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WHY HAS THE NORDIC
ELECTRICITY MARKET WORKED SO
WELL?



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Why has the Nordic electricity market worked so well?¹

By

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Abstract:

The general opinion among power industry representatives and electricity market analysts is that the Nordic electricity market has worked well. The purpose of this paper is to explore why the Nordic electricity market has performed well and to consider to what extent the Nordic experiences are relevant for other countries. In particular, we investigate causes as to why the Nordic market managed to withstand the supply shock in 2002 – 2003. A comparison is made with the California case, and the potential problem of market power abuse is investigated in particular. The relatively successful electricity market reform in the Nordic countries seems to be attributable to: a simple but sound market design, a successful dilution of market power, a strong political support for deregulation and voluntary, informal commitment to public service by the power industry.

Keywords: Nordic electricity market, California electricity market, supply shock, market power.

JEL classification code: L 10, L 11, L 51, L94

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1. Introduction

Between 1991 and 2000 the electricity markets in Denmark, Finland, Norway and Sweden were opened up for competition in generation and retailing, and the four national markets were integrated into a single Nordic electricity market. To a large extent this development was induced by the first EU electricity market directive⁴ that came into force in 1997⁵. It also was inspired by the electricity market reform in England & Wales in 1989, as well as by widely held beliefs that increased competition would raise power industry efficiency to the benefit of consumers.

But there were also doubts about the blessing of electricity market reform. One fairly common claim was that traditional vertical integration of generation and transmission facilitated a high level of security of supply and gave rise to economies of scope that were likely to exceed the efficiency increases resulting from competition in generation and retailing. Another claim was that the major power companies were large enough to be able to exercise market power and thus prevent much of the potential gains of competition to be realized.

By now the general opinion among power industry representatives and electricity market analysts is that the Nordic electricity market has worked well. Unlike the California electricity market that collapsed following from severe demand and supply shocks in 2000-2001, the “lights have stayed on” in the Nordic market in spite of similar adverse supply and demand shocks in 2002 - 2003. Furthermore, the power industry productivity has increased in the Nordic market according to available data. Seemingly as a result of increased competition both wholesale and retail profit margins have been squeezed. However, very high wholesale prices in late 2002 and early 2003 may indicate the exercise of market power. As will be discussed below, however, a careful analysis of the developments in 2002 and 2003 does not support that view.

Yet the picture is not entirely rosy. In spite of the positive developments in terms of continuous market clearing and increased power industry productivity the public at large is less enthusiastic about the results of electricity market reform. Thus there are frequent complaints about bills that are difficult to understand and administrative problems in connection with change of retailer. Needless to say an important reason for the limited general popularity of the electricity market reform is that retail electricity taxes have increased to the extent that most households currently pay more for their electricity than they used to do. Likewise, the introduction of the new European system of CO₂ emission permits (ETS) has led to rising wholesale prices that have not been very popular with the power consuming industry. However, the administrative problems are likely to be temporary, and a political decision to raise electricity taxes and to introduce emission permits is not, after all, a sign of a badly functioning electricity market.

⁴ The first EU electricity market directive and its implementation are discussed in Bergman et.al. (1999).

⁵ The deadline for transcribing the directive into national legislation was in February 1999.

In view of this it seems that the Nordic electricity market, particularly the wholesale market and related financial markets, has worked quite well. The purpose of this paper is to explore why this is the case, and to what extent the Nordic experiences are relevant for other countries. In other words, is the Nordic electricity a relevant role model for other countries? To answer this question we seek to investigate causes as to why the Nordic market managed to withstand the shock it was subjected to in 2002 - 2003 while other electricity markets did not sustain similar shocks. For this purpose we also make a comparison with the California case. First, however, we give a short overview of the Nordic electricity market with its regulatory framework and market design.

2. Consumption, production and market structure

The total consumption of electricity in the Nordic countries is around 390 TWh per annum, reflecting internationally very high per capita electricity consumption. For a long time electricity consumption grew by more than 5 percent per annum, but after 1990 the rate of growth have been quite low (see Table 1). Thus competition in generation has been introduced during a period when the need for new capacity was low, and the room for entry of new generators thus quite limited.

Table 1. Electricity consumption data for the Nordic countries 2001⁶

Country	Consumption TWh	Annual growth 1990-2001 %	Consumption per capita kWh
Denmark	35	1.1	6 929
Finland	82	2.5	16 264
Norway	125	1.6	28 428
Sweden	151	0.7	17 347
Total	393	1.4	16 997
OECD	-	-	8 404

Source: The Swedish Energy Administration.

