Central Asian Gas in Eurasian Power Game

Onur Cobanli

Humboldt–Universität zu Berlin

onur.cobanli@hu-berlin.de

first draft: October 2012
this version: February 2013

Abstract

Holding huge natural gas reserves the Central Asian countries consider several pipeline projects in order to diversify their export markets and transit routes. Using cooperative game theory I evaluate how these projects alter the power structure in the Eurasian gas trade. There is no strategic interaction between China and Western consumer markets. Gravitating eastwards to China benefits the Central Asian countries more than the western pipeline options, but for Turkmenistan heading westwards to Turkey is more profitable. Carrying Turkoman gas further to European markets has marginal impact on the power of Turkmenistan and European consumers. Thanks to its transit position Turkey enjoys large benefits. European consumers gain more from by Russia sponsored South Stream pipeline than by the EU initiated Southern Corridor.

Keywords: Bargaining Power, Network, Trade links, Natural Gas, Caspian Sea, China
JEL class.: L5, L9, O22

1 Introduction

The dissolution of Soviet Union in 1991 bore three new sovereign states in Central Asia: Kazakhstan, Turkmenistan and Uzbekistan. They host 27.8 tcm of proven conventional natural gas reserves, which is 13.3% of the world total.[1] However, being landlocked pipelines carrying Central Asian gas to distant markets have to cross multiple countries with different strategic interests. By virtue of the Soviet gas pipeline network the Central Asian countries rely on Russia to transport their gas westwards to European markets and Turkey.[2] In the beginning of nineties the USA initiated an offshore pipeline through Caspian Sea in order to mitigate the newly sovereign Central Asian countries' dependence on Russia and to diversify imports of Southeast Europe and Turkey. Following the American example, in the last two decades different stakeholders in the region broached several pipeline projects which compete for transit of Central Asian gas to the West. However, in 2007 the Central Asian countries endorsed the Turkmenistan-China pipeline heading to the East in order to access the rapidly growing Chinese market. In this paper I investigate the Central Asian countries' choice of gravitating eastwards to China instead of westwards to Europe and Turkey. I go back in time before the inauguration of the Turkmenistan-China pipeline and compare several pipeline options in order to infer the best diversification route for the Central Asian countries. Later, I return to the present day when the Turkmenistan-China pipeline is in operation. I study the strategic interaction between the West and the East in terms of demand competition and check if the Turkmenistan-China pipeline prevents investment in the pipeline options heading to western markets. Finally, I examine which western pipeline project benefits the Central Asian countries at most.

A pipeline can increase the Central Asian countries' (bargaining) power in two ways: it intensifies demand competition for their gas by linking them to new consumer markets, and it enhances transit competition for their gas by introducing a new transport route to their export markets or increasing capacities of existing transport routes. Players can act strategically in order to shape the pipeline network according to their benefit. By endorsing a pipeline project a player can increase demand and/or transit competition for particular supplies and thus, can forestall investment in alter-

[1] BP (2012a)

[2] In 2011 Caspian exports totalled 55.3 bcm. While half of this sum (28.7 bcm) flowed to Russia, China and Iran imported 10.2 and 14.3 bcm, respectively (BP (2012)). In 2007 the dominance of Russia on Central Asian exports was much stronger. 90% of Caspian exports (64.1 bcm) was sent to Russia (IEA (2008)).

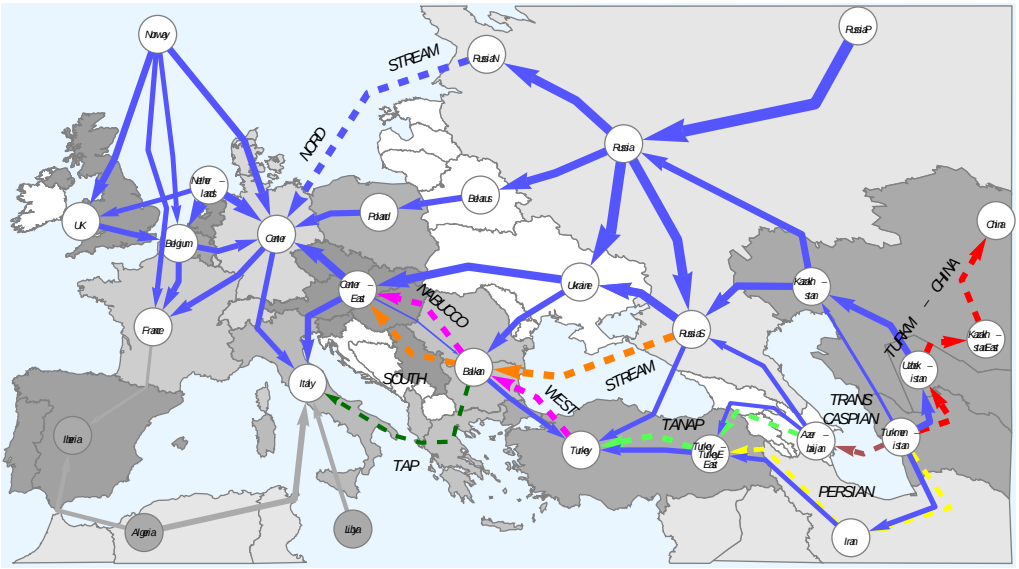
native pipeline projects which lessen its power. For example, Russia initiates the South Stream pipeline and aims to increase transit competition for Central Asian gas in order to forestall investment in the Southern Corridor, which will increase supply competition in Russia's export markets. If a player will loss from a pipeline project, it can transfer part of its gains from international gas trade to the project's initiators through gas prices, tariffs etc. in order to dissuade them from investment in the project. For instance, Russia increased the price for its imports from Azerbaijan and Turkmenistan to European netback level and passes on part of its gains from transit monopoly on Central Asian gas back to these countries in order to forestall any supply commitment for the Southern Corridor. Similarly, a benefiting player can transfer part of its gains from a pipeline project through prices, tariffs etc. to other players in order to convince them for investment in the pipeline project which subsides their power.

The Central Asian countries have a number of pipeline options to diversify their transport routes as well as export markets. While there is only the Turkmenistan-China pipeline to reach eastwards, three routes extend from Central Asia to the West: via Caspian Sea, via Iran, and via Russia (see the Figure 1). However, each route has its own peculiar obstacle. Towards the East in order to reach China Turkoman gas has to travel long distances through two transit countries: Uzbekistan and Kazakhstan, which are potential suppliers as well.[3] Towards the West the route via Caspian Sea is blocked by Russia and Iran due to legal disputes over Caspian Sea's status and demarcation. The route via Russia strengthens Russia's dominance on transport of Central Asian gas and exacerbates the Central Asian countries' deadlock. The West's protests and political uncertainties make investment in the route via Iran unlikely any time soon. In the paragraphs below I introduce the four pipeline options considered in this study. For a more detailed presentation of the projects please see Appendix A.

The forerunner of the western options, the Trans Caspian pipeline had to be shelved due to poor European demand prospects as well as legal issues over Caspian Sea's status. In the last decade conflicts between Russia and the transit country Ukraine raised concerns about European energy security. In order to diversify its imports, the EU initiated the Southern Corridor and revived the Trans Caspian pipeline in order to provide supplies for its ambitious Nabucco pipeline, which would carry gas from Central Asian as well as Middle Eastern producers through Turkey to Central

[3] With its huge reserves of 24.3 tcm Turkmenistan is the main supplier in the region.

Figure 1: The Network



Those pipelines under construction or planning, which we consider in detail are dashed: Nord Stream in Blue, South Stream in Orange, and Nabucco-West in Magenta, Trans Adriatic (TAP) in Dark Green, Trans Anatolian (TANAP) in Light Green, Trans Caspian in Pink, the Persian in Yellow and the Turkmenistan-China in Red. White circles represent regions where we have a major transit node, which is linked to local production, local customers and local LNG regasification plants if there is any (the nodes are not shown separately). Solid arrows represent the main pipelines as existing in 2009. Grey nodes and pipelines are taken into account for but not associated with a region in our analysis.

European markets.[4]

Instead of backing the legally disputed Trans Caspian pipeline, the Central Asian countries can employ the already serving transit countries, Russia or Iran. Both of these countries strongly object the offshore project across the Caspian Sea. With the South Stream pipeline Russia aims to clinch its dominance on the transit of Central Asian exports to the West and to avoid supply competition in its export markets. The project bypasses the transit countries, Ukraine and Belarus, via an offshore pipeline across Black Sea and reaches Central Europe after crossing the Balkans.

