

Market Power Mitigation By Contracts:

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Abstract

Abuse of market power by dominant generation firms is a concern in electricity markets worldwide. In response to this threat, regulators are developing methods for market power mitigation. This paper discusses several legal and economic tools to address market power and suggests that the regulator should use ex-ante regulatory powers to give firms incentives to sign contracts with consumers.

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Mixed success of the liberalization of the EU-electricity market

The internal market for electricity was conceived in 1996, with the European Directive 96/92/EC and further specified in a follow-up directive 2003/54/EC.¹ The main idea of the directives was to split the electricity market in four separate sectors: generation, transmission, distribution, and retail. The generation and retail sectors were considered viable for competition, while the transmission and distribution sectors were regarded as natural monopolies that require regulation.²

Ten years after the opening of the electricity markets, the results of the liberalisation are mixed. Some progress has been achieved, but a healthy internal market for electricity has not developed.³ In this paper we will concentrate on the lack of effective competition in generation, and the (potential for) abuse of market power by generation companies.

There are a number of reasons why abuse of market power by electricity generators is an important issue in Europe. First, two main characteristics inherent to electricity markets make market power abuse particularly attractive. These are the *non-storability* of electrical energy and the *low demand elasticity*⁴. Both properties make unilateral withholding of production output highly profitable for firms. Generators are often producing close to the technical maximum plant output during periods of peak demand. This inevitably leads to steep supply and residual demand functions. Even in relatively unconcentrated markets, relatively small players can find it profitable to withhold output and drive up prices.⁵ (Wolak 2003b), shows for instance that uni-lateral market power in California can explain the substantial price increases in the summer of 2000.

The second factor contributing to market power abuse is the lack of a good regulatory framework at the EU-level. The liberalization directive fell short in defining common rules with respect to *market structure* and *market design*. Concerning market structure, countries were allowed to create national champions and not directed to split up their electricity firms. This decision by the EU-commission was based on the assumption that no European electricity company will have significant market power. It was assumed that market structure would be addressed by establishing a larger market rather than creating more generation firms. This is in sharp contrast to other liberalized energy markets, such as the England-Wales market, in which market structure was a major concern during the energy market development.

Furthermore, the directive specified no clear rules concerning market design. No clear guidelines exist with respect to cross-border trade, international congestion management and the role of power exchanges. Instead, market design definition was left to member countries and the different actors in the respective market. The decision not to impose a market design is based on the subsidiarity principle: the commission should only make decisions on the community level that are absolutely necessary, but should leave practical implementation to member countries. This lack of clear guidelines has seriously hampered the development of an internal market.

¹ (EU Commission 1997; EU Commission 2003).

² Generation is the production of electricity, transmission is the high voltage transmission of energy, distribution is the low-voltage distribution of energy, and retail is the sale of energy to small consumers.

³ This was also recognized in a preliminary report of DG competition on their sector inquiry in the energy markets. (EU Commission 2006)

⁴ This effect is even worse because changes in real-time wholesales price are not passed through to consumers. Instead consumers pay a flat rate which is changed only infrequently, and does not reflect the scarcity of electricity in certain periods. Hence, consumers do not have the right incentives to reduce their demand when the market is tight.

⁵ The characteristics of the electricity market not only make the uni-lateral abuse of market power profitable, but could also encourage tacit collusion. Homogenous products, certain demand evolution, and repeated interactions are electricity market characteristics than could make tacit collusion more likely.

Third, merger policy has largely failed in precluding the formation of dominant energy firms. Mergers have increased the barriers to market entry if not directly hindering competition. A stricter merger policy should have been applied by the European and national anti-trust authorities.

The lack of a clear mandate by national electricity regulators is the fourth factor contributing to market power abuse. In some markets, the role of the regulators is limited to controlling the transmission and distribution sectors. Their responsibility in the generation market is often limited with an advisory role in anti-trust decisions.⁶ These regulators can neither proactively change the market rules nor regulate power exchanges. The mandate of the FERC (Federal Energy Regulatory Commission) in the United States is more extensive. This body has the legal obligation of regulating the generation sector and ensuring fair and just prices. Additionally, a necessary EU-wide regulator does not currently exist in Europe to address cross-border issues.

In this paper, we discuss the legal and economic instruments that can be used to address generation market power in an European context.⁷ We compare advantages and drawbacks, and conclude that an optimal electricity market requires a mixture of both legal and economic instruments. In particular, we show that the standard tools of anti-trust policy (ex-post market power regulation and ex-ante merger regulation) are insufficient. Sector-specific regulation is essential to designing a market with integrated market power mitigation tools.

The paper further discusses which tools should be incorporated in the market design. We show that price and bid caps destroy economic incentives, and propose an alternative regulation that works through contracts control. The second section of this paper presents guidelines on the implementation of regulation by contracts. First we show that all contracts signed by firms should be regulated. If only some contracts would be regulated, then there would be a crowding out of private contracts by regulated contracts and regulation would have no effect.

Second, the regulator should set a target contract quantity for each firm, and impose a penalty if firms deviate. These targets should be based on the historical market shares of the firms, and remain fixed for a sufficiently long period of time. If contract targets would change too often, firms will strategically try to influence regulation, and market power would increase.

I Market Power Mitigation

Anti-trust authorities and regulators are concerned about the dominant position of the incumbent generators in the electricity markets, and have looked into remedies to mitigate market power of large generators. These mitigation procedures can be classified into legal and economic instruments, which we discuss below.