Around 50 percent of total power generation in the area is based on hydropower, but the share of hydropower differs significantly between the four countries⁷. The high share of hydropower, and the fact that electric heating is a major electricity consumption sector, means that variations in climatic conditions may, and frequently do, cause supply or demand “shocks”. Thus, since 1996 the annual variations in potential hydropower production have been quite significant, and there have been spells with extreme loads reflecting unusually cold weather conditions in the entire Nordic area.

Another aspect of the supply side of the Nordic electricity market is the number and relative size of the power companies. As can be seen in Table 2 a few major power producers have a dominating position on their respective national markets. At the same time none of them has a share of the Nordic market that exceeds 20 percent. This

⁶ International per capita consumption data for a later year are not available. However, in the Nordic countries electricity consumption went down to a total of 380 TWh in 2003.

⁷ The share of hydropower varies significantly between the four countries, and is close to 100 percent in Norway, around 50 percent in Sweden, around 15 percent in Finland and zero in Denmark.

suggests that the degree of competition to a very large extent depends on the degree of integration of the four national markets, which in turn depends on inter-connector capacities and institutional barriers to trade between the four countries.

Table 2. Power producers and market shares 2003

Company (Country)	Share of national market %	Share of Nordic market %
Vattenfall (Sweden)	47	17
Fortum (Finland)	29	14
Statkraft (Norway)	27	9
Sydkraft (Sweden)	19	8

Source: The Swedish Energy Administration

Public ownership is still dominating in the Nordic countries. Thus Vattenfall is owned by the Swedish state and Statkraft by the Norwegian state. Fortum is in the midst of a privatization process, with the Finnish state still being a big minority owner. Sydkraft is owned by the German power company E.ON with the Norwegian state being a big minority owner.

3. Regulatory framework and market design

The overall design of an electricity market has three fundamental components: The regulatory framework, the trading arrangements, and the design of transmission tariffs. In this section the Nordic electricity market will be briefly described from these three points of view, beginning with the regulatory framework.

In Table 3 the regulatory framework in the Nordic countries is described using the criteria and requirements⁸ of the first EU electricity market directive. Needless to say the electricity market is regulated in many other ways, but the basic regulations adopted by the EU are crucial for the creation of a competitive electricity market. In particular third party access to the network infrastructure is a key prerequisite for a competitive electricity market.

As can be seen in the table the EU directive allowed the individual member states to choose between two or more alternatives. However, the Nordic countries have in general chosen the alternatives that are most likely to foster a competitive electricity market. Thus regulated third party access (rTPA) is likely to foster a competitive electricity market more than a regime with negotiated third party access (nTPA) would do. In the same way an authorization procedure probably stimulates competition in generation more efficiently than a regime with tendering for new generation would do.

⁸ For a detailed discussion of these criteria and requirements see Bergman et.al. (1999).

Table 3. Basic regulatory framework

	New generation procedure	Unbundling of generation, transmission and distribution	Third party access	<i>Market opening</i>
Denmark	Authorization	Accounting and management separation	rTPA	100%
Finland	Authorization	Legal separation	rTPA	100%
Norway	Authorization	Accounting and management separation	rTPA	100%
Sweden	Authorization	Legal separation	rTPA	100%
<i>EU Directive</i>	<i>Authorization or Tendering</i>	<i>Accounting and management separation as a minimum</i>	<i>Regulated (rTPA), Negotiated (nTPA) or Single Buyer</i>	<i>30 %</i>

The key trading institution in the Nordic electricity market is the Nord Pool power exchange, which is an “energy only” spot market at which hourly “system prices” are determined in single price auctions. As long as transmission capacity is sufficient the system price is equal to the wholesale trading price in all four countries. But whenever lack of transmission capacity prevents cross-border trade the “area prices” differ from the system price. Norway is divided into several “price areas”, while there is only one price area in Finland, Sweden and the two parts of Denmark⁹, respectively.

Nord Pool also operates financial (forwards, futures and options) markets at which generators and major buyer can hedge system price risks. The system operator in each one of the countries operates a real time market in order to continuously balance generation and load at minimum cost. In Finland and Sweden the system operators also manage transmission bottlenecks within the respective country by means of a counter-trade system, while a zonal pricing system is used in Norway.

