Empirical Evidence of Strategic Bidding in California ISO Real-time Market

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Empirical Evidence of Strategic Bidding in California ISO Real-time Market (Summary of Results)

This study builds on previous studies by the California Independent System Operator Corporation's Department of Market Analysis ("DMA") of indications that prices in the California electricity markets have persisted at levels indicating that significant market power is being exercised in the California wholesale energy markets.[1] This study examines bids by individual suppliers (both instate and importers) in the real-time imbalance energy market of the ISO in order to determine whether individual suppliers' behaviors were responsible for raising prices above competitive levels.[2] Resolving that issue affirmatively, it then explains how suppliers successfully employed bidding strategies to insure high market clearing prices. The evidence described in this study thus provides a direct link between the observed pattern of prices and the bidding behavior of individual suppliers that produced those prices. Previously, regulators, including the FERC, have found strong evidence of the exercise of market power in the prices prevailing in the ISO and Power Exchange (PX) markets, but have been unable to identify evidence that any individual supplier in the California market exercised market power to create those prices.[3] This report reveals the linkage between individual suppliers' bidding behavior and market prices by examining information available to DMA, including individual supplier bidding data in California markets, bilateral and Power Exchange schedules from generation units, unit specific heat-rates for generation levels, and scheduled outages.

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[1] See Comments of the ISO on Nov. 1 Order, Appendix A, November 22, 2000. Additionally, several analyses have been filed at FERC showing consistent findings on the level of price cost markup in the California energy markets, including "Diagnosing Market Power in California's Restructured Electricity Markets", (Borenstein, Bushnell, and Wolak), August 2000 , MSC Report, September 6, 2000; DMA's *An Analysis of the June 200 Price Spikes in the California ISO's Energy and Ancillary Service Markets*; and Joskow/Kahn. "A Quantitative Analysis of Pricing Behavior in California's Wholesale Electricity Market During Summer 2000."

[2] This study reviewed bidding activities from 5 large in-state non- investor owned utility suppliers and 16 importers in the real time market of CA ISO for each hour between May and November of 2000.

[3] Both the November 1, 2000 FERC proposed order on California power market and the accompanying staff report contained a finding that the ISO and PX electricity markets were not workably competitive. They did not, however, identify actions of individual suppliers exercising market power. *San Diego Gas and Electric Company, et al.*, 93 FERC 61, 121 (2000); Staff Report to the Federal Energy Regulatory Commission on Western Markets and the Causes of the Summer 2000 Pricing Abnormalities-Part 1, November 1, 2000. Then, in FERC's February 1, 2001 Report on Plant Outages, the agency again concluded that it had not found evidence that the outages examined were the result of market manipulation or any form of market power abuse.

Study of System Price-Cost Mark-Up

In an earlier study, DMA examined the overall system price-cost mark-up to assess the market power impact in the combined ISO/PX markets[4]. It calculated the mark-up of system market clearing price over system marginal cost, which is considered a proxy for a competitive benchmark of market clearing prices. The analysis also attributed the overall increase in prices from May to November 2000 into component factors: (a) increases in the cost of production (b) increases attributable to high prices during hours of scarcity, and (c) the remainder of the increase where market power alone resulted in prices above what would be expected in a competitive market. The findings were:

- Increases in the cost of production (allowing for costs as expensive as full purchases at spot prices for natural gas and emissions credits which may severely overstate actual costs incurred) accounted for approximately one third of the increase in hourly electricity prices. Increased demand and reduced imports accounted only for an additional few percent.
- Approximately one sixth of the total increase was represented by non-cost price spikes during hours of scarcity,[5] which the study defined generously as conditions when total supply is less than total demand, represented by total load plus 10% (for reserves). The analysis made allowance for scarcity conditions, where some have argued that all price spikes are justified since it facilitates reduction in demand and encouragement for new supply to enter the market.
- The remainder, amounting to approximately 50% of the increase in prices, could not be attributed to production cost increases or price signals during periods of scarcity. The analysis thus attributes approximately one-half of the increase to the influence of market power exercised by suppliers.

This initial study caused the DMA to identify individual suppliers who caused system prices to be significantly above explainable competitive costs and examine how suppliers bid to exercise such excessive levels of market power. In this study of individual suppliers bidding behavior, there was direct evidence that many of the suppliers used bidding strategies that resulted in market clearing prices rising above competitive levels in the California electricity markets during the period of May to November 2000.