In the South of Caspian Sea Iran intends to be a transit country for Central Asian gas flowing westwards by increasing the transport capacities from Turkmenistan to Turkey via its territory.[5] Although Iran holds the second largest gas reserves in the

[4] In 2012 the Nabucco was split up into the Nabucco-West and Trans Anatolian (TANAP) pipelines, which cover parts of the initial project and have smaller capacities. The Trans Adriatic pipeline competes with the Nabucco-West in order to carry the Caspian gas in the EU's territory.

[5] The other option is to supply the gas to energy hungry emerging Asian economies such as

world, its production is barely enough to satisfy its domestic demand due to high subsidies on gas and poor investment in production fields. Currently, Iranian gas which is substituted by imports from Turkmenistan are exported to Turkey. However, the West objects strongly any involvement of Iran in Eurasian gas trade.

In 2009 the Turkmenistan-China pipeline outstripped all the western pipeline projects competing for Central Asian gas. The pipeline connects the main supplier Turkmenistan through Uzbekistan and Kazakhstan to the fastest growing energy market in the world, China.[6] On the one hand, the Turkmenistan-China pipeline increases demand competition for Central Asian gas and challenges the Russia's position as the major importer. Increase in Central Asian gas' price paid by Russia shows that the Central Asian suppliers benefit from intensified demand competition. On the other hand, the pipeline interlocks gas supplies necessary for the Southern Corridor and safeguards Russian transit monopoly on Central Asian gas flowing to the West.

In order to analyze the impact of the pipeline projects on the power structure of the Eurasian gas trade, I modify the disaggregated quantitative model introduced in Hubert & Cobanli (2012) slightly. I shift the focus of the model from the EU towards Central Asia by introducing non-European consumer markets and China which were left out in the referred paper. I apply the cooperative game theory and represent interdependence among the players in value function form which captures essential economic features of the Eurasian gas trade, especially the architecture of the pipeline network. The Shapley value, which is referred as the power of the player as well, allocates the surplus from cooperation within the players by taking interdependence among them into account. Since introduction of a new pipeline alters the pipeline network, the value function and thus, the Shapley value of the players change accordingly. The difference between a player's pre- and post-project Shapley values gives the pipeline's impact on its power. Later the pipeline's impact on different stakeholders is compared with its cost in order to analyze its viability.

My results confirm the Central Asian countries decision to uphold the Turkmenistan-China pipeline since it benefits them more than the western pipeline projects aiming European and Turkish markets. The Central Asian suppliers have enough spare

Pakistan and India. Since early nineties the Iran-Pakistan pipeline is under discussion. It can be extended further to India and China.

[6] In 2011 China's gas consumption soared by 21.5% from 107.6 bcm in 2010 to 130.7 bcm (BP (2012)), and IEA projects that it will hit 197 bcm in 2015 (IEA (2011))

production capacity to serve Western and Chinese demand simultaneously. Thus, there is no demand competition between the West and the East. The Central Asian countries are heterogeneous with respect to their export capacity and closeness to major consumer markets. Most of the gains from the Turkmenistan-China pipeline accrues to the transit countries on the route, Uzbekistan and Kazakhstan. Gravitation westwards to Turkey, which is a major importer in the region, is more profitable for the main supplier, Turkmenistan. Russian and Iranian objections to the Trans Caspian pipeline as well as the West's protests on Iran's involvement compelled Turkmenistan to endorse the less beneficial eastwards option. Carrying Turkoman gas further to European markets via the Southern Corridor brings marginal gains to Turkmenistan and European consumers. Azerbaijan and Turkey, the transit countries on the route to European markets, enjoy large benefits. Access of the Northern exporters, Norway and Netherlands, to Southeastern European and Turkish markets wipes out gains from linking Central Asian suppliers to European consumers for both parties. In the same way, if Azerbaijani gas is carried through the Southern Corridor to European markets, the leverage accruing to the European regions from additional Central Asian supplies is insufficient for an European investment in the Trans-Caspian pipeline. In contrast to European concerns, the South Stream pipeline benefits European consumers much more than the Southern Corridor, and it cannot hinder investment in the alternative projects.

2 The Model

In this study I employ the disaggregated quantitative model presented in Hubert & Cobanli (2012). The Eurasian gas network is represented by set of nodes R and links L. A link $l = \{i, j\},\ i \neq j \in R$ connects the node i with j. A typical region except Norway consist of four nodes. In a region production field R_P, LNG regasification plant R_{LNG} and consumer market R_C are attached with a respective associated link to transportation node R_T. Norway is composed of only production and transportation nodes since it has no LNG imports and its consumption is negligible. Regions' transportation nodes are connected with links to each other, which represent the international pipeline network. A positive x_{ij} designates gas flow from the node i to j through the link l_{ij}, while a negative value describes a flow to the opposite direction. Gas flow trough the link l_{ij} is constrained by the link's capacity k_{ij} and is subject to a link specific piece wise linear transportation cost $T_{ij}(x)$, which depends

on the volume of gas shipped. Since flows from production node R_P and LNG node R_{LNG} to transportation node R_T and flow from transportation node R_T to consumption node R_C indicate production, LNG imports and consumption, respectively, they have to be positive ($x_{ij} \geq 0, \ \forall\, i \in R_P$ or $i \in R_{LNG}$ or $j \in R_C$). The inverse demand is denoted as $p_j(x_{ij})$.

N refers to the set of strategic regions. The value function $v : 2^{|N|} \rightarrow R_+$ maximizes surplus for each subset of the regions $S \subseteq N$ with respect to flows through links x_{ij}. The regulatory framework determines the set of links, thus consumer markets, production fields, LNG facilities and international pipeline network, which a subset of regions S can use. Hence, the value function reflects most important features of the Eurasian gas trade such as the pipeline network, the regulatory frame work, demand for gas in regions, production capacities, transportation cost via different routes etc. The value function is calculated as:

$$v(S) = \max_{\{x_{ij} | \{i,j\} \in L(S)\}} \left\{ \sum_{\{i,j\} \in L(S),\ j \in R_C} \int_0^{x_{ij}} p_j(z)dz - \sum_{\{i,j\} \in L(S)} T_{ij}(x_{ij}) \right\} \tag{1}$$

subject to the node balancing constraints at each transportation node $\sum_i x_{it} = \sum_j x_{tj}, \ \forall\, t \in R_T(S)$, the capacity constraint at each link $|x_{ij}| \leq k_{ij}, \ \forall\, \{i,j\} \in L(S)$ and non-negativity constraints at production, consumption and LNG links $x_{ij} \geq 0, \ \forall\, i \in R_P$ or $i \in R_{LNG}$ or $j \in R_C$.

The Shapley value ϕ_i of a region $i \in N$ gives its weighted contribution to all possible coalitions:

$$\phi_i(v) = \sum_{S : i \notin S} P(S)\,[v(S \cup i) - v(S)] \tag{2}$$

where $P(S) = |S|!\,(|N| - |S| - 1)!/|N|!$ is the weight of coalition S. Thus, the Shapley value, also called (bargaining) power, allocates the surplus from cooperation within the regions by considering how they complement with each other.

Since the value function reflects the pipeline network, a change of the pipeline network through a project alters the value function and thus, the Shapley value as well. The change in a region's Shapley value gives the project's gross impact on the region's power. Since a major pipeline project is capital intensive, crosses several national borders and needs international consensus, it is undertaken by a group of regions interested in the project which is called the project's consortium. If the project's total gross impact on the regions in the consortium is larger than its cost, then it is strategically viable for the consortium.

The set of regions considered in the model covers a large geography ranging from Europe to China. In Central Asia Kazakhstan, Turkmenistan and Uzbekistan are examined in detail. In the Middle East Iran is taken into consideration, since it is a potential supplier and a transit country for Turkmenistan's gas flowing westwards. Turkey is a major consumer and an emerging transit country in the East-West gas trade. Russia and Norway are the major non-European suppliers to European markets. Ukraine and Belarus, which depend totally on Russia to meet their demand, are the transit countries for Russian and partly Central Asian gas flowing to European markets. I leave out the North African exporters Algeria and Libya since they have minor strategic importance for Central Asian gas. Although the EU's members have considerably different import dependency characteristics and contradictory energy policies, I combined them in three regions: Balkan, Continental Europe, and UK. Since the Southeast Europe is isolated from the rest of European markets due to poor pipeline connections (1.7 bcm/a), I consider "Balkan" composed by Bulgaria, Greece and Romania as a region. Germany, Benelux countries, France, Italy, Poland, Switzerland, Denmark, Austria, Czech Republic, Slovenia and Hungary are collected under "Continental Europe". In the region only Netherlands is a net exporter, while other countries depend on imports from Norway, Russia, North Africa and LNG. Iberian Peninsula, the Baltic states and Scandinavia are left out. Spain and Portugal satisfy their demand from LNG and North African suppliers, and the link between Spain and France has a small capacity (4.7 bcm/a). Baltic states and Scandinavia have negligible production and consumption. Both do not position strategically with respect to any pipeline project considered in this study.