Transmission tariffs are designed in largely the same way in the four countries. A key feature is that transmission prices are independent of the geographical distance between trading parties. As there are no border tariffs between the Nordic countries, the physical inter-connector capacity constraints are the only remaining barriers to trade across the national borders

4. The Nordic supply shock of 2002-03 and market development

As noted the Nordic electricity market relies heavily on hydro power. Variation of precipitation and inflow to hydro reservoirs, make total hydro stocks and power generation uncertain, but normally this does not create any problems. However, hydrological conditions of the autumn and winter season of 2002-2003 turned out to be

⁹ There are two separate electricity supply systems in Denmark, East and West.

rather special. The year 2002 started out quite well. Water reservoir levels were well above normal in July 2002 both in Finland, Norway and Sweden. Thus, in order to make room for the expected water inflow from autumn precipitation Norwegian power producers started to draw down water reservoirs (exporting) during August, September and October. However, expectations on water inflow failed, (see Fig. 1.). In October and November a sharp decline of precipitation and water inflow took place. Total inflow in Finland, Norway and Sweden from July to December 2002, was around 35 TWh below the normal level, a gap corresponding to some nine percent of Nordic electricity consumption over a year. This size of hydro shortfall is indeed a rare event. Estimates indicate that conditions of this kind will recur only every 100-200 years for Norway and Sweden combined¹⁰.

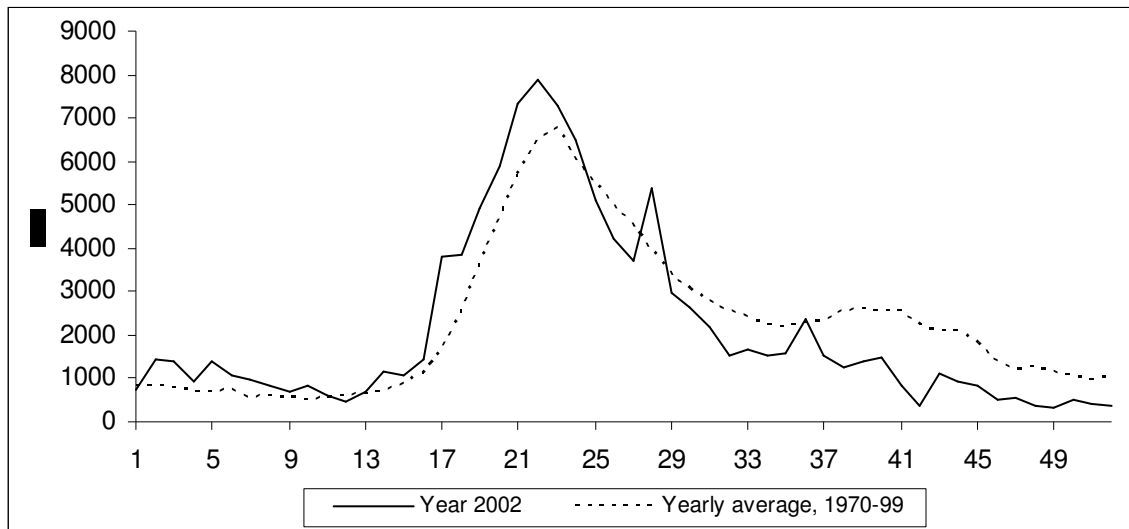


Figure 1: Weekly inflow to Norwegian hydro reservoirs (Source: Norwegian Water and Energy Authority)

As a consequence of the extremely dry hydrological conditions, spot prices started rising during the autumn of 2002 and accelerated from late November on, (see Fig. 2.). The spot prices then kept a level of 2-3 times the normal until the beginning of February 2003. At its peak, the average daily price reached NOK 831 per MWh (USD 130) as compared with the 2002 average spot price of NOK 200 per MWh (USD 31). The reduction of hydro power output was offset to a great extent by increasing thermal power generation. The Nordic oil-, gas- and coal fired electricity generation in the second half of 2002 was about nine TWh higher than the generation in the same period of the year before. Nuclear energy output was roughly the same as in the previous winter. Also net electricity imports to the Nordic countries grew steadily from the summer 2002. In the first part of 2003 net imports were about 9.5 TWh higher than in the first half of the year before. In particular,

¹⁰ For an overview of the development in numbers see Ministry of Petroleum and Energy (2004)