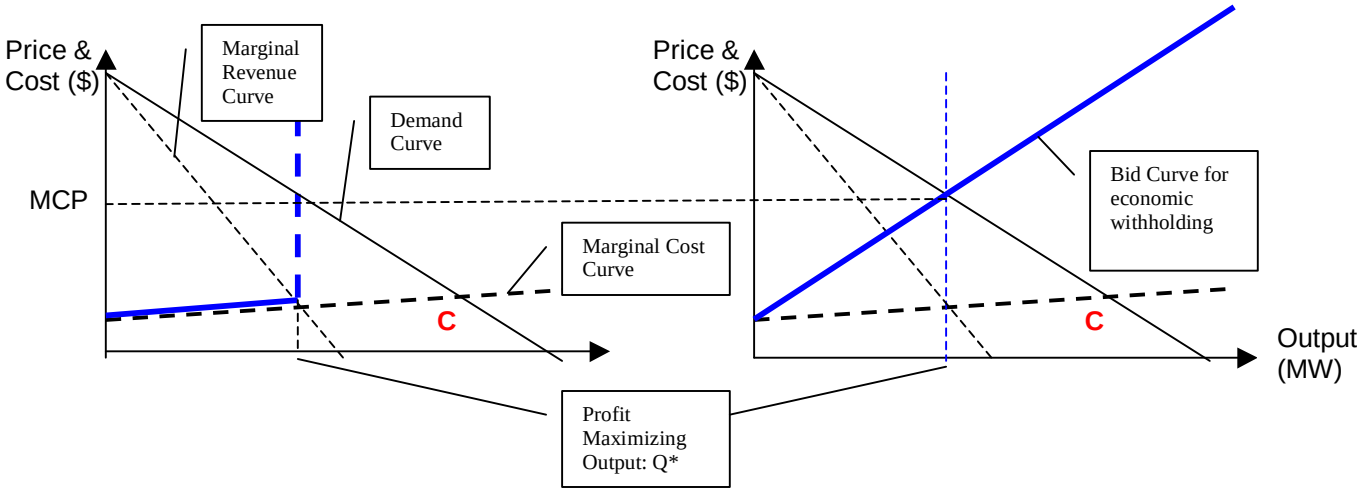
[4] See ISO filing in December on the System Price-cost Mark-up and part X of this filing: Eric's update for system price-cost mark-up.

[5] The analysis used a very generous allowance for "scarcity," defining scarcity as the condition when total supply is less than total demand, represented by total load plus 10% (for reserves). The Study recognized that scarcity conditions justify price spikes to attract new investment. Many of the price spikes occurred outside these scarcity hours, however, giving rise to market power concerns.

Study of Individual Suppliers' Bidding Behavior

Two Forms of Withholdings: In the study, DMA observed two main bidding strategies used by large suppliers to influence market clearing prices to maximize their own profits. They either submitted bids at prices significantly above marginal cost of their generation unit, or withheld part of the available capacity from bidding or scheduling into the market[6]. Both bidding strategies will prevent some economic generation capacity, which has a marginal cost below the market clearing price, from being utilized to serve the load. This is referred to as withholding of economic production resources (simply withholding hereafter). Specifically, the behavior of bidding above marginal cost is called economic withholding, and the action of not bidding or scheduling available resources in the market is called physical withholding. Either form of withholding prevents some lower cost resources from supplying the demand, and compels the ISO to buy more costly resources to meet the load, therefore result in higher market clearing prices than what the competitive outcome would have been. These two bidding strategies or withholding patterns are illustrated in Figure 1 below.

Figure 1. Two Types of Alternative Bid Curves Allow Suppliers to Maximize Profits by Reducing Output and Inflating Prices above Competitive Levels



For an oligopolist in the market facing a residual demand curve, it has two bidding strategies available: physical withholding (left panel) and economic withholding (right panel). Both strategies result in the same reduced output available to the market and at prices inflated above competitive levels. The expected competitive production and price levels are at the point marked "C".

[6] Although only a fraction of actual generation to meet the load are bid into ISO real time market, all generation serving ISO load must schedule through ISO in the day-ahead or hour-ahead time frame. Any capacity of a generation unit either scheduled into ISO or bid into ISO real time market is considered offered into the market. The remaining capacity of generation unit, after deducting outages, is considered withheld from the market.

This graph shows how a large supplier acting as an oligopolist (an oligopolist in economics refers to a small number of large suppliers able to influence prices in the market) would bid to maximize profits either by withholding capacity or bidding high to achieve the same result. The net result is higher prices in the market than what would have been found in a competitive market.

Study Methodology

The first step of the study was to quantify the direct responsibility suppliers had in setting the market clearing price through their effective bid in the market. The effective bid for each supplier is either the market-clearing price, or the generator's highest accepted bid price.

Determine Effective Bid Prices by Each Supplier: The study examined how a supplier's bids in the ISO's real-time market can set market clearing price. DMA compared the detailed individual bidding data in the real-time market to the marginal cost of generation for each supplier after accounting for all bilateral and PX energy schedules. If a supplier does not withhold and does bid all economic resources at production costs, their effective bid price is the bid price for their highest bid accepted by the market. When a supplier withholds (economically or physically) it bids effectively at the market clearing price and one can say that the supplier's effective bid price is to the market clearing price. Figure 2 illustrates the effective bid prices for each types of bidding pattern.

