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UNILATERAL MARKET POWER IN WHOLESALE ELECTRICITY MARKETS

FRANK A. WOLAK*

The past two decades of international experience with wholesale electricity markets has demonstrated that significant consumer harm can result from firms simply engaging in unilateral profit-maximizing behavior given the actions of their competitors. Different from other product markets, coordinated actions among suppliers or the concentration of production capacity in the hands of a small number of firms is unnecessary for some suppliers to be able to raise prices substantially above competitive levels for sustained periods of time.

Wholesale electricity markets with Hirshman-Herfindahl Indexes (HHIs) that would not raise market power concerns if they were from other industries have been subjected to severe market power problems. The relevant competition authorities have not found evidence of coordinated actions to raise prices in violation of the competition or antitrust law during any of these market power episodes. These facts provide strong evidence that competition or antitrust policy as it is applied to other industries may be insufficient to protect electricity consumers from substantial economic harm.

The technology of electricity production and remnants of the former monopoly regime imply that conventional competition policy must be augmented with an industry-specific regulator endowed with a pre-specified set of responsibilities. This combination of regulatory oversight and competition law will provide consumers with the same level of market power protection they receive for other products from conventional competition law. An industry-specific regulator is necessary because: (1) uni-

lateral market power problems can be extremely difficult to predict, and (2) they can impose significant economic harm even though they occur for a short period of time.

Clearly specified regulatory safeguards tailored to the electricity supply industry are needed to prevent the harmful exercise of unilateral market power before it can occur and rapidly implement the necessary remedies if it does occur. The primary goal of this regulatory process should be to prevent market participant behavior that significantly degrades system reliability and market efficiency, rather than prevent the exercise of unilateral market power.

The role of the regulatory process is to ensure that the conditions necessary for vigorous competition exist and to limit the economic harm associated with the exercise of unilateral market power when they do not exist. Regulatory mechanisms that attempt to prevent all exercise of unilateral market power can introduce market inefficiencies that cause more economic harm than the market power they are attempting to prevent.

Why electricity is different

It is difficult to conceive of an industry more susceptible to the exercise of unilateral market power than electricity. It possesses virtually all of the product characteristics that enhance the ability of suppliers to exercise unilateral market power. Supply must equal demand at every instant in time and each location of the network. Electricity is very costly to store and production is subject to extreme capacity constraints in the sense that it is impossible to produce more than a pre-specified amount of energy from a generation unit in an hour. Delivery of the product consumed must also take place through a potentially congested transmission network. How electricity has been priced to final consumers makes wholesale demand extremely inelastic, if not perfectly inelastic, with respect to the wholesale price. The technology of electricity production historically favored large generation facilities, and in most wholesale markets

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the vast majority of these facilities are owned by a relatively small number of firms. Finally, generation capacity ownership also tends to be concentrated in small geographic areas within these regional wholesale markets. All of these factors also make wholesale electricity markets substantially less competitive the shorter the time lag is between the date the sale is negotiated and the date delivery of the electricity occurs.

The uncertain availability of generation units and portions of the transmission network implies that system conditions can arise when virtually any generation unit owner in the wholesale market possesses substantial market power in the local market created by the transmission congestion or generation unit outages. Consequently, a prospective local market power mitigation (LMPM) mechanism that provides effective bid mitigation is a necessary component of any wholesale market design. The need for an independent entity charged with the design and administration of the LMPM mechanism implies the first rationale for an industry-specific regulator.

A second rationale for an industry-specific regulator during the transition period is the potential for small market design flaws that cause little harm during most system conditions to lead to substantial consumer harm under certain system conditions. The experience of California illustrates this point. From the start of the California market in April 1998 until April 2000, it was probably the most competitive wholesale market in the US. Conditions changed when it became clear that the amount of hydroelectric energy available from the Pacific Northwest during the summer of 2000 was significantly less than the previous two summers.