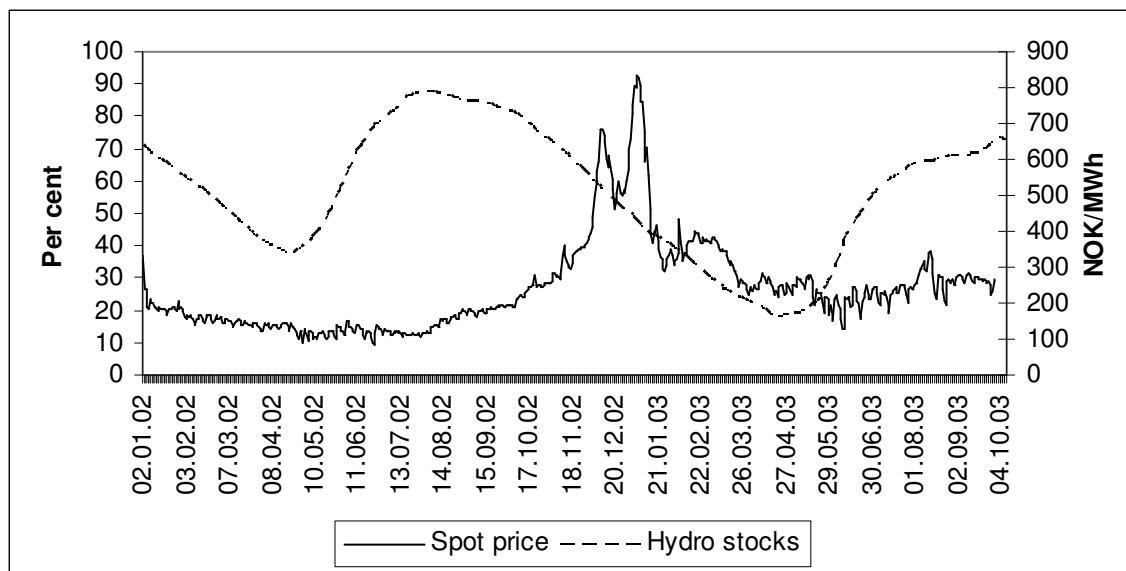


Figure 2: Spot price and Norwegian hydro stock, 2002-2003 (source: Statistics Norway and Norwegian Water and Energy Authorities)

Russia was an important source of Nordic imports. Also, electricity import from Germany through the Western Danish border (Jutland) was important¹¹

Along with the rising spot prices, contract prices for end-users (so-called variable contracts and contracts based on the spot price itself) started to increase with some delay. The end-user prices in Norway reached unprecedented levels in January 2003, (see Fig. 3.). As for Denmark, Finland and Sweden retail price increases were much more modest. The reason for this was that these countries to a much larger extent relied on annual fixed price contracts (notably in Denmark and Finland). The increasing retail prices and a massive media exposure resulted in a sizable reduction of electricity consumption during the winter months, in particularly for Norway (around 7 percent for the household market, 5 percent for the energy intensive industries and electrical boilers as compared with the November-May period the year before). Finally, from the early spring on, a gradual normalization took place with regards to prices and quantities.

In total Nordic electricity consumption from July 2002 to June 2003 showed a slight increase of 0.7 percent compared with the preceding 12-month period. The growth in consumption was highest in Finland, while Denmark and Sweden experienced a modest increase and Norway showed a decline. Though the discussion of whether to intervene or not ran high during the critical months of January and February of 2003, particularly on the Norwegian political scene, no such things happened. Hence, in general, the Nordic power market seemed to function as intended without any interventions from the authorities, neither from the Government nor from the Competition Authorities¹².

¹¹ On the significance of the Western Denmark price area, see Olsen et al. (2005)

¹² For a further analysis of how the Nordic market coped with supply shock, see von der Fehr et al (2005).

