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## From the Editor

The European Commission has just published a report by London Economics which appears to show that electricity market prices are higher than expected, given the costs of production. The Commission attributes the higher margins to the exercise of market power, made possible by a concentrated industry structure in each market. The finding is surprising, since it covers markets such as Britain which many (including the national regulator) regard as competitive. In this Energy Regulation Insight, Oscar Arnedillo of NERA's energy team dissects the analysis in the report and identifies a number of flaws that suggest the report provides no basis for regulatory intervention.

—Graham Shuttleworth, Editor

## Structure and Performance in Europe: A Review of the Report for DG COMP

*By Oscar Arnedillo*

In June 2005, the European Commission launched an inquiry into competition in gas and electricity markets, pursuant to Article 17 of Regulation 1/2003 EC.

According to the Commission, the inquiry responds to concerns voiced by consumers and new entrants in the sector about the development of wholesale gas and electricity markets and limited choice for consumers.

The Commission adopted the Final Report of the inquiry in January 2007, concluding that consumers and businesses are "losing out because of inefficient and expensive gas and electricity markets". Among other problems, it highlighted the existence of high levels of market concentration.

The European Commission's Directorate-General of Competition (DG Comp) then commissioned London Economics (LE) to carry out an in-depth and detailed study into the structure and functioning of the EU's electricity markets. LE delivered the report, entitled "Structure and Performance of Six European Wholesale Electricity Markets in 2003, 2004 and 2005", to the DG COMP in February 2007.

The report analyses six national electric markets (Belgium, Germany, Spain, France, Holland and United Kingdom) and concludes that the observed prices have been affected by the level of concentration in each market. This finding is likely to be taken by the EC as further evidence of the need to change the structure of EC electricity markets.

Unfortunately, the report's methodology is flawed on a number of fronts. As a result, its conclusions will tend to yield "false positives", i.e. apparent problems of market power even when there are none. Thus, the LE report is not a solid basis for justifying further EC intervention in industry structure.

The flaws in the report, which I discuss below, include:

- overestimating the level of concentration and the "pivotal" nature of companies in the market,
- underestimating the marginal costs of the system, especially during peak hours, and
- incorporating these biases into regression analysis that purports to capture the effect of pivotal suppliers on prices.

## Structural Analysis

The concentration measures calculated by LE tend to exaggerate the level of concentration in electricity markets that were analysed. As a result, the markets will tend to appear more troublesome than they really are.

### Definition of the Relevant Market

While LE recognises the need to define a relevant geographic market, the study adopts throughout the notion of a "national market", without apparently undertaking any analysis to justify that approach. This will tend to exaggerate the market shares of the generators (who may, in fact, be competing in a regional market) and, thus, will also exaggerate the values of the various concentration measures. Simply taking interconnectors into account, as LE does, does not correct this bias.[1]

Similarly, LE defines the relevant product market as "the wholesale generation market", without explaining precisely what it includes. The text suggests that it excludes generation from renewable energy sources and must-run generators, perhaps on the basis that such generators run regardless of the market price. However, the same could be said of other plants such as run-of-river and nuclear plants, which LE does not exclude. Applying a uniform criteria, including all forms of generation in the calculations, would also have led to different market shares and possibly to much lower measures of concentration.

### Hydroelectric Plant Capacity

To calculate the various measures of concentration, LE adjusts the data submitted by the companies. While some of the adjustments appear reasonable, others appear to distort or bias the capacity-based concentration measures.

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Specifically, when determining the capacity of storage hydro units, LE puts a ceiling on the installed capacity reported by the companies, equal to the maximum level of generation achieved by each of the units in each month. Hydro plants rarely run at their maximum capacity, but would be able to do so if another generator tried to withdraw its capacity. Complex economic models can analyse such responses. The adjustment carried out by LE artificially exaggerates the time when generators appear to be "pivotal" in the market (i.e. essential to supplying the market).

### Regulatory Measures

Finally, the calculations make no allowance for revenue stabilisation measures akin to long-term contracts. Long-term contracts transfer effective ownership of output to others and diminish a generator's incentive to raise spot prices. However, other regulatory arrangements may have similar revenue stabilisation effects. For example, during the period studied, stranded cost payments in Spain were negatively related to the spot market price, and had the same effect.

To give a more accurate picture of each market, LE would have had to adjust the calculation of concentration for any regulatory measure that had effects similar to those of long-term contracts, or to have included stern caveats about the value of measures that ignore such effects.

## Market Simulation

LE measures "mark-ups" as the difference between market prices and marginal production costs. However, LE's market simulation underestimates the marginal costs of the system, especially during peak hours. Thus, what LE interprets as "mark-ups" caused by concentration in the market is either partly or fully caused by the errors and limitations in the simulation.

