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Cooperative Rivalry – A Prospective Alternative to International Organisations on a Global Energy Market: A Case of Russia – USA European Gas Standoff[1]

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Abstract

The purpose of this article is to consider the options for settling equilibrium on the world gas market in the absence of international regulating institutions while political instruments of non-market competition are actively being used by European market players. A market analysis from the point view of cost structure and the interests of key suppliers and consumers is undertaken, and an attempt to build a model of market interactions accompanied by sanctions is made. Modelling the internalization of political restrictions is used to ground actors' motives and their strategies in new conditions. The results of this analysis provide for essential conclusions regarding market change in general as well as changes in the positions of separate players. Mathematically sound results inspire optimism that actors can take optimal and efficient decisions despite non-economic competition and de facto failure of international institutions.

Keywords: international competitiveness, European gas market, Nord Stream, LNG, price and non-price competition, economic and political rivalry, political economy modelling, sanctions, added value, energy security

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Introduction: Context and Challenges

At this point in the development of the world economy, in which the global energy sector is one of the foundations of all production processes (in a broad sense, including household activities), humanity is facing a number of new challenges and threats. These are posed not by external factors (forces of nature, as it was beforehand), but by endogenous variables originating from the peculiarities and customs of interactions among individuals, companies and states.

The European gas market can be regarded as a vivid large-scale example of emerging and functioning international politico-economical systems. This market was chosen for analysis for

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several reasons: it represents an energy system with hundreds of millions of consumers, operating a sophisticated technical and financial infrastructure, and having established standards and customs [Andronova, Osinovskaya, 2017]. These circumstances decrease transactional costs and make it possible to approximate this market structure with an almost perfect competition pattern (especially from the demand side – the limits of such an assumption are discussed below). An important detail of the European gas market is the growing deficit of domestic supplies; domestic production has been steadily decreasing and the vast majority of demand is satisfied by imports (see Fig. 1). Moreover, production and export volumes have almost become equal. Hence, European consumption is secured by imports only.

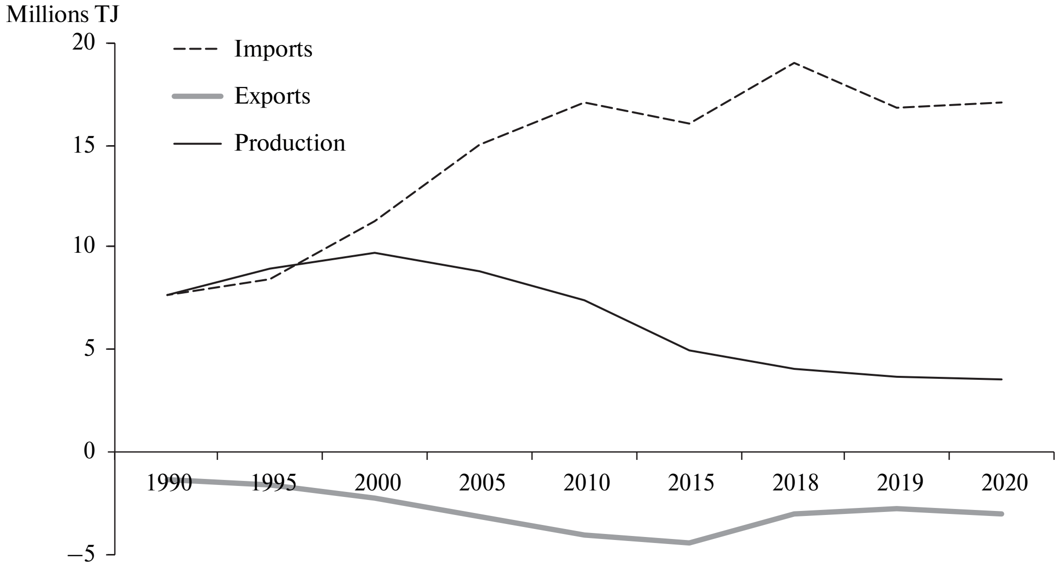

Figure 1. Production, Imports and Exports of Natural Gas in EU-28, TJ

Source: Compiled by the authors based on data International Energy Agency.

Meanwhile, a few large suppliers (Russia, Norway, Qatar, the U.S. and Libya), carrying out various business strategies, delivery schemes, and pricing mechanisms, tend to dominate the market. At the same time, natural gas is a rather homogeneous good (only a fraction of its main ingredient – methane – varies from 80% for biogas to 95–99% for a high calorific fossil fuel) which theoretically makes price competition the only efficient tool (this statement will be tested below).