A Legal Instruments

The three approaches used to mitigate market power are merger control, sector specific regulation, and prohibiting dominant position abuse. The first two measures are ex-ante forms of intervention, i.e. the regulator or the court acts before there is an abuse and the last instrument is ex-post, that is, the court acts after abuse has been established. We also discuss the advantages and drawbacks of each instrument.

- *Ex-ante merger regulation* (Based upon article 83⁸). The EU merger regulation can forbid mergers or impose market power mitigation methods to *restore* the level of competition present

⁶ The Netherlands is an exception where, the energy regulator, DTE is a subdivision of the anti trust authority NMA.

⁷ THE CONSULTATION REPORT OF EU COMMISSION

⁸ Article 81, 82 and 83 are part of the EU-treaty and form the basis of EU-competition policy. (EU Commission 2002)

before the merger. This is an important instrument in the electricity markets to prevent the creation of dominant players. The main advantage of merger control is transferring the burden of proof to the generators; firms have to provide evidence to the court explaining why problems will not arise from the merger. However, merger control is *not strong enough* to tackle existing problems in the European electricity market because markets are highly concentrated and still national in scope. Because merger control aims at restoring the level of competition present before the merger, it maintains the status quo and does not create a competitive market. A merger of two national players does not fall under the jurisdiction of the DG-competition⁹ as markets are still national and authorities deciding about the merger might be guided by national interests. A cross-border merger (for instance E.On - Endessa) does not hinder competition as markets are national despite the creation of a larger company with increase market power.

- *Ex-ante market regulation.* The EU commission or individual countries can impose sector-specific regulation in the electricity market. This regulation forms part of a market design, which should consist of a coherent package of regulations and the appropriate set of markets. In such a package, attention should be paid to both market power and security of supply. An *ex-ante market regulation* process is more expedient than ex-post market regulation, and might therefore be more appropriate in the electricity market. It also has a lower burden of proof, which is partially shifted to the firms. Companies are given ex-ante rules on behaviour and deviations are easier to prove. Ex-ante regulation is often combined with continuous market monitoring further reducing the burden of proof. The drawback of ex-ante regulation is the possibility of destroying true market competition and hampering innovation. Generators might begin to game regulatory rules rather than competing for marketshare,. Also, regulation made with current technologies in mind may be inadequate for future technologies..
- *Ex-post market regulation.* Article 82 prohibits the abuse of a dominant position by firms. A firm with a dominant position can be punished if it is proven to engage in anti-competitive practices such as bundling, price discrimination, rebates etc. In the electricity market, ex-post market regulation can be used to address unilateral market power of generators. In contrast with other sectors, abuse of market power is not always related with specific practices, but rather with selling less and increasing prices. Excessive pricing is prohibited by Article 82(a) but the jurisprudence is very limited¹⁰. *Ex-post market regulation* is used in most sectors as an instrument to deal with market power abuse by existing dominant firms. It is still unclear whether ex-post regulation will be effective in the electricity market. Until now very few cases have been brought to court. The high burden of proof makes ex-post regulation difficult. Observation of ‘abnormal behaviour’ by a firm in the electricity market may be insufficient as proof of “abuse” but could be attributed to bad market design. Additionally, ex-post regulation may be inappropriate in dealing with market power problems arising during short periods of super peak demand in small geographical areas. The delay in legal decisions, often years after significant economic transfer has occurred, is an additional problem of ex-post market regulation that makes it difficult to undo the damage done to consumers.

⁹ The Directorate General for Competition of the European Commission is responsible for enforcing competition rules of the Community Treaties. Its role is comparable to the Federal Trade Commission and the Department of Justice in the U.S. In merger cases, DG competition only has jurisdiction if the merger has a sufficiently large European Dimension. Otherwise, mergers fall under national courts.

¹⁰ In 40 years of European competition policy, only four cases of excessive pricing have been brought to court. (Motta and de Stree 2003)

B Economic Instruments

The two economic approaches used to mitigate market power are structural and behavioural remedies.

- *Structural Instruments.* These are needed to address a structural problem in the electricity market. For instance, a divestiture might be the best way to address concerns of market power abuse when a dominant generator has an 80% market share. A structural remedy forces the dominant energy companies to divest parts of their assets in one of two ways. In a horizontal divestiture, the firm sells generation assets, while a vertical divestiture requires a vertically integrated generation firm to sell some of its retail activities.¹¹ Horizontal divestitures, which are more often used, breaks up a firm to create several smaller competing firms. Foreclosure may be averted by separating some of the retail activities of a generation firm, and entrants might find it easier to enter the generation market when retail and generation are not vertically integrated.
- *Behavioural Instruments.* These involve regulating the actions of the firms. Behavioural rules are used to address structural problems, but have several drawbacks relative to structural remedies. They require costly, continuous monitoring of the actions of the firms involved¹²; deviations from rules are difficult to detect and enforcement would require a new legal process to prove deviations and to impose sanctions. Behavioural remedies might also distort the market and create inefficiencies. They might form an entry barrier for new generation, if the remedies help the incumbent to commit to a certain strategy. However, behavioural remedies are justified in addressing problems of market power when dominance is temporary and/or localized. For instance, during periods of super peak-demand, every generator is needed to ensure that the electricity market does not break down. In this scenario, even small firms are able to withhold production capacity and to significantly increase prices. Behavioural mechanisms then become necessary as divestitures are not an effective solution.

