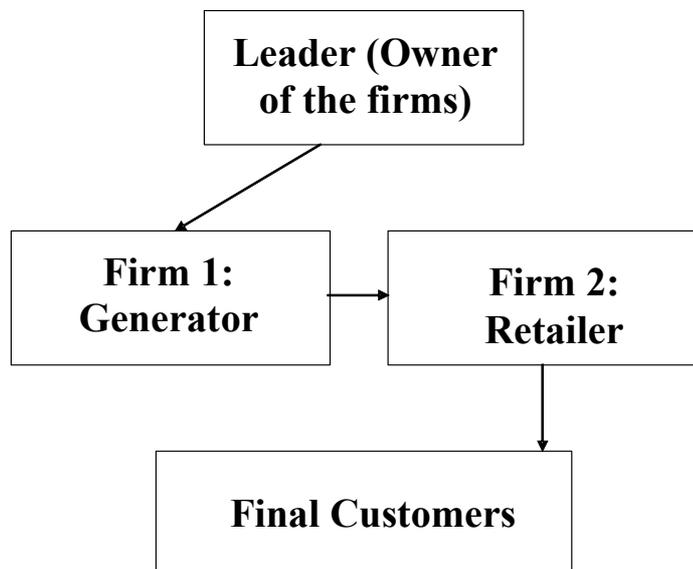


Executive Summary

Recently restructured wholesale electricity markets work as multi-unit auctions. In such markets some operators may dispose of the production capacity necessary to clear the market when competitors have already exhausted theirs and so they cannot satisfy the residual demand. The former producers are generally called pivotal and consequently they are expected to sell at a monopolistic price on that residual portion of the demand. In other words, they are expected to fully exploit their market power. Yet, empirical evidence shows that, contrary to expectations, asked “pivotal” prices recorded in wholesale electricity markets are often below the theoretical profit maximizing level. This finding has stimulated scholars to explore possible reasons explaining this seemingly irrational empirical outcome. Discussion has concentrated on three possible reasons, namely a) forward contract obligations of generators; b) Virtual Power Plant auctions; c) firms' vertical integration. In this paper we pursue the third line of investigation and analyze vertical integration of firms belonging to a group – coordinated by a leader – as possible explanation of generators' supply price moderation in wholesale electricity markets. Vertical integration in a group composed by generators and retailers is a widespread characteristic of companies operating in the electricity industry and this implies that in each group there is at least one firm selling electricity in the wholesale market and some other firms of the same group simultaneously buying electricity in that market for later reselling it to final consumers in a retail market at regulated prices.

So, the question is: how do the above firms belonging to a group interact when they take price/quantity decisions? And how does this interaction affect equilibrium prices in the wholesale market? The paper tries to provide some theoretical and empirical answers to these questions.

We start by observing that a group may be structured as follows:



The leader instructs (upper vertical arrow) the generator to post supply bids according to a policy of maximization of the entire group profits, not exclusively the generator's. The generator supplies electricity to the retailer through the wholesale market (horizontal arrow) and in so doing he receives a revenue that corresponds to the retailer's expenditure. The retailer sells (lower vertical arrow) to final consumers. Therefore, there is a trade-off between the profits of the two firms and this requires careful coordination on the part of the leader. To perform this coordination activity information is essential. We assume that Firm 1 and Firm 2 know their own costs but that the leader/headquarter does not know generation costs and therefore he cannot evaluate precisely the cost/supply price relationship characterizing the bidding policy of generators. Since the leader coordinates all activities and is interested in the group's net profit, the above asymmetry of

information on costs implies that his coordination activity, i.e. his instructions to generator on how a bid should be determined, trades off informational rent extraction (from generator) and groups profits allocation. We analyze this trade-off by means of a simple Principal-Agent model of the relationship between the leader and the generator and obtain the conditions leading to supply price moderation as a result of the above mentioned trade-off. Before giving a synthetic account of the results we found, we stress that *a*) the above mentioned coordination activity can be costly in terms of intra-group efficient allocation of resources and consequently the generator bidding behavior is affected by this cost and *b*) that our recasting of the vertical information framework and its use in the analysis of electricity market not only allows a better understanding of the under/over bidding behavior of integrated generators but can also be used to analyze other vertically integrated market where some asymmetry of information between a group leader and operational firms may exist. Empirical results are obtained using Italian panel data recorded in the sample period from 2007 to 2011. We estimate bidding functions using equilibrium price data and use the estimations to discuss the meanings and possible values of the parameters characterizing the incentive mechanism. We also compare our findings with previous literature on vertical integration. We show that the former Italian public monopolist (ENEL) has adopted a strong integration pricing policy during the first years of the sample set (supply bids moderation). Yet, this policy has been somehow changed in the last part of the sample period and supply bids have increased. This has generated, in a period of demand reduction, some profit redistribution from retailers to generators.