While demand level, production and transit capacities as well as costs determine the amount of surplus generated from cooperation in international gas trade, the share of surplus the regions get depends on who has access to these. The recent EU regulation promotes liberalization of the European gas market. Therefore, I assume that third parties can freely access the international pipeline network in the EU to ship gas between markets, and the European regions cannot draw benefits from blocking gas shipments through their pipeline network.[7] In the rest of the regions third party access to international pipeline network depends on the owning regions' permission. All regions control their production, consumption and LNG facilities exclusively. Thus, they can block third parties from entering their consumer markets and using domestic gas supplies.

I employ short sighted view of 2-3 years, which are long enough to set up the

[7] However, the liberalization of the European pipeline network is still in progress.

Table 1: Regions

Regions	Consumption [bcm]		Production [bcm]		LNG Capacity [bcm]		Import Dep.[a] [%]	
	2009[b]	2015[c]	2009[ad]	2015[e]	2009[f]	2015[g]	2009	2015
Balkan	20.2	22.7	10.8	10.8	5.3	7.3	46.5	52.4
Cont. Eur.	341.0	383.7	121.8	125.8	43.7	84.5	64.3	67.2
UK	90.5	101.8	62.1	37.0	51.1	51.1	31.4	63.7
Turkey	36.4	40.9	0.7	0.7	12.2	12.2	98.1	98.2
China	89.2	197.0	82.1	135.0	12.6[h]	44.4[h]	8.0	31.5
Ukraine	53.3	60.0	21.9	21.9	0	0	58.9	63.5
Belarus	17.9	20.1	0.2	0.2	0	0	98.9	99.0
Russia	426.4	467.0	550.5	679.0	–	–	–	–
Azerbaijan	10.0	11.0	14.9	20.0	–	–	–	–
Kazakhstan	22.9	40.0	27.2	47.0	–	–	–	–
Turkmenistan	18.6	29.0	38.3	85.0	–	–	–	–
Uzbekistan	51.8	64.0	65.6	72.0	–	–	–	–
Iran	136.5	136.5[i]	137.4	137.4[j]	–	–	–	–
Iraq	1.1	–	1.1	9.0	–	–	–	–
Norway	6.0	–	106.3	109.0	–	–	–	–

[a]Net imports/Consumption

[b]Data is compiled from IEA(2010a) and IEA(2011).

[c]Figures for China and Russia are taken from IEA(2011). Figures for Caspian region (Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan) are taken from IEA(2010a). IEA(2011) forecasts that European demand will increase by 12.5% from 2009 to 2015. Therefore, consumption of European countries, Belarus, Ukraine and Turkey in 2009 are multiplied by 1.125.

[d]Exports to countries which are left out in the geographical scope are deducted from figures

[e]Figures for China, Iran, Iraq, Netherlands, Norway, Russia and UK are taken from IEA(2011). Figures for Caspian region are taken from IEA(2010a). I assume that production levels of other European countries, Belarus, Ukraine and Turkey remain unchanged from 2009 to 2015 (IEA(2010b))

[f]GIE(2010)

[g]GIE(2011)

[h]Higashi(2009)

[i]assumed equal to the consumption in 2011 although IEA projects an increase of 17.2% in Middle East's demand.

[j]assumed equal to the production in 2011 although IEA forecasts 137 bcm.

international pipeline network bidirectionally but too short to undertake investments such as new pipeline links and enlargement of existing capacities.

Data for roduction, consumption and LNG imports in 2009 is compiled from IEA(2010a), IEA(2010b) and IEA(2011). Gas trade flows at the European borderpoints in the same year is collected from IEA(2010b). Since the pipeline projects studied in this paper are expected to be inaugurated earliest in 2015, I projected the production, consumption and LNG figures in 2009 to 2015 by using forecasts

of International Energy Agency (IEA) and Gas Infrastructure Europe (GIE). The Table 1 presents assumptions and their sources in more detail. Later the database is used to calibrate the model. I work with linear demand functions and assume same intercept for all regions. Thus, demand of several regions can be aggregated easily, and the regions are differentiated simply by the relation of their consumption to indigenous production since there is poor information about demand functions of consumers. I assume piece wise linear, constant cost for production and make minor adjustments for different producers. So, differences between the suppliers rely on their production capacity and transport routes to their export markets since it is hard to get information about wellhead production cost of the producers. Then, given the consumption in 2015 and the assumptions on the intercept and production cost, the slope parameters are estimated.

The calibration of the model implies that the international pipeline network as existing in 2009 is efficient. Given the production and transport cost of gas, it has enough capacity to carry gas efficiently from Russia and the Central Asian countries to Europe and Turkey in order to satisfy demand in these markets. The pipeline projects running from the East to the West do not create surplus but they alter the distribution of surplus from cooperation within the regions. A central planner or the grand coalition composed by all regions would not invest in any of the pipeline projects heading from the East to the West. Therefore, I focus on the projects' strategic viability for different stakeholders.

The selection of intercept is critical for the conclusions about the strategic viability of the pipeline projects. Since the difference of the intercept and the production cost determines the total surplus from international gas trade, the overall surplus of the grand coalition, thus the absolute shares of the regions increase with the intercept while the relative shares of the regions remain robust. In this study I use an ad hoc estimate of 1500 €/tcm for the difference between the intercept and the production cost. I checked robustness of my results for a relatively conservative estimate of 500 €/tcm. In this case, the pipeline projects' impact of on the relative power of the regions are robust, but none of the pipeline projects considered in this study are strategically viable in absolute terms.

3 Results for Pipelines

A region's power is not only determined by size of its consumer market, production and transportation capacities but by how these complement with other regions'

characteristics. It depends on its role in international gas trade via pipelines. A new pipeline alters the network and thus, the nature of interaction between the regions. The interaction between the regions can be couched in terms of supply, demand and transport competition. Supply competition in a consumer market intensifies in the number of suppliers having access to this market, in the suppliers' export capacities and in the variety of transport options as well as their capacities. Demand competition for a supplier's gas increases in the number of consumers linked with the supplier, in their demand level and again in the variety and capacity of transport options. Lastly, transit competition increases in levels of demand and gas available for exports linked with each other and in scarcity of alternative transport routes.

In the following subsections I discuss each pipeline option's impact on the regions' bargaining power in more detail. First, I examine the case before the inauguration of the Turkmenistan-China pipeline and investigate the Central Asian countries' decision to uphold the Turkmenistan-China pipeline instead of a western option. Then, I analyze how the Turkmenistan-China pipeline alters the interaction between the West and the East and show which pipeline project heading westwards benefits the Central Asian countries at most.

3.1 Pre-Turkmenistan-China Pipeline

The case before the inauguration of the Turkmenistan-China pipeline is shown in Table 2. The first column presents the benchmark and exhibits distribution of total surplus from cooperation within the regions. The other columns show each pipeline option's impact on the regions' power in differences with respect to the benchmark. All the figures are in annualized absolute terms, bn €/a. The Central Asian countries acquire a very small share of surplus (in total 0.2 bn €/a) since they rely on Russia and partly on Iran to ship their gas westwards to European markets and Turkey. Russia's Gazprom controls the Central Asia-Center pipeline system, which connects the Central Asian countries with each other and Russia's pipeline network, and Russia has enough spare production capacity to satisfy European and Turkish demand in the absence of the Central Asian countries. However, in the West of the Caspian Sea Azerbaijan has a relatively higher surplus (1.2 bn €/a), since it diversified its transport routes via the South Caucasus pipeline[8] and gained access to Turkey and Southeast European markets. Although China is a major consumer, it gains no surplus from cooperation since there is no pipeline linking China

[8]The South Caucasus pipeline runs from Shah Deniz I field in Azerbaijan through Georgia to the East of Turkey.

to an exporter, thus no trade of pipeline gas.