The outcome of price competition can be assessed on the basis of suppliers' cost comparison (Figure 2 illustrates the cost structure of Russian and U.S. suppliers). It is notable that the variable costs of these producers are rather similar. However, adding up tolling fees (liquefaction at liquefied natural gas (LNG) terminals) almost doubles the U.S.' total costs. Since a majority of U.S. LNG terminals provide their capacities on a prepaid basis, the liquefaction costs of U.S. suppliers are regarded as sunk costs, forcing them to optimize short-term profit only (that is, covering at least variable costs). Thus, U.S. exporters have a strong incentive to duck into non-price competition options. At the same, the ability of some market players to influence other players' costs, including transactional ones, remains an understudied issue within the framework of economic theory.

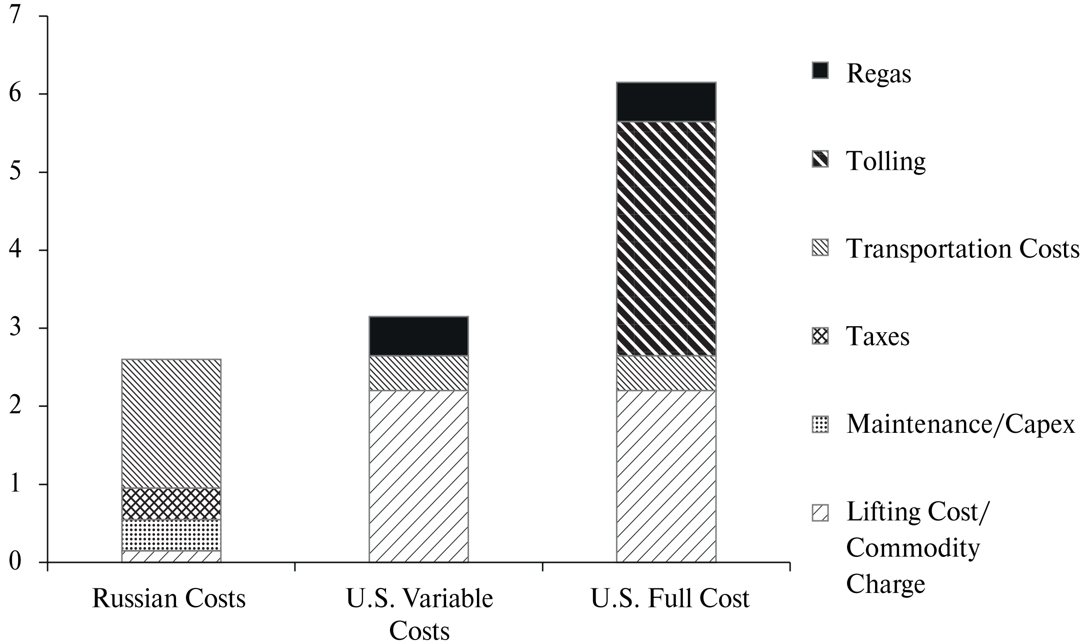

Figure 2. Cost Structure of Russian Natural Gas and U.S. LNG suppliers, $/MMBtu

Source: Compiled by the authors based on data PIRA.

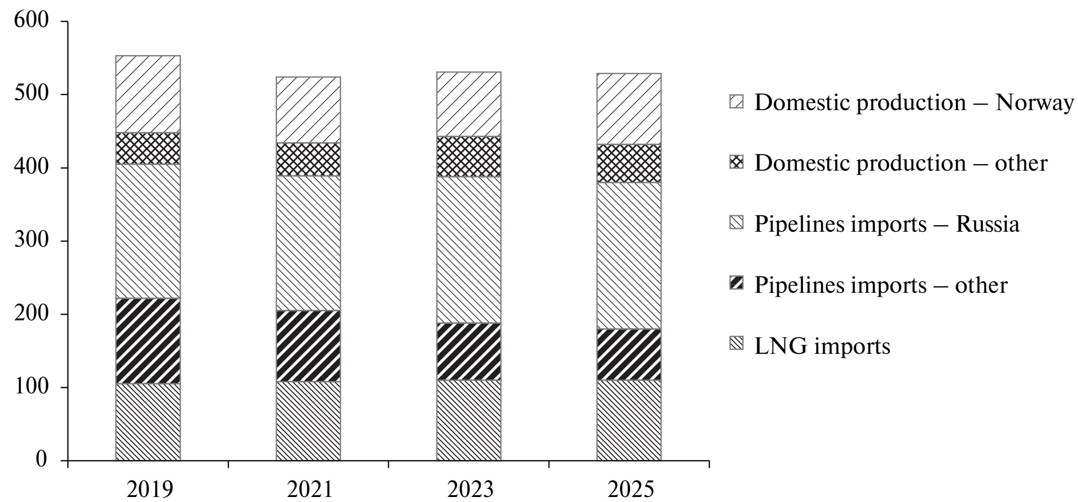

Figure 3. Evolution of European Natural Gas Supply, 2019–25, bcm

Source: Compiled by the authors based on data International Energy Agency.

