.0	0.0	4.9	0.1	0.0	17.0	-6.4%
ESTONIA	0.4	4.4	0.5	0.0	0.0	0.8	-0.3	0.0	5.9	7.0%
FINLAND	7.4	5.0	2.6	5.9	1.1	8.7	1.4	1.1	33.2	1.8%
FRANCE	78.4	11.8	38.6	110.4	5.4	21.3	-4.2	0.0	261.8	0.7%
GERMANY	110.8	81.5	74.2	25.3	1.8	32.5	-2.9	6.5	329.7	2.6%
GREECE	10.7	7.0	3.2	0.0	0.6	2.2	0.2	0.0	23.8	-15.5%
HUNGARY	5.8	2.4	7.8	4.0	0.0	1.9	1.0	0.0	22.9	-2.5%
IRELAND	6.3	2.0	3.9	0.0	0.0	0.9	0.2	0.1	13.4	-0.7%
ITALY	59.0	14.6	57.4	0.0	4.5	26.2	3.6	0.0	165.4	-3.0%
LATVIA	1.4	0.1	1.2	0.0	0.3	1.3	0.1	0.1	4.5	0.0%
LITHUANIA	2.5	0.2	2.2	0.0	0.0	1.2	0.6	0.3	7.0	-5.5%
LUXEMBOURG	2.8	0.0	0.9	0.0	0.0	0.2	0.5	0.0	4.4	-1.3%
MALTA	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	-1.4%
NETHERLANDS	29.1	8.2	33.4	0.7	0.0	3.2	1.6	1.3	77.4	-0.9%
POLAND	22.7	53.3	13.7	0.0	0.2	8.6	-0.4	0.8	98.9	0.4%
PORTUGAL	9.4	2.7	3.7	0.0	1.3	4.0	0.2	0.3	21.6	0.8%
ROMANIA	9.0	5.6	10.3	2.6	3.4	1.1	0.0	0.0	32.0	-4.0%
SLOVAKIA	3.3	3.4	4.3	4.1	0.4	1.1	0.0	0.0	16.6	-0.3%
SLOVENIA	2.3	1.3	0.7	1.4	0.4	0.8	-0.1	0.0	6.8	-2.6%
SPAIN	52.9	10.5	26.1	14.8	3.2	14.0	-0.6	0.2	121.1	-6.0%
SWEDEN	12.0	2.2	1.0	17.2	5.3	11.1	-0.9	0.2	48.0	-6.8%
UNITED KINGDOM	69.1	38.3	65.9	15.4	3.0	8.8	1.2	1.1	202.8	-0.1%
EU-28	554.3	288.5	386.7	224.1	39.4	168.2	1.8	12.8	1 675.8	-0.9%
% Change 2013/2012	-2.2%	-2.7%	-1.5%	-0.3%	11.0%	5.0%	-47.3%	16.0%	-0.9%	
SWITZERLAND	12.0	0.1	3.1	6.5	3.4	1.6	-0.2	1.3	27.8	2.2%
TURKEY	31.6	32.8	37.6	0.0	5.1	8.4	0.5	0.0	116.0	-0.8%

Units: million tonnes of oil equivalent (net calorific value).
Note: other renewables includes biomass, wind, solar and geothermal energy.
figures are best estimates available at the time of publication.

Source : Eurogas (2014) : Statistical Report 2014, p. 2

[16] Eurogas (2014) : Statistical Report 2014, p. 3
[17] Eurogas (2014) : Statistical Report 2014, p. 3

Natural gas demand has therefore also decreased by 1.5% from 2012 to 2013, especially due to renewables. In Figure 6 it can be seen that the consumption of Hydro increased by 11.0% and the consumptions of other renewables increased by 5.0%. Since 2011 the competition in power generation from renewables and coal led to a decline in gas used. Coal has become cheaper, therefore being used more than gas. Additional to this, as already mentioned before, Europe's slow economic growth led to a decrease in electricity demand, driving gas demand down.

The most important part, considering the rest of this paper, is to take a look at the natural gas supplies. Special attention should be put on Russia. Russia is the second biggest supplier with 27% of total net supplies, behind indigenous production with 34%. Figure 7 shows this in more detail. Norway and Algeria follow with respectively 21% and 8%. In 2013 pipelines have been the mode of transport for 86% of the net imports from non-EU countries to the EU-28, 5% more than in 2012. This means that Liquefied natural gas flows lost 5% of their shares to pipelines, which can also be seen in Figure 7, by taking a look at Qatar. The share of gas from Qatar, the main LNG supplier of natural gas for the EU-28, in EU supplies decreased from 6% to 5% from 2012 to 2013. Nevertheless it remained Europe's leading LNG supplier with 51% in the EU LNG imports. The total length of pipelines for the EU-28 is 2.210.667km. For Turkey the length of pipelines is 82.859km.[18]

[18] Eurogas (2014): Statistical Report 2014, p. 5-8

Figure 7: Natural gas supplies in the EU-28, Switzerland and Turkey, 2013

TWh	Indigenous production	Norway	Russia	Algeria	Qatar	Other sources*	Changes in stocks**	Others balances	Total net supplies	% Change 2013/2012
AUSTRIA	14.5	16.1	55.8	0.0	0.0	-3.9	7.7	0.0	90.2	-6.0%
BELGIUM	0.0	71.4	2.0	0.0	34.4	74.5	0.7	0.0	183.0	-1.4%
BULGARIA	1.8	0.0	27.0	0.0	0.0	0.0	1.2	-2.1	27.9	-6.5%
CROATIA	19.5	0.0	0.0	0.0	0.0	9.4	0.6	0.0	29.5	-5.4%
CYPRUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
CZECH REPUBLIC	1.6	9.9	55.7	0.0	0.0	24.3	-2.8	-0.7	88.0	1.9%
DENMARK	56.0	4.2	0.0	0.0	0.0	-14.4	-2.9	-7.1	35.8	-4.4%
ESTONIA	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0	7.0	3.2%
FINLAND	0.0	0.0	36.8	0.0	0.0	0.0	0.0	0.0	36.8	-5.1%
FRANCE	3.7	191.8	90.0	59.1	20.8	129.5	8.2	-1.5	501.6	1.6%
GERMANY	115.8	225.0	436.0	0.0	0.0	175.2	4.0	0.0	956.0	6.4%
GREECE	0.0	0.0	27.6	6.9	0.0	7.4	-0.1	-0.2	41.6	-11.7%
HUNGARY	19.2	0.0	86.0	0.0	0.0	-11.7	8.2	2.5	104.2	-7.1%
IRELAND	1.8	0.0	0.0	0.0	0.0	48.3	-0.5	0.1	49.7	-5.5%
ITALY	81.9	27.5	254.0	132.3	56.9	182.7	6.3	0.0	741.6	-6.5%
LATVIA	0.0	0.0	15.0	0.0	0.0	0.0	0.0	0.0	15.0	-0.8%
LITHUANIA	0.0	0.0	28.0	0.0	0.0	0.0	0.1	0.0	28.0	-18.5%
LUXEMBOURG	0.0	7.4	2.9	0.0	0.0	1.3	0.0	0.0	11.6	-14.9%
MALTA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
NETHERLANDS	796.4	168.9	22.1	0.0	5.5	-566.0	1.8	2.2	431.0	1.1%
POLAND	49.4	0.0	102.3	0.0	0.0	29.3	-3.6	1.1	178.5	0.3%
PORTUGAL	0.0	2.8	0.0	24.4	3.6	17.8	0.3	-1.1	47.8	-4.4%
ROMANIA	112.3	0.0	20.3	0.0	0.0	0.0	0.6	-0.6	132.6	-8.3%
SLOVAKIA	1.0	0.0	58.3	0.0	0.0	-6.2	1.2	0.0	54.3	-2.0%
SLOVENIA	0.0	0.0	5.5	0.0	0.0	1.9	0.2	0.0	7.6	-8.4%
SPAIN	0.5	13.4	0.0	192.0	40.6	87.1	0.0	-0.1	333.5	-8.0%
SWEDEN	0.0	1.1	0.0	0.0	0.0	11.4	-0.1	0.0	12.4	-4.0%
UNITED KINGDOM	424.2	306.6	0.0	4.5	95.2	19.2	-0.6	2.0	851.0	-1.1%
EU-28	1 699.7	1 046.1	1 332.3	419.2	257.0	216.9	30.4	-5.5	4 996.0	-1.5%
% Change 2013/2012	-0.6%	-3.9%	12.6%	-12.3%	-20.5%	-23.6%	-1 531.8%	-214.8%	-1.5%	
SWITZERLAND	0.0	0.0	0.0	0.0	0.0	39.9	0.0	0.0	39.8	5.4%
TURKEY	5.7	0.9	278.9	42.6	3.3	148.7	6.1	-0.8	485.5	0.9%

Units: terawatt hour (gross calorific value).
Note: Figures are best estimates available at the time of publication.
** Including net exports.*
*** (-) Injection / (+) Withdrawal.*

Natural gas supplies (or inland consumption calculated) are defined

Source : Eurogas (2014) : Statistical Report 2014, p. 6

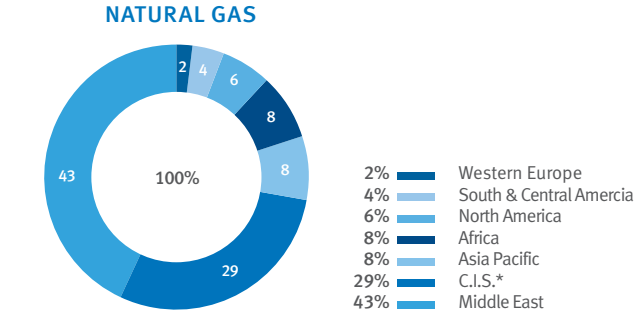
3.2 Gas reserves

Figure 8 shows the global natural gas reserves, where a look at the reserves-to-production (R/P) ratio clarifies its meaning. R/P ratio "represents the length of time the remaining discovered reserves would last if production was to continue at the same level of that year, and if no new reserves were to be discovered."[19] In 2000 the R/P ratio for gas was about 58 years and in 2013 the R/P ratio has only slightly decreased to 55 years, which reflects the fact that new discoveries have kept pace with the production and use of gas. New production techniques create additional reserves, but until now it is

[19] Eurogas (2014): Statistical Report 2014, p. 9

very difficult to predict how much more gas there is to be exploited with new technologies.[20]

Figure 8: Global Gas Reserves by Region, 2013



Total proved reserves at end 2013: 186 tcm

** Commonwealth of Independent States*

Source : Eurogas (2014) : Statistical Report 2014, p. 9

3.3 Future demand of natural gas

Another very important part of the natural gas market is how demand will evolve in the future. Demand has decreased over the last years, due to a number of reasons mentioned above, but in order to plan e.g. infrastructure for the future, policy makers need reliable long-term estimates of future demand. Some more detailed reasons will be mentioned hereafter for the EU-27 (projections were made before Croatia joined the EU in 2013). First the EU set itself ambitious energy and climate targets, often referred to as 20-20-20 targets. By 2020 the key objectives are a 20% reduction of EU greenhouse gas emissions from 1990 levels, raising the share of EU energy consumption produced from renewable resources to 20% and a 20% improvement of the EU's energy efficiency. The EU needs to explore policy options to achieve these targets and therefore needs reliable estimates. The ten-year network development plan for the gas and electricity networks needs also reliable estimates of long-term future gas demand to plan the infrastructural developments. And due to the Russia-Ukraine dispute in 2009 (explained in more detail in one of the next parts of this paper), the EU became more aware of its import

[20] Eurogas (2014): Statistical Report 2014, p. 9

dependency and shows a strong interest in new supply routes and sources. To establish capacity levels, future demand estimates have to be reliable.[2122]

The International Energy Agency (IEA) and the European Commission (EC) make projections, but to concentrate just on one projection may be misleading, due to errors or assumptions being made in this projection. That's why it makes more sense to compare projections and the next part will take a look at one of these comparisons and highlight the important parts.