The Turkmenistan-China pipeline avoids conflicts on the routes heading westwards and diversifies the Central Asian countries' export markets by linking them to energy hungry China. According to projections for its demand, production and LNG capacities in 2015, China needs at least 17.6 bcm/a of pipeline gas to meet its domestic demand.[9] Therefore, the Turkmenistan-China pipeline has an economic impact in addition to its strategic effect, and the grand coalition's surplus increases slightly by 1.5 bn €/a to 1187.8 bn €/a. The project's main supplier is Turkmenistan. While Uzbekistan supplies gas to China as well, Kazakhstan's major production fields in the West and North-West are disconnected from the Turkmenistan-China pipeline lying in the Southeast of the country.[10] The figures in the second column of Table 2 presents the Turkmenistan-China pipeline's impact on the regions' bargaining power in differences. The gains from the pipeline are heterogeneously distributed within the Central Asian countries due to their different roles in the eastern gas trade. Major gains accrue to the transit countries, Kazakhstan and Uzbekistan, and the importer, China, instead of the supplier, Turkmenistan. The consortium's total gain sums up to 1.6 bn €/a, which is more than enough to cover the project's cost, 0.7 bn €/a.[11] All other regions' surplus remains unchanged. Thus, there is no strategic interaction between the East and the West. This explains the absence of objections from other regions to the project, especially from Russia and the EU.

The figures confirm the Central Asian countries' decision to gravitate eastwards to China instead of westwards to Europe and Turkey. Jointly they gain 1.1 bn €/a from the introduction of the Turkmenistan-China pipeline while the most profitable western option, via Caspian Sea, benefits them 0.5 bn €/a in total. Although Turkmenistan is the main supplier of the project, only 0.1 bn €/a accrues to it. For Turkmenistan the western routes via Caspian Sea (0.5 bn €/a) and via Iran (0.3 bn €/a) are more beneficial than the eastwards option as presented in columns 5 and 7 of Table 2, respectively. Apparently, objections of Russia and Iran to the Trans-Caspian pipeline as well as the West's protests on Iran's involvement compelled Turkmenistan to endorse the less beneficial eastwards option.

[9] See Table 1 in Approach, Section 2.

[10] In 2010 Kazakhstan and China agreed to build a 1400 km long pipeline to link Kazakhstan's production fields in the West and North-West to the Turkmenistan-China pipeline and consumer markets in the South of the country.

[11] If the 2nd West-East pipeline's cost is included, the total cost increases to 2.1 bn €/a, and the project becomes unviable.

Table 2: Pre-Turkmenistan-China Pipeline: Projects Impact on Bargaining Power [bn €/a]

Players	Bench-mark	Impact of pipelines							
		to the East	*to the West*						
			via Russia	via Caspian Sea			via Iran		
		Turkmenistan -China	South Stream	TC[a]+TANAP[b]	TC+TANAP +NabW	TC+TANAP +TAP[c]	Persian	Persian +NabW[d]	Persian +TAP
Azerbaijan	1.2	0.	−0.2	0.9	0.7	0.7	−0.1	−0.2	−0.2
Kazakhstan	0.1	0.5	0.	0.	0.	0.	0.	0.	0.
Turkmenistan	0.1	0.1	0.	0.5	0.5	0.5	0.3	0.3	0.3
Uzbekistan	0.	0.5	0.	0.	0.	0.	0.	0.	0.
Balkan	1.3	0.	0.3	0.1	0.3	0.3	0.1	0.3	0.2
Cont.Eur.	30.6	0.	1.2	0.2	0.1	0.1	0.2	0.1	0.1
UK	12.1	0.	0.3	0.	0.1	0.1	0.1	0.1	0.1
Turkey	14.2	0.	0.2	0.9	1.6	1.6	0.9	1.7	1.7
Russia	28.9	0.	1.8	−1.7	−1.7	−1.7	−1.9	−1.9	−1.9
Ukraine	14.5	0.	−1.8	−0.2	−0.9	−0.9	0.	−0.8	−0.8
Belarus	10.5	0.	−0.4	0.	0.	0.	0.	0.	0.
Iran	1.7	0.	−0.3	−0.2	−0.4	−0.4	0.9	0.7	0.7
Norway	18.7	0.	−1.2	−0.3	−0.1	−0.1	−0.4	−0.2	−0.2
China	0.	0.5	0.	0.	0.	0.	0.	0.	0.
project cost[e]		0.7	1.8	1.2	2.0	1.5	1.5	2.2	1.8

[a]the Trans Caspian pipeline

[b]the Trans Anatolian pipeline

[c]the Trans Adriatic pipeline

[d]the Nabucco-West pipeline

[e]Investment cost annualized with an interest of 15%.

3.2 Post-Turkmenistan-China Pipeline

Now I return to the present day when the Turkmenistan pipeline is already in operation. The Table 3 has the same structure as Table 2 but it presents the impact of the each pipeline in the presence of the Turkmenistan-China pipeline. Figures in both of the tables are the same. Turkmenistan has large spare production capacities, and the Chinese demand is relatively small to interlock large volumes of Central Asian gas. Thus, Turkmenistan can serve demand of the West as well as the East simultaneously, and there is no demand competition between Europe and China for Central Asian gas.

The route via Russia, the South Stream pipeline, preserves the status quo. The Central Asian countries depend largely on Russia in order to ship their gas to the West. Therefore, their power remains unchanged. Kazakhstan and Uzbekistan gain nothing from the other two western pipeline options, the routes via Caspian Sea and via Iran since they depend on Turkmenistan to access the pipelines and Turkmenistan has enough spare production capacity to serve the pipelines alone. Large benefits accrue to the transit countries, Turkey and Azerbaijan. The route via Caspian Sea benefits Turkmenistan at most. It introduces a new transport route for Turkoman exports to western markets while the route via Iran enlarges the capacity of the existing pipeline link.

3.3 To the West

Via Russia

Russia proposes the South Stream pipeline in order to protect its dominance on the transport of Central Asian gas as well as to avoid supply competition in its export markets. The project bypasses the transit countries, Ukraine and Belarus, but strengthens the Central Asian countries dependence on Russia. The second column of Table 3 shows that the Central Asian countries' power remains unchanged since they still rely on Russia to ship their gas to Europe and Turkey, and in their absence Russia's production capacity is enough to serve the demand in these markets. The figures challenge the EU's skepticism against the project. Getting around the transport countries through an offshore pipeline benefits Russia and Continental Europe 1.8 bn €/a and 1.2 bn €/a, respectively and to some extent Balkan and

Turkey.[12] Other exporters serving European and Turkish markets suffer from intensified supply competition with Russia. Large benefits accruing to Russia are enough to cover the project's cost of 1.8 bn €/a.[13]

Via Caspian Sea and the Southern Corridor

The route via Caspian Sea bypasses the current transport countries Russia and Iran and introduces a new transport route for Central Asian exports to Europe and Turkey. As presented the third column of Table 2, the Trans Caspian pipeline and the TANAP together benefit Turkmenistan by 0.5 bn €/a while the power of Kazakhstan and Uzbekistan remains unchanged. Kazakhstan and Uzbekistan rely on Turkmenistan to access the offshore pipeline, and Turkmenistan's spare production capacity is more than enough to fill up the Trans Caspian pipeline's capacity. Major gains from the projects accrue to Azerbaijan and Turkey. Both are the transit countries for Central Asian gas flowing to Europe. While Turkey enjoys intensified supply competition in its market, Azerbaijan profits from better access to consumer markets through the TANAP. Intensified supply competition in Turkey and Balkan hurts Russia remarkably. The projects alter the European regions' bargaining power marginally since the bottleneck between Balkan and Continental Europe obstructs shipments of Central Asian gas to European markets.

I consider strategic viability of the Trans Caspian and the TANAP separately since they are undertaken by different consortiums. The TANAP alone is strategically viable for its investors, Turkey and Azerbaijan, since their total gain (0.8 bn €/a) surpasses the project's cost (0.7 bn €/a).[14] If the TANAP is extended with the Nabucco-West pipeline or the TAP to carry Azerbaijan's supplies to Western and Central European markets, introducing Turkmenistan via the Trans Caspian pipeline returns European consumers only 0.4 bn €/a.[15] Major gains from the project accrue to the supplier Turkmenistan and the transit countries Azerbaijan and Turkey (1.5 bn €/a in total). Therefore, with a cost of 0.5 bn €/a the Trans Caspian pipeline is strategically viable for the non-European countries, Turkmenistan, Azerbaijan and Turkey, but not for its endorser, the EU. Russia and Iran block the Trans Caspian

[12] The Southern Corridor benefits Continental Europe only by 0.1 bn €/a (See the fifth column in Table 3).

[13] See Hubert & Cobanli (2012) for a detailed analysis of South Stream's impact on the European regions.

[14] See column 2 in Table 5 in Appendix.

[15] See columns 5 & 6 in Table 5 in Appendix.

pipeline since they will suffer from intensified transport as well as supply competition. In order to convince them of permission to the project, Turkmenistan, Azerbaijan and Turkey can transfer a share of their gains to Russia and Iran through several instruments such as prices, tariffs etc. and compensate their losses from the pipeline (-1.3 bn €/a).