Classification of Behavioural Economic Instruments

There are different forms of behavioural regulations, and a simple classification does not exist. In this text, we suggest a classification system based on the *level of detail* and the *firmness of rules* that firms have to comply with. A rule is detailed when it is a precise prescription of allowable actions. A rule is firm when the rule-maker agrees not to change it. This classification system can be divided into *spot market regulation, contract regulation, and monitoring*.

- *Spot Market Regulation.* On one end of the classification spectrum, the regulator micro-manages the decisions of the generators; he determines the selling prices, the production amount, and adjusts regulation to changes in the market environment. It is very detailed and time-dependent. This regulation, called *spot market regulation*, can take the form of bid-caps or price-caps. A *price-cap* puts an upper limit on the clearing price the market can achieve and are present in most power markets. The caps are set administratively by the regulator; however, “software constraints”, set by power exchanges, also limit prices. *Bid-caps* restrict the generators’ bid prices

¹¹ A generator might also be obliged to sell its distribution and transmission assets. This type of divestiture is called *ownership unbundling*, and is foreseen partially in the EU-directives.

¹² It is unclear if monitoring is more costly in the electricity market than other markets. Though current regulation in electricity markets makes monitoring cheaper, deviations might be harder to detect given market technicalities.

but do not restrict the clearing price of the market. These bid-caps can be different for different players and generation plants. Often, they are based upon estimates of the marginal costs of the generator or on historical bidding of that plant. Bid caps have been implemented in several markets in the United States.

The major drawback of spot market regulation¹³ is its tendency to destroy incentives for both the generators and consumers, thereby hindering the development of an efficient electricity market. *Price caps* destroy economic incentives for consumers and generators as prices do not reflect scarcity in period of peak demand. Consumers do not reduce their consumption and will consume more than the efficient amount. Generators do not have an incentive to produce during scarcity. For example, they have the wrong incentives to schedule plant maintenance and may shut down when they are most needed. In these cases, price caps are ineffective forcing network operators to sign bilateral contracts with generators at higher prices to avoid black-outs. Extra regulation is needed to address investment problems as prices are too low on average for peak-load generators.

Bid caps, on the other hand, limit the players' bids while allowing the free movement of price to clear the market. It has certain advantages over price cap regulation.¹⁴ Clearing prices are high during peak demand reflecting the scarcity of electrical energy. This gives generators the right incentive to produce electricity during peak periods. Also consumers reduce consumption to avoid paying the high peak periods prices. The downside is that bid caps do not particularly reduce market power. To be effective, bid caps should be combined with quantity regulation which obliges players to bid into the market. This prevents generators from withholding capacity and increase prices not by bidding higher prices, but by bidding less.

- *Contract Regulation.* At the mid-point of the classification spectrum, the regulator no longer micromanages the short term production decisions of the generators but instead focuses on setting the right incentives. The regulator signs supervisory contracts with generators or controls the contracts signed between generators and retailers to reduce the incentives of generators to exercise market power. In this type of regulation, rules are less detailed and the regulator commits itself not to change rules too often. This type of regulation, which we will call *contract regulation*, can have different characteristics. They differ in duration, indexation to fuel prices, renegotiation power, flexibility in quantity, etc. Contract regulation has not been used extensively in electricity markets; however, there are some cases where generators were obliged to sell contracts for the delivery of power to retailers.¹⁵

Contract regulation is often superior to spot market regulation. For instance if generators are obliged to sell call options to the regulator, then these contracts can mimic the effect of a bid cap without destroying the short-term production decisions and the long-term investment incentives. The call option behaves as an implicit price cap in the spot market. If a player bids a higher price than the strike price, then it will receive a higher price from the spot market for its energy, but it will have to pay out more money for the call option it has sold. The net revenue for the generators is the same with the call option as with the price cap. Simultaneously, an option contract will give generators the incentive to be available during peak demand periods. The generator will pay a penalty equal to the difference between spot price and the strike price if it does not produce energy during peak demand. Hence, the option contract includes an implicit must-offer obligation.

¹³ A complication of spot market regulation (price and bid caps) is that it requires a well functioning and liquid spot market, in which generators are obliged to participate. Such markets are currently not available in every European country.

¹⁴ Some energy markets use pricing algorithms who do not allow the price to clear the market, and bid caps do not improve upon price caps.

¹⁵ These contracts were called Virtual Power Plants.

Furthermore, generators will receive financial contributions to cover their fixed investment costs if call options are sold in a competitive market. Hence the contracts do not destroy long-term incentives to build new generation capacity. Contracts have several other advantages such as:

1. Conferring legal certainty to players. For the contract duration, players are fully knowledgeable of the conditions under which electricity will be supplied.
2. Allowing regulators to commit to certain regulatory strategy. Such a commitment is ideal to prevent the regulator from exercising too much discretionary power. The inability to commit will lead to a ratchet effect, which will reduce efficiency (Sappington 1980).
3. Easy integration of regulated contracts with existing, unregulated contracts.
4. Reflecting the costs of the imposed regulatory rule, which allows the design of an optimal regulatory system. The cost of regulation is not directly observable, for example, when price caps are imposed on the market.

I would therefore argue that it is advantageous to consider regulation by contracts over spot market regulation.