First of all, a projection isn't the same as a forecast as it is based on a set of assumptions. Circumstances can change over time and assumptions have to be revised, resulting in updated projections. Figure 9 shows a number of gas demand projections of these two institutions for the years 2020 and 2030, as a function of time. First, a general downward trend can be seen, as the estimates of future demand mostly decreased coming closer to the target dates. This could reflect the ambition of the EU to achieve their 20-20-20 targets, and/or the increased price of gas at the EU borders. Second, the more recent IEA projections differ from those of the EC. The shale gas development in the United States and the consequent drop in the US gas price can explain this. Shale gas can be defined as "natural gas that is trapped within shale formations. Shales are fine-grained sedimentary rocks".[23] Third, IEA projections imply demand growth between 2020 and 2030, whereas EC projections are essentially flat for that period. The EU climate and energy policy will have a huge impact on future gas demand and so only time will tell which of these projections is closer to reality.[24]

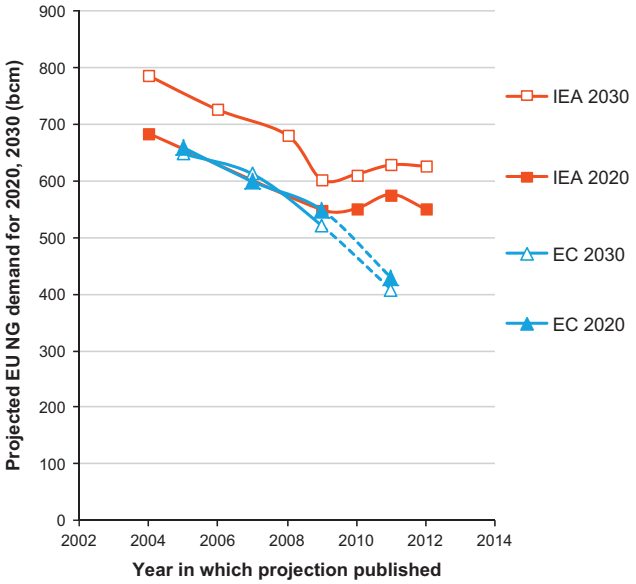
[21] European Commission (2015): The 2020 climate and energy package, http://ec.europa.eu/clima/policies/package/index_en.htm, 23.04.2015

[22] William J. Smith (2013): Projecting EU demand for natural gas to 2030: A meta-analysis. Energy policy 58, p. 163-164

[23] Geology.Com (2015): What is Shale Gas ?, http://geology.com/energy/shale-gas/, 23.04.2015

[24] William J. Smith (2013): Projecting EU demand for natural gas to 2030: A meta-analysis. Energy Policy 58, p. 164

Figure 9: IEA and EC projections over time



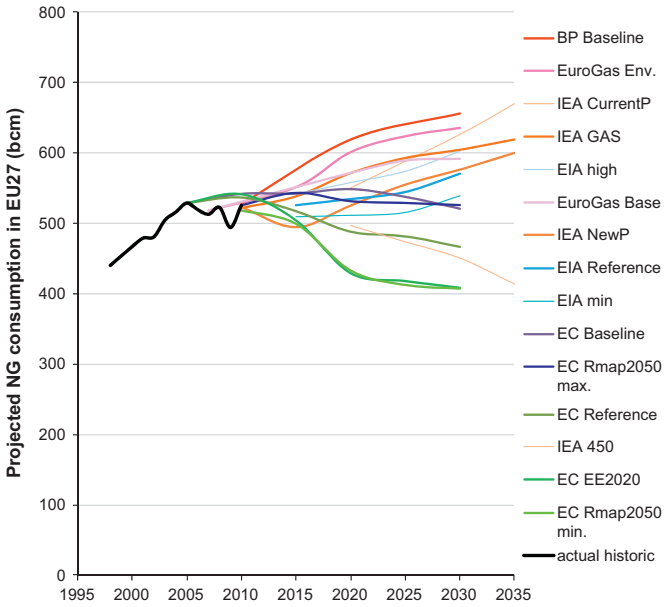
The evolution with time of Baseline projections for EU natural gas consumption in 2020 and in 2030. The dashed lines lead to projected demand if the 20% Energy Efficiency targets are met

Source: William J. Smith (2013) : Projecting EU demand for natural gas to 2030 : A meta-analysis. Energy policy 58, p. 164

Figure 10 shows the historic consumption of EU member states since 1998 and the wide disparity in projected future gas demand. The difference between the highest and lowest projection for 2020 is 190 bcm (billion cubic metres). This difference will increase to 248 bcm for the year 2030. The fact that total demand in 2010 was at 537 bcm makes these values very significant. Furthermore it is interesting to notice that half of the projections stagnate or decline from the 2010 level, whereas the other half expect future growth in demand.[25]

[25] William J. Smith (2013): Projecting EU demand for natural gas to 2030: A meta-analysis. Energy Policy 58, p. 164

Figure 10: Projected EU27 gas demand vs time



Source : William J. Smith (2013) : Projecting EU demand for natural gas to 2030 : A meta-analysis. Energy Policy 58, p. 165

The question remains why the projections differ so much. In general GDP and energy consumption have a high and positive correlation and so the models, used for the different scenarios, used GDP as input. The differences in the projected demand could therefore be due to different assumptions concerning GDP growth, different assumptions about the energy-intensity of GDP or different assumptions about the projected gas-intensity of the energy mix.

The different scenarios have similar economic assumptions and as the correlation between GDP and gas consumption is essentially non-existent, it becomes evident that the differences in projected demand are not due to differences in projected GDP growth.

More than by economic assumptions, scenarios are distinguished by assumptions about policy. These can be put in two broad categories: those intended to reduce the carbon-intensity of energy consumption and those intended to reduce the absolute level of consumption. A strong correlation is evident between gas consumption and primary energy-intensity, as natural gas consumption tends to correlate positively with energy-intensity of GDP and negatively with penetration of renewables.

At last the different scenarios have different assumptions about the change in Gross Inland Consumption (GIC) of all fuels for 2020 and 2030. Except for one scenario, the other entire scenarios project an overall decrease in GIC coupled to an increase in

renewables. This leads unsurprisingly to a projected decrease in demand for fossil and the correlation between gas-intensity and gas demand is reasonably strong. [26]

The most significant source of demand variance between scenarios is electricity generation, even if it only has a relatively modest contribution to gas demand. The explanation for this disproportionate contribution of the electricity sector is the relative ease with which gas can be substituted in power generation. The differing projections are due to different assumptions about how fossil fuels will be displaced by renewables and/or nuclear generation and due to different assumptions about how gas will displace other fossil fuels for electricity generation.
Summing up, the differences between scenarios are due to differing assumptions about the generation mix in the electricity sector, the penetration of renewables in the energy mix and the energy efficiency/energy intensity. Demand projections tend to decrease for future demand, but as it is very difficult to project future natural gas demand, projections need to be revised, taking into account developments of the market, of the law, of the infrastructure, of politics, … .[27]

4. Russian and European gas interdependence

The next part of the paper will focus on the relationship between Russia and Europe with regard to natural gas. Their (inter)dependence will be discussed, as well as the presumable market power of Russia. Alleged risks and possible responses from both countries are being analyzed and finally this part will take a look at their network interdependence, especially what role the pipelines play in decisions being made about natural gas.

The difference in gas reserves between Russia and Europe should normally lead both countries to trade gas in the mutual interest of both their economies. As mentioned above, Russia is the second biggest supplier of gas in Europe, behind the EU's own gas

[26] William J. Smith (2013): Projecting EU demand for natural gas to 2030: A meta-analysis. Energy Policy 58, p. 164-170
[27] William J. Smith (2013): Projecting EU demand for natural gas to 2030: A meta-analysis. Energy Policy 58, p. 169-175

production and will also play a key role in the years to come. However, at the same time, Russia will also depend on Europe as a buyer, due to time and cost factors linked to the development of new infrastructure to tap other regional markets. [28]

4.1 "Markets and Institutions" and "Regions and Empires"

A look at the history of international and regional energy markets shows that the state of the world influences the global oil and gas industry. There exist two opposite stories in international energy relationships, the "Markets and Institutions" approach and the "Regions and Empires" approach to international economic and political cooperation. The former means an integrated, multilateral world with effective institutions and competitive markets. In this perspective market-based rules are the order of the day and best describe the EU. The latter involves a world broken up in rival political and economic blocks, which compete for resources and markets via political, economic and military power. In contrast to the EU, the present world tends toward the "Regions and Empires" approach. That's why the EU needs to reconsider its position to stay strong in its foreign policy.[29]

4.2 Difference in Russian and European energy policy

To explain the relationship between Russia and Europe, one first needs to understand how they both handle their energy sector. Vladimir Putin's idea for Russia is to become an "energy super-power" and to do so he moved to consolidate political and economic power in the hands of the Russian state and its leader. This consolidation focused especially on regaining control over energy resources, in particular oil and natural gas. Through pseudo-autonomous "national champions", the Russian state tightened its control over oil and natural gas supplies to the rest of the world, by reinforcing its monopoly over oil (Transneft) and gas (Gazprom) export pipelines. Russia used also the (threat of) cut off of energy supplies to achieve its political objectives. The action of the companies isn't restricted exclusively to Russian resources and the domestic market, but

[28] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.423-425
[29] Aad Correljé, Coby van der Linde (2006): Energy supply security and geopolitics: A European perspective. Energy Policy 34 p.532-543

extends to Russia's "near abroad". Here they try to control recently exploited reserves and exports. Their influence goes even further as they are keen to play a role in the downstream market in some European countries and by that tighten their hold on revenues along the entire value chain. Since 2001 the development of production, transport, and exploitation resources is reorganized under direct control of the state. In fact, Russia wants to establish a position of leadership and therefore it instrumentalises domestic gas and oil companies.[30][31]

Gazprom plays a central role in Russia's energy market by being a major corporation that serves the Russian state's objectives of political and economic power. The Russian state holds almost a 51% share of the company, strengthening by that government control over the gas industry. Gazprom even took control of privately owned production by purchasing companies and shares in companies that are exclusively involved in gas production. Gazprom exerts Russian foreign policy, as its decisions are often those of the Russian government.[32]

Europe contrasts with Russia in the way that it has not been applying traditional energy policy, but rather an application of competition policy in the energy sector. The energy trade inside the Union should be liberalized and so the energy market is characterized by a complexity of relationships between the energy companies and the governmental spheres at the dual levels of EU and member states. Furthermore Europe lacks the attributes of a State and the means of geopolitical power, resulting in a multilateral conception of international relations. Europe hasn't got, as a whole, a significant foreign policy. The interests of the member states often diverge and it is difficult to create common positions among the EU member states towards Russia.[33][34]

[30] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.425-426
[31] Richard Ericson (2009): Eurasian Natural Gas Pipelines: The Political Economy of Network Interdependence. Eurasian Geography and Economics, 50:1, p. 32-33
[32] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.426
[33] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.426
[34] Oistein Harsem, Dag Harald Claes (2013): The interdependence of European-Russian energy relations. Energy Policy 59, p.786-787

4.3 Policy approaches towards Russia

For the EU member states, five distinct policy approaches towards Russia can be found:

- "Trojan Horses" (Cyprus and Greece) who often defend Russia's position in the EU system, and are willing to veto common EU positions;
- "Strategic Partners" (France, Germany, Italy and Spain) who have, beside Spain, strong political and economic bilateral relationships with Russia and which occasionally undermine common EU policies;
- "Friendly Pragmatists" (Austria, Belgium, Bulgaria, Finland, Hungary, Luxembourg, Malta, Portugal, Slovakia and Slovenia) who maintain a close relationship with Russia and focus on business interests rather than on political goals;
- "Frosty Pragmatists" (Czech Republic, Denmark, Estonia, Ireland, Latvia, the Netherlands, Romania, Sweden and the United Kingdom) who also focus on business interests, but are not afraid to speak out against Russia on the political level;
- "New Cold Warriors" (Lithuania and Poland) who openly seek a more critical EU line towards Russia and also use their veto to block EU negotiations with Russia.[35]

4.4 Risks for Europe

There exist some possible risks for the natural gas market in Europe concerning its relationship with Russia, which will be mentioned hereafter. It will also be discussed if these risks are realistic ones or not.

There exists the risk associated with monopoly power on short-term markets, meaning that Gazprom might exercise its market power by increasing prices. This scenario is based on the implicit assumption that the European market is going to be dominated by spot sales or short-term transactions. There are two reasons which make this scenario an unrealistic one: Gazprom, due to its status as monopoly, puts its priority to long- and

[35] Marc Leonard, Nicu Popescu (2007): A Power Audit of EU-Russia Relations. European Council on Foreign Relations (ECFR), p. 27-50

medium-term transactions and sellers will probably prefer to trade a mix of these contracts on the European market with no link to the spot price. This risk is therefore being reduced.[36]

Another risk is the risk of collusion with the other exporting companies. Such a worldwide cartelization is difficult to achieve due to the different conditions of physical trade inside each region (Europe, North America, Asia) and the interactions between these three regional markets in the medium term. Furthermore the varying interests of the major sellers hinder reaching an agreement on volumes and prices. A final obstacle to such a cartelization are the long-term contracts, with prices indexed to oil product's prices. Until the gas market moves to become a spot market system, this risk will not be a realistic one.[37]

Other risks would be risks of long-term market power or the risk of contracts breaking up. For the former, Gazprom could use its dominant position to impose changes in long-term contracts and create pressure on long-term gas prices by a restriction of the development of capacities oriented towards Europe. For the latter, Gazprom could again use its dominant position, this time to break up contracts and obtain better prices (without respecting any conditions). But this would mean that Gazprom would lose its credibility and it is not in its interest to jeopardize its relations with Europe, as it is also dependent on European markets.[38]

Gazprom could also restrict investment in new capacity supply to the European market. No new investments in infrastructure raises the question if Russia will be able in the future to supply Europe with the same amount of gas than it does nowadays, considering that their 'old' gas fields have reached their peak. But Russia created a huge buffer, by agreeing to purchase massive amounts of gas from the countries of Central Asia. So a part of the gas sold to Europe will be supplied by Central Asian gas, purchased by Russia.

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[36] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.430-431
[37] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.431-432
[38] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.432

Furthermore, Gazprom could deploy its gas production and infrastructures towards alternative markets. Here again Gazprom can use its dominant position to supply the Asian and North American markets instead of continuing its European supply projects. This risk will become more threatening in the near future when transport infrastructures will be developed to these markets. Until now, Europe still brings a more rapid and secure return on investment.

One more issue is the risk of market power in direct sales on national markets. This risk is based on Gazprom's strategy of downstream diversification, already mentioned above. This strategy consists of setting up marketing subsidiaries, purchasing shares in local companies and forming joint ventures with national partners.