The Nabucco-West pipeline and the TAP compete for the transit of Central Asian gas in the EU territory. Both of the projects eliminate the bottleneck between Balkan and Continental Europe with the same capacity of 10 bcm/a, and all regions can employ the pipelines to ship gas between the markets. Therefore, the projects have exactly the same impact on the regions' bargaining power as presented in the fourth and fifth columns of Table 3. While Turkmenistan and Azerbaijan enter to Western and Central European markets, Norway and Russia gain better access to markets in Turkey and Balkan. Thus, the supply competition in both sides of the bottleneck intensifies. These counter effects offset each other by Turkmenistan. Therefore, it is indifferent about the projects. Again, Turkey collects major part of the gains from the projects due to Norway's and Netherland's introduction to its market and its transit position between the Eastern suppliers and the Western consumers. Surprisingly, Azerbaijan suffers from the supply competition in Turkey and Balkan, and the pipelines, which are backed by the EU, harm Continental Europe slightly since the losses from intensified demand competition for Dutch and Norwegian supplies surpasses the gains from stronger supply competition in the EU.

The Nabucco-West pipeline's consortium is composed by Continental Europe, Balkan and Turkey. Their total gain covers just about the project's cost (0.8 bn €/a), but a major share of the gains accrue to Turkey (0.7 bn €/a) instead of European consumers. The relatively cheaper TAP (0.3 bn €/a) is strategically unviable for its consortium members, Continental Europe and Balkan, since Turkey is not included in the project's consortium. Considering low gains accruing to the European regions, I do not expect that European companies will invest in the Nabucco-West pipeline or the TAP.

European concerns or Russian expectations that the South Stream pipeline will forestall investment in the Southern Corridor are unfounded. The comparison of the second and fourth columns in Table 6 in Appendix B shows that the presence of the South Stream pipeline alters the consortium's gains from the opening of the Southern Corridor only slightly,[16] and the total benefits accruing to the consortium

[16]The joint consortium of the Trans Caspian, the TANAP and the Nabucco-West pipelines consists of Azerbaijan, Balkan, Continental Europe and Turkey.

(2.5 bn €/a) exceeds the projects' cost (2.1 bn €/a). The South Stream pipeline and the Southern Corridor benefit European consumers through different effects. While the South Stream pipeline intensifies transit competition for Russian gas flowing to Europe, the Southern Corridor increases supply competition in Europe by introducing new suppliers. Actually, in the presence of the South Stream pipeline, Continental Europe gains 0.2 bn €/a more from access to Azerbaijani and Central Asian supplies through the Southern Corridor. The South Stream pipeline facilitates import of Russian supplies to European and Turkish markets. Thus, in Continental Europe demand competition with Balkan and Turkey for Dutch and Norwegian supplies hurts the importers in a smaller extent, and the only exporter, Netherlands, benefits more from access to Balkan and Turkey. Although additional supplies from Azerbaijan and Turkmenistan benefit the importers in Continental Europe less, the net impact of these three effects are larger.

Via Iran and the Southern Corridor

The routes via Caspian Sea (the Trans Caspian pipeline and the TANAP) and via Iran both intend to carry same volumes of Central Asian gas (15 bcm/a) to East Turkey and then to the EU-Turkey border. Therefore, the fourth and seventh columns in Table 2 are compared in order to deduce the most beneficial route for the Central Asian countries to western markets. Like by the route via Caspian Sea, Kazakhstan and Uzbekistan leave empty handed since Turkmenistan has enough production capacity to serve the Iranian route exclusively. While the route via Iran extends the capacity of the already serving pipelines, the route via Caspian Sea adds a new third transport option. Therefore, for Turkmenistan the route via Caspian Sea is more beneficial. Both routes increase supply competition between Azerbaijan and Turkmenistan in Balkan and Turkey. Since Azerbaijan is a transport country for Turkmenistan's gas on the route via Caspian Sea, the supply competition is weaker. The rest of the regions are affected by both routes analogously. The route via Iran is strategically viable for its consortium composed by Iran and Turkey since their total gain (1.8 bn €/a) exceeds the project's investment cost of 1.5 bn €/a. The impact of the Nabucco-West and Trans Adriatic pipelines on regions' power is very similar as described in Subsection "Via Caspian Sea and the Southern Corridor".

Table 3: Post-Turkmenistan-China Pipeline: Projects Impact on Bargaining Power [bn €/a]

Players	Bench-mark	Impact of pipelines *to the West* via Russia South Stream	via Caspian Sea TC+TANAP	via Caspian Sea TC+TANAP +NabW	via Caspian Sea TC+TANAP +TAP	via Iran Persian	via Iran Persian +NabW	via Iran Persian +TAP
Azerbaijan	1.2	−0.2	0.9	0.7	0.7	−0.1	−0.2	−0.2
Kazakhstan	0.5	0.	0.	0.	0.	0.	0.	0.
Turkmenistan	0.2	0.	0.5	0.5	0.5	0.3	0.3	0.3
Uzbekistan	0.5	0.	0.	0.	0.	0.	0.	0.
Balkan	1.3	0.3	0.1	0.3	0.3	0.1	0.3	0.3
Cont.Eur.	30.6	1.2	0.2	0.1	0.1	0.2	0.1	0.1
UK	12.1	0.3	0.	0.1	0.1	0.1	0.1	0.1
Turkey	14.2	0.2	0.9	1.6	1.6	0.9	1.7	1.7
Russia	28.9	1.8	−1.7	−1.7	−1.7	−1.9	−1.9	−1.9
Ukraine	14.5	−1.8	−0.2	−0.9	−0.9	0.	−0.8	−0.8
Belarus	10.5	−0.4	0.	0.	0.	0.	0.	0.
Iran	1.7	−0.3	−0.2	−0.4	−0.4	0.9	0.7	0.7
Norway	18.8	−1.2	−0.3	−0.1	−0.1	−0.4	−0.2	−0.2
China	0.5	0.	0.	0.	0.	0.	0.	0.
project cost[a]		1.8	1.2	2.0	1.6	1.5	2.2	1.8

[a]Investment cost annualized with an interest of 15%.

4 Concluding Remarks

In this paper I evaluate the strategic impact of several major pipeline projects, which aim to diversify transport routes and export markets of the Central Asian countries. I applied cooperative game theory on a disaggregated model of the Eurasian gas trade. Interdependence among the regions is presented in value function form, and the Shapley value allocates the surplus from cooperation within the regions depending on their role in the international gas trade via pipelines. The share of surplus received by a region is called its (bargaining) power. Since a pipeline project alters the pipeline network, it changes the value function, thus the distribution of the power within the regions according to the Shapley value. Changes in the power of the regions can be compared with the pipeline project's cost in order to make conclusions about the project's strategic viability.

Four major pipeline routes compete for transport of Central Asian gas to consumer markets. While the Turkmenistan-China pipeline extends eastwards to rapidly growing China, three routes head westwards to Europe and Turkey: via Russia, via Caspian Sea and via Iran.

The comparison of the four pipeline options' impact on the Central Asian countries' power supports their decision to gravitate eastwards to China instead of westwards to Europe and Turkey. The main supplier, Turkmenistan enjoys only a marginal increase in its power and benefits more from the routes via Caspian Sea and via Iran heading to Turkey. I believe that political issues attached to these routes compelled Turkmenistan to the less beneficial Turkmenistan-China pipeline. The Turkmenistan-China pipeline is strategically viable for its stakeholders, but only if the cost of the Second West-East pipeline in China is excluded.

The Turkmenistan-China pipeline's presence does not alter the power of the regions in the West of the Caspian Sea, and it has no impact on the strategic viability of the pipeline projects heading westwards. China's demand of pipeline gas is relatively small, and by virtue of its large spare production capacities Turkmenistan can serve both the West and the East simultaneously. Thus, I do not observe demand competition between China and the West for Central Asian supplies.

The South Stream pipeline, Russia's flagship project, maintains the status quo. Since the Central Asian countries' dependence on Russia prevails, there is no change in their power. Contrary to European skepticism, diversification of the transit routes carrying Russian supplies to European markets returns European consumers large benefits. Gains accruing to Russia confirms its insistence on

the project. The South Stream pipeline fails to forestall investment in the Southern Corridor since the projects benefit Europe and Turkey through different effects: transport and supply competition, respectively.

For the Central Asian countries the route via Caspian Sea is the most beneficial pipeline project in the options heading to the West since it bypasses the transit countries, Russia and Iran, and introduces a new transport route for the Central Asian gas flowing westwards. While Kazakhstan and Uzbekistan experience no changes in their power, benefits accrue to the main supplier, Turkmenistan, and the transit countries on the route, Turkey and Azerbaijan.