### Perfect Information

All market simulations ignore many real-life constraints and, consequently, such simulations tend to underestimate the costs of production and the market price, to different degrees in different markets.

In particular, there is one constraint that few models capture adequately and which should not be ignored—the fact that generators operate under conditions of imperfect information, without perfect foresight. Generators make forecasts about a variety of conditions which influence their decisions as to how to run their plants. The clearest example is that of operators of hydro storage plants, who have to decide how much water to use at different times on the basis of their forecasts of future prices (which are in turn affected by expectations about the level of demand, fuel costs, production by wind generators, etc.) and expectations about rainfall. Even with the best forecasting tools, generators can make errors which

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lead to actual despatch being less efficient—and actual costs being higher—than a model suggests.

It is inappropriate to benchmark actual costs *directly* against the cost of an optimal despatch run *ex-post* with perfect information about system conditions. Such simulations will always show that markets have prices above the "competitive" prices (i.e. simulated costs). Further, the bias may be different in different markets, depending on the range of uncertainties faced by generators in each one (e.g. relative size of hydro and wind production).

### Hydro Despatch

LE's optimisation assumed that hydro storage plants provide perfect peak shaving for any amount in excess of the minimum hourly production in any given month. In other words, it assumes that *all* of the remaining production of hydro storage plants can be located in the peak demand hours. This assumption ignores the many constraints that affect the despatch of hydro storage plants in the real world.

First, hydro plants are frequently required to release water off-peak for a variety of non-commercial reasons, primarily obligations to maintain a certain level of water downstream, for consumption, irrigation, recreation, etc. Ignoring these constraints will naturally, though unrealistically, lead to lower estimates of the costs of supply and of the appropriate market price.

Second, most hydro plants are situated in river basins where other hydro plants operate. The production of those plants is linked. If the plants within one river basin want to achieve full production at peak hours, upstream plants must often release water (and thus start generating) prior to that peak, and downstream plant will often continue to receive water (and to generate) even after the peak period is over. Thus, perfect peak shaving such as LE assumes is, in fact, unrealistic.

### Fuel Cost

LE simulations use the cost data provided by companies, which reflects their actual purchase costs. However, competitive generators will in fact despatch their plants based on the opportunity cost of using that

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NERA is at the forefront of the continuing transformation of energy industries worldwide. Our experts have developed approaches for introducing competition in segments such as power generation and gas supply, where competition is workable, and for improving the regulation of sectors where it is not. We work with companies, governmental bodies, and regulators worldwide to design competitive gas and electricity markets and to develop tariffs and rules of access for regulated transmission and distribution systems for electricity and gas, and the transport of oil and oil products.

NERA helps companies develop strategies for exploring new opportunities and minimising new risks, including issues related to climate change and other environmental initiatives. We also help our clients to develop new regulatory strategies, and support them with analysis and testimony before regulatory commissions, antitrust and competition policy agencies, and domestic and international courts.

Our work includes designing and conducting energy auctions and providing strategy and valuation advice on mergers and acquisitions, the financing of energy companies, and the financial restructuring of distressed companies.


fuel, which may be higher or lower than the purchase cost. To the extent that generators have entered into long-term contracts and do not buy their fuel on the spot market, this could lead to substantial discrepancies between the estimated marginal system cost and the true one.

Therefore, the mark-ups identified by LE may not be evidence of companies behaving in a non-competitive manner (offering their production at costs above their true costs) but rather of companies earning a profit by behaving competitively (offering their production at opportunity costs).

### Hydro Offers

LE estimates the marginal cost of hydro plant as equal to the marginal cost of the most expensive thermal plant running at the time, as if hydro plants could not have marginal costs in excess of thermal plants. However, in reality, water in hydro storage may have a marginal cost well of the above that of the most expensive thermal plant running at the time, for instance the cost of a more expensive thermal plant that the hydro plant may displace at a later date. This simplification compounds LE's tendency to underestimate the marginal cost of the system, especially during peak hours.

### Start-up Costs

In its estimation of the marginal costs, LE ignores start-up costs, apparently on the basis that they represent only about 0.1-0.2% of average fuel costs. In so doing, LE is, once again, underestimating the true marginal costs of the system.

LE does not explain where the above percentages come from, but in any case they seem to ignore non-fuel start-up costs, such as wear and tear on equipment, or the cost of the risk of major faults. These costs are also costs that generators should be able to recover.

In addition, although start-up costs represent a certain percentage of "average" costs, that says nothing about their impact on the "marginal" costs of the system. Start-up costs can be regarded as a marginal cost of generating at peak times, or a common cost to be allocated efficiently to times of low price elasticity (which usually means peak periods as well). In either case, the impact of start-up costs will be much higher than suggested by its share in total fuel costs.