As documented in Wolak (2003a), the five largest fossil fuel electricity suppliers in California now faced significantly less elastic residual demand curves than they did during first two summers of the market and these suppliers found it in their unilateral interest to bid less aggressively into the spot market in order to raise wholesale electricity prices in California. As discussed in Wolak (2003b), this strategy was not unilaterally profitable during the first two years of the market because the greater availability of hydroelectric energy from the Pacific Northwest and inexpensive coal-fired energy from the Desert Southwest during that time period caused these suppliers to face significantly more elastic residual demand curves.

This change in competitive conditions during the summer of 2000 enabled in-state suppliers to raise prices substantially through their unilateral actions. The California experience demonstrates that some market design flaws, in this case insufficient forward contracting by electricity retailers, can be relatively benign under a range of system conditions. However, when system conditions conducive to the exercise of unilateral market power occur, this market design flaw can cause enormous harm to consumers. Consequently, industry-specific regulatory oversight is necessary to intervene as quickly as possible to limit harm when these system conditions arise.

Besides the need to correct market design flaws after they are determined to be harmful, there is also a need to engage in prospective market monitoring to find market design flaws that lead to substantial harm by less noticeable means. Aspects of the market design can enhance the ability of suppliers to exercise their unilateral market power. Therefore, another important role for an industry-specific regulator is to monitor the wholesale market to determine prospectively which market rules might enhance the ability of suppliers to exercise unilateral market power or increase the likelihood that the attempts of suppliers to coordinate to raise market prices will be successful.

This role for the industry-specific regulator also has a pedagogical component. The transition to a wholesale market regime involves a dramatic change in behavior by a number of market participants. Companies that fail to adapt to the new regime are very likely to go bankrupt and exit the industry, but there are often significant external costs to consumers associated with this outcome. Consequently, an industry-specific regulator can take prospective actions to encourage adaptation to the new regime and limit the resulting external costs if this change in market participant behavior does not occur.

Responsibilities of industry-specific regulator

The three major responsibilities of the industry-specific regulator are: (1) disseminating information to existing and prospective market participants, (2) ensuring compliance with all the market rules, and (3) protecting against behavior that degrades market efficiency and system reliability.

“Smart sunshine regulation”

A minimal requirement of any industry-specific regulatory process is to provide “smart sunshine regulation”. The regulator must have access to all information needed to operate the market and be able to perform analyses of this data and release the results to the public. At the most basic level, the regulator should be able to replicate market-clearing prices and quantities given the bids submitted by market participants, total demand and other information about system conditions. This is necessary for the regulator to verify that the market is operated in a manner consistent with what is written in the market rules.

The second crucial aspect of “smart sunshine regulation” is public data release. Specifically, all data submitted to real-time market and produced by the system operator should be immediately released to the public. The public data release should identify the market participant and specific generation unit associated with each bid, generation schedule or output level. Masking the identity of the market participants, as is done in all US wholesale markets, limits the disciplining value of public data release on market participant behavior.

Another potential benefit associated with public data release is that it enables third-parties to undertake analyses of market performance. The US policies on data release severely limit the benefits from this aspect of a public data release policy. Releasing data with the identities of the market participant masked makes it impossible to definitively match data from other sources to specific market participants. For example, some market performance measures require matching data on generation unit-level heat rates or input fuel prices obtained from other sources to specific generation units. Strictly speaking, this is impossible to do if the unit name or market participant name is not matched with the generation unit.

A long time-lag between the date the data is produced and the date it is released, as is the case in all US markets, also greatly limits the range of questions that can be addressed with this data. Taking the example of the California electricity crisis, by 1 January 2001, the date that masked data from June of 2000 was first made available to the public, the exercise of unilateral market power in California had already resulted in more than \$5 billion in overpay-

ments to suppliers in the California electricity market, as measured by Borenstein, Bushnell and Wolak (2002). Consequently, a long time-lag between the date the data is produced and the date it is released to the public has an enormous potential cost to consumers that should be balanced against the benefits of delaying the data release.

Ensuring compliance with market rules

Many market outcomes that are harmful to system reliability and market efficiency could be prevented if market participants fulfilled all of their contractual obligations. If the cost of violating a contractual commitment or market rule is less than the unilateral benefit from this action, the market participant will find it profitable to violate, which also adversely impacts system reliability and market efficiency. This logic implies that the second responsibility of the regulatory process is to: (1) design market rules to resemble publicly verifiable contractual obligations and (2) determine the appropriate penalties and sanctions to deter violations of these rules without adversely impacting market efficiency or system reliability.