The TANAP exclusively breaks even for its investors Azerbaijan and Turkey. If Azerbaijani gas is carried to European markets via the Nabucco-West pipeline or the TAP, the EU's investment in the Trans Caspian pipeline is not justified due to the small leverage from additional Central Asian supplies.

The Nabucco-West pipeline and the TAP both link European markets with the Central Asian exporters. Negligible benefits accrue to the Central Asian suppliers as well as European consumers. In Europe gains from supply competition are wiped out by demand competition for Norwegian and Dutch supplies. Supply competition in Turkey and Balkan between the Eastern and Western producers harms the Central Asian suppliers. Turkey collects a major share of the gains. Considering low gains accruing to the European regions, which are major partners in the consortium, I doubt investment in these projects from European companies.

The Iranian route enlarges the capacity of the existing pipeline link extending from Turkmenistan to Turkey through Iran. Thus, increase in transit competition for Central Asian gas is limited, and Turkmenistan's power increases slightly. The project is strategically viable for the host countries, Iran and Turkey. However, in the light of political uncertainties in the region and objections from the West I do not expect that the project will materialize any time soon.

References

BP, British Petroleum (2012a), Statistical Review of World Energy June 2012, http://www.bp.com/statisticalreview

BP, British Petroleum (2012b), Shah Deniz Selects a Second Export Route Option to Europe, viewed 31 August 2012, http://www.bp.com/genericarticle.do?categoryId=2012968&contentId=7075514

ENTSOG, European Network of Transmission System Operators for Gas (2010), Capacity map dataset in Excel format, version June 2010, http://www.entsog.eu/mapsdata.html

GIE, Gas Infrastructure Europe (2010), GLE Map Dataset in Excel-format, version: June 2010, http://www.gie.eu/maps_data/lng.asp

GIE, Gas Infrastructure Europe (2011), GLE Map Dataset in Excel-format, version: August 2011, http://www.gie.eu/maps_data/lng.asp

Higashi (2009), Natural Gas in China: Market Evolution and Strategy, IEA working paper series

Hubert, Franz and Cobanli, Onur (2012), Pipeline Power, Working paper, http://www.ms-hns.de/files/publications/Pipeline_Power.pdf

IEA, International Energy Agency (2008), Perspectives on Caspian Oil and Gas Development, International Energy Agency Working Paper Series, December 2008

IEA, International Energy Agency (2010a), World Energy Outlook 2010, Paris

IEA, International Energy Agency (2010b), Gas Trade Flows in Europe, viewed 6 January 2011, http://www.iea.org/gtf/index.asp

IEA, International Energy Agency (2011), World Energy Outlook 2011, Paris

IHS CERA (2010), Caspian Development Corporation Final Implementation Report, viewed 31 August 2012, http://ec.europa.eu/energy/infrastructure/studies/doc/2010_12_report_cdc_final_implementation.pdf

NIC, Nabucco Gas Pipeline International GmbH (2012), Nabucco West Scenario, viewed 31 August 2012, http://www.nabucco-pipeline.com/portal/page/portal/en/press/Nabucco%20West%20Scenario

A Pipelines

This section presents the four pipeline options of the Central Asian countries to diversify their transport routes as well as export markets. I start with the already inaugurated eastern route and then, list the three western options, which are still under consideration. The Table 4 presents the pipeline projects considered in this paper in detail.

A.1 To the East

The 1850 km long Turkmenistan-China pipeline starts from Turkmenistan and reaches through Uzbekistan and Kazakhstan to Northwest China. The pipeline has a capacity of 30 bcm/a and is expected to cost 5 billion €. The project was initiated by China National Petroleum Corporation (CNPC) and undertaken together with local companies Kazakhtan's KazMunayGas, Turkmenistan's Turkmengas and Uzbekistan's Uzbekneftegas. CNPC also invested in Turkmenistan's production fields to supply the pipeline.[17] From Northwest China the Central Asian gas is shipped to demand centers in East China via the 4850 km long Second West-East pipeline. The pipeline has the capacity to transmit 30 bcm/a. I estimate the pipeline's cost at 9 billion €.[18] Two leading Chinese energy companies, CNPC and PetroChina carried out the project.

A.2 To the West

Via Caspian Sea and the Southern Corridor

Westwards the Trans Caspian pipeline connects the Central Asia via an offshore pipeline under Caspian Sea to Azerbaijan. The project is planned to have a capacity of 30 bcm/a, and its cost is estimated at 3.5 billion €. Since 2009 the EU considers the concept of Caspian Development Corporation (CDC) to promote European investment in the project.[19]

From the West Caspian shore the gas is shipped through the South Caucasus pipeline to Eastern Turkey and from there via the Nabucco pipeline to Central Euro-

[17] such as Bagtyyarlik. The cost of developing fields are not considered in this study.

[18] This is only the length of the major line. Together with eight sub-lines the total length of the project sums up to 8650 km. The total cost of the project is 16 billion €.

[19] IHS CERA (2010)

Table 4: Pipeline Network: New Pipelines

Links from	Links to	Capacity[a] old + new [bcm/a]	Flow[b] [bcm/a]	Operation Cost [€/tcm]	Capacity Cost[c] [bn€]	Capacity Cost[c] [bn€/a]	required for for access
Turkmenistan-China							
Turkmenistan	Uzbekistan	44 + 30	10.7	1.7	1.5	0.2	Turkmenistan, Uzbekistan
Uzbekistan	Kazakhstan	44 + 30	22.5	1.8	1.6	0.2	Kazakhstan, Uzbekistan
Kazakhstan	China	0 + 30	–	14.6[d]	1.9[e]	0.3	China, Kazakhstan
South Stream							
RussiaS	Balkan	0 + 63	–	5.6	8.6	1.3	Russia
Center-East	Balkan[f]	1.7 + 30	1	3.3	3.5	0.5	Russia
Trans Caspian							
Turkmenistan	Azerbaijan	0 + 20	–	0.9	3.5	0.5	Azerbaijan, Turkmenistan
Trans-Anatolien (TANAP)							
Azerbaijan	TurkeyE	8.8 + 16	4.5	2.4	2.4	0.4	Azerbaijan, Turkey, Georgia
TurkeyE	Turkey	20 + 16	11.8	2.4	2.4	0.4	Turkey
Nabucco-West							
Balkan	Turkey[g]	16.3 + 10	8.9	1.8	1.8	0.3	Turkey
Center-East	Balkan[d]	1.7 + 10	1	3.3	3.2	0.5	
Trans-Adriatic (TAP)							
Balkan	Turkey[h]	16.3 + 10	8.9	1.8	1.8	0.3	Turkey
Balkan	Italy	0 + 10	–	1.8	1.5	0.2	
Persian							
Turkmenistan	Iran	20 + 15	5.8	2.3	2.0	0.3	Iran, Turkmenistan
Iran	TurkeyE	13.7 + 15	7.2	1.2	5.4	0.8	Iran, Turkey
TurkeyE	Turkey	20 + 16	11.8	2.4	2.4	0.4	Turkey

[a] Existing capacity as compiled from ENTSOG (2010) and public sources + planned capacity

[b] Data are compiled from IEA (2010).

[c] Capacity expenditure (left column) is converted to annualized capacity-cost (right column) using a discount rate of 15%.

[d] Operation cost of the 2nd West-East pipeline (4000 km long) is included.

[e] The 2nd West-East pipeline's cost is estimated at 9 billion €.

[f] Currently gas flows from Center-East to Balkan. The projects plan to revert the flow.

[g] Currently gas flows from Balkan to Turkey. The project plans to revert the flow.

[h] Currently gas flows from Balkan to Turkey. The project plans to revert the flow.

pean markets. The EU listed Nabucco pipeline in its Trans-European Energy Networks (TEN-E) and backs it by appointing a coordinator.[20] The pipeline starts from eastern and southern borders of Turkey and reaches up to Austria through Bulgaria, Romania and Hungary. The Nabucco pipeline's consortium is composed by only consumers and transit countries but no suppliers.[21] In the last decade the project has experienced several delays due to lack of supply commitments from potential suppliers to fill the large capacity of the pipeline, 31 bcm/a.[22] Due to its size and long range, the project's cost reaches up to 17.6 billion €. In order to achieve economic viability, in 2012 the Nabucco pipeline is split into smaller projects which cover shorter range on the map and have a smaller transportation capacities: the TANAP and the Nabucco-West pipeline.