- *Monitoring.* On the other end of the classification spectrum, the regulator imposes no rules beyond the standard, non-detailed competition rules. Its role is therefore restricted to market monitoring. As they build upon the judicial precedents and the existing legislation, rules are firm but do not change quickly through time. We will call this type of regulation *monitoring*. As the regulator does not impose additional rules, it is a light abuse of terminology to call monitoring a behavioural remedy. However, monitoring is not just the collection of data, but also a definition of relevant markets, good substitute products, market abuse indicators etc.¹⁶

It is still unclear if monitoring is sufficient to obtain competitive electricity markets. Non sector-specific standard competition rules make it difficult to prove market power abuse. When a regulator monitors the market, he will often define dominant players, relevant markets, and indicators of market power abuse. This implicitly creates subjectivity leading to a form of pseudo-regulation, which can result in several problems:

1. Lack of legal certainty for generators. Regulators might change measures of market power over time and courts may disagree with the regulators' viewpoints.¹⁷
2. Over-emphasis on indicators not necessarily related to underlying market fundamentals. For instance, a measure of the length of time a generator sets the clearing price is probably not a meaningful indicator for long-term market power, if it excludes information on production costs, long term contracts etc.

C Optimal Combination of Legal and Economic Instruments

Table 1 shows the different economic and legal instruments which can be used to address market power in the electricity market. The rows give the three different legal instruments, while the columns

¹⁶ This type of regulation is sometimes called *sun-spot regulation*.

¹⁷ During the Nuon-Reliant merger in the Netherlands, disagreements surfaced with regard to the definition of relevant markets. The competition authority argued that the merged firms would obtain a dominant position during periods of peak demand, but the appeals court did not follow them in their reasoning. Decision LJV AZ3274, College van Beroep voor het bedrijfsleven, AWB 05/440 of November 28, 2006.

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represent the different economic instruments. We also discuss combinations of legal and economic instruments and their role in the electricity markets. The most feasible combination of economic and legal instruments is indicated by an “X” while the bold “X” symbolizes combinations that should receive more attention in the future.

		Economic Instruments			
		Structural Remedy	Behavioural Remedy		
			<i>Spot Market Regulation</i>	<i>Contract Regulation</i>	<i>Monitoring</i>
Legal Instruments	Ex-ante Merger Control	X		X	
	Ex-ante Market Regulation		X	X	
	Ex-post Market Regulation	X^a		X ^a	X

Table 1 Applicability of economic and legal instruments for market power mitigation

(a) Ex-post regulation uses monitoring to define rules that generators need to abide by. If these rules are broken, then other types of remedies such as structural or contract regulations can be imposed

The relation between legal and economic instruments is not a one-to-one relation. During a *merger review* the court makes a thorough analysis of the potential effects of the merger on the market. Given this strong review process, the court should first issue structural measures such as obliging firms to sell some of their generation capacity in markets where both firms have large market shares. In prior merger reviews, some firms have had to sell Virtual Power Plants (VPPs); this is a form of contract regulation (behavioural remedy). Selling Virtual Power Plants changes the generator’s incentives and makes the market more competitive. The sale of VPP, while useful, has serious limitations compared with structural unbundling and strict conditions on the sale of VPPs should be set by the courts during the merger review.

Ex-ante market regulation has been underestimated in European electricity markets. Contract regulation should be imposed to regulate generators with sufficient attention paid to market design. Public good characteristics such as security of supply and market power should be considered as regulators set regulation. It must be noted, however, it is difficult to set strong conditions on the sale of contracts given the soft nature of ex-ante market regulation.

Ex-post market regulation has not yet been very successful in European electricity markets. However, cooperation between regulators and antitrust authorities provides a large potential for improvement. Ex-post market regulation combined with continuous monitoring might form an effective tool once clear indicators are established to measure and define market power abuse. Anti-trust authorities can impose merger regulation remedies such as having firms sell off parts of their capacity or some long-term contracts in a situation of market power abuse. As we discussed above, this approach has certain drawbacks. Ex-post market regulation is slow, the burden of proof for abuse of market power is high, and transfers of economic gain from consumers to the generation firms cannot always be undone. Monitoring might create legal uncertainty; shifting the focus to short-term indicators and concentrating on market power might also lead to a lack of clear vision on long-term market power effects and security of supply (investments).

Comparison between different forms of regulation

Any type of behavioural remedy can be used to obtain a competitive outcome if a regulator has perfect information about the market. In spot market regulation, the regulator can set a bid cap equal to the marginal cost of each generation plant. In contract regulation, he can impose that hourly contract

position reflects the perfect competitive outcome during that hour. During market monitoring, firms that behave anti-competitively can be fined to maintain a competitive market without setting any rules. Under every type of regulation, the spot market will become perfectly competitive and firms will invest in the competitive amount of generation capacity.

However, information asymmetry exists between the players. It is impossible to measure the success of regulatory instruments without including information asymmetry and direct and indirect regulation costs. The direct regulation costs are costs of designing rules and monitoring the players' behaviour while indirect regulation costs are inefficiencies created during the investment, contracting, and spot market stages. The theory of incentive regulation shows that an optimal form of regulation will leave decision-making to agents (generation firms) when the firms have information not available to regulators. Hence the regulator should not strictly specify how much a generator should sell, or at what price, but should set up the right incentive structure for the agents.

It is essential to formally model the information asymmetry and dynamic interaction between the regulator and the market players to compare different regulatory instruments. In practice, however, this type of modelling is intractable. Without building such a formal model we will nevertheless argue that regulation should become more detailed when the regulator has more information on the industry, and less detailed when the regulator knows less. If the regulator has very good information about the market and the generators, then it is optimal to set precise task descriptions for the generators. Destruction of some market incentives is not a major concern as optimal regulatory instruments can be created to achieve the optimal outcome. In this case, spot market regulation is ideal as it prevents any abuse of market power. If the regulator has reasonable information about the market and generators, then he should use a light handed type of regulation. Under this approach, generators have more power to adjust their production decision and to use their informational advantage vis-à-vis the regulator. Standard competition policy should be relied upon if the regulator has no market information.