A high level of economic development, increased living standards, and advanced industries contribute toa strong energy demand in Europe. Previous studies [Lavrov, Simonov, 2021] spotted a probable lack of potential substitutes for natural gas among other energy carriers (related to forced nuclear station shutdowns, disqualified coal generation, and the impossibility of supplying peak load via renewable only).

Taking the above-mentioned into consideration, the European gas market can be described as a market of a homogeneous good with many of well-off consumers, a developed technical and financial infrastructure, and a heavy dependence on imports [Karpova, Lavrov, Simonov, 2014]. This description largely matches a classical definition of perfect competition [Arrow, Debreu, 1954]. The only significant obstacle to be mentioned is large foreign enterprises. Thus, a significant uncertainty arises, caused by importers' strategies (theoretically varying greatly, from price collusion to price war) and depending upon importers' policymaking (applied both to importers and setting energy market rules and regulations). The European gas market is substantially susceptible to regulations and prescriptions on a national, as well as supranational, level. The measures taken by importing states can significantly contort competition, impact supporting and related industries, and affect energy business strategies in the long run. Such measures may include a de facto discriminatory approach toward supplies from different sources, establishing large local intermediaries (for example, European energy distributors) to take part in profit distribution, or artificially creating substitutes (for example, promoting green energy and imposing duties derived from emission parameters). The latter is a well-researched phenomenon; when political factors are considered exogenous, the substitution of fossil fuels with renewables can be described within the framework of Porter's five forces model [1979] as the "threat of substitutes." Theoretically, the energy transition can also be considered a creative destruction within Schumpeter's approach [1994]. Nevertheless, for reasons stated above, the development of green technology (at least currently) can hardly guarantee better selling propositions when compared to traditional energy sources along key economic and technological criteria.

In this article, an analytical approach toward settling European gas market equilibrium in the short run is developed. Constructing a facilitated mathematical model that includes a political element may help to create an efficient tool to spot the potential for multilateral compromises based on the economic interests of various parties. In the case a principle of settling equilibrium without regulating institution is grounded, there is a conclusion to be made: current competition scheme turns out to be credible as an alternative to international organizations and treaties. This may pave the way for large-scale investigations focused on other regions and industries. This moment is highly important, as a better understanding of the ongoing evolution of international economic relations accompanied by the actual failure of many international organizations (such as the United Nations (UN) and the World Trade Organization (WTO)) could provide a new impulse to the development of the world economy [Larionova, 2016] and could become a competitive advantage for those actors who develop techniques to take optimal decisions in the absence of regulating institutions.

Key Concepts (Terms) and Analytical Paradigm

The oil and gas business is a classic sample of positive economies of scale (decreasing average costs caused by increasing output). Therefore, in most countries, especially those with significant resources, large (often the only) enterprises were formed and consolidated production, transportation, and refinery assets [Karpova, 2016].This, in combination with substantial fiscal dependency on oil and gas industries, leads to a blurring of lines between state and corporate interests in this sphere and makes some international organizations (primarily the WTO) unable to moderate interactions among business entities, perceived inter alia as state agents [Lavrov, Aleksanyan, 2017; Lavrov, Simonov, 2021]. The demand-side situation is rather similar: energy security underlies not only economic power, but also provides for basic necessities of households. This creates incentives for states (and politicians, for electoral reasons) to actively interfere in energy procurement issues in the short run and exercise pressure on energy balance transformation and energy sources selection in the long run. Thus, logical questions arise: what, if any, are the options for settling equilibrium in these conditions, and what principles and rules of interactions on international energy (gas) markets are being shaped?

The consequences for the market and its players in the short term can be analyzed when major players take their egoistically best decisions (profit maximization) for two cases. The first one is\ price competition and the second one is the case where one player possesses strings to limit export capacities of the other. This approach looks applicable due to higher costs of delivering LNG from the U.S. compared to pipeline shipments. It is expected that restricting export capabilities of Russian suppliers is the only effective tool of profit maximization for U.S. suppliers under price competition [Simonov, Lavrov, 2022].