The analysis shows that through high bids, a supplier caused economic withholding and set the market clearing price directly by making one of their inflated bids close to or equal to the market clearing price. Acts of physical withholding set the market clearing price more indirectly by making more expensive bids from other suppliers determine the market clearing price. Although actions of physical withholding set market clearing prices indirectly, they are equally effective as economic withholding and are as directly as responsible for the resulting market prices.

Calculate Bid-Cost Mark-up Indices: The second step of the study was to utilize the effective bid price for each supplier by hour, and calculate a bid-cost mark-up index. The bid-cost mark-up is the difference between effective bid price and the corresponding marginal cost of generation for each supplier. This calculation allowed DMA to identify and assess the exercise of market power for all hours during the period, and analyze the ability of individual suppliers to determine prices in the market.

In calculating each supplier's cost for the bid cost mark-up, DMA used characteristics of each generation unit, such as heat rates, variable costs and capacity availability. We used the California border spot market price for natural

gas for all fuel purchase estimates although this likely overestimates the price of actual fuel used. Emission costs were based on the spot price of NOx emission credits which also overstated actual emission costs for production. DMA calculated available plant capacity by deducting all scheduled outage from a generation unit, and by allowing a 10 % forced outage rate which is above industry standard outage rates for gas-fired plants of the current age.[7]

Bid Price in Response to Higher Demand: The third step in the study was to calculate how much more individual suppliers could have increased prices had market demand been slightly higher. Each supplier had bids in the market ready to be accepted for slightly higher or lower levels of system demand (plus and minus 50 MW change in demand). The results shows, by using the typical bidding patterns identified, suppliers were not only able to effectively raise the market clearing price but also to insur it remained high within a reasonable range of variation in demand.

Excessive Profit Resulting from Market Power: The fourth step in the study was to calculate the monopoly rents[8], which are the amount of excess profits above competitive levels extracted by each supplier as a result of their individual bidding actions. Rent for a supplier in a given hour is calculated as its effective bid price minus system marginal cost (the competitive market price). The rent calculation does not use MCP but a supplier's bid price, therefore it does not attribute profit earned by price takers as monopoly rent. Actual rent earned by a supplier might be higher than the calculated monopoly rent when a higher effective bid by another supplier sets the MCP.

This study uses a narrow definition of market power[9], which strictly examines variable cost of production and not consider fixed cost of production. This narrow definition is intended as an input to the second attachment of this filing by Eric Hildebrandt, which examined whether the variable profit through "market power" is excessive after considering fixed cost of investment. This part of the filing shows the amount of monopoly rents earned is excessive using any reasonable standard.

Economic Models of Bidding Behavior: Finally, we compared the actual bidding strategies with economic model's predictions of behavior in an oligopolistic market. This allowed us to confirm that our observations were not simple hit-and-miss pricing behavior but that bidding behavior was consistent with what would be predicted from profit maximizing behavior in an oligopolistic market.

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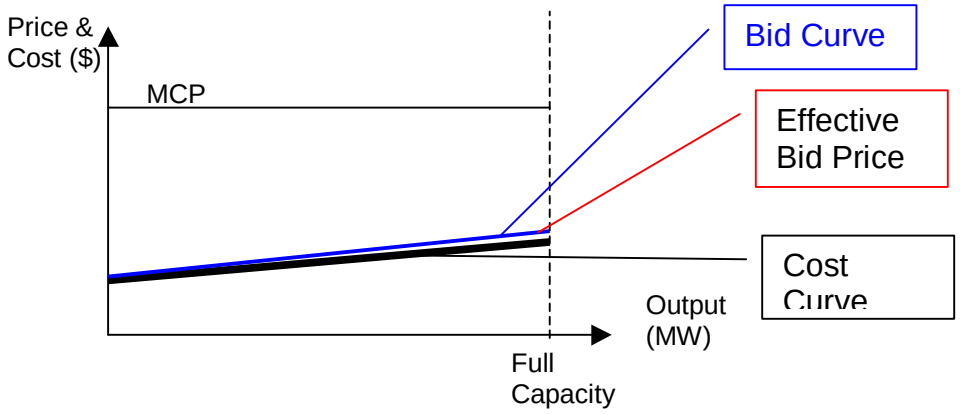
[7] Used NERC GADS (Generation Availability Data Standards) for steam plants of average age of 40 years.

[8] The phrase monopoly rent, as defined in the text, does not imply any single firm has complete domination over the market. Here we use the term to refer to excess variable profit earned by many of the large suppliers through exercising of market power.