D Conclusion

It is realistic to rely on an optimal to combine ex-ante merger, ex-ante market, and ex-post market regulation to mitigate market power rather than a single type of economic or legal measure. In particular, we identify ex-ante market regulation by contracts as an important instrument in addressing market power. Too little attention has been given to this instrument in Europe. In the rest of this text we focus on the use of contracts in electricity markets as a regulatory instrument. First, we discuss the effect of contracts in competitive and non-competitive markets and then consider two ways of incorporating contracts into the current regulatory framework.

II Role of Contracts in Electricity Markets

This review presents the role of contracts in competitive and oligopolistic markets, with an emphasis on electricity markets. For simplicity we only discuss forward contracts in this paper, i.e. contracts which specify a fixed quantity and a fixed price for future delivery.¹⁸ Two types of forward contracts exist: physical and financial contracts. With a physical contract, the seller promises to deliver the quantity physically to the buyer. With a financial contract, the seller pays the buyer a sum of money which the buyer to buy goods on the spot market. For most practical purposes, financial and physical contracts are equivalent and we will not make a distinction between the two in this text.¹⁹

¹⁸ Contracts used in practice often go beyond standard forward contracts. Often delivery prices are indexed to fuel price and delivery quantities can be either time dependent or flexible (options, or take-or-pay contracts). See (Willems 2006) for a discussion of options and market power.

¹⁹ The distinction between financial and physical property rights is difficult to make in the electricity market. Central coordination of real-time network operation makes physical delivery of a good impossible. With the inexistence of physical

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A Effects of contracts in a perfectly competitive market

Contracts have an important function in markets. Buyers and sellers specify conditions for future transactions with a contract. By signing contracts, generators and retailers can trade their risks and minimize their exposure to price changes in the spot market. As generators typically have a downward exposure to spot prices and retailers an upward exposure, they are natural trading partners. A generator reduced the risk of both players by selling a forward contract to the retailer. This is a first role of contracts: the players' ability to change their revenue stream.

Contracts are also important as a commitment and co-ordination device. Forward prices can be used as a signal as generators decide about new investments. Forward contracts are useful in coordinating an optimal level investment by aligning future demand with supply. The role of contracts as a co-ordination device is not generally accepted. There are two arguments against the use of contracts in driving investment decisions. One set of ideas states that the information value of forward contracts is very low in the electricity market. The best prediction of electricity price either two or one year from now is essentially identical. (Suenaga and Williams 2004) argue therefore that only forward contracts with a short duration will develop in a market. This will obviously destroy the co-ordination purpose of contracts. The second set of ideas refers to other industries where contracts are not used to guide investments. The typical example is the chip-manufacturing industry, where investments decisions are taken by firms like Intel and AMD, without having a contract between the buyers and the sellers of a contract.

We will now discuss briefly the effect of contracts on production and investment decisions.

- *Effect on the spot market..* Contracts do not change production decisions in the spot market. Generators should produce electricity as long as the short run marginal production cost is below the willingness to pay of the retailers independent of signed contracts.
- *Effect on investments and entry.* Contracts reduce the risk for both generators and retailers by reducing cost of capital and making investments cheaper. Therefore the existence of a market for contracts will increase investments in generation assets and also increase the investments in new electricity consuming factories.²⁰

B Effect of contracts in oligopolistic markets

In oligopolistic markets, contracts affect players' strategies, and hence, market outcome. Contracts are a form of vertical restraint in markets that can both increase or decrease competition. This subsection will describe the effects of contracts first by looking at the spot market (production decisions), contract market, and finally investment decisions and new entry.

- *Effect on the spot market.* Players who signed contracts in accordance with their natural position in the market (generators selling forward contracts, and buyers buying them), have an incentive to behave more competitively in the spot market. This is because generators will only compete for the uncontracted retail market. Firms have fewer incentives to drive up prices as they compete for smaller quantities. This is generally true and is independent of the type of competition in the spot market. Markets become more competitive when generators set prices or quantities. The

(Contd.) _____

delivery in electricity markets, physical contracts are defined as giving the buyers effective control over underlying asset basis, while with financial contracts provides the generators continue to control their assets.

²⁰ Generators and consumers optimize their portfolio which consist of physical and financial assets. When contracts (financial assets) can hedge the risk of their physical assets, then they will invest more in physical assets. ((Anderson and Danthine 1980))

reasoning behind this effect is observable in the extreme case of players signing contracts for quantities corresponding to the competitive outcome, whereby the spot market becomes perfectly competitive. Hence, contracts reduce the incentives for unilateral abuse of dominance.