Methodology

The model assumes one consumer and two suppliers in the market. The market is observed in the short term, thus fixed costs are considered sunk and neglected at settling short term equilibrium. Demand and supply functions are linear, moreover, the volumes traded depend on price as well as physical limitations (such as the maximal transportation capacity of pipelines and LNG tanker fleet). Due to political leverage, the second supplier can influence pipeline transportation capacity and load factor, having incurred costs as well. The consumer's payoff is calculated as consumer surplus, and the suppliers' payoff is calculated as the difference between relative revenue and costs. This model contains a number of significant simplifications; however, it is expected to have sufficient predictive power to identify key equilibrium/equilibria regularities and to spot the factors exerting the greatest impact on each player's results. The following notation is used:

$MC_1 = AC_1 = a$	marginal and average costs of the first supplier;	
$MC_2 = AC_2 = b$	marginal and average costs of the second supplier;	
$Q^S = q_1(P)+q_2(P)$	the volume supplied equals the sum of volumes shipped by the first and the second player;	(1)
$TC_i = q_i * AC_i$	total costs equal volume multiplied by average costs;	
$TR_i = q_i * P$	total revenue equals supplied volume multiplied by price;	
$Q^D(P) = c - dP$	linear demand function;	(2)
$Q^s(P) = Q^D(P)$	market equilibrium condition.	(3)

I The equilibrium for the case of no price collusion is to be found. Each supplier defines volume to be supplied independently, only considering its own profit

From (1), (2), and (3):

$$P = \frac{c - Q}{d} = \frac{c - (q_1 + q_2)}{d} \tag{4}$$

$$TR_1 = P * q_1 = \frac{c - q_1 - q_2}{d} q_1;$$

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In a similar way:

$$MR_1 = \frac{\partial TR_1}{\partial q_1} = \frac{c - 2q_1 - q_2}{d}.$$

Profit maximization rule provides for the following system of equations:

$$\begin{cases} MR_1 = MC_1; \\ MR_2 = MC_2; \end{cases}$$

$$\begin{cases} \frac{c - 2q_1 - q_2}{d} = a; \\ \frac{c - 2q_2 - q_1}{d} = b. \end{cases} \tag{5}$$

Having response functions derived and system solved, the following supply volumes and equilibrium quantity can be found:

$$\begin{cases} q_1 = \frac{c - q_2 - ad}{2}; \\ q_2 = \frac{c - q_1 - bd}{2}; \end{cases}$$

$$\begin{cases} q_1 = \frac{c + d(b - 2a)}{3}; \\ q_2 = \frac{c + d(a - 2b)}{3}; \end{cases} \tag{6}$$

$$Q^* = q_1 + q_2 = \frac{c - d(a + b)}{3}.$$

It is clear that for the case of equal costs we are obtaining Cournot duopoly equilibrium [Varian, 2005]

Then from (1), (2), and (5) equilibrium price is derived:

$$P^* = \frac{c + d(a + b)}{3d}. \tag{7}$$

To find each player's profit:

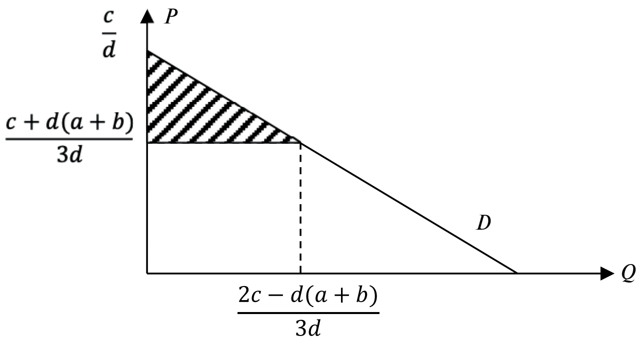
$$\Pi_i = TR_i - TC_i = q_i P - q_i AC_i = q_i (P - AC_i).$$

From (6) and (7):

$$\Pi_1 = \frac{\left(\frac{c + d(b - 2a)}{3}\right)^2}{d}; \tag{8}$$

$$\Pi_2 = \frac{\left(\frac{c + d(a - 2b)}{3}\right)^2}{d}.$$

Consumer surplus (CS). As far as functions are linear, equilibrium quantity (6) and price (7) have already been calculated; the computation can be performed based on diagram (the square of a striped triangle):



(9)

$$CS = \frac{(P^D(Q = 0) - P^*) * Q^*}{2};$$

$$CS = \frac{\left(\frac{2c - d(a + b)}{3}\right)^2}{2d}.$$

II Let us suppose that the second player, having incurred some costs (B⩾0), can limit the first player's access to transportation capacities. The model shall be completed with new conditions and the equilibrium shall be found