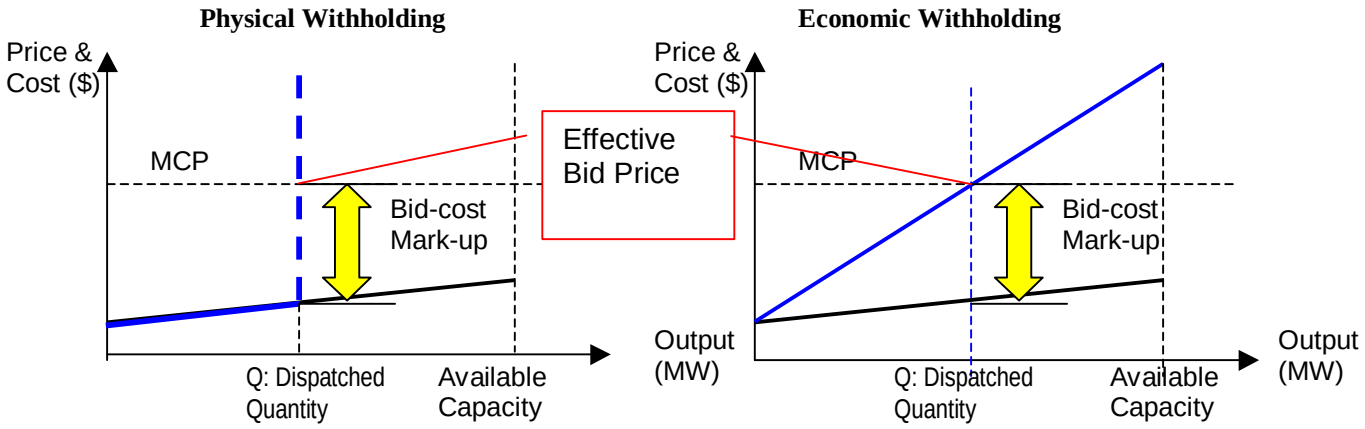
[9] Which is the convention used in economics when examining short term operational behavior.

Figure 2. Bidding Patterns: Effective Bid Price and Bid-cost Mark-up

(a) Price Taking Supplier: Effective bid price equals to bid price at dispatch quantity, which can be less than MCP(as in chart) or equal to MCP(when MCP line intersect the bid curve and cost curve). The bid curve shown below illustrates that this supplier's bidding has no significant bid-cost mark-up.



(b) Strategic Suppliers use physical withholding and economic withholding. Effective bid price is calculated to be equal to the Market Clearing Price in both cases shown below. Both strategies allow the supplier to set the MCP. The calculated bid-cost mark-ups are significant as shown in the figure.



Results

This study reviewed bidding activities from 5 large in-state non-investor owned utility suppliers and 16 importers in the real time market of CA ISO for each hour

between May and November of 2000.[10] Since the real-time market represent the final opportunity to supply in any market before the power is actually consumed, it is easier to determine a sellers cost to produce energy because the seller has no other opportunities left to supply power. As the real-time market represents the last market to sell, this means there is less concern about holding back a bid while waiting for a better opportunity in another market. By comparing the detailed bidding data in the real-time market to the cost of supplying energy in real time after accounting for all bilateral and PX energy schedules, DMA could analyze the level of the mark-up for each supplier. Five typical bidding patterns were identified. Only one of these patterns was consistent with competitive bidding while the other four displayed some form of withholding; either physical withholding, economic withholding or a combination of both.

Withholding patterns and bid-cost mark-up indices indicate that most of the five in-state suppliers and many of the large importers displayed bidding patterns which were consistent with the exercise of market power. Many suppliers bid in excess of their marginal cost of generation either through economic or physical withholding. These bidding strategies contributed significantly to the system price spikes in summer and fall 2000. The observed bidding patterns show that suppliers bid in expectation of increasing the market clearing price, because they are setting the high market clearing price directly or indirectly in most hours. As a result of their exercise of market power, many of the suppliers earned extraordinary amounts of excess profit (or monopoly rents) at huge cost to the consumers. Some of the important findings of the study are:

- Withholding, especially economic withholding, impacted the market for most hours from May to November 2000. Among the 25,000 hourly bidding profiles studied (about 5000 hours for each supplier) for the five large in-state generation owners, less than 2% of these hourly profiles displayed no clear pattern of withholding or market power. The other 98% of the hourly bidding profiles displayed various withholding patterns leading to inflated market prices. Withholding patterns and frequency are summarized on Figure 3[11].

[10] Utility-owned generation was not studied at this time because the utilities are net buyers and they are under a retail rate freeze, making it difficult for them to profit from price spikes. We recognize that successful exercise of market power by other suppliers did inflate the opportunity cost of limited hydro resources, thereby exacerbating the market power experienced in the market.

