Consequences of U.S. LNG Exports on Gazprom and European gas markets

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Overview

Since the dramatic shift in the energy balance of the U.S., driven by take up of unconventional energy production and, in particularly shale gas, there has been active debate amongst industry and academic community about possible implications of such a development on global gas markets. The discussion has evolved in the context of greater uncertainites in demand for gas from Asian countries, and greater competition from other gas suppliers such as Australia, Qatar and potentially from East Africa. In the European context, the debate was largely focused on economic and geopolitical implications of possible reactions from Gazprom to the developments in the global gas markets. In particular, should Gazprom engage in a *'price war'* and keep LNG competitors out of Europe or should it maximise prices and accommodate greater entry of LNG surpluses. A question of Gazprom's commercial strategy in Europe is of course driven by both geopolitical developments in Europe and global market dynamics. Thus, my research objective is to understand implications of U.S. LNG on the economics of Gazprom's export strategies and consequences for Europe.

Methods

To assess possible impacts of U.S. LNG on Gazprom's export strategies in the context of global demand and supply uncertainties I used global gas market model to simulate different scenarios of market dynamics. The model was formulated as a quadratic programme whose objective function is to maximise social welfare subject to linear contraints representing physical and contractual limitations in the whole gas value chain – from production to wholesale markets. Using insights from a seminal work by Hashimoto (1985)[1] the model can either simulate a perfectly competitive market outcome or Cournot game in quantities representing possible excersice of market power by large gas producers and suppliers.

In terms of data and assumptions, the model represents production, transit, demand, LNG and gas storage facilities and incorporates main producing countries, such as Russia and Qatar that are explicitly represented in the model as separate supply 'nodes' while other producers are aggregated into regions, e.g., North America (USA, Canada and Mexico). Europe is disaggregated into national markets at wholesale market level (i.e., the model only takes into account wholesale markets and not modelling distribution networks). Other demand centers are aggregated to regional level, such as Middle East, or JKT (Japan, S. Korea & Taiwan). The model was setup to run for 546 time periods (days) or 1.5 years (Jan-2020 until Jun-2021[2]). The model, therefore, approximates operations of day-ahead markets with market participants having perfect foresight.

Using the model, I analysed two strategies that Gazprom may adopt in responde to the development in U.S. LNG exports:

1. **'Defending market share' export strategy**. Under this strategy I assumed that Gazprom exports gas to Europe until (i) either price covers Gazprom's short-run marginal cost, and/or (ii) until gas fully prices coal out of European electricity generation mix. The strategy is consistent with the idea of *'flooding'* the market with cheap Russian gas to lock US LNG out of Europe & deter future investments in global LNG export capacity

2. **'Defending prices' export strategy.** Under this strategy, I assumed Gazprom, 'if needed', could lower contractual volumes to Europe and hence forcing its customers to procure more gas at hubs and consequently pushing up hub-based market prices. I have assumed that Gazprom's profit and contract prices are related to hub-based market prices which is consistent with the realities of Gazprom's main gas contracts with European buyers. The model, depending on input assumptions, such as production cost of competitive supplies as well as elasticity of demand, will determine optimal volumes that Gazprom may wish to *'withdraw'* from the European markets so that to maximise its profi

Results

Using the model I found that compared to *'Defending market share'* strategy – where I assumed that all gas supplies are priced based on short-run marginal cost (SRMC) of gas supplies to wholesale markets – Gazprom can unilaterally exercise market

[1] Hashimoto (1985). 'A spatial Nash equilibrium model' in Spatial Price Equilibria: Advances in Theory, Computation and Application, P.T. Harker, ed., Springer Verlag, New York.

[2] The reason for focusing on the years of 2020-2021 is that it is expected that in that period international LNG export capacities (from the US and Australia, in particular) will ramp up dramatically and hence may constrain any hypothetical market power exerted by Gazprom resulting from its dominant position in the supply markets of Europe.

power in Europe. Figure 1 below shows increase in Gazprom's profits (cases 1-3) relative to its profit under the *'competitive bechmark'* scenario (*'defending market share'* case) where all gas supplies are priced according to (SRMC).