Let *e* be a new transportation capacity (which is now less than the previously disposable value by the first player, otherwise this limitation would not have any effect):

$$e < q_1 = \frac{c + d(b - 2a)}{3}. \tag{10}$$

Then from the response function (6):

$$q_2 = \frac{c - e - bd}{2};$$

$$Q^* = q_1 + q_2 = e + \frac{c - e - bd}{2} = \frac{c + e - bd}{2}. \tag{11}$$

Having defined new equilibrium quantity we can find new market price:

$$P = \frac{c - Q}{d} = \frac{c - e + bd}{2d}. \tag{12}$$

It is easy to prove that the new price will be greater. To do this, subtraction of the original price (7) from the new one (12) will provide positive value. (13)

Similarly, (8) the new profit of each player can be calculated:

$$\Pi_1 = e\frac{c - e + d(b - 2a)}{2d};$$

$$\Pi_2 = \frac{\left(\frac{c - e - bd}{2}\right)^2}{d} - B. \tag{14}$$

Similarly, (9) we can compute new consumer surplus:

$$CS = \frac{\left(\frac{c - e - bd}{2}\right)^2}{2d}. \tag{15}$$

It is easy to prove that the new consumer surplus is less than the one before the limitation on the transportation capacities of the first supplier was imposed. To prove this, a subtraction of the original CS (9) from the new one (15) can be performed. Due to condition (10), the result will be negative: limiting the first player's capacity worsens consumer benefit (16)

It can be proved as well, that the first player's profit falls under limitation, as the difference between the new profit (14) and the original one (8) is negative (17)

The difference of the second player shall be non-negative (otherwise, it is senseless to take any actions to limit the first player). This statement enables us to estimate **B** (costs for limiting the first player) as a value lying in-between 0 and additional profit, hence, it can be derived from (8) and (14)

Results and Conclusions

The modelling results lead to the conclusion that, when one player has the capability to limit its competitor's transportation capacities (for example, by imposing an obligatory Third Party Access (TPA) condition for export pipelines or derailing new transportation projects) it ends up significantly shifting market equilibrium. Generally, it results in decreasing volumes shipped and increasing prices. In addition, the first player's profit decreases, while the second player's profit, to the contrary, goes up. However, consumer surplus shrinks. The topic of the second player's costs remains open. It may be both costs of political lobbying as well as consumer reimbursement for price surcharge. In case the reimbursement is lower than the surplus decrease, the consumer's terms deterioration shall be considered as the cost of switching suppliers.

Limitation of the first player's transportation capacities by the second will be inefficient if the remaining capacities exceed original optimal volume, which maximizes the first player's profit. The second player will limit the first one only if this increases its own profit, since limiting the export capacities of the first player incurs costs for the second player. Therefore, a conclusion regarding economic feasibility of excessive capacities of the first player may be drawn: first, it secures market dominance due to lower costs and ability to significantly increase supplies; second, it diminishes limitation efficiency regarding existing and under-construction transportation capacities.

Modelling results are indicative of a cost structure influence upon optimal choice by the international relations participants; moreover, the existing option to affect others' costs can be treated as a new form of competitive advantage. Thus, there are reasons for formulating a relevant conclusion of Coase theorem [Coase, 1960] for competition at the global level: economic benefits on a global scale and on all levels (individuals, firms, states) depend on international transaction costs. Logically, this means that actors capable of influencing the international transaction cost system are capable of affecting the economic results of other actors.

Analysis of the European gas market structure provides another conclusion regarding conditions and prerequisites of price discrimination: a relatively high level of consumer differentiation by location and economic characteristics (income, available generation capacities, budgeting, and so on) provides opportunities for suppliers to offer different contract terms and schemes (price, volumes, terms, special conditions like "take-or-pay," complicated pricing formula, or pegging to other commodities). These options can be actively exploited by all suppliers for product differentiation and to build up competitive advantages.

All in all, despite apparent chaos in modern international relations, modelling results from analysis of the European gas market suggest a possibility of equilibrium, even in the face of permanent political interference which damages fair competition. Moreover, as far as each party acts according to its own interests, which are usually pairwise contradictive, there is a strong link between economic factors and political decisions. It establishes a basis for creating an efficient instrumetarium of economic forecasting and decision-making within new conditions. Even when international regulators fail, the functioning of an effective economic system remains highly likely. The basis for such development is a complex of overlapping, as well as contradictory, politico-economic interests, i.e. cooperative rivalry. A capability to impact business conditions at the regional, and more importantly, global scale will create a key competitive advantage.

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