[11] Five Typical Bidding Patterns are classified in our study are: 1.) No withholding (Pattern 0). This is only bidding pattern that does not represent market power and did not inflate market clearing prices: 2.) Full Output at High Mark-up(Pattern 1). Although full capacity is bid in, they are all at significantly inflated prices. The highest bid price is used in calculating the effective bid price of the supplier; 3.) Physical withholding with no mark-up for bids submitted (Pattern 2). This is the pure form of physical withholding. Although there is no significant bid mark-up, there is significant unused economic generation capacity. In this case, the effective bid price is the MCP; 4.) Physical withholding used in combination with significant bid mark-ups (Pattern 3). This consists of physical withholding at high loads, along with significant mark-up to ensure higher prices in case the level of system demand does not require all the bids submitted; 5.) Economic

- Economic withholding was the dominant bidding strategy utilized to inflate the prices and had a significant impact in raising prices. Economic withholding was used more than 60% of the time if the five in-state suppliers are averaged, but two in-state suppliers used it more than 80% of the time. It was not only used consistently, but was accompanied by bid prices marked-up well above cost resulting in significant impact on the market.

- Physical withholding was less prevalent during Summer and Fall 2000. All five in-state suppliers studied, on average, used a physical withholding strategy for less than 30% of the time. Two of the suppliers used that strategy for less than 15% of the time. Physical withholding included the activity of declaring a unit on outage or otherwise unavailable, or simply not scheduling or bidding available capacity into the ISO or PX market. The low frequency of observable physical withholding highlights the importance of monitoring economic withholding (bidding excessive prices above cost) and explains why the review of physical outages alone is insufficient to uncover supplier behavior producing high market prices. Economic withholding rather than physical withholding may be the most significant source of the problem in the market during the study period.

- Frequent economic withholding and physical withholding translate into high bid prices and high bid-cost mark-up. During some summer peak months, the average bid-cost mark-up was more than $100/MW/hr. All five of the suppliers marked up their bids significantly above costs and did so in every month from May to November. Figure 4 and 5 report the average effective bid price and bid-cost mark-up by month for each of the large suppliers.

- Many suppliers used well planned strategies to ensure maximum possible prices at all load conditions. A 50 MW increase[12] in the amount demanded from a supplier's portfolio would have increased the market clearing price substantially. A review of suppliers' bid prices above and below the actual dispatch quantity revealed the strategic nature of their bid schedule. If the demand were higher, suppliers have much higher bid prices ready to push up the price much further. If the system demand were lower, suppliers still have fairly high bids in waiting to support high prices. Figure 6 and Figure 7 report the impact of this bidding strategy. The "mark-up potential" in Figure 7 represents the mark-up associated with a 50 MW increase in demand. In Figure 7, the graph showing mark-up for importers assumed an estimated heat rate of 12,000 MMBtu/KWh for the cost of imports. The zero $ amount

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withholding (Pattern 4). The only difference between Pattern 4 and Pattern 1 is that with Pattern 4 there is still available capacity that did not clear the market. Capacity is bid in at a significant mark-up. In the summary chart of bidding patterns in Figure 3, patterns 1 and 4 are combined into Economic Withholding and patterns 2 and 3 are combined into Physical Withholding.

[12] The exact incremental amount used in this test is the higher of 20% of real time dispatch quantity or 50MW. So sometimes, the increment is more than 50MW. Either value is to simulate a high likelihood demand shock in the real time market.

on the graph represents this baseline cost. (i.e., an importer with a bid below this cost is shown as a negative number.

- As a result of the excessive bid prices and associated bid-cost mark-ups, many large in-state suppliers and importers earned large amount of excess profit (or monopoly rent) through exercise of market power, calculated as the difference between a supplier's effective bid prices and the system marginal costs (the benchmark of a competitive market outcome).[13] Average monopoly rent per MWh is reported in Figure 7 for the five in-state suppliers. The total cumulative monopoly rent (sum of (Rent x Dispatch Quantity) over the period of study) is reported for the suppliers that earned the largest total economic rents during the period studied in Figure 8 below. Figure 9 displays the monthly trend of monopoly rent by in-state and importers. The total amount of monopoly rent shown by the study to have been earned by the large suppliers was more than $500 millions from May to Nov 2000.

  It is important to bear in mind that this total only covers the rent earned by these large suppliers, the total cost impact on the ISO real-time market as the result of their exercise of market power is larger since it must include added revenue earned by other small suppliers and generation units owned by other companies, municipal utilities, and state agencies. Although these other suppliers may not have bid high in order to set the market clearing prices, they did receive the same price in an uniform price auction market. DMA's separate estimate put the total impact on ISO real time market at about $1.19 billion for the study period[14].