The necessity to respect the contractual arrangements, by which Gazprom wants to sell the quasi-totality of its gas to the European gas markets, reduces the risks of it exerting market power. So despite Gazprom's dominant position there will not be additional risks of market power.[39]

4.5 Responses

One response to the alleged risks mentioned above would be the integration of Russia in the European single regulatory area for trade in energy. This proposal is set in the "Market and Institutions" paradigm. Europe already tried this by asking Russia to ratify the Energy Charter Treaty in 2006, which insisted on the role of liberalized markets in the energy sector. This would create greater interdependence and legal alignment would help limit the risks. Russia refused to ratify the Energy Charter, as it has no plans on bringing its regulations in line with European legislation. Concerning gas issues, Russia uses political and economic reasoning. So this proposal didn't help, as it wasn't in Russia's interest and of any added value.[40]

Another proposal would be to speak a common voice by creating a common negotiator; an answer forged in the perspective of "Regions and Empires". As mentioned above, the interests of the Member States often diverge and a common negotiator could take direct

[39] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.432-436

[40] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.436-437

coordinated action in the negotiation of contracts with the gas exporting countries. The problem is that the Commission could only manage the harmonization of contractual arrangements with foreign producers, as the role of this common negotiator is not consistent with market principles. A common external policy on energy would also derive from the interests and ideas of the Member States. Also European players won't be happy to lose their bargaining power. This shows that this common negotiator type is not justified in the situation of the market for long-term gas contracts in Europe.[41]

A final response could be the improvement of infrastructures to promote diversification of supply sources. The EU and the Member States should try to enhance physical market integration and improve gas pipeline and LNG connections with the major exporters. Furthermore the EU could try to organize solidarity in the event of an interruption of supply.[42]

4.6 Interdependent Relationship

As mentioned earlier, on the one hand Russia is the second biggest gas supplier to Europe (caused by its geographic location, rapidly developing pipeline systems, technical skills and know-how), but on the other hand Europe imports almost the same percent of their total gas consumption from Russia, making both parties dependent on each other. This results in an interdependent relationship. Taking the risks and possible responses mentioned above into account and looking in greater detail at this relationship, it becomes obvious that Russia seems to be relatively less dependent on Europe than vice-versa. Russia is dependent on the income it generates from its gas exports to Europe, but Europe is more dependent on the gas supplies from Russia. This is due to the fact that gas is an important commodity, helping to fulfill basic needs in a society (e.g. heating, cooking, …) and that gas is, in the short-run, almost impossible to substitute. The Ukraine crisis in January 2009, when Russia suspended its gas inflow, showed how vulnerable certain European states are to disruption of their gas supply. A shut-down in gas supply would also affect some European countries more than others,

[41] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.437-439
[42] Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.439-441

due to the varying Russian share of gas imports across European countries (as seen in the beginning of the paper). This is also true for trade with Russia, as the Russian market is more important for former eastern-European countries concerning their export, than for Western Europe (Fig.11). These circumstances have created the concept of asymmetric interdependence, which best describes the Russia-EU energy relationship and which will be looked at in greater detail in the following paragraphs.[43][44]

Figure 11: The trade (inter)dependency matrix

		Russian trade dependency on European countries	
		High	Low
European countries' trade dependency on Russia	High	Finland, Latvia, Slovakia, Poland, Hungary, Czech	Lithuania, Estonia, Greece, Bulgaria, Romania
	Low	Sweden, Netherlands, Spain, Italy, France, Austria, UK , Germany	Slovenia, Denmark, Belgium, Portugal, Luxembourg, Ireland

Source: Oistein Harsem, Dag Harald Claes (2013): The interdependence of European-Russian energy relations. Energy Policy 59, p.790

4.7 Transportation of natural gas and its consequences

It has been shown in the previous paragraphs that gas markets are highly political. Especially due to its infrastructure requirements the geopolitical side of natural gas has to be considered. Geopolitics is the "study of the influence of such factors as geography, economics, and demography on the politics and especially the foreign policy of a state"[45]. The following discussion about the transport system for natural gas will underline the necessity of geopolitics.[46]

[43] Oistein Harsem, Dag Harald Claes (2013): The interdependence of European-Russian energy relations. Energy Policy 59, p.787
[44] Mert Bilgin (2009) : Geopolitics of European natural gas demand : Supplies from Russia, Caspian and the Middle East, Energy Policy 37, p.4482-4492
[45] An Encyclopedia Britannica Company Merriam Webster (2015) : Geopolitics, http://www.merriam-webster.com/dictionary/geopolitics, 01.06.2015
[46] Richard E. Ericson (2009) : Eurasian Natural Gas pipelines : The Political Economy of Network interdependence, Eurasian Geography and Economics, 50:1, p.29

The dependence on Russia for Europe is caused by the difficulty of transporting natural gas from its source to where it is needed and by the high costs of storage. Road and rail transport are uneconomical for industrial use, because as a gas, natural gas carries far less energy per unit volume. It can be liquefied as seen above, but the technology therefor is complex and costly and transport over long distances is also extremely costly. Considering the costs, the cheapest way to transport natural gas is in a compressed (still gaseous) form through a large-diameter pipeline. This pipeline system constitutes a part of the reason for the dependence. It is extremely expensive to establish such a system, creating by that a true "natural monopoly" due to the high up-front investment costs, leading to long-term (typically 25-year) commitments. These commitments by buyers should justify the development costs of the pipeline. Furthermore, rising demand or supply in different regions cannot be balanced automatically as such infrastructures already need a lot of time to be build and considering that the investment can be postponed or never even be realized (due to geopolitical reasons), producers and consumers might not get connected at all.[47][48]

It seems that using a pipeline isn't that much cheaper considering the costs for its construction, but once the pipeline system is in place, natural gas can be supplied at a unit cost far below what a competitor would ask in order to set up a competing supply system. This allows the first system to maintain its monopoly and charge a sufficient price to compete with oil and coal and to recoup the up-front investment in a reasonable time frame. This leads to long-term contractual relationships as already mentioned before. Without competing pipelines or LNGs, a market price seems to be impossible and natural gas is rather priced through buyer-seller negotiations. The price usually paid is bounded below by unit costs of production plus the low marginal cost of pipeline transport and from above by the costs to the users of retooling to use alternative fuels. These negotiations lead to market power for the supplier, in our case Russia. The risk of market power and the possible response have been discussed above; the concentration here lies on the network interdependence.[49]

[47] Richard E. Ericson (2009) : Eurasian Natural Gas pipelines : The Political Economy of Network interdependence, Eurasian Geography and Economics, 50:1, p.29

[48] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.8

[49] Richard E. Ericson (2009) : Eurasian Natural Gas pipelines : The Political Economy of Network interdependence, Eurasian Geography and Economics, 50:1, p.29-38

The "lock-in" effect created by the pipeline networks leads to a deep dependence and allows for political leverage. Especially the price is politically influenced, reflecting more interstate relations than costs and benefits (Russia and its independent neighbors) and the balance of market power when stronger states interact. In fact the negotiated pricing formula for the delivery of natural gas to Europe is based on the market price of a primary potential fuel substitute, oil. Security issues for both countries arise due to this network interdependence. Europe will be deprived of natural gas in case of a supply disruption and Russia will have the negative effects of not getting paid. Supply disruption and/or price increases are even more hurtful for the Eastern European countries and former states of the Soviet Union, which are more dependent on Russia than Western Europe, giving Russia even more leverage for the pursuit of economic and political objectives. In this case Russia uses natural gas as a political weapon as Russia has managed to sustain its monopoly over almost all existing pipeline systems to Europe and kept Caspian gas under its control and by that has kept itself in a privileged position in Europe. The infrastructure of the pipelines however gives some of these countries (e.g. Ukraine, Moldova, Belarus, Poland) a "countervailing power" as they control sections of the pipelines needed to export natural gas to Europe.[5051]

This circumstance constitutes another vulnerability, meaning that additional to facing an ultimate monopoly supplier, Europe also needs to deal with uncertainties introduced by relations between that supplier and a number of transit states. These transit states suffer physically and financially from disruptions in the network flow, as they are users and recipients of income from the transit tariffs. Some case studies will be analyzed in more detail later on, but as history has shown, Europe's natural gas supplies are subject to disruption from political difficulties between Russia and former states of the Soviet Union. This shows that security of supply is very important. There exist buffers for these situations of supply disruption, like natural gas storage facilities and financial reserves, but with time these buffers will be exhausted. In that case having no energy input is a by

[50] Richard E. Ericson (2009) : Eurasian Natural Gas pipelines : The Political Economy of Network interdependence, Eurasian Geography and Economics, 50:1, p.29-38
[51] Mert Bilgin (2009) : Geopolitics of European natural gas demand : Supplies from Russia, Caspian and the Middle East, Energy Policy 37, p.4482-4492

far more serious problem than financial difficulties, as people's lives are directly affected by it. The financial problems can be addressed on world credit markets.[52]

To recapitulate the asymmetric interdependence, it shows that users (Europe in our case) of natural gas are more vulnerable than suppliers. Users, including transit states, need to deal with the physical lack of natural gas, which has a direct impact in the welfare of people, especially in winter, due to the lack of heating and cooking fuel, as well as electricity as a substitute power. This impact can cause economic breakdown as well as political and social instability and the costs to protect users from this are too high for a disruption situation to last long.
Suppliers (Russia in our case) on the other hand have direct control over the flow of natural gas to users, only limited by alternate gas supplies and their willingness to bear the financial consequences of their decisions. If they decide to interrupt the flow of gas, they have to suffer a financial opportunity loss, which means that they do not receive the expected income needed for necessary expenditures. These costs are largely long-term; they don't have an immediate impact on the overall economic activity and can mostly be compensated for through fiscal and monetary policy. It is clear that if the supply disruption lasts long enough, this also becomes a serious problem for the suppliers, but in comparison with users, suppliers can handle such a disruption far longer. This asymmetry is even more pronounced in the case that the supplier has substantial market power, which can be seen for Russia and Gazprom.[53]

4.8 Necessity to consider geopolitics for the natural gas market

The previous paragraphs showed the dependence between Russia and Europe created by the natural gas transport system and political decisions and underline therefore the necessity to apply geopolitics. As mentioned before only applying economic factors to study the natural gas market are not enough, geographical and political forces should also be considered. The natural gas market differs from other markets in various points, some of which will be named hereafter. First, huge required investments resulting in

[52] Richard E. Ericson (2009) : Eurasian Natural Gas pipelines : The Political Economy of Network interdependence, Eurasian Geography and Economics, 50:1, p.38-40
[53] Richard E. Ericson (2009) : Eurasian Natural Gas pipelines : The Political Economy of Network interdependence, Eurasian Geography and Economics, 50:1, p.38-40

huge sunk costs and relatively small variable costs and the risk of hold up and risk allocation are responsible for the contractual nature (long term, take or pay). Second, gas is distributed unevenly on earth and substantial transport costs (above 8 times more than oil) made long term contracts the less risky alternative. Third, bilateral relations can be seen, an example being the monopolistic-monopsonistic relationship between Norway and the Ruhrgas consortium. Fourth, transit countries can cause externalities making cost-ineffective investments preferable, as the third party violates the right of producer and consumer to be in the market freely. And last, many players are nations where regulation is restricted compared to the anti-trust regulation of private companies. [54][55]

The crucial role of geography lies in the selection of paths of pipelines or LNG ports. If an abstract setting is being considered, an optimization problem of selecting optimal trajectories of pipelines in a 2-dimensional space should be solved. Leaving other constraints apart, there exists a problem with spatial density of discovered gas deposits and density of consumption around the world, leading to a continuum of possible paths. These paths can be aggregated under a class of ideas, which can result in a set of generalized pipelines. Of course new discoveries of gas deposits need new pipeline routes. Another role of geography lies in its influence on market structure. It "brings spatial heterogeneity in market access for different market participants"[56]. This may lead to local monopolies or, in the case of transit countries, to the dependence on the third party of the relationship between producer and consumer.[57]

The role of politics needs also to be considered and in our case it is important to take into account potential rewards for Russian and EU politicians if they behave uneconomically. Politicians need at least some support to survive in their field of work and to get this support they might like the idea of non-economic considerations as for example the idea of a Russian or European super-power. Opportunistic behavior in the

[54] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.3-4
[55] Yuri Yegorov, Franz Wirl (2011) : Gas transportation, geopolitics and future market structure, Futures 43, p.1057
[56] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.7
[57] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.5-7

case of politics cannot be tamed with long-term contracts and therefore markets may be made more inefficient due to politics.[58]

The study of Hayes & Victor gives some more insight in the interaction between economics, geography and politics. Coming back to geography and politics while taking a look at the role of state, case studies show that the exit of state from gas trade has been slowed by namely these two segments. Even if private firms are big players in different countries, host governments still maintain control over taxation, royalty treatment and access to gas resources. There are still a lot of gas reserves, but R/P ratios differ among producing countries, especially due to geography. Pipelines are the cheapest way to move gas and so proximity to large markets is essential. That's why geography needs to be considered.

Another factor in the study was security of supply. The oil crisis in the 70's caused an increase in gas trade, which was followed by the construction of infrastructures that needed long-term planning. Long-term contracts helped with this by assuring energy security for governments and making investments less risky for investors. As political factors can affect the risk of investment in different countries, they should not be forgotten when studying the gas market.[59][60]

The difficult part is to find a balance between applying geopolitics and economics to the natural gas market. The year 2014 has shown that focusing purely on geopolitical interests instead of accounting also for economic interests can cause more damage than it will do good. One restriction of geopolitical origin was to join the US embargo on Iran. Iran holds 15% of the world reserves and it is expected that between 2011 and 2035 Iran will increase its production by 56 bcm, which results in increasing natural gas exports. The decision of the EU however deprives Europe from this potential gas supplier and competitor to Russia. The NABUCCO project, which was declared dead at the end of 2014, could have used gas from Iran.