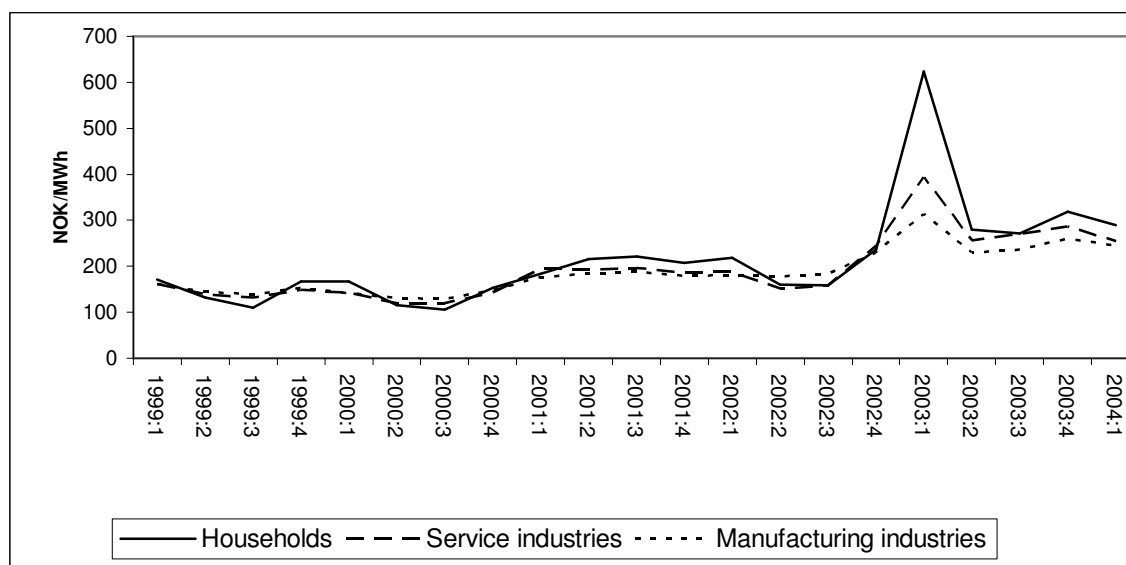


Figure 3: End-user prices (excl. taxes and network tariffs), quarterly observations, 1999-2004 (source: Statistics Norway)

5. Comparison with the California case

It is not obvious that a market based system for electricity is capable of sustaining market shocks of the kind that hit the Nordic power market. To investigate this matter further we make a comparison with the California case and seek to reveal some of the causes why the California market failed while the Nordic market did not.

First of all it is important to recognize that the shock that resulted in a collapse of the electricity market in California¹³ was bigger than that to the Nordic market. Even without market power in the California market the prices during the summer of 2000 would have been three times those of the summer of 1998. Many systems would have had problems tackling such a shock (Borenstein et al., 2002). The California crises involved a lack of energy capacity due to low precipitation, a lack of power capacity due to a sharply increasing demand, and rising input costs. The Nordic events mostly involved lack of energy capacity due to a precipitation shortfall and there were no sharp increase of demand comparable to that in California.

With respect to the development of end-user prices, there were no price caps on the Nordic power market (as was the case for California). In California almost no customers were charged end-user prices dependent on spot prices. For this reason end-user demand was not very sensitive to the variation in spot prices/wholesale prices. Contrary to this a more frequent use of end-user price contracts that were sensitive to spot prices, in

¹³ A large literature exists on the California electricity crisis, see for instance: CBO (2001), Faruqui et al. (2001), Joskow and Kahn (2002), Wilson (2002), Borenstein et al. (2003), Wolak (2003 a) and b)), Bushnell (2004).

particularly in Norway (see Fig. 4.), resulted in a sizeable reduction of electricity consumption (see numbers above).

Furthermore, in California the increase of gas power generation, despite rising gas prices, led to soaring prices for NO_x emissions permits, thus increasing electricity generation costs. In the Nordic system gas power was not an essential source of additional power, and gas prices were not affected. Also, for the Nordic market no environmental markets (i.e. for CO₂ or NO_x) existed at the time the shock took place. Hence, the increase of coal power could come about without inducing increasing prices of CO₂– emission, (that would otherwise add to the cost and reduce the generation of additional coal power.)

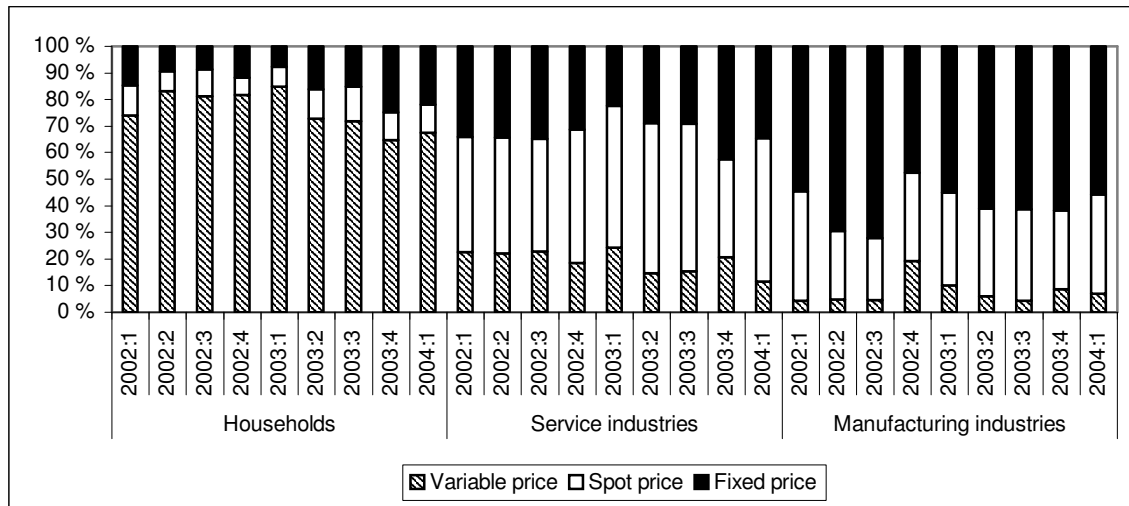


Figure 4: Contract shares in Norwegian consumption, quarterly observations (source: Statistics Norway)

Another factor explaining the different end result of the two shocks is that Californian companies may have been more prone to exercise market power based on extreme short-run inelasticity of demand (gaming and hockey stick bids) and structures of exchange, balance and reserve markets that made this possible.¹⁴ Compared with this the Nordic power companies may still have a “public service mind” and are thus not particularly eager to exercise market power even though possibilities for this may come up e.g. in cases where transmission lines are filled up between price areas (see discussion in section 6). Along with this Nordic authorities (e.g. the Norwegian Competition Authority) saw no reason to intervene in the market as did FERC in California.