  Looking beyond ISO real-time market, the exercise of market power had a significant impact on the PX market. Price shocks in the ISO market quickly spread to the PX the next day due to the expectation of high ISO prices. It is also conceivable that the suppliers used withholding as an integral part of their overall strategy to influence market prices in both ISO and PX markets. Since the trading volume is many times higher in PX market than ISO real-time market, the indirect impact of market power would be multiples of $1.19

[13] Some additional details of the definition of monopoly rent are: Rent is defined as greater or equal to zero. Rent is calculated as bid price minus individual marginal cost if individual cost is greater than system marginal cost. Finally, the rent calculation does not use MCP but a supplier's bid price. So it does not attribute profit earned by price takers as monopoly rent, which is the indirect market impact of the strategic bidders activity on other suppliers in the market.

[14] Two main reasons explain the difference between the total identified monopoly rent (about $500 millions) and the total market power impact in real time market (about $1190 millions). First, there are many suppliers not covered by this study, mainly the UDC generation and small suppliers. Although they may not be responsible to the higher prices, their output earns the high MCP. Second, for some hours the suppliers included in the study (especially importers) did not bid as high as the MCP. Their monopoly rent calculated for these hours are below the actual rent they earned due to others' market power impact. In short the monopoly rent only include excess profit attributable to the a supplier's own activity and include only suppliers in the study. But any supplier setting MCP cause more impact to the market than its own profit.

billion calculated. Further analysis of bidding data in the PX can verify the indirect and direct impact of the exercise of market power.

- In exploring the issue of whether an oligopoly pricing model helps to explain the observed bidding pattern in California power market, DMA found evidence that the dominant bidding pattern is consistent with two characteristics of a supply function equilibrium model of oligopolist pricing. There was a positive correlation between bid-cost mark-up and system load, and a positive correlation between bid-cost mark-up and the quantity dispatched from a large supplier. These results confirm two of the important characteristics of a supply function equilibrium pricing strategy.

Policy Implications

In terms of policy implications, this study helps to fill a gap left by most studies of market performance in summer 2000. So far most studies have concluded that market power has been exercised on a system-wide basis with a significant price-cost mark-up. However, previous studies failed to identify an individual exercise of market power and could not establish a link between individual strategic bidding actions and their impact on market clearing prices. This study provides evidence that many large suppliers actively engaged in strategic bidding efforts and that their activity had a direct impact on market prices. Moreover, their bidding strategy was not ad hoc, but consistent with a certain model of oligopoly pricing behavior. This implies the systematic exercise of market power to maximize profit.

Figure 3. Frequency of Withholding by Type for 5 Large In-state Suppliers:

A Withholding Strategy (both economic and physical withholding) Was Utilized During May to Nov. 2000 For More Than 98% of the Hours

