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MULTIDIMENSIONALITY OF ENERGY SUPPLY SECURITY ISSUE IN EURASIAN CONTEXT

Природний газ є цікавим прикладом того, коли ринкова структура не може будуватись тільки на економічних аспектах, через необхідність великих фінансових вкладень, витрат на транспортування, високий рівень неоднорідності речовини в розробках та їх значну розосередженість; географія родовищ також дуже важлива. Політика є суттєвим стримувальним фактором розробки та оптимізації родовищ. Не тільки економіка, але й політика будуть відігравати важливу роль, якщо ми звернемося до питань збереження запасів газу. У статті розглянуто різні аспекти збереження запасів газу в Євразії.

Природный газ является интересным примером того, когда рыночная структура не может строиться только на экономических аспектах, из-за необходимости больших финансовых вложений, затрат на транспортировку, высокого уровня неоднородности вещества в разработках и их значительной рассредоточенности; география месторождений также очень важна. Политика является существенным сдерживающим фактором разработки и оптимизации месторождений. Не только экономика, но и политика будут играть важную роль, если мы обратимся к вопросам сохранности запасов газа. В данной статье рассматриваются различные аспекты сохранности запасов газа в Евразии.

Gas is an interesting example in which the market structure cannot be derived from purely economic aspects. Due to huge required investments, substantial transport costs and large heterogeneity in gas deposits and major consumption areas, geography is also very important. Politics plays an important role as a restriction to the development of otherwise optimal investment projects. When we address the issues of security of gas supply, not only economics but also geography and politics play important role. The present paper addresses different aspects of the gas supply security issue focusing on Eurasia.

investments, heterogeneity, gas deposits, gas supply, gas supply security

1. Introduction

There has been a recent revival of interest in energy security, stirred by high oil prices in the period up to 2008 and geopolitical supply tensions. We observe further concentration of oil and gas reserves in a few politically less stable countries. This is an important topic today, especially in relation to natural gas. After the Russian-Ukrainian crisis in gas transit of January 2009 many EU countries have been affected, and topic relevance got a second birth. Many papers and conference presentations are devoted to it (see, for example, [8, 9, 11, 13, 16]), and there are many documents of European Commission [4] and IEA [7].

The interest in energy security is based on the notion that an uninterrupted supply of energy is critical for the functioning of an economy. Hence, one of the EU objectives is to ensure energy security [2]. To reach this objective, they plan maximally

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diversify the suppliers of natural gas in the coming future. The document also states EU energy solidarity in helping its members to diversify energy supply when they are highly dependent on a single supplier.

In this article we will show that security issue has many dimensions. First of all, there is inter-link between security of supply and security of demand. Second, besides short term security issues (that are mostly addressed in literature), there is a question of long term security in supply.

The overall approach of Vanhoorn and Faas (2009) is driven by the task to have immediate reaction to the events similar to transit dispute with gas supply interruption. They define different variables (for demand, supply, general macroeconomics, substitution, infrastructure, geopolitics) and give recommendations for optimal short and middle term reaction (in particular, to increase storage capacity especially in Balkans and to have more LNG terminals and EU pipelines interlinking countries). However, at the moment there are little incentives for private business for such investments.

European Commission also reacted to this supply disruption. In the document «New proposals for security of gas supply»² it is recommended that «gas suppliers and transmission system operators should deal with the disruption for as long as possible before any State intervention is taken». Management of supply disruption «requires sufficient infrastructure to transport the gas, market transparency to allow the players to know the situation».

Olcott (2009) explores the relationships between Russia and Central Asian countries emerging from the exploitation of oil and gas reserves of Caspian region. At present, Russia does not dominate in extraction of these resources but has a monopoly on transportation of them to markets. One of the major reserves holder, Turkmenistan, has been unable to construct alternative pipelines (bypassing Russia) due to geopolitical reasons. The major present challenge to Russian transport monopoly comes from China, which is developing new trans-Central Asian pipeline system.

Now we can see the importance of interdisciplinary approach for security issue. Only reactions on short term interruptions (that are mostly addressed in European energy policy literature) are only part of a story about energy security. Here we will consider also long term security issues, which are related to long term market structure. Kruyt et al (2009) distinguish four dimensions of energy security that relate to the availability, accessibility, affordability and acceptability of energy. They consider the notion of energy security to be highly context dependent.