A large fraction of harmful market outcomes can be prevented and the costs of operating the market and the costs of participating in the market will be lower if all market participants are confident that all contractual commitments will be honored regardless of system conditions. Contract enforcement costs stem from ambiguous or overly broad market rules or market rules that are not, or cannot be, enforced. A transparent rule that can be rigorously enforced is superior to an overly broad rule that is difficult to enforce. Irregular enforcement, either because of imprecise rules or inconsistent effort, increases the cost of market participation. This can also lead to increased market rule violations as more market participants push the boundaries of acceptable behavior.

This logic implies that regulators should divide market rules into two categories: (1) those that resemble publicly verifiable contractual obligations with little subjective judgement to determine compliance, and (2) those that require a formal administrative process to determine compliance. Rules in first category should be written to limit ambiguity and simplify enforcement. Those in the second category should have pre-specified administrative processes that deter behavior harmful to system reliability and

market efficiency because of the large amount of judgement associated with determining that a violation has occurred.

Both types of market rules require penalty and sanction mechanisms, but for slightly different purposes. In both cases, penalties and sanctions are imposed to deter market rule violations. For the market rules for which determining compliance is straightforward, the penalties and sanctions are the primary mechanism for deterring violations. For the cases that require subjective judgement to determine a violation, penalties and sanctions are the ultimate backstop, but the administrative process is the primary mechanism for preventing harmful market outcomes.

Protecting against behavior harmful to market efficiency and system reliability

The final responsibility for the regulator is to deter behavior that is harmful to system reliability and market efficiency. This behavior may still occur despite public disclosure of the market outcome and the offending actions of the market participant as well as the assessment of penalties for market-rule violations. The regulator should have the authority to intervene if all of these actions fail to stop the harmful market outcomes. Protecting against harmful market outcomes is the most complex aspect of the regulatory process, but it also has the potential to yield the greatest benefit. It involves a number of inter-related tasks.

Local market power mitigation (LMPM) mechanism.

In all bid-based electricity markets a local market power mitigation mechanism is necessary to limit the price bids a supplier submits when there is insufficient competition to serve a local energy need. An LMPM mechanism is a pre-specified administrative procedure (usually written into the market rules) that determines: (1) when a supplier has local market power worthy of mitigation, (2) what the mitigated supplier will be paid, and (3) how the amount the supplier is paid will impact the payments received by other market participants. It is increasingly clear to regulators around the world, particularly those that operate markets using Locational Marginal Pricing (LMP), that formal regulatory mechanisms are necessary to deal with the problem of insufficient competition to serve certain local energy needs.

Formulate and implement efficiency-enhancing market rule changes. The regulator must determine

which market rules detract from market efficiency or system reliability and formulate and implement the appropriate market rule changes. Because the level and geographic distribution of demand, the mix of input fuels used and ownership shares for generation capacity in the control area, and the configuration of the transmission network can all change over time, market rules must also change. The regulator must continually analyze and assess the market efficiency impacts of all market rules. Once it has identified a deficient market rule, the regulator must then work with the system and market operators to devise the necessary remedy. This duty underscores the need for the regulator to analyze market performance using the data it has compiled.

Penalize behavior harmful to system reliability and market efficiency. The regulator is the first line of defense against harmful market outcomes. Persistent behavior by a market participant that is harmful to market efficiency or system reliability should be subject to penalties and sanctions. In order to assess these penalties, the regulator must first determine whether the market participant intended to harm system reliability and market efficiency. The market rules should contain a general provision prohibiting persistent behavior detrimental to system reliability and market efficiency. The goal of this provision is to establish a process for the regulator to intervene to prevent a market meltdown. A well-defined process must exist for the regulator to intervene to protect market participants and correct the market design flaw facilitating this harm.