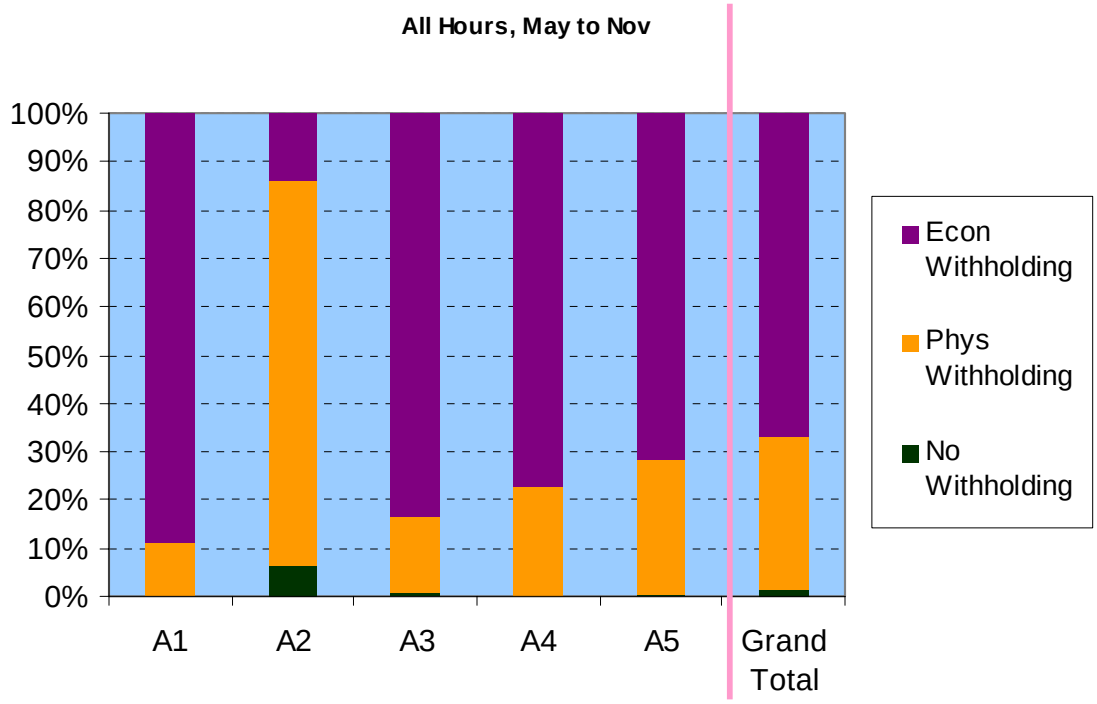
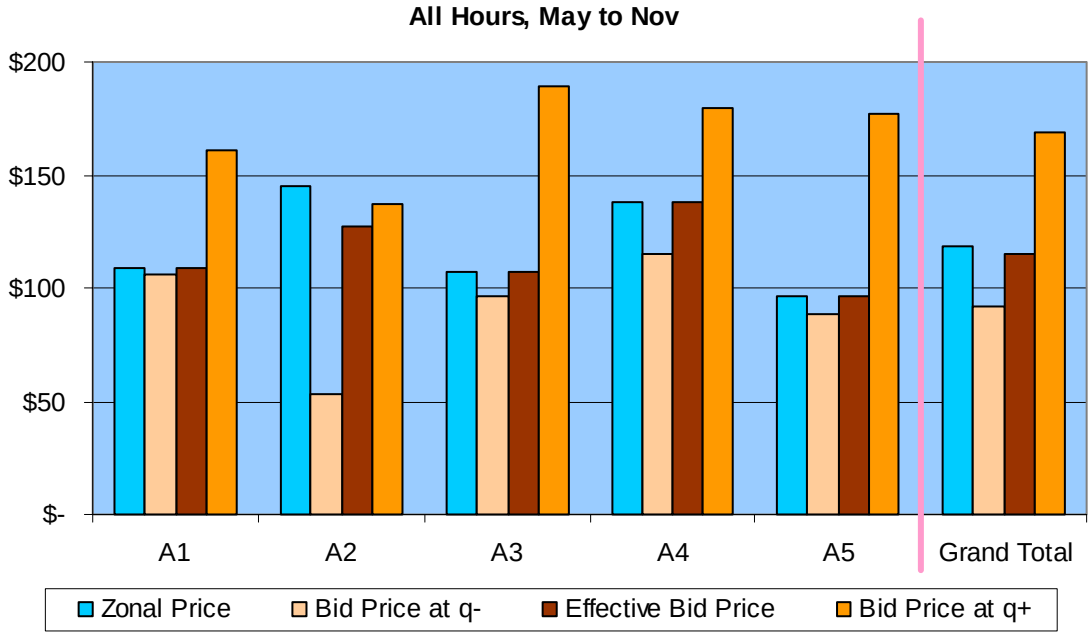


Table 1. Frequency of Withholding by Types (Large In-state Suppliers):

(All Hours, May to Nov 2000)

Suppliers	A1	A2	A3	A4	A5	Grand Total
No Withholding	0%	6%	1%	0%	0%	2%
Physical Withholding	11%	80%	16%	23%	28%	31%
Economic Withholding	89%	14%	84%	77%	72%	67%
Grand Total	100%	100%	100%	100%	100%	100%

Figure 4 High Bid Prices Guaranteed Setting High Market Clearing Prices By Five Large In-state Suppliers



This chart compares the zonal market clearing price with the effective bid price for each supplier at their dispatched output level. This chart also reports the bid prices for a 50 MW change in the dispatch quantity(q+). This shows that if the system demand were somewhat higher, the suppliers would have been successful at setting even higher prices with bids in the market at much higher prices. If system demand were somewhat lower, the suppliers had high bids standing to support high prices and keep them from falling lower.

The average effective bid prices are close to the average zonal MCP because of the fact that for most hours, most in-state suppliers were effectively bidding and setting the zonal MCP. For any hour, when a supplier is withholding, either economic or physical, the supplier is effectively bidding at the zonal MCP, i.e., setting the zonal MCP. Only when they do not withhold, their effective bid price will be significantly below MCP.