It is also important to mention Russian vision of its role as energy superpower. The book of Simonov (2006) gives a good analysis of Russian advantages, objectives and problems from interdisciplinary perspective. Paradoxical situation with Europe is also mentioned (ch. 3). On one hand, energy cooperation between Europe and Russia is mutually beneficial from economic perspective (this is also mentioned in Yegorov and Wirl (2008)). At the same time, since 2006 European press applies political bias to its relations with Russia, «demonizing both Russia and Gazprom». Thus, we need to understand why and how economics and politics became interrelated in gas markets.

2. Interaction between Economics, Politics and Geography

Comprehensive approach to energy supply security should take in account all necessary conditions along supply chain. Security of energy supply exists, when:

- a) Energy resource is sufficient,
- b) Producer is willing to sell and consumer is willing to buy,
- c) There is secure possibility of delivery.

²http://ec.europa.eu/energy/security/gas/new_proposals_en.htm

Traditional economics based on market concept takes into account only condition b). Indeed, there are theorems about existence and efficiency of market equilibrium (such a point in price-quantity space, where utility of consumers and profits of producers are maximized) under certain conditions (positively sloped supply and negatively sloped continuous demand curves). While monopoly can perturb market efficiency, it does not affect existence of equilibrium. Thus, a policy to prevent monopoly can increase utility of consumers and social welfare, but does not represent the major obstacle for supply security.

Energy differs from other goods in two aspects:

a) at present, about 85% of energy is produced from non-renewable sources (that can deplete, and are described by resource economics, with principles described by Hotelling (1931)),

b) energy resources are distributed heterogeneously across countries, and energy trade can involve potentially insecure routes of delivery passing third countries.

When policies for energy trade are derived on the basis on economics only, they neglect two important security aspects: finiteness of resource and potential insecurity of delivery. The first issue is still few decades from being hot aspect, since world proven oil reserves are for 40 years, and gas for 70 years, while exponential discounting of future typically neglects effects coming in few decades. The security of delivery was crucial few centuries ago (in the time of pirates) and during the Second World War. However, nowadays security can be perturbed by conflicts with transit countries that have purely economic origin.

Yegorov and Wirl (2008) have studied the trade off between short and long term diversification of gas supply to EU. This paper argues that the European strive for energy diversification at present is economically inefficient given the nearby resources and existing or committed transport network to Russia. Furthermore, this present diversification strategy will put Europe into competition with other consuming regions in the future, when the sources available for diversification turn dry. Hence, the current policy pursued by the EU faces a serious trade off of risking future supplies for present energy security. The methodology used for reaching this conclusion is based on the analysis of the distribution of gas reserves in different countries and the projection of their dynamics based on current reserve-production ratios and perspectives of its change. Investment in production capacities and transportation are important for middle term dynamics (10–30 years), while depletion of reserves will play crucial role later. Russia is the world largest reserve holder (26%), followed by Iran (15%) and Qatar (14%) (see BP, 2008). The major alternatives of Europe for gas supply, Norway and Algeria, have relatively moderate reserves that can dry in 20–30 years in the case of intensive exploitation. Hence, more competition in the short run will lead to less competition in the long run, when only few countries with largest gas reserves will stay at the market.

In another paper, Yegorov and Wirl (2010), the issue of influence of geography and politics on gas market is addressed. First, this influence has been shown in descriptive and policy oriented literature, which is surveyed there. The book by Victor, Jaffe and Hayes (2006) reveals the substantial evidence related to high role of geography, politics and technology for gas markets. This perturbs functioning of standard economic analysis for natural gas markets and calls for the development of more complex modelling.

Second, some theoretical analysis of this influence is provided. In particular, it is geography and politics that disrupts otherwise normally functioning economic market and leads to emergence of externalities. An important class of such externalities is related to gas transit games. Some countries are land-locked and do not have other mode of importing energy except for pipelines. If these pipelines pass third (transit) countries, transit games can emerge. They are linked to the monopoly of transit (geographically) and rent seeking behaviour (politically). In order to bypass transit countries, more expensive technologies of gas delivery are used, like LNG and submarine pipelines (like

Nord Stream) can be used. However, the issue of territorial waters becomes crucial in potential blocking such projects. Geopolitics can also prevent the construction of pipelines that could be optimal for both producer and consumer. In particular, impossibility to establish security in Afghan gas transit has blocked the construction of gas pipeline between Turkmenistan and Pakistan and India.

