

# Forward contracts and collusion: the European electricity markets

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Recently, in several merger cases of European electricity markets, competition authorities have called on the dominant firms to sell special forward contracts in the form of Virtual Power Plant (VPP). Tacit collusion or coordinated interaction is a major worry in merger cases. Here we investigate whether forward contracts will facilitate tacit collusion through this special forward contract VPP.

There is a widespread presumption among economists that forward trading is socially beneficial. Allaz and Vila(1993) claim that forward trading raises welfare even in the absence of any risk. They investigate the Cournot duopoly case and characterize an equilibrium outcome with greater outputs, hence a lower spot price, compared to the case without forward trading. However, Allaz and Vila's result does not hold when firms play the game repeatedly, as is undeniably the case in most real markets. Meanwhile a dynamic setting may enable firms to commit to keeping their forward positions to a minimum.

The main result of the paper is that the introduction of forward trading, with a special term of virtual power plant contracts, allows firms to sustain (non-cooperative) collusive profits if the forward market is conducted along infinite periods. Otherwise it would not be possible in the static setting. Under certain conditions selling more virtual power plant contract indeed makes it more difficult for incumbent firm to collude tacitly with the competitor. But this conclusion only holds when the quantity of forward contract  $x$  is relatively small and when the profit sharing rule on the collusive path is specific. Otherwise, trading forward contract either has no effect or possibly facilitate tacit collusion between the incumbent firm and the entrant firm. The analysis suggests that competition authorities should worry about the frequency of trading the VPP contract and the regulation of contract quantity.

Here we analyze two kinds of competition patterns: Cournot and Bertrand. There are two dimensions: whether the entrant firm is a fringe firm and whether the entrant firm has its own production capacity besides the virtual capacity it bids. On the one hand, forward trading for virtual power plants makes it indeed more difficult for firms to sustain collusion because it reduces the remaining non-contracted sales along the collusive plan. This is the pro-competitive effect of forward trading and it even holds under the static setting. On the other hand, it becomes less attractive for

firms to deviate from the collusive plan, since forward contract reduces the market share that a deviating firm can capture in the deviation period but the punishment is not milder than that in the repeated single spot market.

Forward market's competition enhancing effect can only hold with strong assumptions and static setting is the critical one. If the forward trading is conducted along infinite periods, the tacit collusion problem will emerge. The present analysis suggests that competition authority should worry about this collusion facilitation effect of forward trading when it decides the frequency of trading the VPP contract and it should also regulate the contract quantity. A longer duration of VPP contracts is preferred from a market power mitigation point of view.

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