However, contracts have a countervailing effect on the ability of generators to sustain tacit collusion by increasing incentives for collusion, making abuse of collective dominance more likely. It lowers the profits when deviation from the tacit agreement occurs and decreases the maximum punishment a player will receive. It has been shown that contracts may actually increase the possibility for tacit collusion among players. ((Le Coq 2003) (Green and Le Coq 2006))

- *Effect on the contract market.* The application of contracts as a commitment device also makes them a good strategic instrument for players in the market. By signing contracts, players can influence the equilibrium in the spot market and increase their overall profit. In particular, by committing to a certain level of aggressiveness, players can influence the behaviour of other participants in the spot market. The precise strategy depends on the type of competition. If generators compete a la Cournot, then they will sell forward contracts to compete more aggressively in the market ((Allaz and Vila 1993)), which increases their market share at the expense of the other participants. On the other hand, if generators compete a la Bertrand, then there is an incentive to buy forward contracts, and commit to being less aggressive ((Mahenc and Salanie 2004)).²¹ Hence, strategic contracting will make Cournot markets more competitive and Bertrand market less competitive. Strategic trading of contracts will only have an effect if the contract positions are observed by other players.²²
- *Effect on investments and entry.* Contract effects on entry decisions depends on the contract stage at the time of entry. Contracts signed before entry might be anti-competitive while contracts signed at the time of entry might favour competition. Markets are likely to become more competitive if potential entrants can compete for and sign contracts. This reduces their exposure risk and increases the ease of finding cheaper investment financing. Contracts signed before possible entrants can compete in the contracting stage are a barrier to entry. For instance, if incumbent generators have signed contracts with retailers, then new entrants might find it extremely difficult to enter the market and to find retailers who will buy their energy. Both the existing buyers and the incumbent generators might benefit from the contracts, at the expense of the profit of possible entrants. ((Aghion and Bolton 1987)). In the context of electricity markets (Newbery 1998) makes a different argument. He shows that in a supply function model, firms will sell base-load contracts to lower the average spot price and to deter entry. Firms use contracts because it is the entry deterrent strategy that is least risky and has the lowest variation in profit.

III Regulation by contracts

In the previous section we observed that contracts reduce the incentive of generation firms to abuse market power in the spot market. These results are robust with respect to the type of assumed competition and information available to players about contract positions. The robustness of these results encourages regulators to consider regulation by contracts in electricity markets. The underlying

²¹ (Newbery 1998) studies the case where firms compete with supply functions. He shows that if firms coordinate on the high price equilibrium, they will sell contracts, and make the spot market more competitive. (Green 1999) conducts a more detailed analysis and shows that if firms compete in linear supply functions in the spot market, and have Cournot conjectures in the forward market, then firms will not sell contracts. (Harvey and Hogan 2000) review these results.

²² (Powell 1993) builds a model of generation market power and price uncertainty, showing that generators expect a premium forward price for selling contracts to offset for a loss of market power in the spot market. As a result retail companies will underhedge.

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idea is that reduction of market power is a public good, which is not internalized when consumers sign contracts with generators. Therefore the number of contracts needs to be regulated.²³

This section discusses how one should implement contract regulation. The arguments in this text are descriptive and will be backed up with formal models in another paper.

The paper is restricted to regulations in which the regulator is active in changing only the incentive structure of the players who participate ‘voluntarily’. The regulator can impose a penalty if the players do not follow its regulatory rules. In the first type of regulation, the regulator creates extra demand for contracts, by actively buying contracts on the contract market. In the second type of regulation, the regulator imposes a penalty on the firms when the firms have not bought a sufficient amount of contracts.

A Extra demand of contracts

One potential mitigation method for market power is one in which the regulator creates an extra demand for contracts, i.e. he buys extra contracts on the contract market. It could, for instance, buy “physical” contracts for energy, which are backed up by physical generation capacity, on behalf of the consumers and resell the energy on the spot market. By buying contracts, the regulator tries to increase the amount of contracts sold by generators, and reduce abuse of market power.

We could think about this type of regulation as a three stage process. In the *first stage*, the regulator decides the amount of physical contracts it will buy on the contract market. In *stage two*, the generators decide simultaneously the amount of (physical) contracts they will sell to the regulator. They compete until they cover the full demand. Generators at the same time decide how much financial contracts they sell to the consumers of electricity or to arbitrageurs. These financial contracts provide the buyers of the contracts a hedge against price changes in the spot market, and are an investment opportunity for traders. In the *third stage*, the generators decide about their production level, and the regulator resells the capacity it contracted in the spot market.

It can be shown that when arbitrage is working well, financial and physical contracts are equivalent and have exactly the same strategic effect on the spot market. Hence what matters for the outcome of the game is the total amount of contracts which firms sold, but not the exact distribution between contracts sold to the regulator, final consumers and arbitrageurs.

Given that financial and physical contracts have exactly the same effect on competition, it can easily be understood that there is perfect crowding-out of private contracts when the regulator buys contracts on behalf of consumers. An increase of the number of contracts bought by the regulator will decrease the amount of contracts which is sold to private players. There is no net effect of buying contracts.

In other words, if a regulator wants to regulate contracts to mitigate market power, it should regulate *all contracts* generators can sign. This result is valid for any form of contract regulation: It is not sufficient to regulate only a subset of the contracts, as otherwise the firms will reduce the amount of unregulated contracts they intend to sell. Contract regulation should in particular be concerned with financial transactions which could be used to offset the strategic effects of regulated contracts. As these financial transactions can be very complex and not need to be restricted to standard forward contracts, careful consideration should be given to their evaluation.

²³ Besides reduction of market power, a second reason for regulating contracts is security of supply concerns. (Green 2003) argues that security of supply will be hampered when retailers do not sign a sufficient number of electricity contracts with a long duration. In Green’s paper, retailers do not sign contracts because the electricity regulator imposes that final consumers should be able to switch retailer on short notice.

In order to obtain an approximation of the strategic effect of contracts, one can look at their impact on the firm's risk. Hedging contracts, which reduce the firm's risk, lessen in general the incentives for market power abuse, whereas speculative contracts, which increase a firm's risk, tend to encourage abuse. If the portfolio of contracts signed by a firm is complex, then the regulator should not regulate each type of contract separately, instead, it should regulate the total risk exposure of firms. The link between a portfolio's riskiness and its strategic effect is however not perfect, and should only be used with care.