However, if interaction is cooperative, pipelines can lead to integration of space. This is similar to the network of blood supply in a biological organism. Any disruption of cooperative interaction between its different organs leads to death. Only organisms with small level of organisation can live with decentralised interaction between different elements. Liberal paradigm in economics tries to promote liberalisation as a remedy to economic welfare. The example of transition in post-soviet space has shown that only small business with low level of organization could adapt to fully liberalised markets, while industries (that were well developed in the époque of the USSR) could not survive it. Although energy sector represents an industry with relatively low level of complexity in organization, we see that geopolitical and technological forces substantially perturb «pure economics», and thus new interdisciplinary models have to be developed. This interaction between economics, politics and geography leads to the failure of welfare theorems of classical economics due to emerging externalities. It is important to develop new economic theory that will take such effects into account³. It is likely that some intermediate level of planning, cooperation and government intervention in the economy leads to more efficient economic functioning than both command system and fully liberalized market. In fact, we observe much higher involvement of state in the economy in EU comparing to post-soviet space.

3. Gas supply security and market structure

The issue of security of supply of natural gas has many components, and we have to address all of them. First, we have to distinguish between short and long term supply security. While in the first case mitigation of external effects from temporal interruption of supply can be done by construction of storage capacities, pipeline interlinks between EU countries and new LNG ports, the long term security requires substitution for renewable energy sources as well as establishment of cooperative links between producers and consumers.

In fact, the effect of temporal interruption of supply in January 2009 was not related to the problems with producer (who has been interested in stable flow of revenues from gas sales and reputation) but from a transit country (which was here like an intermediary). The issues of gas transit games is addressed in many papers; see, for example, Hubert and Ikonnikova (2004), Yegorov and Wirl (2009, 2010).

Hubert and Ikonnikova (2004) use cooperative game theory to analyse the influence of the architecture of gas pipelines on bargaining power in gas transit games. In this sense, their research is a contribution to the game theory on economic networks, with application to export of Russian gas to Europe.

The paper by Yegorov and Wirl (2009) investigates the origin and motif of the stopping of the Russian natural gas flow through the Ukraine to Europe in January 2009 and discusses the strategic situation and losses of the three players (Russia, Ukraine and Europe). The origin of this conflict – the stopping of Russian gas exports to Ukraine and thereby (indirectly) to downstream European consumers – was the failure to reach an agreement between Russia and Ukraine on the prices for its natural gas, and for the control of transit through Ukraine to Europe. The Ukrainian economy cannot presumably afford gas at international price and tried to use its position as the major transit country for Russian exports of gas to obtain favourable terms either for

³See Yegorov Y., Wirl F. «International Gas Markets: Economics, Geography and Politics», 10th IAEE European Conference, Vienna, 7–10 September 2009 (Online Proceedings: <http://www.aee.at/2009-IAEE/details.php>).

gas imports or transport fees. After the dissolution of the USSR Russia has subsidized Ukrainian economy, hoping that it will stay in its geopolitical space. These illusions disappeared after the Orange revolution and Russia decided to stop these subsidies. Hard bargaining in early 2009 between Russia and Ukraine has been motivated by the desire of Ukraine to compensate price growth by corresponding increase of transit fees moving them to unacceptable level even by European standards. This conflict between Russia and Ukraine caused external substantial external costs to Europe. A side effect was loss of Russian reputation as secure gas supplier and increased EU concern about supply security. However, rational motivations for such behavior of Ukraine have not been discovered.

In another paper, Yegorov and Wirl (2010) compare different types of transit games, where transit country can be net gas importer (like Ukraine for Russia) or net gas exporter (like Russia for Turkmenistan). They also study the factors that can influence the transit game structure. In the short run, this may be updating of international law. In the long run, it is more geopolitics that can prevent the construction of alternative pipelines either by direct blocking or worsening of investment climate. Transits allow for power abuse, which can put exporting country with no direct access to consumers into a weak position. In these examples we have seen that one country (here Russia) can be in different positions: abused by Ukraine and abusing Turkmenistan. In theory, omnipotent regulators can prevent such games. Thus, we should study why such games can emerge, and how to prevent them (as well as negative externalities) in future.

Another dimension of the problem is the duality: security of supply versus security of demand. Since infrastructure investment is very costly for natural gas, both producer and consumer are interested in long term security of gas flow (trade). This problem does not have Russian origin (as some short sighted politicians or analysts say). We can also see that European based companies planning infrastructure projects (like Nabucco) have also to address them.

Gazprom receives 65% of its revenues from Europe, and generated 8% of Russian GDP in 2005. 40% of Russian budget depend on the export of energy. Thus, both producers and transit countries are financially dependent on their European energy buyers. Thus, a mutual dependence of Eurasian buyers and sellers exist, and this raises security issues for both sides of this tied market. And both sides are seeking ways to diversify away from this vulnerability. This mutual dependence between Russia and Europe arises largely from the natural «lock-in» imposed by the pipeline system.