The TANAP covers the eastern section of the Nabucco. It starts from Azerbaijan's Shah Deniz II field and meets the Nabucco-West or the Trans Adriatic pipelines at the Turkey-EU border. The project's consortium is leaded by Azerbaijan's SOCAR and includes Turkey's BOTAS and TPAO as small partners. It is expected that other investors of the Azerbaijan's Shah Deniz II field[23] and the Nabucco's partners will join the consortium in the near future. Azerbaijan's participation in the consortium denotes its commitment to supply gas to European markets and its desire to be a transit country for Central Asian gas. Thus, as a supplier Azerbaijan bears part of the infrastructure cost to ship gas westwards, which was a major flaw of the Nabucco's consortium. The pipeline is designed to have an initial capacity of 16 bcm/a, but it can be expanded to deliver Central Asian gas, which will be supplied through the Trans Caspian pipeline. The project's cost is estimated at 4.8 billion €.

The Nabucco-West pipeline proposed by Nabucco's consortium forgoes the eastern section in Turkey and focuses only on the section in the EU. It follows the same route as Nabucco from Turkey's western border to Austria. The initial capacity of the pipeline is cut substantially to 10 bcm/a, but it can be increased up to 23 bcm/a.[24] Decreases in the project's range and capacity are passed through to its cost, which is estimated at 5 billion €.

[20] reference?

[21] such as Germany's RWE, Austria's OMV, Hungary's MOL, Romania's Transgaz, Bulgaria's Bulgargaz EAD, and Turkey's BOTAS

[22] such as Azerbaijan, Iraq and Turkmenistan. Although Iran hosts the second largest gas reserves in the world, in the current political context it is very unlikely that it ships gas to European markets.

[23] The Shah Deniz II field's consortium is composed by UK's BP, Norway's StatOil, Azerbaijan's SOCAR, France's Total, Russia's and Italy's LukAgip, Iran's NIOC and Turkey's TPAO.

[24] NIC(2010)

The Trans Adriatic pipeline (TAP) is selected as a second option in the EU's territory to transport gas from Azerbaijan's Shah Deniz II field westwards to European markets.[25] The pipelines starts on the Turkey-Greece border and after crossing Greece and Albania it reaches via an offshore pipeline across the Adriatic Sea to Italy. It has the same capacity (10 bcm/a) as its rival Nabucco-West pipeline. The TAP's cost is estimated at 2.3 billion €. Switzerland's EGL, Norway's Statoil and Germany's EON compose the project's consortium. All players can ship gas through the TAP and the Nabucco-West pipeline without any restriction. Thus, both pipelines eliminate the bottleneck between the Balkans and the Central Europe for all players.

Via Iran and the Southern Corridor

The Central Asian countries are connected to Iran's pipeline network with a capacity of 14 bcm/a. I assume that the existing pipeline capacities from Turkmenistan to Iran and from Iran to Turkey are extended by 15 bcm/a. From Turkey the gas is transported through either the Nabucco-West or the TAP further to European markets. The project's cost (9.8 billion €) is expected to be higher than the total cost of the Trans-Caspian and the TANAP pipelines (8.3 billion €). The hosting countries' national champions undertake the project together.

Via Russia

The offshore pipeline under Black Sea links Russia to Bulgaria and bypasses transit countries Ukraine and Belarus.[26] From Bulgaria the pipeline runs through Serbia and Hungary and ends in Austria. The offshore section's capacity (63 bcm/a) decreases to 30 bcm/a ashore. The project is expected to cost 16 billion € and is undertaken by Russia's Gazprom and hosting countries' national champions. The onshore section linking Bulgaria to Austria abolishes the bottleneck between Southeast Europe and the rest of European markets but only for Russia and its partners since it is exempt from the European third party regulation. Thus, Russia controls who can ship gas through the pipeline to Southeast European markets.

[25] BP (2012b)

[26] The construction of the South Stream pipeline started in December, 2012.

B Tables

Table 5: Southern Corridor's Impact on Bargaining Power [bn €/a]

		Impact of pipelines *(difference to column 1)*				
	Bench-mark	TANAP	TANAP +NW	TANAP +TAP	TANAP +NW +TC	TANAP +TAP +TC
Azerbaijan	1.2	0.4	0.2	0.2	0.7	0.7
Kazakhstan	0.5	0.	0.	0.	0.	0.
Turkmenistan	0.2	0.	0.	0.	0.5	0.5
Uzbekistan	0.5	0.	0.	0.	0.	0.
Balkan	1.3	0.	0.2	0.2	0.3	0.3
Cont.Eur.	30.6	0.	−0.1	−0.1	0.1	0.1
UK	12.1	0.	0.	0.	0.1	0.1
Turkey	14.2	0.4	1.2	1.1	1.6	1.6
Russia	28.9	−0.5	−0.5	−0.5	−1.7	−1.7
Ukraine	14.5	−0.2	−0.9	−0.9	−0.9	−0.9
Belarus	10.5	0.	0.	0.	0.	0.
Iran	1.7	−0.1	−0.3	−0.3	−0.4	−0.4
Norway	18.8	−0.1	0.1	0.1	−0.1	−0.1
China	0.5	0.	0.	0.	0.	0.
project cost[a]		0.7	1.5	1.0	2.0	1.5

[a] Investment cost annualized with an interest of 15%.

Table 6: Can the South Stream pipeline prevent investment in the Southern Corridor? [bn €/a]

Players	Impact of pipelines			
	w/o SS		with SS	
	Bench-mark	TC+TANAP +NabW	Bench-mark	TC+TANAP +NabW
Azerbaijan	1.2	0.7	1.	0.7
Kazakhstan	0.5	0.	0.6	0.
Turkmenistan	0.2	0.5	0.2	0.5
Uzbekistan	0.5	0.	0.5	0.
Balkan	1.3	0.3	1.6	0.1
Cont.Eur.	30.6	0.1	31.8	0.3
UK	12.1	0.1	12.4	0.1
Turkey	14.2	1.6	14.4	1.4
Russia	28.9	−1.7	30.6	−2.
Ukraine	14.5	−0.9	12.7	−0.5
Belarus	10.5	0.	10.1	0.
Iran	1.7	−0.4	1.4	−0.2
Norway	18.8	−0.1	17.6	−0.1
China	0.5	0.	0.5	0.
project cost[a]		2.1		2.1

[a] Investment cost annualized with an interest of 15%.

Table 7: Pre-Turkmenistan-China Pipeline: Projects Impact on Bargaining Power [%]

Players	Bench-mark	Impact of pipelines							
		to the East	*to the West*						
			via Russia	via Caspian Sea			via Iran		
		Turkmenistan -China	South Stream	TC+TANAP	TC+TANAP +NabW	TC+TANAP +TAP	Persian	Persian +NabW	Persian +TAP
Azerbaijan	0.9	0.	−0.1	0.7	0.5	0.5	−0.1	−0.2	−0.2
Kazakhstan	0.1	0.3	0.	0.	0.	0.	0.	0.	0.
Turkmenistan	0.1	0.	0.	0.4	0.4	0.4	0.2	0.2	0.2
Uzbekistan	0.	0.3	0.	0.	0.	0.	0.	0.	0.
Balkan	1.	0.	0.2	0.1	0.2	0.2	0.	0.2	0.2
Cont.Eur.	22.9	−0.3	0.9	0.1	0.	0.	0.1	0.1	0.1
UK	9.	−0.1	0.2	0.	0.	0.	0.	0.1	0.1
Turkey	10.6	−0.1	0.2	0.7	1.2	1.2	0.7	1.3	1.3
Russia	21.6	−0.2	1.3	−1.3	−1.3	−1.3	−1.4	−1.4	−1.4
Ukraine	10.8	−0.1	−1.3	−0.2	−0.7	−0.7	0.	−0.6	−0.6
Belarus	7.9	−0.1	−0.3	0.	0.	0.	0.	0.	0
Iran	1.3	0.	−0.2	−0.2	−0.3	−0.3	0.7	0.5	0.5
Norway	14.	−0.1	−0.9	−0.2	−0.1	−0.1	−0.3	−0.2	−0.2
China	0.	0.3	0.	0.	0.	0.	0.	0.	0.