[58] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.7-9

[59] Mark H. Hayes, David G. Victor (2006) : Politics, markets and the shift to gas : insights from the seven historical case studies, Natural Gas and Geopolitics : From 1970-2040, David G. Victor, Amy M. Jaffe, Mark H. Hayes, Cambridge University Press, p. 319-356

[60] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.9-10

There have also been sanctions against Russia from the part of the EU harming not only the economics of Russia, but due to the interdependence, also the economics of Europe. The natural gas sector of Europe may suffer severely in the future because of these sanctions. The shift to geopolitics will also harm Europe (not just gas sector) eventually. As seen before geopolitics is important to consider, but only while also considering economics. In response to these sanctions, Russia will now put its volumes to Turkey and then to its border with the EU, which means that the EU has to finance the pipeline from Turkey by itself. Even more important for the EU is that the power of Turkey as a transit country will increase, not only for Russian gas, but also for gas from the Caspian area and from the Middle East.
Geopolitics has too much influence on economics in Europe and non-economic limitations of gas supply from the holders of large gas reserves, like Iran and Russia, will only increase the costs for Europe.[61]

5. Gas transit games

5.1 Problems of gas markets and emergence of transit games

Gas transit is an interesting economic phenomenon, which relates to market structures, externalities and emerging games. Transit games represent an important policy issue and the possibility to apply interdisciplinary approaches. The next part of the paper will discuss two case studies, applying economics as well as geopolitics. Therefore the analysis of the first transit game that will be described focuses more on economics, whereas the analysis of the second transit game takes also geography, politics and technology into account.[62]

As mentioned before, large distances often separate producers and consumers in the gas industry and these distances even grow over time as closer locations are depleted and more remote production areas start to work. The connection of supply with demand

[61] Yuri Yegorov, Franz Wirl, Jalal Dehnavi (2015) : Future of Natural Gas in EU : Will Geopolitics take over Economics?, Conference : IAEE 2015, p.6-11
[62] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.1-2

(net gas producer with a net gas consumer) leads to several problems, including politics, logistics and investment. The political problem means that there is sometimes no way around a third country, which then can constitute a negative externality in the model. The logistic problem tries to find a feasible path for a pipeline or LNG chain and to plan and implement this project. The investment problem has already been described earlier in this paper, as the infrastructure is very costly and an investor has to be found as often neither the producer nor the consumer can finance a transport route alone. Of course this project has to be profitable for an investor to finance it and he has to take into account all the economic and geopolitical risks.[63][64]

There are several obstacles for fully competitive gas markets, some of which have already been mentioned before, and this is just a quick reminder. Due to nature, politics and scale economies, there are only a few gas producers, though these are still sufficient for substantial competition. The main problems are the dominance of the pipeline technologies, the high transport costs and the necessity to pass through a third (transit) country. The high infrastructure costs don't allow for high competition in transit and therefore transit countries have often substantial power over transit, leading to the emergence of transit games.[65]

A transit problem only arises if a gas pipeline passes through a third country, which seeks rents or blocks or sabotages pipelines or pipeline plans. This means that when the producer and the consumer are directly linked (the pipeline passes only through their own countries), there is no transit problem. This is also the case of LNG trade where both the producer and the consumer have ports with only international sea between them.[66]

In the case of a transit problem, several sub-cases are possible. For example if there are one or more pipelines that connect the producer to the consumer, especially if these pipelines pass through different third countries as it is the case of Russia, namely Ukrainian vs. Belorussian transit. Another sub-case is if the transit country is gas net

[63] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.14
[64] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.1-2
[65] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.14
[66] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.1-2

exporter (Turkmenistan), gas net importer (Ukraine) or not in the gas market at all. At last it could be that the transit country is member of a political block, which means that political interests of another (fourth) country or even more countries can impose negative externalities.[67]

5.2 Different types of games

There exist different types of transit games due to geography and politics. Considering the above-mentioned scenario of a unique pipeline going through a third country, there can be an emergence of pie (so-called pie-splitting game) if the pipeline transit generates above cost level. The pie-splitting game is a bargaining game from game theory and the split depends on the distribution of bargaining powers. Even if transit prices are internationally regulated, the different locations of producers and consumers still lead to typical oligopolistic games. Furthermore, as some countries can punish another country using monopoly over transit, there may be political externalities. These games can be modeled using game theory.[68]

5.3 Ukraine

The first case study concentrates on the Ukrainian gas transit game, including the three players Russia, Ukraine and Europe. In fact it tries to answer the question how and why the gas transit confrontation has emerged. This is done by taking a look at the interaction between the three players based on the dynamics of losses from confrontation. As it is a case study, the paper will take a quick look at the history leading to Ukraine becoming a transit country and at the events leading to the transit game of 2009.[69]

[67] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.14
[68] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.17
[69] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.15-16

In 2009 all Russian gas had to cross transit countries (Ukraine and Belarus) before reaching the border of the EU. There was no possibility of a direct connection between Russia and the EU, without passing through one of these two transit countries. This problem only emerged with the dissolution of COMECON (Council for Mutual Economic Assistance) and the divorce of FSU (Former Soviet Union). In the 1980s, when the transcontinental gas pipelines have been constructed, the USSR (Union of Soviet Socialist Republics) was responsible to deliver the gas at the West German border. This was a situation of vertical integration, meaning that the owner of the production facilities was also the owner of the transport infrastructure. In this scenario, there was no transit problem as the USSR included all soviet republics (Ukraine and Belarus) and as Eastern Europe belonged to the COMECON block.

When this changed, Ukraine, Belarus and the eastern European countries (EEC) inherited the pipelines. As EEC entered the EU, one transit problem disappeared, but Ukraine wanted to seek rents from its position as a transit country and so Russia couldn't privatize the Ukrainian pipelines. Legal enforcement was not high and in the 1990s, Ukraine began to siphon some gas without paying, making the problem not only an economic one, but also a political one. Before the Orange revolution of 2004, Russia hoped to create a common economic space, but as it became clear that this wasn't an option for Ukraine, Russia didn't see any more reason to continue subsidizing the price of gas for Ukraine, which was only $50 for Russian gas in 2004.[70][71]

In 2008, Ukraine only paid 170$/tcm, which was less than half of the European price. A rapid increase of the gas price for Ukraine to the world level would have made its economy bankrupt and so Russia suggested a slow increase of the price. Ukraine however wanted to use its position as transit country to either keep the price low or to ask high transport fees. This became obvious when Ukraine asked 9$/tcm as cost of transit instead of the usual 1.7$/tcm per 100km during negotiations with Russia. This led to the gas conflict in January of 2009, as no agreement between Ukraine and Gazprom could be found (Gazprom asked 450$/tcm and full debt repayment). The situation in January changed dramatically during just a few days. Gazprom reduced its gas supply to Ukraine, while keeping its supply to EU at a steady level. Ukraine then

[70] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.15-16

[71] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.2-4

illegally took off some gas from the transit pipelines, which had bad consequences for other European countries, which didn't get the gas they asked for (e.g. Greece, Italy, Poland). Gazprom requested that Ukraine should supply these countries with the gas they stole, but Ukraine refused. Gazprom used alternative supply routes (Belarus and Blue Stream) to fulfill its obligations towards the EU, but couldn't compensate for all of the gas that was lost due to Ukraine. This was between January 4th and January 6th and on the 6th, the EU asked Russia and Ukraine to come to some agreement and to fulfill their contract, as several countries already didn't get no gas at all. On the 7th of January, the transit of gas via Ukraine stopped completely and wasn't resumed until the 19th of January 2009, as Russia and Ukraine didn't reach an agreement on gas price and transit fees.[72]

5.3.1 Problem analysis

For analyzing this problem, the fact that Russia and Ukraine didn't reach an agreement leads to external costs for Europe. Both parties (Russia and Ukraine) can decide at each point in time to agree to a settlement or to continue the conflict. The duration of the conflict is also linked to the storage volume of each player, as this one determines the time each player can hold out without having too high losses.

Ukraine has 31 bcm of storage capacity, 16bcm are its own deposits, and the rest are strategic deposits for EU supplies. Considering Ukraine's consumption, its own production and its storage capabilities, Ukraine can go several months without gas supplies and without incurring substantial losses.

Russia has 65 bcm of storage capacity, which is higher than Ukraine's, although some of this capacity is used for more purposes and not just for storing undelivered gas.

European countries have very heterogeneous storage capacities, which means that some countries are better prepared than others (Austria vs. Moldavia). This means also that every day that goes by without new gas supply, an increasing number of households are affected by gas shortages until every country is exposed. The asymmetric interdependence is hereby shown again.[73]

[72] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.4-5
[73] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.5-6

The losses depend on the duration of the conflict as mentioned above, so let $h_i(t)$, i=R=Russia, U=Ukraine, E=Europe denote the damage per unit of time as a function of the duration of the conflict. These hazard functions differ substantially across the three players. Let T_i i=R,U,E, denote the date the reservoirs are either empty (Ukraine or Europe) or full (Russia). For simplicity a step function with a discontinuity at T_i is used. The heterogeneity among Europe is expressed by the linear hazard function,

$$h_E(t) = \begin{cases} \delta_E t & < T_E \\ \text{for } t & \\ \delta_E t_E & > T_E, \end{cases}$$

since each day without gas supply leads to more consumers being cut off from gas. At $t \geq T_E$ all European inventories are depleted and all consumers that are dependent on Russian gas are affected, leading to the constant ($h_E T_E$). The cumulative damage is quadratic (due to integration with respect to the duration of the interruption) and as a consequence (and as already established before the model), Europe has a strong incentive to settle the conflict, either by arbitrating, threatening or bribing.[74]

One way to calculate the magnitudes of these damages is by computing the loss in consumer surplus. Supposing that gas storages are empty leads to a supply cut by a certain share (in this case the fraction of Russian gas in consumption, 80% for Ukraine, 63% for Austria and 43% for Germany). Assuming a short-term elasticity of ε=0.1, linear demand and the demand-price ($170 for Ukraine and $400 for Austria and Germany), the short run demand relation can be reconstructed and the daily welfare losses can be estimated: $105mln for Ukraine, $19mln for Austria and $84mln for Germany. Using Austria's and Germany's losses a rough estimate of $0.2bln losses per day can be calculated for the EU.[75]

As mentioned before, the losses for Ukraine and Russia are much smaller than for the EU during the first 5-6 months, due to their storage capacities. Mostly deliveries are just postponed, meaning that the loss of revenues for Russia is modest and the reputational loss is estimated by adding the penalties for Gazprom that are evaluated at $4mln per day plus a reduction of future contracts of $1bln/year, leading to an amount of $2.5bln/year. As long as Russia has some storage space left, these losses don't seem too

[74] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.7
[75] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.7-8

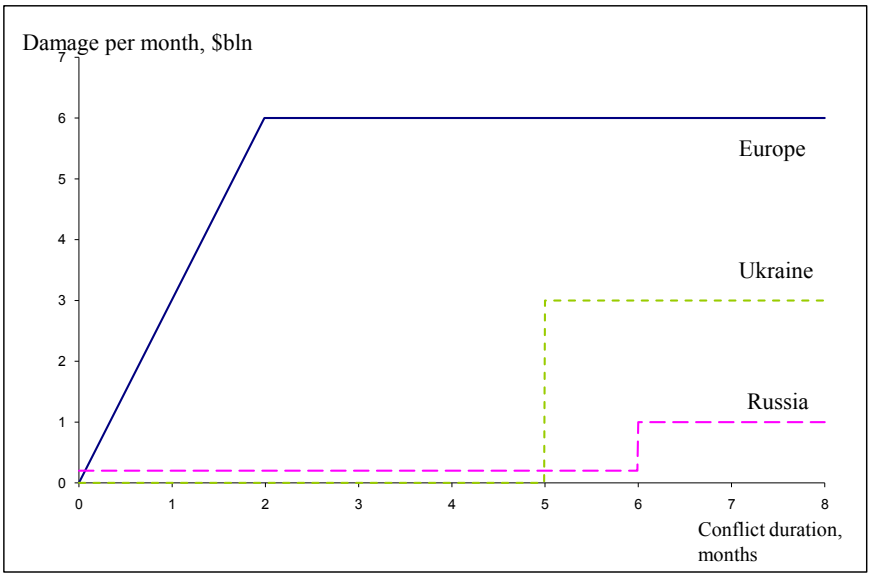
high. Ukraine has only a small reputational loss. On the geopolitical side, Russia alienates a friendly Slavic brother, but shows the world that it is a tough political player.[76]

The next problem is when all the deposits are filled and Russia needs to burn some of its gas. 75% of Russian gas export to Europe goes through Ukraine, and the value of this gas is $24bln. Assuming that half of this gas cannot be extracted without burning, the annual loss for Gazprom is $12bln. Not being able to sell gas to Ukraine at European price also results in a loss of $12bln/year.

The same goes for Ukraine, only that Ukraine suffers when the storages are empty. Ukraine produces only 25% domestically and gets 75% from Russia. The annual subsidy for Ukraine lies at $12bln and by 2011, without being able to seek high rents (due to Nord Stream), this is of the order of $36bln.