Furthermore, rather flexible rules for changing power suppliers in the Nordic system reduced the use of market power that would otherwise come about due to lock-in mechanisms for customers. For instance, during the winter and spring season of 2002-03 there was a strong increase of Norwegian customers that changed power retailing companies away from those that were slow to reduce prices when spot prices started to

¹⁴ Indeed, Borenstein et al. (2002) found that around fifty percent of total electricity expenditures could be attributed to the exercise of market power in California in 2000, whereas this figure was about 25percent in 1998.

fall. On average the market share of the dominant supplier in an area has been reduced from 95% in 1999 to 82% in March 2003. The electricity market calamities of the autumn and winter season of 2002–03 also led to a change of household contracts away from the variable contracts (a semi-fixed contract that turned out to give the highest retail prices and the highest volatility during the period) to spot based contracts and to fixed price contracts. Thus, some households to a larger degree chose to carry the price risk themselves, while other households chose to have the retailing companies carrying a larger part of the price risk.

Yet another difference between the two markets had to do with financial matters. In California one of the main utilities went bankrupt through selling at a fixed regulated price and buying at what turned out to be much higher spot prices. Facing some regulatory restrictions, it had not participated in the (relatively ill developed) forward and futures markets for power. In the Nordic power market generators and retailing companies had the opportunity of making extensive use of the existing Nord Pool markets for forward and futures contracts. Hence, these markets (including contracts for differences) provided opportunities for adjusting and hedging portfolios in terms of price differentials between areas and over time.

6. Prices in 2002-03: Signs of market power?

Needless to say continuous market clearing, implying that electricity always can be bought or sold at the prevailing price, is an extremely important feature of a market for electricity. But from a social point of view it is also very important that the market prices reflect the relevant marginal costs. This is the case if external effects are effectively internalised, and if the market is sufficiently competitive. Here we focus further on the latter aspect, i.e. whether the observed prices to any significant degree reflect the exercise of market power by major generators.

In a system dominated by hydropower exercise of market power is not easy to detect. At any given time a generator has to decide whether to use or continue to store a unit of water in the reservoir. The choice depends on factors such as the expected precipitation before and during the next winter season, the length of the winter season and the expected demand during the period. This means that an outside observer cannot easily judge whether a given reduction of hydropower production reflects exercise of market power or just conservative expectations about climatic conditions during the coming months. One way of getting around this problem is to use a simulation model¹⁵.

In this study a simulation model, PoMo¹⁶, of the Nordic electricity supply system has been used. PoMo is a dynamic optimization model that computes weekly equilibrium prices under the assumption the Nordic electricity market is competitive and that generators are risk neutral. In any given week generators are assumed to know the current stock of water in the reservoirs, demand, and the output of electricity from nuclear, fossil

¹⁵ See also Amundsen and Bergman (2002) for an analysis of the significance of cross-ownership for the exercise of market power on the Nordic power market.

¹⁶ PoMo is developed by EME Analys and Tentum, and frequently used by the Swedish National Energy administration.

and wind power plants. They are also assumed to know the probability distribution for the future weekly inflow of water to the reservoirs, as well as for the future weekly demand and non-hydro generation. The time horizon is three years.

Altogether these assumptions imply that PoMo to a large extent depicts the situation faced by the generators making production decisions and selling power on the Nord Pool spot market during a given week. Deviations between computed PoMo prices and observed Nord Pool prices for a given week obviously reflect various shortcomings of the model. But as PoMo assumes that the Nordic electricity market is perfectly competitive, the deviations also reflect the impact of market power.

In Figure 5 the actual spot market prices (weekly averages) and the corresponding PoMo prices in the second half of 2002 and the first half of 2003 are compared. The “12 TWh” case is a PoMo simulation in which the minimum amount of stored water is allowed to be 12 TWh rather than the standard requirement 15 TWh. As the minimum requirement was in fact reduced to 12 TWh at the beginning of 2003 this case is the most realistic of the two PoMo cases in the figure.