### No-load Costs

When determining the system marginal cost, LE explains that it identifies the variable costs of the most expensive (thermal) plant operating *unconstrained* in each hour. In off-peak hours, LE ignores the variable cost of plants operating at their minimum stable level because it is more economical to operate through the night than to shut down in the evening and restart in the morning. This is a standard method (formerly used in the Electricity Pool of England and Wales, for instance) of estimating system marginal cost in off-peak periods. However, it is not a complete method.

The loss that inflexible generators make overnight is a cost they need to recover from other periods—i.e. peak periods (as in the old England and Wales pool). By forgetting to treat overnight losses as a cost of peak generation, LE biased their cost estimates downwards—which over-states the apparent mark-up even more, especially during peak hours.

### Omitted or Mis-specified Variables

Finally, while the simulation model and the detailed calculations are not public, there is strong evidence to suggest that the simulation is flawed by the omission or mis-specification of key variables.

LE's estimates of mark-ups are correlated across countries. The estimated mark-ups range from 26% to 59% in 2003, but fall to a range between -2% and 22% in 2004, with

the fall being seen *in each and every one of the countries analysed*. It is unlikely such a change would happen simultaneously in all countries by chance. Instead, it suggests that some other key variable was affecting all European markets at the time (e.g. a change in the opportunity cost of fuels, rather than the accounting cost).

### Conclusion

Many of the errors and omissions listed above are understandable simplifications, but they all bias LE's results in the same way. By underestimating marginal costs, LE has overstated mark-ups—particularly at peak times, when measures of market concentration are highest. As a result, LE may have created concerns about mark-ups and market concentration that really represent flaws in their simulations.

## Regression Analysis

LE carried out a regression of estimated mark-ups against an hourly measure of market concentration, the Residual Supply Index, or RSI. RSI measures how often demand cannot be met without at least some output from one company.

However, the regression will tend to produce false positives, because of the flaws discussed in the previous section, which lead to an underestimation of the marginal system cost during peak hours (e.g. no start-up or no-load costs, unrealistic hydro peak-shaving, understated marginal cost of reservoir hydro). Thus, the simulation will tend to yield higher estimated mark-ups during peak hours.

LE runs a regression of these hourly mark-ups against the hourly RSI, to test the hypothesis that mark-ups are higher when generators are pivotal. However, with constant capacity, generators will be more pivotal when load is higher. Thus, the regression is equivalent to running a regression of these hourly mark-ups against a transformation of hourly demand.[2] In other words, LE's regression is equivalent to a regression of the hourly mark-ups against the level of demand.

LE concludes that there is a significant relationship between market power (as measured by the RSI) and the estimated mark-ups. In reality, the regression may simply be showing a significant relationship between the level of demand and the estimated mark-ups, due to the fact that the model underestimates the system marginal cost and overstates the mark-up during the peak hours, when demand is also highest.

## Conclusion: Is there Evidence that Wholesale Markets are Uncompetitive?

LE's analysis does little to increase our understanding of the impact of concentration on market prices. LE applied a flawed methodology, but it is doubtful that any such methodology can ever reasonably be

## Contributors


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| Oscar Arnedillo, Director | Madrid, Spain: +34 91 212 64 41 |
| Graham Shuttleworth, Director | London, UK: +44 207 659 8500 |


*The views in this issue are those of the authors and not necessarily those of NERA Economic Consulting.*


used to justify political or regulatory intervention in electricity markets. Detecting market power requires in-depth investigation of the actual offers made by generators, to determine whether such offers are indeed cost-reflective.

The EC has the power to launch an investigation of this nature, but will need to act judiciously upon LE's results. Results like these are reported widely in the press of the countries included in the study and affect consumers' perception of competition in those countries. Rather than supporting pro-competitive measures favoured by the EC, consumers may instead lobby for the retention of subsidised retail tariffs, in case deregulation does not produce fair and competitive prices.

Moreover, the countries studied in the report are the most transparent in Europe. Selection of these markets may be convenient for the purpose of analysis, but says nothing about where the most pressing problems lie. It would be an odd consequence of the study for the EC to devote attention to the energy markets that provide the best information, whilst leaving the less transparent markets alone.

## End Notes

1 This happens because the size of the interconnection is typically much smaller than the size of the smallest of the interconnected markets. Thus, considering the two national markets as separate markets (rather than a regional one) will inflate the estimated markets shares and the HHI. In addition, considering the two markets separately will lead to a smaller estimated reserve margin (in GW) and increase the number of hours in which generators appear to be pivotal.

2 LE also includes a "scarcity" variable, which is another transformation of demand. LE does not examine the correlation between these variables, but the "scarcity" variable reduces the significance of the RSI variable, without significantly increasing the explanatory power of the regression. This suggests a high correlation between the two explanatory variables, scarcity and RSI.

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