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GAS SUPPLY SECURITY, COMPETITION AND GEOPOLITICS

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OVERVIEW

This paper addresses modeling of competition and decisions about investment in infrastructure in an uncertain environment coming both economics and geopolitics. Geopolitical uncertainty suppresses investment in new gas pipelines. The more competing regional geopolitical powers are equal, the more investment is delayed. If there is a monopoly in regional geopolitics, then investment takes place fast. This happens because gas infrastructure is very expensive, and building two more alternative projects (that serve the same region) can be too costly for investment to take place. Probability of investment to have success is the positive function of local geopolitical power of investor. Consider two competing projects in Black sea region: Nabucco and South Stream. Both can give more security of gas supply to Europe, but the first project is backed by the USA, while the second by Russia. Despite overall loss of the cold war, regional geopolitical power (understood as a field on geographical map rather than scalar with integral characteristic) of Russia can be comparable with one of the USA.

METHODS

To start with, we introduce a quantitative measure for geopolitical power of a country, G. If two rivals have geopolitical powers G_i and G_j, it is possible to introduce index $q_i = G_i /(G_i + G_i)$. This index can have two applied interpretations:

a) Probability to have success in economic games with geopolitical rivals,
b) Bargaining power in pie-sharing games (like in gas transit game).

Further this concept is applied for two models. First, we consider an investment decision in competing and potentially mutually excluding infrastructure is considered. An example is economic success of Nabucco versus South Stream to deliver Caspian gas to Europe in the environment of moderate demand growth. Second, we consider an optimization problem for a large country, like Russia. Profit stream depends on both physical capital and geopolitical power. We study dynamic optimization problem with two states (capital stock and geopolitical power) and two controls as investment flows in both.

RESULTS

Suppose that there are two alternative projects ($i=A,B$) with comparable probabilities of success. This happens when geopolitical powers are comparable. Formally, for each project we can define net present value (NPV) as parametric function of interest rate, r, and probability of success, $q_i=q_i(G_i)$, where G_i is geopolitical power behind a project i. Clearly, NPV is a negative function of both r and q. We can have two different global environments: normal, with low interest rate for borrowing, r, and crisis, with high borrowing interest rate, R, especially for risky projects. If r is low, it may happen that for some interval of q, close to ½, NPV>0 for both projects (Fig.1). So, both investments will take place. If disparity between geopolitical powers is large, then only one project (backed by stronger geopolitical power) will be rationally implemented. In the time of crisis, interest is high, and NPV drops for both projects. For example, we have the infinite sum of discounted constant flow p of profits that are realized with probability $q(G)$ versus constant investment A at zero period. Then expected

revenues are *q(G)p(1+1/r)*. Whether they are above or below *A*, depends both on geopolitical power and interest rate r. If interest rate is high, it might happen that both projects are non-profitable if geopolitical powers are approximately equal. In this case, investment is delayed by crisis. But if there is significant difference in powers, for stronger power investment becomes less risky, and will be implemented. Thus, the market structure for gas can evolve along three paths: a) competitive expansion (when there is no crisis, and geopolitical powers are comparable), b) monopolistic expansion (when one power is stronger), c) stuck or investment delay, when there is crisis and when both powers are comparable. Optimization model shows the existence of steady state with optimal balance of capital and geopolitical power. Other unstable equilibria also take place.

CONCLUSIONS

The models have important applications for the investment in gas market infrastructure. First, we see that crisis can postpone investment in competing projects (like Nabucco and South Stream) and even make them rivals. At the same time, when crisis is over, both demand grows and interest rate lowers, makinh them less competing. What does it imply for long term dynamics of gas market? If infrastructure is fixed (since new investment is postponed), flows are determined not only by demand and supply, but also by existing capacities. For fixed flows and heterogeneous reserves, the capacity of some producers will dry, while others (not connected with infrastructure) will keep their reserves to play potentially more important role in future. In such environment of low flexibility to change infrastructure we can predict the evolution of market structure. Generally, the number of gas suppliers will decline over time. However, at some stage new supplier can suddenly emerge (like Iran) who has been blocked by geopolitical reasons in previous years.

Dynamic optimization problem shows that sometimes it is optimal to increase geopolitical power before investment in new costly infrastructure. Consider the project South Stream as an example. While its cost is higher than one of alternative land pipeline (Nabucco), it will allow for more diverse connectivity between Russia and European union, and will diminish the bargaining power of Ukraine and other transit countries (that potentially can seek rent).

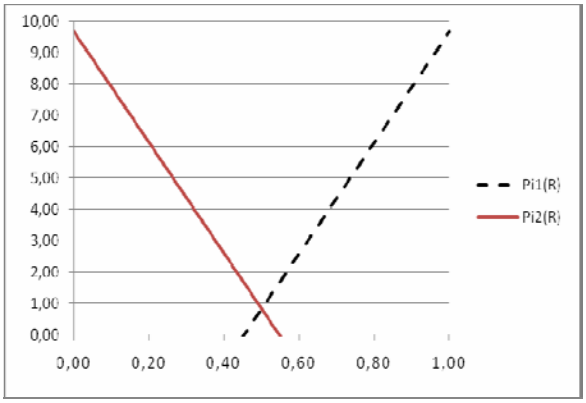

Fig.1. NPV of two competing projects as the function of q. (r=0.06, A=8)