A comparison of the “Nord Pool” and “12 TWh” price paths suggest that real world producers react earlier than the risk neutral PoMo producers. Thus Nord Pool prices increased earlier and exceeded the PoMo prices at the end of 2002, but from the beginning of 2003 the situation was reversed. A possible explanation to this deviation is that real world generators are risk-averse and thus overly fast to reduce hydropower production when the risk of running out of water before the spring period is perceived to be high.

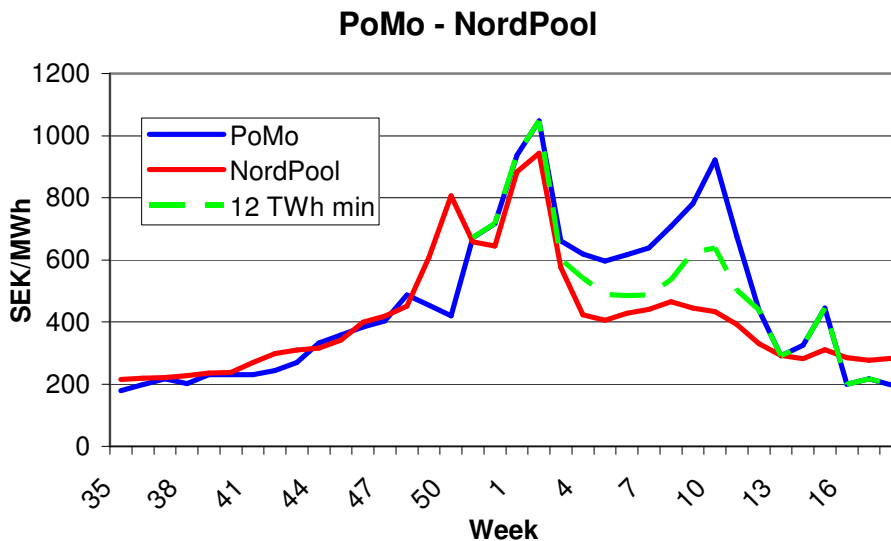


Figure 5. Comparison of actual and simulated prices 2002-2003

However, if the major power companies had been exercising market power, the Nord Pool prices would have exceeded the PoMo prices during the entire period. Thus the simulation results suggest that the Nordic electricity market is quite competitive, with market clearing prices close to the relevant marginal costs. The high prices 2002-03 simply reflected an unusual scarcity of hydropower combined with the usual low elasticity of demand.

7. Why has the Nordic market worked so well?

Most consumers expect the electricity market to work well and they pay no attention to the reasons why that is the case. In a somewhat wider context, however, that issue is important. If the relative success of the Nordic market is due to a good design of regulations and market institutions, then the Nordic experiences are useful for other countries. But if the favourable outcome primarily depends on country-specific factors or temporary circumstances, there is not much for other countries to learn.

On the basis of our own and other studies of the topic our conclusion is that there are four main factors behind the relatively successful electricity market reform in the Nordic countries, namely:

- A simple but sound market design, to a large extent made possible by the large share of hydropower.
- Successful dilution of market power, attained by the integration of the four national markets into a single Nordic market.
- Strong political support for a market-based electricity supply system.
- Voluntary, informal commitment to public service by the power industry.

The second and third of these factors are “transferable”, while the first and fourth to a large extent are country-specific. In the following each one of the four factors will be briefly discussed.

Market design and hydro power

Electricity supply systems dominated by hydropower tend to be energy-constrained rather than capacity-constrained. Thus the need for incentives to maintain sufficient peak capacity is much smaller than in systems based on fossil fuelled power plants. Moreover, contrary to fossil fuelled power plants hydropower plants have negligible start-up costs. Thus the cost of production during a particular hour does not depend on the rate of production during adjacent hours. Altogether this means that hourly trading on a power exchange, such as the Nord Pool spot market, to a very large extent provides the right incentives for efficient allocation of resources in the power industry.

The designers of the Nordic “model” obviously have benefited from the fact that around 50 percent of Nordic power production is based on hydropower. But they were not just lucky. They also actively contributed to an efficient market design by not imposing price regulations or other regulations that would have increased the transaction costs or financial risks carried by generators, industrial customers and retailers. Also, a crucial part of electricity market reform in the Nordic countries was the establishment of Nord Pool, i.e. the company that operates both a common power exchange (a spot market) and forward markets for electricity.¹⁷ In particular, the establishment of the market for forward contracts may play a role in the mitigation of wholesale market power. The idea is that instead of increasing the number of competitors in a given market, a given number of generators are given the possibility to compete both in the spot market and in a forward market. According to economic theory oligopolistic firms will have incentives to enter forward contracts. Moreover, this will lead to an increase of aggregate output and a decrease of the market price¹⁸ as if the number of competitors had increased. An important consequence of forward contracting is that generators have less incentive to reduce output in order to raise the spot market price.