Ericson (2009) analyses Eurasian network of natural gas pipelines. Many gas consumers are concerned about energy security. In particular, EU is concerned about energy dependence on Russia that supplies not only its own but also Eurasian gas. Yet sources of energy are increasingly limited. Due to technology and high infrastructure costs, gas markets are highly inflexible. Very often economic considerations take second place to political issues. Astronomical up-front investment costs lead to emergence of natural monopoly. Development of such system requires long-term contractual relationships that ties producers and consumers together. Contrary to oil, natural gas is typically supplied through singular gas pipeline network. By their physical structure, pipelines generate a natural monopoly on the supply side. They also open up the possibility of monopsony demand if relatively few buyers cooperate. The pipeline network can impose a «lock-in» relationships between producer and consumers, where deep dependence on each other imposes non-market bargaining.

Finally, we have to address long term market structure and associated security in gas supply. In the long run three countries that have the largest proven gas reserves at present) will dominate the market for gas export. These countries are Russia, Iran and Qatar. The reason is the substantially lower reserves (not exceeding 3% of world reserves) for any other market participant. Here we assume political stability and no huge discoveries in unpredicted new regions. According to IEA (2008) forecast, EU demand for natural gas imports will grow even under energy conservation scenario

and reach 478 bcm by year 2030. Asian gas demand will grow substantially (to 355 bcm in 2030), driven mostly by economic growth of China. The major uncertainty of demand for future gas imports comes from the USA. The discovery of new technology of economic extraction of shale gas will moderate their demand for gas imports in the coming decades. Hence, IEA prediction of the necessity to import 142 bcm of gas by USA in 2030 can be downscaled. The cost of shale gas production in the USA today is about 90 \$/tcm. However, current period is likely to be «golden», and uncertainties with future costs and efficiency are high. While some literature is too optimistic about shale gas revolution, no serious assessment of shale gas reserves than can be extracted economically have been done up to now⁴. But even if the USA will demand no gas exports, imports of their shale gas to Europe is under question due to high cost of LNG delivery comparing with pipeline delivery from Eurasia. Even if we take European and Asian import demands alone, we will need export capacity between 800 and 900 bcm of gas in the coming decades. Calculations of reserves show that while African gas (coming from Algeria and later possible from Nigeria, with about 3% of world reserves each) may dominate EU imports in the middle run (IEA estimates that African export will drive our Russia as major gas supplier to EU in 2030), these reserves will dry after intensive exploitation, and in the long run Middle East and Russia will be main gas exporters to Europe. How they will split export to Europe and Asia is an open question, but in any case long run market structure for natural gas will be a narrow oligopoly. Thus, EU push towards more diversification of gas supply sources in the middle run will eventually result in less competitive (and thus less secure) gas market in the long run.

4. Conclusions and policy implications

Recent studies have shown the important role of geography, politics and technology for the evolution of markets for natural gas. Gas market differs from other markets due to very high share of transport and infrastructure costs. Since investment is location specific, it involves geographical and political aspects. Future market structure of it becomes path dependent on the investment decisions, particularly in gas infrastructure (pipelines and LNG). All the players have a vector of strategic choices where geography, politics and technology set their limitations.

We see that the topic of energy supply security has several dimensions:

- a) Mitigation of short run external effects from temporal interruptions,
- b) Elimination or reduction of negative effects from transit games,
- c) Influence of actions today on long term market structure and associated security components.

Finally we provide some theoretical statements with some examples. First, the nature of economics of pipelines coupled with geography determines the density of gas consumption in particular areas. Political aspects can block construction of certain routes (like gas pipeline link from Central Asia to India that has not been constructed yet despite the interest of both producers and consumers).

Second, medium term policy of EU towards maximal diversification of gas suppliers eliminates a lot of options in the long run and leads to less competitive and less secure gas market in future.

Third, there is a policy dimension of pipeline, and it is related to transit game. Elimination or reduction of such games in the absence of international legal framework for transit rules leads to a necessity of double investment in infrastructure that is very costly. The planned and currently constructed gas pipelines North Stream and South Stream serve more the objective of security of supply for producer rather than

⁴http://www.ng.ru/energy/2010-04-13/14_revolution.html. Melnikova S., Geller E. Shale revolution under question (in russian).

the necessity to expand export volume (which is a secondary objective). In a similar manner, Nabucco gas pipeline has the major goal to increase the security of gas supply to EU consumers.

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