Table 8: Post-Turkmenistan-China Pipeline: Projects Impact on Bargaining Power [%]

Players	Bench-mark	Impact of pipelines *to the West* via Russia South Stream	via Caspian Sea TC+TANAP	via Caspian Sea TC+TANAP +NabW	via Caspian Sea TC+TANAP +TAP	via Iran Persian	via Iran Persian +NabW	via Iran Persian +TAP
Azerbaijan	0.9	−0.1	0.7	0.5	0.5	−0.1	−0.2	−0.2
Kazakhstan	0.4	0.	0.	0.	0.	0.	0.	0.
Turkmenistan	0.1	0.	0.4	0.4	0.4	0.2	0.2	0.2
Uzbekistan	0.4	0.	0.	0.	0.	0.	0.	0.
Balkan	0.9	0.2	0.1	0.2	0.2	0.	0.2	0.2
Cont.Eur.	22.6	0.9	0.1	0.	0.1	0.1	0.1	0.1
UK	8.9	0.2	0.	0.1	0.1	0.	0.1	0.1
Turkey	10.5	0.2	0.7	1.2	1.2	0.7	1.3	1.3
Russia	21.3	1.3	−1.3	−1.3	−1.3	−1.4	−1.4	−1.4
Ukraine	10.7	−1.3	−0.2	−0.7	−0.6	0.	−0.6	−0.6
Belarus	7.8	−0.3	0.	0.	0.	0.	0.	0.
Iran	1.3	−0.2	−0.2	−0.3	−0.3	0.7	0.5	0.5
Norway	13.9	−0.9	−0.2	−0.1	−0.1	−0.3	−0.2	−0.2
China	0.3	0.	0.	0.	0.	0.	0.	0.

C Robustness: Tables

Table 9: Pre-Turkmenistan-China Pipeline: Projects Impact on Bargaining Power, with intercept 500 €/tcm [bn €/a]

Players	Bench-mark	Impact of pipelines							
		to the East	*to the West*						
			via Russia	via Caspian Sea			via Iran		
		Turkmenistan -China	South Stream	TC[a]+TANAP[b]	TC+TANAP +NabW	TC+TANAP +TAP[c]	Persian	Persian +NabW[d]	Persian +TAP
Azerbaijan	0.4	0.	−0.1	0.3	0.2	0.3	0.	−0.1	0.1
Kazakhstan	0.	0.1	0.	0.	0.	0.	0.	0.	0.
Turkmenistan	0.	0.	0.	0.2	0.2	0.2	0.1	0.1	0.1
Uzbekistan	0.	0.1	0.	0.	0.	0.	0.	0.	0.
Balkan	0.4	0.	0.1	0.	0.1	0.1	0.	0.1	0.1
Cont.Eur.	9.7	0.	0.3	0.1	0.	0.	0.1	0.	0.
UK	3.9	0.	0.1	0.	0.	0.	0.	0.	0
Turkey	4.6	0.	0.1	0.3	0.5	0.5	0.3	0.6	0.6
Russia	9.	0.	0.5	−0.5	−0.6	−0.6	−0.6	−0.6	−0.6
Ukraine	4.6	0.	−0.5	−0.1	−0.3	−0.3	0.	−0.2	−0.2
Belarus	3.4	0.	−0.1	0.	0.	0.	0.	0.	0.
Iran	0.6	0.	−0.1	−0.1	−0.1	−0.1	0.3	0.2	0.2
Norway	6.6	0.	−0.3	−0.1	0.	0.	−0.1	0.	0.
China	0.	0.1	0.	0.	0.	0.	0.	0.	0.
project cost[e]		0.7	1.8	1.2	2.0	1.5	1.5	2.2	1.8

[a]the Trans Caspian pipeline

[b]the Trans Anatolian pipeline

[c]the Trans Adriatic pipeline

[d]the Nabucco-West pipeline

[e]Investment cost annualized with an interest of 15%.

Table 10: Pre-Turkmenistan-China Pipeline: Projects Impact on Bargaining Power, with intercept 500 €/tcm [%]

		Impact of pipelines							
		to the East	*to the West*						
			via Russia	via Caspian Sea			via Iran		
Players	Bench-mark	Turkmenistan -China	South Stream	TC+TANAP	TC+TANAP +NabW	TC+TANAP +TAP	Persian	Persian +NabW	Persian +TAP
Azerbaijan	1.	0.	−0.1	0.7	0.6	0.6	−0.1	−0.2	−0.2
Kazakhstan	0.1	0.2	0.	0.	0.	0.	0.	0.	0.
Turkmenistan	0.1	0.	0.	0.4	0.4	0.4	0.3	0.3	0.3
Uzbekistan	0.	0.2	0.	0.	0.	0.	0.	0.	0.
Balkan	0.9	0.	0.2	0.	0.2	0.2	0.	0.2	0.2
Cont.Eur.	22.4	−0.2	0.8	0.1	0.	0.	0.1	0.	0.
UK	9.	−0.1	0.2	0.	0.	0.	0.	0.	0.
Turkey	10.6	−0.1	0.2	0.7	1.2	1.2	0.7	1.3	1.3
Russia	20.9	−0.1	1.2	−1.3	−1.3	−1.3	−1.4	−1.5	−1.5
Ukraine	10.6	−0.1	−1.2	−0.1	−0.6	−0.6	0.	−0.6	−0.5
Belarus	7.9	−0.1	−0.2	0.	0.	0.	0.	0.	0.
Iran	1.3	0.	−0.2	−0.2	−0.3	−0.3	0.7	0.6	0.6
Norway	15.3	−0.1	−0.7	−0.3	−0.1	−0.1	−0.3	−0.1	−0.1
China	0.	0.2	0.	0.	0.	0.	0.	0.	0.

Table 11: Post-Turkmenistan-China Pipeline: Projects Impact on Bargaining Power, with intercept 500 €/tcm [bn €/a]

Players	Bench-mark	Impact of pipelines *to the West* via Russia South Stream	via Caspian Sea TC+TANAP	via Caspian Sea TC+TANAP +NabW	via Caspian Sea TC+TANAP +TAP	via Iran Persian	via Iran Persian +NabW	via Iran Persian +TAP
Azerbaijan	0.4	−0.1	0.3	0.2	0.2	0.	−0.1	−0.1
Kazakhstan	0.1	0.	0.	0.	0.	0.	0.	0.
Turkmenistan	0.1	0.	0.2	0.2	0.2	0.1	0.1	0.1
Uzbekistan	0.1	0.	0.	0.	0.	0.	0.	0.
Balkan	0.4	0.1	0.	0.1	0.1	0.	0.1	0.1
Cont.Eur.	9.7	0.3	0.1	0.	0.	0.1	0.	0.
UK	3.9	0.1	0.	0.	0.	0.	0.	0.
Turkey	4.6	0.1	0.3	0.5	0.5	0.3	0.6	0.6
Russia	9.	0.5	−0.5	−0.6	−0.6	−0.6	−0.6	−0.6
Ukraine	4.6	−0.5	−0.1	−0.3	−0.3	0.	−0.2	−0.2
Belarus	3.4	−0.1	0.	0.	0.	0.	0.	0.
Iran	0.6	−0.1	−0.1	−0.1	−0.1	0.3	0.2	0.2
Norway	6.6	−0.3	−0.1	0.	0.	−0.1	0.	0.
China	0.1	0.	0.	0.	0.	0.	0.	0.
project cost[a]		1.8	1.2	2.0	1.6	1.5	2.2	1.8

[a]Investment cost annualized with an interest of 15%.

Table 12: Post-Turkmenistan-China Pipeline: Projects Impact on Bargaining Power, with intercept 500 €/tcm [%]

Players	Bench-mark	Impact of pipelines *to the West* via Russia South Stream	via Caspian Sea TC+TANAP	via Caspian Sea TC+TANAP +NabW	via Caspian Sea TC+TANAP +TAP	via Iran Persian	via Iran Persian +NabW	via Iran Persian +TAP
Azerbaijan	1.	−0.1	0.7	0.6	0.6	−0.1	−0.2	−0.2
Kazakhstan	0.3	0.	0.	0.	0.	0.	0.	0.
Turkmenistan	0.1	0.	0.4	0.4	0.4	0.2	0.2	0.2
Uzbekistan	0.2	0.	0.	0.	0.	0.	0.	0.
Balkan	0.9	0.2	0.	0.2	0.2	0.	0.2	0.2
Cont.Eur.	22.2	0.7	0.1	0.	0.	0.1	0.	0.
UK	8.9	0.2	0.	0.	0.	0.	0.	0.
Turkey	10.5	0.2	0.7	1.2	1.2	0.7	1.3	1.3
Russia	20.7	1.2	−1.3	−1.3	−1.3	−1.4	−1.4	−1.4
Ukraine	10.5	−1.2	−0.1	−0.6	−0.6	0.	−0.5	−0.5
Belarus	7.8	−0.2	0.	0.	0.	0.	0.	0.
Iran	1.3	−0.2	−0.2	−0.3	−0.3	0.7	0.5	0.6
Norway	15.2	−0.7	−0.2	−0.1	−0.1	−0.3	−0.1	−0.1
China	0.2	0.	0.	0.	0.	0.	0.	0.