Determine when market activities can be temporarily suspended. The regulator must have the ability to suspend market operations on a temporary basis when system conditions warrant it. The suspension of market operations should only occur after a pre-specified administrative procedure has been followed and it has been determined that it is the only option available to the regulator to prevent significant harm to market efficiency and system reliability. As has been demonstrated in various countries around the world, electricity markets can sometimes become wildly dysfunctional and impose enormous harm over a very short period time. Under these sorts of circumstances, the regulator should have the ability to suspend market operations temporarily until the problem can be dealt with through a longer-term regulatory intervention or market rule change.

Preventing behavior detrimental to system reliability and market efficiency

This aspect of the regulatory process addresses the concerns about harmful market outcomes typically voiced by parties claiming market manipulation. However, it avoids what I believe to be the impossible task of demonstrating that a market participant manipulated the market. Whether a market participant's actions constitute market manipulation depends on one's perspective. Viewed from one perspective, all suppliers that attempt to impact the price they are paid through their own unilateral actions are engaging in market manipulation.

The extent of unilateral market power possessed by a supplier is typically measured by its ability to move market prices through its unilateral actions. Consequently, a blanket prohibition of market manipulation written into the market rules seems to prohibit suppliers from maximizing profits given the actions of their competitors. These actions can lead to market outcomes that benefit consumers when all suppliers face sufficient competition. This logic is why there is no explicit prohibition against market manipulation under US antitrust law – it amounts to prohibiting behavior that is a major driver of the benefits in competitive markets.

The prohibition of behavior that is detrimental to system reliability and market efficiency focuses on identifying and eliminating detrimental behavior by market participants rather than on punishing this behavior. Penalties and sanctions are a last resort when all other options for eliminating the behavior have been tried, including asking the market participant to stop because of the significant harm this behavior is imposing on other market participants.

The major difficulty associated with implementing this market rule is that the regulator would have to infer from a market participant's behavior whether its bidding, scheduling, or operating behavior intended to harm system reliability or market efficiency. If the regulator identifies behavior that is detrimental to system reliability, and has clear evidence (for example, a whistleblower or internal correspondence) that the market participant engaged in this behavior with full knowledge that it significantly harmed system reliability or market efficiency, penalties may be imposed without first going through the administrative process to determine intent.

However, it seems very unlikely that the regulator would have direct evidence of intent, particularly if there is a market rule that imposes significant penalties on the market participants that have been shown to have engaged in this type of behavior. Enforcing a "behavior detrimental to system reliability and market efficiency" provision is more difficult if this market rule also imposed the very reasonable requirement that this detrimental behavior must also have a significant impact on market outcomes. This would require the regulator to make the often very subjective determination of what constitutes a "significant" market impact.

A key feature of this market rule is a transparent process for identifying intentional behavior detrimental to system reliability or market efficiency. This should include a process for taking the actions necessary to stop this behavior or the harm that it causes. The focus of this process should be on stopping as quickly as possible intentional behavior that the regulator determines causes significant harm to market efficiency and system reliability.

As should be clear from the above discussion, the major focus of this process is on eliminating the harmful behavior as soon as possible, not on assigning blame or imposing penalties. Only when public disclosure of the actions and the regulator's own investigation fails to stop or eliminate the harm associated with this behavior should the regulator attempt to determine intent and assign penalties for this behavior.

Coordinating antitrust and regulatory policy

We conclude with a brief discussion of how the industry-specific regulatory process should interact with the antitrust authority. The primary concern of the regulatory process is protecting against the economic harm associated with unilateral exercise of market power. Antitrust policy is concerned with detecting coordinated actions to raise prices and combinations (typically mergers) that result in a substantial lessening of competition. Antitrust law also prohibits attempts to monopolize, but this is unlikely to be relevant to the electricity industry beyond its implications for merger analysis.

The industry-specific regulator is the first line of defense for consumers against harmful market outcomes. While the industry-specific regulator may

wish to approve mergers, this seems redundant if the antitrust authority does a thorough review. Given the expertise of the industry-specific regulator, a thorough review would require that the antitrust authority to solicit extensive input from the industry-specific regulator, including the provision of industry-specific data that is part of the ongoing regulatory process.

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