B Penalty for under-contracting

Another potential mitigation method is the obligation for generation firms to sign contracts with consumers which cover a certain fraction of their output in the spot market.²⁴ This regulation does not specify strict targets for each generator, but specifies targets relative to their market shares, and if firms do not achieve their target contract quantity, firms will have to pay a penalty. By making the contract quantities endogenous, the regulation automatically takes into account the heterogeneity of firms and accommodates for changes in the industry through time.²⁵

The penalty that firms have to pay might be explicit, a fine for not achieving a target, or, more likely, an implicit penalty with increased costs for under-contracting firms. Two examples of implicit penalties are the imposition of capital adequacy requirements on firms and the threat to force the divestiture of generation capacity when firms have a dominant position in the *spot market*.

In the first form of implicit penalty, the regulator relies on its legal duty to ensure the development of a well functioning and secure market. The regulator makes sure that firms are financially healthy and have a sufficient amount of liquid assets to deal with unexpected events. One way to achieve this is to impose a capital adequacy requirement which obliges firms to hold capital commensurate with the level of risk in their portfolio. A crude measure of a portfolio's risk is the unhedged position of a firm, equal to the difference between quantities sold in the spot market and the contract market. A capital adequacy requirement forms an implicit penalty for undercontracting, as firms incur the opportunity cost of holding capital. The advantage of this approach is that the regulator does not need to obtain additional legal power, as he is already responsible for ensuring security of supply in the sector.

In the second form of implicit penalty for undercontracting, the regulator warns firms with a *dominant position* in the *spot market* to divest some generation capacity. As dominance is determined by net sales, (total production – contract quantity) the threat to divest becomes a penalty for undercontracting. This approach was tried by the Italian electricity regulator²⁶, but was later blocked by the court and was ruled to be outside the legal responsibilities of the regulator.

²⁴ In order to cope with abuse of market power in the California energy market, the market surveillance committee (MSC) advised FERC to oblige generators to sell 75% of their expected annual sales in the form of two-year forward contracts at *regulated prices* ((Wolak 2001b), (Wolak and Nordhaus 2001) and (Wolak 2003a)). In our paper we assume that the forward prices are not regulated.

²⁵ (Wolak 2001a) suggests to oblige incumbent generators to sell sufficiently amount of hedge contracts at regulated prices, as a form of effective price regulation. This measure would be temporary and phased out as the market becomes more competitive, but states that “it is an open question what the optimal sequence is for reducing the levels of these vesting contracts over time and how the prices of these contracts should change if their level is reduced.” In our model, forward prices and contract quantities adjust automatically to changing market situations.

²⁶ The Italian energy regulator measured the dominance of generators by looking at the pivotal supplier index, which roughly measures if the net quantity that a firm sells in the spot market can be also be provided by competitors. It concluded that ENEL, the incumbent generator, had a dominant position in the south of Italy, and it obliged ENEL to sell more electricity by contracts. If ENEL would not sell these contracts, then the regulator would oblige the firms to divest generation capacity. (Delibera n. 212/05). Note that the contracts were of a special kind: they were call options. (= virtual power plants). The measure of the energy regulator was blocked in court, but subsequently, Italian antitrust authorities stepped in and started a case against ENEL for breaching Article 82. ENEL offered to remedy the situation and agreed to sell 1000MW of energy with long term contracts.

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In order for contract regulation to be welfare improving, the penalty should not be wasted, i.e. the money that the firms have to pay, is recovered by society and redistributed. Implicit penalties require a careful evaluation of social costs. For instance, a capital adequacy requirement creates an “opportunity cost” for society, but system wide stability benefits for the electrical system might outweigh these costs.

The rest of this section describes how to organize contract cover regulation. First we will describe how in a simple three stage process; contract regulation creates a undesired feedback effect, as firms will try to manipulate their target contract quantities. Then we will give some suggestions on how the feedback effect can be decreased.

For now, we could think about this type of regulation as a three stage process. In the first stage, the regulator specifies the regulatory mechanism. It specifies which percentage of their final sales generators should cover by contracts and the penalty that firms need to pay if they do not reach the target quantity. In the second stage, the firms sign simultaneously contracts with consumers. In the third stage, generation firms decide about their production output. Firms receive income from selling long term and short term contracts, incur their production costs, and have to pay a penalty when their contract positions fall short.

The effect of regulation can be split up in a direct and an indirect effect. The direct effect of regulation is the effect of regulation on one single firm, not taking into account strategic interactions with competitors. With the indirect effect we mean those effects that are driven by the oligopolistic interaction of generation firms.

The *direct effect* of the penalty is that it gives firms an incentive to reduce the difference between their contract position and their production level. First, it will increase the number of contracts that generation firms will sign with consumers. This makes the market more competitive. Second, given that firms will pay a penalty if they deviate from their contract position, firms will compete less vigorously in the spot market. This reduces competition. This last effect is an undesirable *feedback*: firms will change their behaviour in the spot market to change the target contract quantity.