These losses can be seen in Figure 12, where European losses are already very high after two months, whereas the losses for Ukraine and Russia only start to become high after 5 or 6 months.[77]

Figure 12: Damage per unit of time and as a function of the duration (t) of conflict – no Russian gas deliveries to Ukraine



Source: Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.9

[76] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.8
[77] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.8-9

After taking a look at the losses, the next part will concentrate on the profits that can be gained with different contracts. For simplicity, a contract only includes two numbers (*G,A*), where *G* is the price of one unit (1 tcm) of gas for Ukraine and *A* is the transit fee through Ukraine (price to move 1 tcm of gas over 100km). Each pair (*G,A*) determines the net present value of future profits, $V_R(G,A)$ for Russia, $V_U(G,A)$ for Ukraine and $V_E(G,A)$ for Europe. The pairs *(G,A)* can have a lot of different values with *R** being the best possible contract for Russia, *U** the best for Ukraine and *E** the best for Europe. Expressed arithmetically this gives *R**=argmax $V_R(G,A)$, which is subject to some constraints. Of course Russia prefers a high *G* and a low *A,* whereas Ukraine hopes for exactly the opposite. Europe is not directly affected by the pair *(G,A)* and suffers only external costs, but may value that Ukraine will get some preferential terms and thus the rankings of the Russian and Ukrainian payoffs are as follows:

$$V_R(U^*) < V_R(E^*) < V_R(R^*), \qquad V_U(R^*) < V_U(E^*) < V_U(U^*)$$

In order to assess the loss after depletion, V_C represents Ukrainian gas imports, V_T denotes the volume of gas transiting Ukraine to Europe, p the gas price for Ukraine, p_e the gas price for Europe, p_t the price of gas transit per 100km, L the average distance of transit measured in hundreds of km. The real (1.7) and negotiated cost of transiting has also to be considered. The profit for Ukraine can then be estimated as the sum of implicit subsidy plus rent earned on transit:

$$\prec = (p_e - p)V_C + p_t L V_T$$

Considering realistic numbers: p_e = 400$/tcm, p = 170, p_t = 1.6$/tcm per 100km, V_C = 60bcm, V_T = 130bcm, L =10; then $\prec$ = *const* along the line $\Delta p = 20\Delta p_t$. If the price of the Ukrainian gas imports is increased by 20$/tcm, then Ukraine is indifferent to this if there is also an increase of the transit tariff of 1$/tcm per 100km.[78]

For simplicity the following ideal outcomes for the different players are assumed:

$$R^* = (400,2),\ E^* = (300,3),\ U^* = (200,4)$$

[78] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.9-10

Ukraine couldn't pay a favorable contract (G_0,A_0) = (170,1.6) at the end of 2008 and hopes therefore for a contract (G_0,A_0) = (200,2), which would leave its payoff almost unchanged. Europe would then have to pay a gas price of about $400. The implicit subsidy for Ukraine amounts to $12bln annually.
With the contract R^*, Ukraine would have to pay $400 for 1 tcm of gas and receive $2 per 100km of transit. Ukraine would loose in this case, but Russia would also have a geopolitical loss by loosing its opportunity to bring Ukraine closer.
On the 18th of January an agreement was reached between Ukraine and Russia with the contract (G,A) = (360,1.6), which was a 20% discount from European prices.[79]

5.4 Turkmenistan

The difference between the case described above (transit from Russia via Ukraine to EU) and the following case (transit from Turkmenistan via Russia to EU) lies in the export property of the transit country. In the first case, Ukraine is net gas importer, which means that it doesn't export its own gas, but Russia only exploits Ukraine's pipeline infrastructure for its own export of gas. In the second case, Russia is net gas exporter, which means that it also exports its own gas. As seen earlier in this paper, the high transport costs and the limited number of producers give any exporter substantial market power. This leads to the fact that the export of Turkmen gas via Russia influences also the Russian export price. The land-locked geographical location of Turkmenistan has determined the market structure and Turkmenistan is largely dependent on Russia for its export, although there is some room for bargaining over the price of gas with Russia. The game structure for Turkmenistan is defined by Russia, whereas in the case of Ukraine, the game structure is defined by international law.[80]

Economic factors described the first model (Ukraine), but in the next case study geopolitics has become more important than economics. There are crucial constraints due to geography and politics as Turkmenistan is a land-locked country and has substantial reserves. Before 2006, Russia was only a transit country for Turkmen gas, giving Russia significant policy leverage, as Turkmenistan couldn't export its gas any

[79] Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.12
[80] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.23-24

other way to its main customer Ukraine. As Gazprom had difficulties in increasing its own gas production, it changed its strategy toward Turkmenistan. Instead of just transiting Turkmen gas, Russia now wanted to buy Turkmenistan's gas and to re-export it to other countries. From an economic point of view, this would benefit Russia, as it could buy the gas at a price that was significantly lower than the market price. One problem was that the price for Turkmen gas had to be renegotiated every year. The price that Gazprom had to pay at the Turkmen-Uzbek border went up from 44 to 150 dollars mcm over the period 2004-2008 (Figure 13). In April 2003 Russia and Turkmenistan signed a long-term agreement, which provided that Russia would import 2 trillion cubic meters (tcm) from Turkmenistan over 25 years. Annual gas trade in 2003-2006 was at 5-7 bcm and should increase to 70-80 bcm by 2009. Furthermore direct gas trade between Turkmenistan and Ukraine would cease in 2007, consequence of an agreement between Gazprom and Naftogaz (Ukraine). Gazprom forced this agreement to be reached by its control over Turkmenistan's pipeline system. The gas dispute between Russia and Ukraine in 2006 led to the agreement taking effect one year earlier and so Russia became a major buyer of Turkmen gas in 2006.[81][82]

Figure 13: Russia's purchase price of Turkmen gas at Turkmenistan's border and Russia's sale price of Turkmen gas at Europe's border

Year	Russia's purchase price of Turkmen gas at Turkmenistan's border ($/mcm)	Russia's sale price of Turkmen gas at Europe's border ($/mcm)
2005	44–60	213.70
2006	65	285.20
2007	100	294.10
2008	130–150	418.90

Source: Yusin Lee (2014): Opportunities and risks in Turkmenistan's quest for diversification of its gas export routes, Energy policy 74, p. 333

In 2009 the price for Gazprom for Turkmen gas rose sharply, reaching 300$/mcm. This was the same year as the conflict between Russia and Ukraine, and another blow for Gazprom. In the first quarter of 2009, Russian gas export almost fell by 40 percent. Gazprom wanted to renegotiate the price, but Turkmenistan refused, so Russia halted gas transit from Turkmenistan in April 2009. Turkmenistan didn't expect this and

[81] Yuri Fedorov (2010) : THE TURKMEN GAS GAMES, Security Index: A Russian Journal on International Security, p.45-46

[82] Yusin Lee (2014): Opportunities and risks in Turkmenistan's quest for diversification of its gas export routes, Energy policy 74, p. 332

couldn't adapt to the situation, as it has no gas storage capacities, causing an explosion of a pipeline on the 9th of April. Only at the very end of 2009 was an agreement reached between Russia and Turkmenistan, providing Russia with 30bcm every year. The main problem was, like in the case of Ukraine, that there was no alternative export route.
The geopolitical situation of Turkmenistan was about to improve as it had signed the General Agreement with China on the 3rd of April 2006. This agreement had the purpose of implementing the Turkmenistan-China gas pipeline project and Turkmenistan should supply 30bcm of gas to China every year, for a period of 30 years. This would make Turkmenistan less dependent on Russia.[83][84]

5.4.1 Problem analysis

The following model focuses on the transit game with the transit country being a net gas exporter. As mentioned before, this is the case with Turkmenistan and Russia. Only the gas for European consumers is considered and the following notations are being used in the model:

- Q_T – volume of gas produced by Turkmenistan;
- Q_R – volume of gas produced by Russia;
- Q – volume of gas imported by Europe from other producers (fixed here);
- P_T – price of gas from Turkmenistan at the border with Russia;
- P_E – price of gas in Europe;
- $C(Q_R)$ – unit cost to produce and deliver gas from Russia to Europe;
- C_T – unit cost to produce gas in Turkmenistan (assumed to be constant);
- τ – unit cost to transport gas via Russia;
- T – transit price via Russia (for unit of gas assuming international regulation);
- a – bargaining power of Turkmenistan ((1-a) – power of Russia)

There are two sub-problems, which are also considered in the model, namely the bargaining problem between Russia and Turkmenistan over the gas price P_T and the

[83] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.13-17
[84] Yuri Fedorov (2010) : THE TURKMEN GAS GAMES, Security Index: A Russian Journal on International Security, p.44-47

optimization problem of Russia taking into account the demand function and the bargaining outcome.
The model considers the mix of monopolistic optimization and bargaining and focuses on two cases, a regulated transit price and a non-regulated transit price.[85]

5.4.1.1 Regulated transit price

Having a regulated transit price, Russia knows that it can only get a mark up of $Q_T(T-\tau)$ for transiting Turkmen gas and which it sells directly to Europe. Turkmenistan alone decides about its production volume and its profit is now:

$$\Pi_T = Q_T (P_E - C_T - T)$$

Russia now only has to decide about its own production, as this could influence the European price. Q and Q_T are taken as given and so Russia has to solve the problem:

$$\max_{Q_R} \Pi_1, \quad \Pi_1 = Q_R P_E(Q_R+Q_T+Q) + Q_T(T-\tau) - CQ_R$$

The demand function is linear in order to get analytical solutions:

$$P_E = A-Q$$

In this case no pie-splitting game emerges, as Russia and Turkmenistan can both decide on their own output. Nevertheless there are some constraints, either on production capacities or on transit capacity. There may also be asymmetric information about transit cost in Russia. Taking a look at the volumes of flow, it becomes clear that any increase in Q_T undermines the price in Europe and by that also the profits of Russia. Russia can exploit asymmetric information about its transit capacity and own production in order to limit the transit flows of Turkmenistan and increase its profits. In

[85] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.19-20

this case, Russia would use its position as a transit country for its own benefits at the detriment of Turkmenistan. But will it always have the incentive to do that?[86]

With Q_{T1} being the capacity constraint on production and Q_{T2} being the capacity constraint on transit and given the profit function of Turkmenistan, Turkmenistan is interested to export gas on the maximal level, i.e. $Q_T = \min \{Q_{T1}, Q_{T2}\} = Q_{TM}$.
If the capacity constraint is binding, then the optimization problem for Russia only involves its decision about own production:

$$\text{Max } \Pi_1, \quad \Pi_1 = Q_R P_E(Q_R+Q_{TM}+Q) + Q_{TM}(T-\tau) - CQ_R$$
$$Q_R = (A-Q-Q_{TM}-C)/2, \qquad P=(A-Q-Q_{TM}+C)/2.$$

Suppose that $T-\tau > P_E-C$ for all range of prices given a feasible set of Russian strategies. This means that the marginal profit from transit exceeds the profit from exporting Russian gas. For this to happen the transit price set by the regulators has to be high enough compared to Russian cost or getting an extra unit of Russian gas is just too expensive. In the opposite case, $T-\tau < P_E-C$, Russia wants to substitute Turkmen gas by its own as the marginal gains of transit are low. To do this Russia can use the asymmetric information in order to limit the flow of Turkmen gas.[87]

Assume that cost depends on quantity and that the marginal cost to extract one unit of gas in Russia is C for $Q<Q_{R1}$ and sharply increases to γC (where $\gamma>1$) for $Q>Q_{R1}$. The natural threshold for Russian export may then be at $Q=Q_{R1}$. The European price depends on the sum Q_R+Q_T and so the marginal cost for an extra unit of gas in transit is Q_{R1}. The marginal benefit is $T-\tau$ and if $T-\tau-Q_{R1}>0$, then Russia will allow all possible transit gas from Turkmenistan.[88]

[86] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.20
[87] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.20-21
[88] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.21

5.4.1.2 Non-regulated transit price

The case of bargaining now has to be considered first, where Russia has to solve the following profit-maximizing problem:

$$\text{Max } \Pi, \quad \Pi=[Q_R+Q_T]P_E(Q_R+Q_T+Q) - C(Q_R) - P_TQ_T.$$
$$\{Q_R;Q_T\}$$

This function takes into account the belief about the price of Turkmen gas and decides how much Russia should produce of its own gas as well as how much gas it should import from Turkmenistan. Assume that cost is linear-quadratic, $C(Q_R)=cQ_R+dQ_R^2$, while demand is linear, $P_E=A-Q-Q_R-Q_T$. Two first order conditions lead to equations that reflect equalization of marginal costs for Russia either to produce one extra unit of its own gas or to import one extra unit from Turkmenistan and to a monopolistic decision about the optimal sum of flows, Q_R+Q_T. Finally,

$$Q_R=(P_T-c)/2d, \quad Q_T=(A-Q-P_T)/2 - (P_T-c)/2d.$$

This shows that Russia's decision on its own production depends on the price at which it can import Turkmen gas. If there is no bargaining over surplus, then Russia restricts the quota for Turkmenistan given some previously agreed price P_H. The supply cut of 2009 happened due to falling demand in Europe and a price set too high before.[89]

The next case is when Russia rationally expects future bargaining and thus optimizes the joint profit (pie size), which has to be split later. In this case Russia has to solve the problem where the price of Turkmen gas is substituted by its cost:

$$\text{Max } \Pi_j, \quad \Pi_j=[Q_R+Q_T]P_E(Q_R+Q_T+Q) - C(Q_R) - C_TQ_T.$$
$$\{Q_R;Q_T\}$$

This gives a slightly different solution as the optimal output now doesn't depend on the price, but on the cost of Turkmen gas:

