What models tell us about long-term contracts in times of energy transition

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Executive summary

Motivations and findings

The efficiency of short-term markets is a recurrent and major concern in EU documents on the restructuring of the gas and electricity sectors. The Winter Package of the European Commission reinforces that message: efficient short-term energy markets and associated short-term energy price signals are implicitly presented as sufficient conditions for steering investment in the energy transition. This is a folk, theorem for which one finds no proof whether in theory or observation. The reason is that there is a long and risky path between creating value in short-term markets and appraising this value in investment calculations. Without a proper environment for trading risk the future benefits from the efficient short-run market will not be properly conveyed to the investor. Risk is today overwhelming both in the global economy in general and in the gas and power sectors in particular and it is commonly acknowledged that it has a devastating effect on investment. Short run efficiency is certainly of the essence for the success of the restructuring and the transition of the energy sector but it will not suffice if unmanageable risks cloud the path from the short term to the long term.

In contrast to short-term markets, which have received considerable attention in the restructuring of the gas and power industries, the development of long-term capacities or infrastructures has so far largely been "left to the market". This paper is motivated by a recent but growing interest in instruments, in particular, financial contracts that could mitigate the negative impact of risk on investment. The objective of the paper is to present and illustrate a methodology for assessing the extent to which those instruments might reduce this negative impact. Based on our simulations, we conclude that (i) these instruments can in principle mitigate the devastating effects of untraded risk, (ii) these instruments themselves require very liquid markets the feasibility of which is not clear in today markets where products of maturities exceeding five years are largely absent (iii) policy interventions can probably improve the situation by reallocating the risk.

Methodology

We work with equilibrium models of capacity expansion to disprove the implicit assumption that short-term efficiency is sufficient. We first assume fully efficient short-term markets throughout. As to the analytics we depart from the optimization found in many modeling works and simulate interactions between agents (producers, merchants, and final demand) in the market who do not

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have the same objectives. These models are "two stages": decisions to invest and contract are made in a first stage before uncertainty is revealed; short-term physical markets (hubs or PX) efficiently clear in the second stage, leading to payments from physical and financial transactions. Agents in the market are risk-averse. The treatment of risk is performed through "coherent risk functions" (Artzner et al. 1999), which developed in the last decade in the finance literature. These are related to the standard mean-variance model of portfolio theory or to the value at Risk (VaR) in traditional risk management. Risk neutrality in coherent risk functions implies a straight expectation of profits; risk aversion progressively discounts higher profits, which decreases their value and reflects higher prudency in the presence of risk. Specifically, an agent invests or enters a financial position when the investment cost is covered by the risk-adjusted (by the risk function) value of the future payoffs accruing from physical and financial transactions. Our approach can price risks correlated to the market or not. None of this is esoteric: it is just computational implementation of well-established finance notions.

Main conclusions and policy implications of the work

The first important message is that risk has an obvious detrimental impact on investment and the market will not reap the benefits of short-term efficiency without accompanying instruments to guarantee long-term efficiency. The work also suggests that financial instruments can be very effective for that purpose but that they require huge risk trading to effectively incentivize investments, both for gas and power systems. This may need more drastic measures than the ones proposed by the European Commission. The restructuring of the US gas market, which could get the riskiest part of the value chain financed by private sources maybe a possible source of inspiration but it requires properly rights that may contravene current EU legislation. Also, property rights are not the same in gas and electricity and what worked in one industry may fail in the other. Alternatively, partial public guarantees as observed in some trends in the European market should be a solution.

In any case, a minimal requirement is that the institutional process does not unduly increase risk (especially regulatory risk) for which it is highly unlikely one would have risk-trading instruments.