The *indirect effect* of the penalty is a reduction of the *strategic* incentives of firms to contract. In other words, regulation of contracts crowds out the strategic contracts signed by the firms. Recall that when a firm sells contracts it makes a trade-off between the strategic gains from contracts (a higher market share) with the losses (a lower spot price). A penalty for undercontracting will change this tradeoff in two ways. (1) it becomes less profitable for a firm to increase market shares as a larger production is less valuable because it increases penalties (2) competitors will react less to a more aggressive competitor, as they like to stick closer to their contracted quantities. An equal increase in market shares therefore leads to a larger price drop. These two indirect effects reduce the amount of strategic contracts which are signed. The overall effect of the contracting penalty is determined by the combination of direct and indirect effects, and depends on the precise specification of demand and supply functions.

In equilibrium, the combination of direct and indirect effects will typically reduce social welfare. Especially the feedback effect is problematic: firms reduce production in the spot market in order to reduce the number of contracts they have to sign. For very large penalties the intuition for this result is very simple. Competition in the spot market disappears, and firms will set production equal to the contract quantity. As a result, firms only compete in the contract market, and the equilibrium of the game converges to the standard Cournot equilibrium.

The negative feedback effect is reduced, when regulators make the manipulation of target contract quantities less profitable. We propose the following regulation process, which is inspired by the theory of dynamic regulation.²⁷

²⁷ Section 3.2 in (Armstrong and Sappington Forthcoming) review the literature on the dynamic aspects of regulation.

At the beginning of a regulatory period, the regulator fixes a target contract quantity for each generation firm, based upon its historical production. The targets are fixed for the whole regulatory period.²⁸ During the regulatory period, firms sell contracts to the consumers, pay a penalty if they do not achieve the target contract quantity, and compete in the spot market. At the end of the regulatory period, the regulator will adjust the contract targets based upon the market shares of the previous regulatory period.

By fixing contract targets for the duration of the regulatory period, the regulator reduces the negative feedback effect. Firms can still influence the target contract quantity by changing production output, but longer regulatory periods reduce discounted profits of manipulation. Firms therefore manipulate less. The drawback of long revision lags is that it can bar entry and distort risk management.

The main conclusion of this subsection is that regulating the contract cover of firms might reduce welfare, as long as the period between the revisions of contract quantities is sufficiently long. Otherwise it destroys the incentives for private contracting, and will shift market power from the spot market to the contracting market.

IV Summary

The paper states that both structural and behavioural remedies are necessary to address market power problems in electricity markets. Structural remedies are needed to address large structural problems in the market, while behavioural ex-ante remedies are needed to address market power during periods with super-peak demand, security of supply problems, or to correct the myopic preferences of consumers. Behavioural remedies should be imposed by a *regulatory authority*, as intervention by legal authorities is too slow, as specific knowledge about the market is needed, as rules should be tailored to the concrete problems, and as the burden of legal proof is too high. Behavioural rules are therefore best embedded in the regulatory framework, and should be incorporated in the market design.

Among the class of behavioural remedies, the paper argues for the use of contract regulation as opposed to spot market regulation. Contract regulation is a better option because it is more market-conform, it does not destroy spot market incentives, and makes long-term commitment of the regulator explicit. If contract regulation becomes part of standard market design and are imposed on the firms by the regulator without strong judicial backing, then they should not infringe on the property rights of the generators. Regulation should be restricted to softer forms of regulation.²⁹ In the paper we look at two such non-intrusive types of regulation.

In the first type of regulation, the regulator creates an extra demand for physical contracts. We show that this type of regulation has no effect on the outcome of the market. The higher demand from the regulator will be off-set by a lower demand for financial contracts by final consumers. There is perfect crowding out. Hence, regulation of contracts has only an effect on the market if all contracts signed by the generators are regulated.

In the second type of regulation, generation firms are obliged to sell a fixed percentage of total production with contracts or pay a fine. We show that this regulation creates an undesired feedback effect because firms will compete less in the spot market to reduce their contract obligations. The feedback effect can be reduced, if the regulator revises the contract target level only periodically.

²⁸ If there are clear historical trends in the evolution of market shares, the regulator might accommodate these trends by fixing a pre-determined change in contract quantities.

²⁹ Note that soft regulation would not have solved the Californian electricity crisis. As discussed by (Wolak 2003a), FERC should have used its strong regulatory powers to oblige firms to sell contracts at *regulated prices*. This measure would be phased out once entry would make the market more competitive. Soft regulation is well placed in a mature and healthy electricity market.

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Furthermore, the regulator should take care that the penalties, which are incurred by the firms, are not a loss for society. Therefore, penalties which take the form of extra capital requirements are justified only if they increase system stability.

The role of contracts has, to a large extent, been neglected in the European debate on market power mitigation methods. The aim of this paper is to emphasise the potential benefits of such a regulation compared with several alternatives, and to open the debate on its implementation. The paper did concentrate on the effects of contracts on market power, and has neglected additional benefits on the stability of the electricity system, and on a potentially increased contestability. The paper leaves several questions unanswered, and future academic work is needed to jointly address the regulatory process, the contracting and investment decisions of firms, and the impact of market imperfections such as market power, market incompleteness, and the lack of consumers' response.

I want to stress that I do not believe that contract regulation can substitute for a sound market design and a healthy market structure. These two problems should be dealt with head on, and require additional legislation at the EU-level.³⁰ Instead contract regulation and capital adequacy requirements should become *an extra tool* for sector specific regulators, which are responsible for securing supply and mitigating market power. As a first regulatory step, firms should become obliged to analyse and report their contract position and risk exposure to the regulator.

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³⁰ In this respect, (Harvey and Hogan 2000) contend that given the flaws in Californian market design, it was unlikely that contract regulation would eliminate the abuse of market power.

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