Yet another aspect of market design that contributes to the mitigation of market power in the Nordic power market, is the market rules of Nord Pool. The trading rules adopted by Nord Pool are very stringent with respect to dissemination of information to all market participants. Thus information about available hydro stocks and the operation plans for power nuclear plants can not be kept as company secrets.

Dilution of market power

Like in most other European countries the national electricity markets in the Nordic area were all dominated by a publicly owned “national champion”. This was particularly the

¹⁷ Around 30 percent of total electricity consumption in the Nordic area is traded at the Nord Pool spot market, while the total forward market turnover is around five times the spot market trade. Thus forward contracting is quite extensive.

¹⁸ The result is due to Allaz and Vila (1993) and their analysis of a duopoly case.

case in Sweden where the market share of the state owned company Vattenfall was more than 50 percent. Given the new regulatory framework the major companies would be able to exercise considerable market power on their respective home market and thus jeopardize the competitive electricity markets that the reforms were intended to create.

The strategy adopted to solve this problem was market integration. Again thanks to the large share of hydropower, in conjunction with the uneven distribution of hydropower resources between the four countries, inter-connector capacities were quite large. Thus the barriers to cross-border trade were institutional rather than physical. By abolishing border tariffs and adopting a system with distance-independent transmission prices the relevant market was significantly enlarged and the market power of the major generators diluted.

However, from time to time the physical inter-connector constraints are binding so that the Nordic market becomes two or several regional markets with different prices. With the exception of 2000, when inter-connectors from Norway were congested most of the time, there has been complete price equalisation between 30 and 60 percent of the time and only small price differences during most of the remaining time. The Swedish electricity market has been fully integrated either with the Finnish or the Norwegian market essentially all the time. Thus from a competition point of view the Nordic electricity market is close to a single market in which the combined market share of the four major producers is less than 50 percent (see Table 2).

Political support

Even though electricity market reform came about as a result of political decisions continued political support by no means is guaranteed, particularly if employment in the power industry is reduced as a result of increased competition or supply and demand shocks lead to high electricity prices. In the Nordic countries the development of prices in 2002-03 was a major test of the degree of political support for the market based electricity supply system. Although there were strong demands for political intervention, particularly in Norway, no intervention took place.

Thus, instead of blaming the power companies leading politicians stated that electricity prices were high because hydropower was unusually scarce, and that no regulation could change that situation to the better. Apart from the fact that no regulations, temporary or permanent, were imposed the no-intervention policy probably also had long-term effects. Due to annual variations in hydropower supply wholesale electricity prices inevitably will vary between different years. By confirming that prices will be allowed to be high in “dry” years the politicians in effect increased the expected rate of return on investments in new generation capacity.

Commitment to public service

Although the power companies in the Nordic countries have been exposed to competition for quite some time a strong commitment to public service seems to remain. Alternatively there may be expectations that collusion and exploitation of market power will induce new regulations or even a return to the “old” system. In any case an analysis of the

development of electricity prices give no indication that there is collusion between generators, or that major power companies exploit the market power that they in fact have. Thus actual wholesale electricity prices have constantly been lower than the prices obtained in simulations with numerical oligopoly models in which Cournot competition is assumed (see Bergman (2002)).

8. Concluding remarks

There are two major threats to the success of electricity market reform in the Nordic countries. The first is that security of supply can not be maintained. The second is that market power prevents the potential benefits of competition to be realized. So far security of supply has been maintained, although exceptional storms have created serious problems in electricity distribution. The major power companies have been accused of exercising market power, but convincing proofs are lacking. At the same time power industry productivity has increased, and retail electricity prices (before tax) have become strongly linked to wholesale electricity prices.

The situation may change in the future. Thus it remains to be seen that investments in new capacity are carried out when they are needed, and that mergers and capacity expansion do not significantly increase concentration and market power. But the development of the Nordic electricity market so far to a large extent is quite successful. Does this mean that the “Nordic model” should be adopted all over the world?

The answer is “no”. In many ways the success of the Nordic model depends on area specific factors such as ample supply of hydropower and significant inter-connector capacities. Yet there are some “universal” lessons that can be learned from the Nordic experiences. In particular the Nordic experiences suggest that a “deregulated” market for electricity works well if:

- There are no price regulations and constraints on the development of financial markets
- There is continued political support for a market based electricity supply system also when electricity is scarce and prices are high.

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