[89] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.21-22

$Q_R^*=(C_T-c)/2d, \quad Q_T^*=(A-Q-C_T)/2 - (C_T-c)/2d.$

Turkmenistan gets the payoff:

$$B=Q_T(P_T-C_T),$$

where the gas price P_T is the outcome of the bargaining game. Given its power is a, Turkmenistan gets share a of the pie size S. This pie size is the difference of the values of Russia's profit it gets with the optimal output and the profit it gets when no gas comes from Turkmenistan:

$$S=\Pi_j(Q_R^*,Q_T^*) - \Pi_0(Q_R^{**},0),$$

where $\Pi_0(Q_R^{**},0)$ is the solution of the baseline problem (no transit of Turkmen gas). Russia has to solve the problem:

$$\text{Max}_{Q_R} \Pi_0, \quad \Pi_0=Q_R P_E(Q_R+Q) - C(Q_R),$$

and gets the baseline profit Π_0 at the optimal level of output Q_R^{**}. As mentioned before, Turkmenistan gets share a of the pie, B=aS, and so the bargaining outcome for the price on Turkmenistan's border is:

$$P_T=C_T + aS/Q_T^{**}.$$[90]

5.4.1.3 Capacity constraint for Turkmenistan

In a simpler example, it is supposed that Turkmenistan operates on its capacity limit: $Q_T=Q_{TM}$. This has to be allowed by Russia and Russia now only decides on its own volume, given any price of Turkmen gas at Turkmenistan's border. This problem is

[90] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.22-23

mathematically identical to the binding capacity constraint problem in the case of the regulated transit price, and thus $Q_R = (A-Q-Q_{TM}-C)/2$, $P=(A-Q-Q_{TM}+C)/2$.[91]

The pie size has to be calculated and also the shares of the pie. The total pie size is $S=Q_{TM}(A-Q-Q_R-Q_{TM}-C_T)$. Turkmenistan's profit, $B=aS$, should constitute the share of the pie, as a split of the bargaining powers is assumed. This gives:

$$P_T-C_t=a(A-Q-Q_R-Q_{TM}-C_T); \quad P_T=C_T+a(A-Q-Q_R-Q_{TM}-C_T).$$

The pie size depends on the Russian strategy and in this case it is the transit country (Russia), which defines the game. Russia allowed Turkmenistan to transit all of its gas, but bargained with it about the price on the border.
These different models have shown that the emergence and the structure of games depend on geography, international laws and politics.[92]

6. Turkish Stream

The relationship between Europe and Russia has been discussed in the previous chapters and the role of transit states has been explained and has even been illustrated by two case studies. The next part of the paper will take a look at the Turkish Stream project between Russia and Turkey. At first the events that led to the Turkish Stream will be discussed and later on a potential future transit game will be modeled.

6.1 History

In 2006, the South Stream project was launched, which should transport gas from Russia via Bulgaria through Serbia, Hungary and Slovenia, further to Austria (Figure 14). This pipeline should pass through the Black Sea and was intended to bypass Ukraine, due to all the problems Russia had (and as we know will have (see 5.3)) to endure with Ukraine being a transit state.

[91] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.23
[92] Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.23

The introduction in 2011 of the already discussed Third Energy Package (TEP) of the EU then worsened the regulatory environment for Gazprom dramatically. Regulated third party access to pipeline capacity as well as unbundling of transmission assets and certification of transmission system operators are part of the TEP and created problems for Russian gas export to EU countries. Maybe the biggest problem that Russia had to face was that the company, which owns the pipeline, couldn't be the owner of the gas that passes through that pipeline. This legal problem turned into a political problem, due to the Ukraine crisis. The EU's willingness to find a solution decreased and it even pressured member states to withdraw from the South Stream project. This led to Bulgaria not permitting Gazprom to lay the pipeline without permission from Brussels.
On 1st of December 2014, the Russian president Putin and Gazprom's CEO Alexey Miller announced during their visit in Turkey that the South Stream project had been cancelled due to the failure of the Bulgarian government to assure that the pipelines could be laid and due to the failure of the European Commission to provide assurances that gas could flow through the pipelines. President Putin said: "If Europe does not want it implemented, then it will not be implemented. We will redirect our energy flows to other regions of the world."[93][94][95]

[93] RT (2014) : Putin : Russia forced to withdraw from South Stream project due to EU stance, http://www.rt.com/business/210483-putin-russia-gas-turkey/, 31.08.2015
[94] Le Monde diplomatique (2015) : Why Russia cancelled South Stream, http://mondediplo.com/2015/06/07south-stream, 31.08.2015
[95] Jonathan Stern, Simon Pirani, Katja Yafimava (2015) : Does the cancellation of South Stream signal a fundamental reorientation of Russian gas export policy ? The Oxford Institute for Energy Studies, p.2-5

Figure 14: South Stream

Source: Gazprom (2014): Gazprom pushing ahead with South Stream and Southern Corridor projects, http://www.gazprom.com/press/news/2014/february/article184145/, 01.09.2015

The South Stream pipeline should have brought 63bcm to Europe and on the same day that the South Stream project has been scratched, Gazprom and the Turkish company BOTAS Petroleum Pipeline Corporation signed the Memorandum of Understanding on constructing the Turkish Stream pipeline, which has the same capacity. This new pipeline shall pass through the Black Sea via Turkey to the Greek border. Turkey replaces Ukraine as a transit country and it is assumed that its decision to participate in the Turkish Stream project goes along with its ambition to become an energy hub and not only a mere transit country. But the events before the signature under the Memorandum of Understanding show that Russia pushed Turkey to become part of the Turkish Stream project.[96][97]

At the end of September 2014, Russia began to reduce gas exports to Turkey to critical volumes. The heavily populated area of Istanbul only received half of the gas volumes they were used to. Normally Turkey receives 42mcm/day of Russian gas through the Trans-Balkan pipeline, going through Ukraine, Romania and Bulgaria. However, by the

[96] The Washington Review (2015): The Reality behind Russia's Turkish Stream, http://www.thewashingtonreview.org/articles/the-reality-behind-russias-turkish-stream.html, 01.09.2015

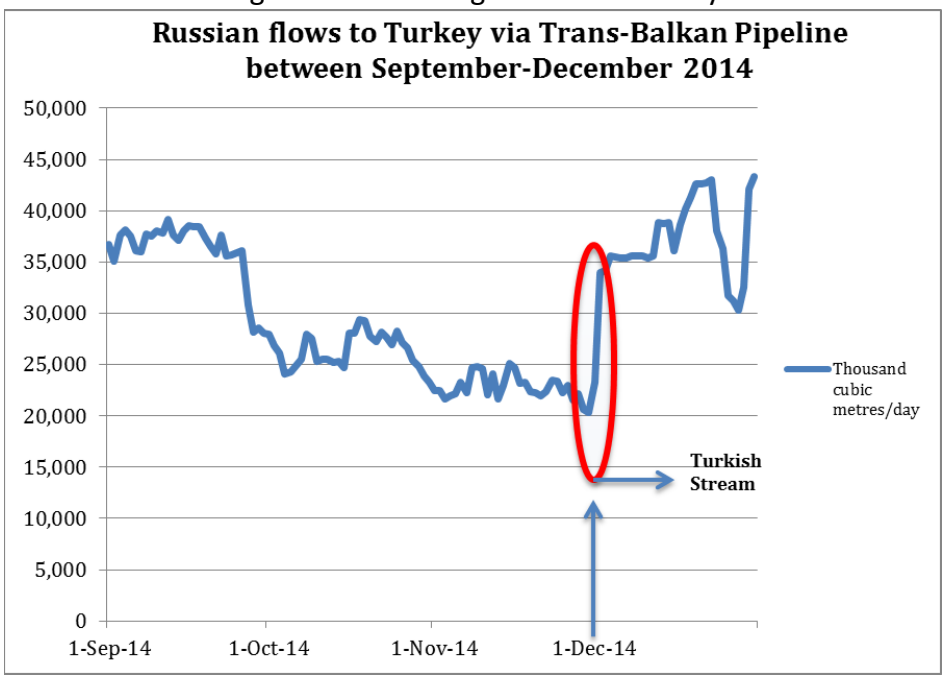
[97] Gazprom (2015) : Turkish Stream, http://www.gazprom.com/about/production/projects/pipelines/turkish-stream/, 01.09.2015

last day of November, imports of Russian gas have dropped to only 20.3mcm/day, creating panic among Turkey's government and private natural gas companies that there would be extensive blackouts during winter. Turkey is heavily dependent on Russian gas imports from the Trans-Balkan pipeline, as two-thirds of Turkey's energy consumption is concentrated in the northwestern Marmara region. The other sources of gas like the storage facility and the two LNG terminals in this area are not sufficient if there is a cut in Russian gas supply. Turkey's additional gas imports from Iran and Azerbaijan, as well as from Russia (Blue Stream) land in the east of Turkey and technical constraints in the transport infrastructure make it difficult to move the gas to the west, leaving Turkey's energy security and economy at risk. During October and November the risks of a crisis grew steadily as there weren't enough supplies to cover peak demand in winter.[98]

However, within two days of president Putin's visit to Ankara and the decision of Turkey to take part in the Turkish Stream project, daily volumes of gas imports from Russia in the Marmara region increased by 13 mcm/day and by mid-December they reached their normal daily average of 42 mcm/day (Figure 15). There were no explanations from Gazprom to why they cut gas supplies to Turkey and the ongoing conflict in eastern Ukraine could have been the reason for the supply cuts. But there is also reason to believe that Russia wanted to pressure Turkey into signing up to the Turkish Stream project.[99]

[98] The Washington Review (2015): The Reality behind Russia's Turkish Stream, http://www.thewashingtonreview.org/articles/the-reality-behind-russias-turkish-stream.html, 01.09.2015
[99] The Washington Review (2015): The Reality behind Russia's Turkish Stream, http://www.thewashingtonreview.org/articles/the-reality-behind-russias-turkish-stream.html, 01.09.2015

Figure 15: Russian gas flows to Turkey



Source: The Washington Review (2015): The Reality behind Russia's Turkish Stream, http://www.thewashingtonreview.org/articles/the-reality-behind-russias-turkish-stream.html, 01.09.2015

6.2 Details

Turkey is the second largest sales market for Gazprom behind Germany. The gas consumption in Turkey has doubled over the last 10 years and in 2014 Russia exported 27.4 bcm of natural gas to Turkey. The Turkish Stream pipeline will bring additional Russian gas to Turkey, besides the gas from the Trans-Balkan pipeline and the Blue Stream pipeline. The Turkish Stream pipeline will run from the Russkaya CS near Anapa across the Black Sea to Kiyikoy village in the European part of Turkey further via Luleburgaz to Ipsala on the border between Turkey and Greece.

The offshore part of the pipeline will be 910km long, 660km of which will be laid in the old corridor of the South Stream pipeline and 250km within a new corridor towards the European part of Turkey. The maximal depth of the pipeline through the Black Sea will reach 2200m. Gazprom will build the 660km long section.

The onshore part of the pipeline will be 180km long from the Black Sea coast to the border between Turkey and Greece. Luleburgaz will be the delivery point for the gas intended for the Turkish customers, whereas Ipsala will serve as delivery point for the European customers. Gazprom will partner up with BOTAS to build the 180km onshore part.

The capacity of the four strings will total 63bcm of natural gas per year. 15.75bcm/year are intended for the Turkish customers and 47.25bcm/year are supplied to the Turkish-Greek border.[100][101][102]

Figure 16: Turkish Stream

Source: The Washington Review (2015): The Reality behind Russia's Turkish Stream, http://www.thewashingtonreview.org/articles/the-reality-behind-russias-turkish-stream.html, 01.09.2015

6.3 Model

In order to try and find out if the Turkish Stream will be a good investment, the next part of the paper takes a look at the profits that Europe, Russia and Turkey can make. This means it models the transit game between Turkey and Russia. Therefore we consider three different cases: the first case reflects the reality the best, as it shows the profits that are calculated with the most realistic numbers. This means that the negotiations concerning the Turkish Stream are still not finished and that we use the numbers that are right now the most probable ones to be chosen. There are still some points in the negotiations that haven't been made public and here we can only make assumptions.

[100] Gazprom (2015) : Turkish Stream, http://www.gazprom.com/about/production/projects/pipelines/turkish-stream/, 01.09.2015
[101] Gazprom Export (2015) : TurkStream, http://www.gazpromexport.ru/en/projects/6/, 01.09.2015
[102] The Washington Review (2015): The Reality behind Russia's Turkish Stream, http://www.thewashingtonreview.org/articles/the-reality-behind-russias-turkish-stream.html, 01.09.2015

As nothing is definite, we are left with speculations, which will be used for the other two cases. These cases show on the one hand what would happen if the best case for Russia would be applied and on the other hand what would happen if the best case for Turkey would be applied.
Russia and Turkey planned the Turkish Stream without Europe and that's why Europe isn't directly affected, but just indirectly. Therefore Europe doesn't take part in the negotiations between Turkey and Russia concerning gas price and transit fees and so we don't have a best case for Europe. But the effects of the negotiations affecting Europe will be looked at.