Figure 1: Gazprom's profit under possible export strategies in Europe

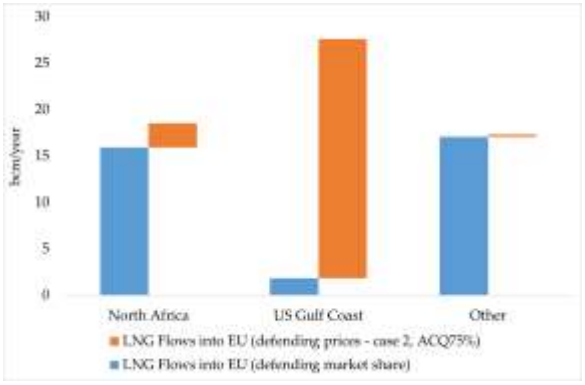

Figure 2: LNG imports into Europe under Gazprom's two export strategies

Thus, it is indeed profitable for Gazprom to withdraw gas from European markets thereby creating tighter market conditions and hence higher prices scenario. According to results from Cases 1-3, it seems that Gazpom's optimal export strategy depends on a particular mix of minimum long-term fixed price contracts and some sort of 'free' or spot market sales. All in all, Gazprom can profitably raise prices in Europe and that a mix of fixed price long-term contracts and free (strategic) trading volumes will ensure higher profits for the company. However, I found that with lower forward selling coverage (anything less than 75% of Gazprom's 2015 gas deliveries to Europe) Gazprom's profit begins to fall. Importantly, I found that when Gazprom adopts *'defending prices'* scenario then U.S. LNG would respond to this commercial developments expediately. In particular, I found that U.S. LNG would increase its deliveries to Europe substantially – from circa 2 bcm/year under Gazprom's *'defending market share'* strategy to around 27 bcm/year (see Figure 2). An important conclusion from this analysis is that irrespective of possible contractual limitations impeding free flow of LNG trade, U.S. exports are the most *'flexible'* sources of LNG for Europe by virtue of its relative economic geography – a combination of abundance (and cheap) of U.S. shale gas, distance from the U.S. Gulf Coast and export capacity available by 2020. As the results from my analysis suggests (Figure 2) U.S. LNG is the only source of flexibility available to Europe should Gazprom decides to pursue *'defending prices'* strategy. Indeed, thanks to the U.S. LNG, price effect of Gazprom's potential market power in Europe in 2020-2021 is limited to a maximum of $1.5/mmbtu relative to a *competitive benchmark* (Figure 3 & 4).

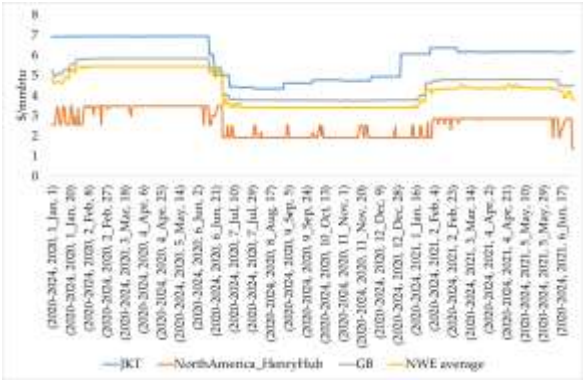

Figure 3: Prices under Gazprom's *'defending market share'* scenario

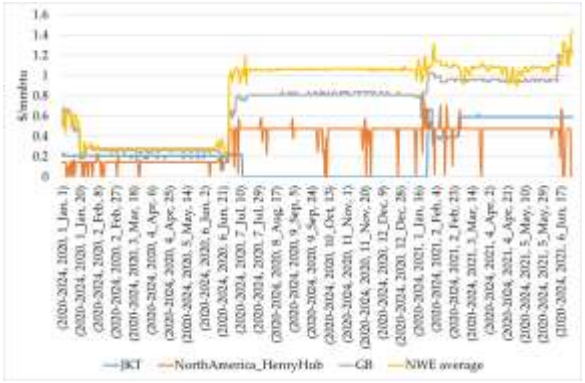

Figure 4: Price increase under *'defending prices (ACQ75%)'* scenario relative to prices under Gazprom's *'defending market share'* scenario

Conclusions

My preliminary results for market scenarios of 2020-21 show that it may be profitable for Gazprom to *'defend prices'* in Europe rather than engage in *'price war'* with the U.S. LNG exports. When Gazprom *'defend* prices' Europe, it appears that the only source of flexibility that may constrain Gazprom's potential pricing power is U.S. LNG. This is not so much due to the often discussed 'business model' of the U.S. LNG export facilities[3] but because of its relative economic geography – abundane of cheap shale gas, close proximity to liquid European gas trading hubs, and substantial export capacity. I intend to undertake further analyses by taking into account possible global gas market dynamics in 2025-2030 timeframe; in particular, analysing how Russia-China gas pipelines may change the above conclusions as well how other important global energy scenarios may impact U.S. LNG exports and hence Gazprom's position in Europe and in other markets.

[3] 'tolling' agreement