6.3.1 First scenario

Turkey only exports a very small portion of the gas it produces. This portion is so small that it can be neglected. Turkey imports 99% of its natural gas, leaving its own production just with 1% and consequently just a negligible amount of exports (numbers of 2013). The case of the Turkish Stream and Turkey as a transit country becomes the case of a net gas importer. Therefore it will be comparable to the case of Ukraine, which was also a net gas importer.[103]

We will take a look at the profits that Turkey and Russia make per year and for simplicity only take economic factors into account. The geopolitical effects will be discussed afterwards. The focus lies on the Turkish Stream, other pipelines going through Turkey are not considered here. Then the parameters used for the formulas are the following: p_t denotes the price for gas transit per 100 km, L denotes the length of transit (in this case just the length of the Turkish Stream) measured in hundreds of km, V_E denotes the volume of gas transiting Turkey on its way to the Turkish-Greek border (gas destined for Europe), p_T denotes the gas price for Turkey, p_E denotes the gas price for Europe and V_T denotes the volume of gas destined for Turkey and coming through the Turkish Stream pipeline. The profit of the Turkish Stream for Turkey would then be:

$$\rho_T = p_t L V_E - p_T V_T$$

[103] eia (2015) : Turkey, http://www.eia.gov/beta/international/analysis.cfm?iso=TUR, 21.09.2015

Turkey and Russia are still discussing the price for transit and we need to assume this price. Ukraine wanted to raise their price for transit from 2.70$/tcm per 100 km to 5$/tcm per 100 km, which Russia didn't want to pay. Let us assume that in this 'realistic' case, the price for transit will be at p_t=3.7$/tcm per 100 km. The length of the pipeline is almost 1100 km, so L will be 11, V_E = 47.25bcm and V_T=15.75bcm. The price that Turkey pays is at 407$/tcm (we will use the numbers of 2013 for the gas price), but during the negotiations with Russia, Turkey seems to have managed to get a 10.25% discount on its price for gas. This would mean that the price of gas for Turkey would now be at 365.2825$/tcm. For readability, we will only calculate with 365$/tcm. The 'profit' for Turkey would then be: -3 825 675 000$, which constitutes an opportunity loss! By opportunity loss we mean that the formula results in a negative number, but is still in someway a win for Turkey, as they would have to pay much more for Russian gas if they wouldn't get a discount on the gas price or the transit fees that Russia has to pay them. The negative number is due to the amount of gas that Turkey gets from Russia for its own purpose, but would be a lot higher if they wouldn't be the transit country for the gas going to Europe.[104] [105]

This result shows that even though Turkey gets paid for the transit of Russian gas through its territory, this doesn't put Turkey even with what they are paying for their own imports going through the Turkish Stream. But it shows also why Turkey is still arguing with Russia over the price for transit and the price of gas, as Turkey wants to get as much as possible for the transit and pay as little as possible for Russian gas in order for the Turkish Stream to really benefit Turkey.

It is important to understand that the Turkish Stream project means more for Turkey than just money. Turkey aims at becoming an energy hub someday and being a reliable and strong transit country may help. Its geographic position also helps with this aim and that's why Turkey is bargaining for an optimal deal with Russia. Russia needs Turkey for their new pipeline, leaving Turkey with some leverage over Russia. But Turkey imports most of its gas from Russia, creating an interdependent relationship, which reveals itself in the negotiations between these two countries.

[104] eia (2015) : Turkey, http://www.eia.gov/beta/international/analysis.cfm?iso=TUR, 21.09.2015
[105] ASIA TIMES (2015) : Russia-Greece pipeline : Will Turkish Stream ever stream ? http://atimes.com/2015/06/russia-greece-pipeline-will-turkish-stream-ever-stream/, 22.09.2015

Figure 17: European prices ($/tcm) for Russian gas (2013)

Macedonia	564
Poland	526
Bosnia-Herzegovina	515
Czech Republic	503
Bulgaria	501
Lithuania	500
Denmark	495
Slovenia	486
Ukraine	485
Greece	478
Serbia	457
Estonia	442
Switzerland	442
Italy	440
Romania	432
Slovakia	429
Latvia	416
Turkey	407 (with 10.25% discount → 365)
Austria	397
France	394
Hungary	391
Finland	385
Germany	379
Netherlands	371
Moldova	368
United Kingdom	313
Armenia	189
Belarus	166
Europe	422.5

Source: Figure created by author, data from: Radio Free Europe Radio Liberty (2015): Gazprom's Grip: Russia's Leverage over Europe, http://www.rferl.org/contentinfographics/gazprom-russia-gas-leverage-europe/25441983.html, 22.09.2015

Let us take a look at Russia's profit from the Turkish Stream. Here fore we will need to know the price of gas that Europe pays. In Figure 17 are listed the gas prices for Russian gas of 28 European countries (Armenia is here also considered as being part of Europe). The price range varies from 166$/tcm to 564$/tcm. To calculate the average gas price we already considered in this case the 10.25% discount for Turkey. On average a European country has to pay 422.5$/tcm.

We will calculate the profit for Russia the same way than we did for Turkey. From the result that we got for Turkey we can deduce that the profit for Russia will be a positive number. The profit that Turkey makes for transiting Russian gas doesn't help them to break even on the cost of their own gas imports coming from the Turkish Stream. This shows that the profit that Russia makes is higher than what they have to pay for transit, and we didn't even consider the 47.25bcm of Europe here. This volume destined for Europe will be taken into account in the next formula, as well as the average price for Russian gas for a European country that was calculated earlier. The profit would then be:

$$\rho_R = (p_E V_E + p_T V_T) - p_t L V_E$$

The numbers remain unchanged leading to a Russian profit of 23 788 800 000$! As mentioned before, this positive number was to be expected, otherwise Russia wouldn't want to build the Turkish Stream. The question for Russia is if their move away from Ukraine to Turkey will be a good one in the long run. Their negotiations about transit price and price of gas are already lasting longer than expected by the Russian government. Furthermore Turkey, as a transit state, is even more powerful than Ukraine, because of their geographic position. Being a transit state for pipelines not coming from Russia, Turkey has some leverage in the negotiations. Getting most of their gas from Russia makes Turkey dependent on Russia, but they still know that they have a strong position and can use this in the negotiations. Russia has to try and make this investment profitable in the long run, without forcing Turkey to behave like Ukraine. Or else there will be a next transit game in the future.

Europe is just indirectly affected. The transit price will most certainly have an effect on the price that European countries pay for gas. This has to be determined in the future, as

well as how Europe will manage to get the gas from the Turkish-Greek border to the different countries. The relationship between Europe and Russia also suffered due to the Turkish Stream, as Russia didn't consider Europe in its plans for a new pipeline. Here the future has to show how Russia and Europe will behave towards one another. Turkey still isn't part of the EU and the Turkish Stream may get negotiations started again more seriously. This shows that geopolitical factors will also come to play in the future as they already did in the planning of the Turkish Stream.

Let us compare this formula to the formula for the profit in 5.3.1. Here we would get a positive number, namely 2 828 700 000$. In this case we would look at the profit Turkey makes from the transit, but instead of subtracting what they have to pay for their own imports, we would add the price difference between the European price and the Turkish price times the gas volume destined for Turkey. This gives us the 'profit' that Turkey makes on its own imports from the Turkish Stream, compared to what Europe would have to pay. And of course Europe doesn't get a profit for transit fees. The difference to the profit of the formula of 6.3.1 is then just $p_E V_T$ = 6 654 375 000$.
In fact: 2 828 700 000 – 6 654 375 000 = - 3 825 675 000$. In the scenario that we just described, we just wanted to take a look at the profit (or loss) of the two countries responsible for the Turkish Stream, just by looking at what they make or loose due to the new pipeline.

6.3.2 Second scenario

The negotiations concerning the Turkish Stream are still not finished and give us the possibility to look at a best-case scenario for Russia. Russia decided not to transit its gas through Ukraine anymore, but through Turkey from now on. While taking this decision, there must have been a best-case scenario that Russia imagined for the Turkish Stream and its relations with Turkey. It was clear that Russia wasn't going to sell the gas at the Turkish border to Turkey, so that Turkey could re-export the gas to Europe. And of course Russia hoped for the best possible outcome of the negotiations concerning the discount they will give Turkey on the gas price and concerning the transit fee that Russia has to pay.

The transit price that Russia paid to transit its gas through Ukraine was at 2.7$/tcm per 100 km. Ukraine wanted to raise this price at 5$/tcm per 100 km, which Russia didn't want to pay. Turkey knows which price Ukraine asked for the gas transit and so Russia is not going to think it can transit Turkey for less money, but best-case scenario for the same price than in Ukraine. This would mean that Russia would save 2.3$/tcm per 100 km, which constitutes almost half of what Ukraine was asking. That's why we use for the best-case scenario p_t=2.7$/tcm per 100 km.

Turkey helps Russia by transiting its gas through Turkey, and besides the transit fee, Turkey wants to get rewarded for its help. For this purpose Russia wanted to give Turkey a discount on its gas price. At a first stage in the negotiations and constituting the best case for Russia, Russia offered a 6% discount on the Turkish price for Russian gas. As mentioned before, this doesn't seem probable to happen at the stage the negotiations are at now, but this is just to model the best-case scenario for Russia. A 6% discount will lower the gas price from 407$/tcm to 382.58$/tcm. We will use p_T=383$/tcm.

Leaving the rest of the numbers unchanged, the best-case scenario for Russia would give Turkey the following profit:

$$\rho_T = p_t L V_E - p_T V_T$$

The result here fore is: - 4 628 925 000$! This is a greater opportunity loss than in the 'realistic' case. This shouldn't come as a surprise, as this is the best-case scenario for Russia, meaning by that almost exactly the opposite for Turkey. In this case Russia would have dominated the negotiations, getting exactly what it wanted. And Turkey would have lost in the negotiations, attributing the lowest transit fee to Russia and getting the lowest discount on its own price for Russian gas.

Consequently we know that the profit of Russia will be higher than in the 'realistic' case. A lower transit fee and a lower discount, leading also to a higher gas price for Europe (as Turkey is considered here for calculating this price) and the fact that this is the best-case scenario of Russia all lead to a higher profit. Using the new gas price for Turkey, 383$/tcm, we calculated the European price for Russian gas. This one is now at

423.1$/tcm, and we will use 423$/tcm for the formula. The formula stays the same as for the first scenario:

$$\rho_R = (p_E V_E + p_T V_T) - p_t L V_E$$

Using the best numbers for Russia, the result of the profit is: 24 615 675 000$. From the previous observation this result was to be expected, as it is higher than in the first scenario. During the negotiations, Russia is doing everything to get Turkey to agree to these conditions, whereas Turkey tries to get Russia to agree to their conditions. In this scenario, without considering hypothetical future problems, the decision of Russia to change from the Ukraine to Turkey would have been the right one.

We said before that Europe is only indirectly affected by the negotiations and assumed that a higher transit fee might cause Russia to ask higher gas prices. In this scenario we already saw that for our case also the discount in the Turkish price for Russian gas plays a role. As this price is used to calculate a European gas price, a discount affects the result. So in this case the transit fee is low and might therefore not affect European prices. The discount affects Europe just in our formula, as the common European price changes through changes in the Turkish gas price.

When we compare this result to the formula in 5.3.1, we get the same conclusion as for the 'realistic' case. This is due to the fact that our formula as well as the formula in 5.3.1 didn't change. Using the numbers of the Russian best-case scenario, the profit for Turkey would be: 2 033 325 000$. Of course the profit calculated by this formula will also be lower than in the 'realistic' case. Again, the only difference is $p_E V_T$ = 6 662 250 000$.
In fact: 2 033 325 000$ - 6 662 250 000$ = - 4 628 925 000$.
The difference in the profit of Turkey between the first and the second scenario are as follows: for the formula in 5.3.1: 795 375 000$; for the formula in 6.3.1: 803 250 000$. The difference between these two numbers is 7 875 000$, which is nothing else than the difference between the $p_E V_T$ of the first and second scenario, namely:
6 662 250 000$ - 6 654 375 000$ = 7 875 000$.

6.3.3 Third scenario

The 'realistic' case and the best-case scenario for Russia have been described above and so the remaining case to take a look at is the best-case scenario for Turkey. In fact this constitutes the opposite of the best-case scenario for Russia, as Turkey wants a higher transit fee and a higher discount on the gas price. As Russia, Turkey also wants to get the most out of the Turkish Stream project. As mentioned before, this should help Turkey in its ambition to become an energy hub someday. But for our model, considering only economic factors, it is important that Turkey gets as much concessions from Russia than possible, in order to maximize what they're getting for the transit and to minimize what they have to pay for Russian gas.

Ukraine wanted to ask 5$/tcm per 100 km of transit. Russia didn't accept this and went on to plan the Turkish Stream. Russia did this in hoping that it wouldn't encounter as much problems with Turkey than with the Ukraine. But let as pretend, just for the sake of the argument, that in the best-case scenario Turkey would have been able to get the 5$/tcm per 100 km from Russia. This would clearly be a huge win for Turkey in the negotiations and show how much Russia really needs the Turkish Stream.

In the previous case, Russia wanted to offer Turkey a 6% discount on the price for Russian gas. In the best-case scenario for Turkey this is clearly not enough and Turkey asked for a 15% discount. In order to calculate the profit of Turkey, we will use a 15% discount, meaning that instead of 407$/tcm, we will now calculate the profit with 346$/tcm (15% of 407$/tcm is 345.95$/tcm).
We use the same formula as before:

$$\rho_T = p_t L V_E - p_T V_T$$

The result here fore is: - 2 850 750 000$. This loss is considerably lower than for the second scenario and there is even a big gap compared to the first scenario. This result should give Turkey a big incentive to try and get big concessions from Russia.

Consequently a lower loss for Turkey means a lower profit for Russia. In fact what is good for Turkey in this case is bad for Russia and vice-versa in the second scenario. We

know that the profit will be lower due to a higher discount of the Turkish price for Russian gas and due to a higher transit fee that Russia has to pay. Again as Turkey is used to calculate the gas price for Europe, a higher discount leads here to a lower price, affecting also the profit of Russia. The new price for Turkey, considering the 15% discount is now 346$/tcm and we will use this price in order to get the European price, which is now at 420.71$/tcm. We will use 421$/tcm for our calculations.
The formula stays the same:

$$\rho_R = (p_E V_E + p_T V_T) - p_t L V_E$$

The result for the profit of Russia is: 22 743 000 000$. This result is lower than in the previous two cases and shows why Russia doesn't want to make these concessions to Turkey. In this case Russia pays a high price for the Turkish Stream, as they didn't expect these conditions at all. But of course, this is just a best-case scenario for Turkey and not a very realistic case.

Europe might in this case feel the consequences when Russia decides to ask higher prices, due to the higher transit fee it has to pay. The discount for Turkey affects Europe just in our formula. The effect on Europe might also be that Turkey feels itself to be in a stronger position now that it has gotten big concessions from Russia and that Turkey wants to use this in the talk about joining the EU. Europe as well as Russia have to hope that Turkey isn't going to act out like Ukraine did, for the Turkish Stream to be a success.

Let us now look at the profit of Turkey when using the formula from 5.3.1. In this case we know that the profit will be higher than in the two scenarios before, namely:
3 780 000 000$. The difference to our formula is again only $p_E V_T$: 6 630 750 000$.
In fact: 3 780 000 000$ - 6 630 750 000$ = - 2 850 750 000$. We can also compare this scenario to the first and second scenario and we will find out that the difference in the profit of Turkey for the different scenarios is also due to the difference of $p_E V_T$.

Let us compare this scenario with the first one. For the difference between the scenarios using the formula in 5.3.1 we get: 951 300 000$. Using our formula we get:
974 925 000$. The difference between these two numbers is: 23 625 000$. This is the same as the difference between the $p_E V_T$ of the first and third scenario:

6 630 750 000$ -6 654 375 000$ = 23 625 000$.

Now let us compare this scenario to the second one. Calculating the difference between the scenarios using the formula in 5.3.1 we get: 1 746 675 000$. Using our formula we get: 1 778 175 000$. The difference between these two numbers is: 31 500 000$. Again, this is the same as the difference between the $p_E V_T$ of the second and third scenario:
6 662 250 000$ - 6 630 750 000$ = 31 500 000$.

The difference between comparing the third scenario with the first and second scenario is then equal to comparing the first and second scenario with one another. Let us just take a look at the results we got by comparing the profits of Turkey using the different formulas in the different scenarios. Here we got: 31 500 000$ (third and second scenario); 23 625 000$ (third and first scenario); 7 875 000$ (second and first scenario). This gives us: 31 500 000$ - 23 625 000$ = 7 875 000$.

7. Conclusion

The negotiations between Russia and Turkey are still not finished, as month-long discussions haven't helped to find an agreement on the Turkish Stream project. In fact the whole project has been postponed by Russia, the official reason being the political crisis in Turkey. This shows that such a big project involves a lot of risks, risks that Russia was willing to take in order to be less dependent on the Ukraine.

We showed in this paper how the natural gas market looks like, by describing the GASMOD model and analyzing the underlying statistics. We evidenced that the focus of this paper also included and highlighted geopolitical issues instead of just concentrating on economic factors. This has been done by explaining the interdependent relationship between Russia and Europe, focusing on their individual energy sector, the alleged risks and possible responses for Europe and finally by giving an overview and analysis of the transportation system. The concept of asymmetric interdependence has been explained and the difficult transportation system for the natural gas market has been described

and both of these relevant themes have let to the main part of the paper, namely the transit games.

The paper worked out the concept of transit games, showed the different varieties of transit games and then concentrated on two different case studies. These case studies both involved Russia, the first case study describing the case of a net gas importer (case study of the Ukraine) and the second case study describing the case of a net gas exporter (case study of Turkmenistan). Finally the next possible transit game has been elaborated and this has been the one involving Russia, Turkey and Europe. This part of the paper focused especially on the Turkish Stream project.

The history of the Turkish Stream project, together with the information gathered throughout this paper about the complicated and delicate relationship between Europe and Russia, showed how and why the decision was made to switch from the South Stream project to the Turkish Stream project. The details have been described in depth here, before trying to model the expected profits that Turkey and Russia could get out from the new Turkish Stream project. Three different scenarios analyzed how these profits could possibly change by considering different outcomes of the negotiations between Russia and Turkey. The profits for Turkey have been compared to the profits we could work out by using the formula from the case study of the Ukraine. The model showed that the project benefits both parties (Turkey and Russia). As Europe is indirectly affected, the paper also considered the effects of the Turkish Stream for Europe.

We mentioned before that the negotiations are still ongoing and so we had to make a lot of assumptions. The Turkish Stream project would surely benefit both Turkey and Russia, but to get there, they first have to agree on the terms and conditions for the project and end the negotiations. Turkey will try and use the Turkish Stream in its effort to become an energy hub and Russia will (in the future) no longer have to deal with the uncomfortable Ukraine. Furthermore, it is Europe that has to organize itself to find the best possible way to get the natural gas from the Turkish-Greek border to the different countries. The major issue with the Turkish Stream project is that on the one hand, Turkey and Russia are not able to agree on the terms and conditions for the project and that on the other hand, Russia still is in doubt that Turkey won't copy the Ukraine once

the Turkish Stream is built. The future has to prove if the decision of the Turkish Stream was the right and the best one for Russia, as well as for Turkey.

8. Literature

- Aad Correljé, Coby van der Linde (2006): Energy supply security and geopolitics: A European perspective. Energy Policy 34 p.532-543
- An Encyclopedia Britannica Company Merriam Webster (2015) : Geopolitics, http://www.merriam-webster.com/dictionary/geopolitics, 01.06.2015
- Anouk Honoré (2014) : The Outlook for Natural Gas Demand in Europe. The Oxford Institute For Energy Studies, p.13-21
- Dominique Finon, Catherine Locatelli (2008): Russian and European gas interdependence: Could contractual trade channel geopolitics? Energy Policy 36 p.423-442
- Eurogas (2014) : Statistical Report 2014, p. 2-9
- European Commission (2015): The 2020 climate and energy package, http://ec.europa.eu/clima/policies/package/index_en.htm, 23.04.2015
- Franziska Holz, Christian von Hirschhausen, Klaudia Kemfert (2008): A strategic model of European gas supply (GASMOD). Energy Economics 30 p.767-785
- Gazprom (2014): Gazprom pushing ahead with South Stream and Southern Corridor projects, http://www.gazprom.com/press/news/2014/february/article184145/, 01.09.2015
- Gazprom Export (2015) : TurkStream, http://www.gazpromexport.ru/en/projects/6/, 01.09.2015
- Geology.Com (2015): What is Shale Gas ?, http://geology.com/energy/shale-gas/, 23.04.2015
- Investopedia (2015) : Cournot competition, http://www.investopedia.com/terms/c/cournotcompetition.asp, 17.04.2015
- Jonathan Stern, Simon Pirani, Katja Yafimava (2015) : Does the cancellation of South Stream signal a fundamental reorientation of Russian gas export policy ? The Oxford Institute for Energy Studies, p.1-15
- Le Monde diplomatique (2015) : Why Russia cancelled South Stream, http://mondediplo.com/2015/06/07south-stream, 31.08.2015
- Marc Leonard, Nicu Popescu (2007): A Power Audit of EU-Russia Relations. European Council on Foreign Relations (ECFR), p. 27-50

- Mark H. Hayes, David G. Victor (2006) : Politics, markets and the shift to gas : insights from the seven historical case studies, Natural Gas and Geopolitics : From 1970-2040, David G. Victor, Amy M. Jaffe, Mark H. Hayes, Cambridge University Press, p. 319-356
- Mert Bilgin (2009) : Geopolitics of European natural gas demand : Supplies from Russia, Caspian and the Middle East, Energy Policy 37, p.4482-4492
- Oistein Harsem, Dag Harald Claes (2013): The interdependence of European-Russian energy relations. Energy Policy 59, p.784-791
- Planète energies (2015): About the Energy Mix, http://www.planete-energies.com/en/medias/explanations/about-energy-mix, 21.04.2015
- Richard Ericson (2009): Eurasian Natural Gas Pipelines: The Political Economy of Network Interdependence. Eurasian Geography and Economics, 50:1, p. 28-57
- RT (2014) : Putin : Russia forced to withdraw from South Stream project due to EU stance, http://www.rt.com/business/210483-putin-russia-gas-turkey/, 31.08.2015
- The Washington Review (2015): The Reality behind Russia's Turkish Stream, http://www.thewashingtonreview.org/articles/the-reality-behind-russias-turkish-stream.html, 01.09.2015
- William J. Smith (2013): Projecting EU demand for natural gas to 2030: A meta-analysis. Energy policy 58, p. 163-175
- Yuri Fedorov (2010) : THE TURKMEN GAS GAMES, Security Index: A Russian Journal on International Security, p.39-49
- Yuri Yegorov, Franz Wirl (2009) : Ukrainian Gas Transit Game, p.1-15
- Yuri Yegorov, Franz Wirl (2010) : Gas Transit, Geopolitics and Emergence of Games with Application to CIS Countries, USAEE/IAEE Working Paper Series, p.1-27
- Yuri Yegorov, Franz Wirl (2011) : Gas transportation, geopolitics and future market structure, Futures 43, p.1056-1068
- Yuri Yegorov, Franz Wirl, Jalal Dehnavi (2015) : Future of Natural Gas in EU : Will Geopolitics take over Economics?, Conference : IAEE 2015, p.1-12
- Yusin Lee (2014): Opportunities and risks in Turkmenistan's quest for diversification of its gas export routes, Energy policy 74, p. 330-339

- eia (2015) : Turkey, http://www.eia.gov/beta/international/analysis.cfm?iso=TUR, 21.09.2015
- ASIA TIMES (2015) : Russia-Greece pipeline : Will Turkish Stream ever stream ? http://atimes.com/2015/06/russia-greece-pipeline-will-turkish-stream-ever-stream/, 22.09.2015
- Radio Free Europe Radio Liberty (2015): Gazprom's Grip: Russia's Leverage over Europe, http://www.rferl.org/contentinfographics/gazprom-russia-gas-leverage-europe/25441983.html, 22.09.2015

9. Abstract

The news of the Turkish Stream project, replacing the South Stream project, came unexpected to the world of the natural gas market. Russia's patience with the Ukraine and also with Europe had come to an end and so Russia had found a new ally with Turkey. Too many problems with the Ukraine and a non-cooperative Europe led to the decision of the new project with Turkey. The reasons behind this change of mind of Russia are manifold and can be found in its relationship with Europe.

This paper describes the European natural gas market, before comparing how Europe and Russia handle their natural gas markets respectively. The paper then analyzes the complicated relationship between Europe and Russia concerning the natural gas market, focusing not just on economics, but also on geopolitics. It shows that the difficult transportation system for natural gas leads to transit games, for which two case studies have been described. The paper then concentrates itself on the history and the geopolitics leading to the Turkish Stream project and investigates the profits that Russia and Turkey can make from the Turkish Stream project. It also compares three different scenarios and shows how these different outcomes will affect Europe. In fact the paper takes a look at the transit game involving Russia, Turkey and Europe.

10. Zusammenfassung

Die Meldung des neuen Turkish Stream Projekts, welches das South Stream Projekt ersetzen soll, kam als Überraschung für viele in der Welt des Gas Marktes. Russlands Geduld mit der Ukraine sowie mit Europa war aufgebraucht und so hat Russland sich einen neuen Partner mit der Türkei ausgesucht. Zu viele Probleme mit der Ukraine und ein nicht-kooperatives Europa zwangen Russland zu der Entscheidung ein neues Projekt anzugehen. Es gibt viele Gründe hierfür und die meisten lassen sich in der komplizierten Beziehung zwischen Russland und Europa finden.

Diese Arbeit beschreibt den europäischen Gas Markt, bevor sie einen Vergleich zwischen Russland und Europa anstellt wie beide ihren eigenen Gas Markt führen. Diese Arbeit beschreibt dann die komplizierte Beziehung zwischen Europa und Russland indem sie nicht nur auf ökonomische Faktoren Rücksicht nimmt, sondern auch geopolitische Faktoren mit einbezieht. Die Schwierigkeit Gas zu transportieren führt zu Konflikten zwischen dem Land, welches Gas transportieren möchte und dem Land, durch welches das Gas fließen soll. Hier beschreibt die Arbeit zwei Fallstudien, welche das Verständnis für diese Art von Konflikten erleichtern sollen. Daraufhin konzentriert sich die Arbeit auf die Ereignisse und die geopolitischen Faktoren, welche zum neuen Turkish Stream Projekt geführt haben, bevor sie die Gewinne analysiert welche Russland und die Türkei durch das neue Projekt machen können. Hierfür vergleicht diese Arbeit drei verschiedene Szenarien und beschreibt wie die verschiedenen Ergebnisse Europa beeinflussen.

11. Curriculum Vitae

11.1 Education

10.2013 – 07.2015	**University of Vienna** Master of Science in International Business Administration Specialization: Industrial Management
10.2010 - 07.2013	**University of Vienna** Bachelor of Science in International Business Administration
09.2009 – 07.2010	**University of Luxembourg** Studies in Education (BScE)
09.2008 – 07.2009	**University of Brussels** Studies in Law (BA Droit)
09.2001 – 07.2008	**Lycée de Garçons,** Luxembourg (High School)

11.2 Language Skills

Luxembourgish: C2

German: C2

French: C2

English: C2

Italian: A2