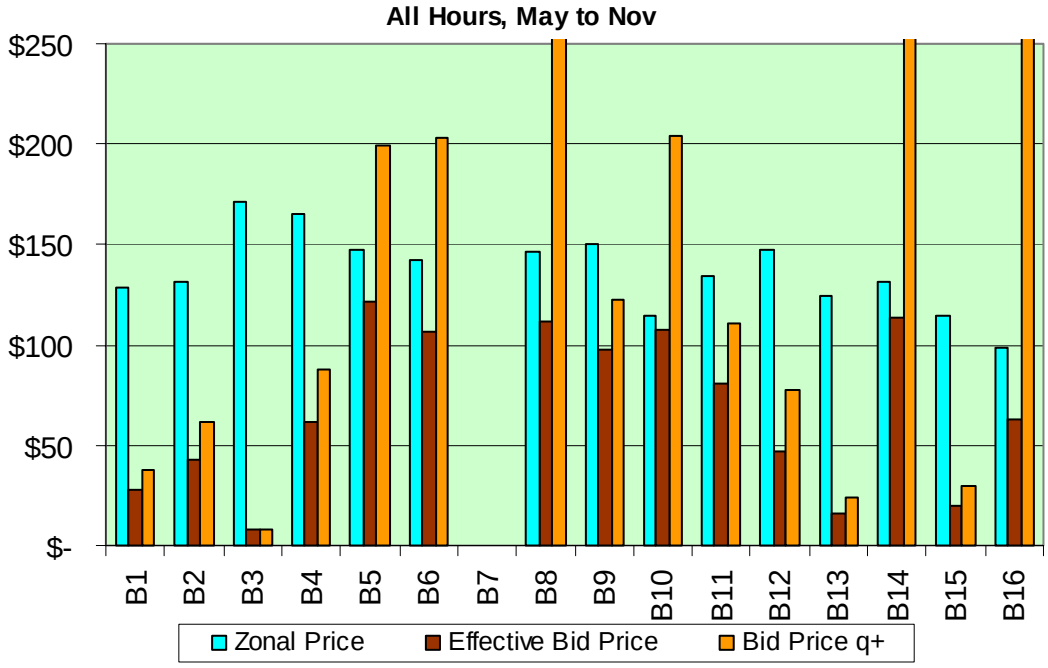
Table 2. Average Bid Prices*

(Five Large In-state Suppliers, All Hours, May to Nov. 2000)

Suppliers	A1	A2	A3	A4	A5	Grand Total
Zonal Market Clearing Price	**$ 108.77**	**$ 145.08**	**$ 106.87**	**$ 138.28**	**$ 96.12**	**$ 119.02**
Bid Price at q-	$ 106.39	$ 52.72	$ 96.43	$ 114.97	$ 88.53	$ 91.81
Effective Bid Price	**$ 108.73**	**$ 127.33**	**$ 106.70**	**$ 138.25**	**$ 96.04**	**$ 115.41**
Bid Price at q+	$ 161.12	$ 137.19	$ 189.44	$ 179.41	$ 176.78	$ 168.79

*See notes for Figure 4.

Figure 5. Large Importers Also Bid High to Support Setting High Market Clearing Prices



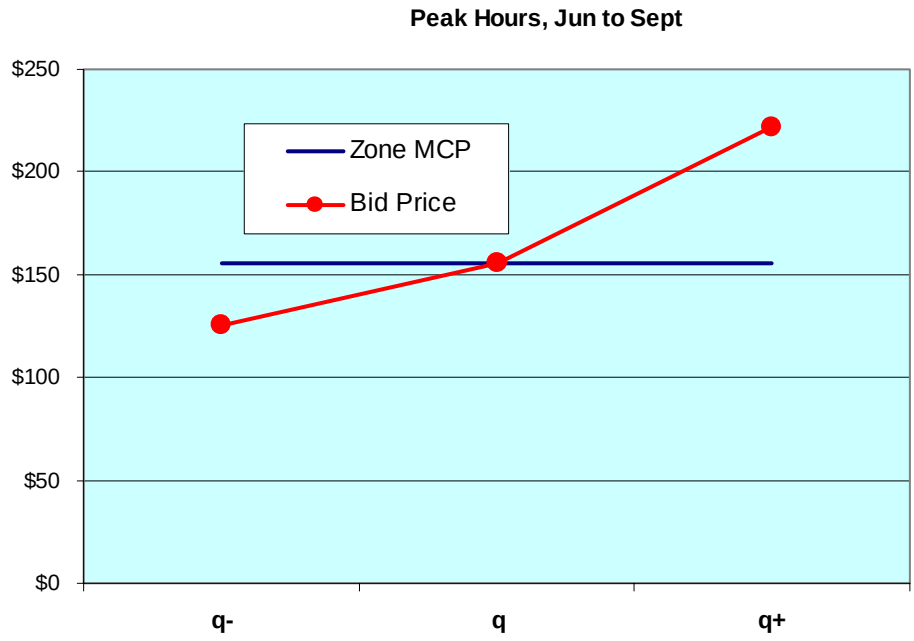
For importers, only economic withholding was calculated as impacting prices, since we did not have the data to attribute any physical withholding. This resulted in zonal prices generally higher than the calculated average for effective bid prices. Effective bid price and bid mark-up were calculated based on actual bid prices submitted. There was no imputed effective bid price for physical withholding.
Bid price at dispatched output and for a 50 MW increase are reported here along with the corresponding zonal MCP for comparison. Some of the importers, such as B5, B6, B8, B10 and B14 consistently bid high prices at dispatch quantities close to the zonal MCP, and bid much higher prices above MCP at quantity above actual dispatch MW. The data shows they clearly exercised market power to inflate prices further at higher load conditions.

Table 3. Average Effective Bid Prices by Large Importers (All Hours, May to Nov 2000) *

	Zonal MCP	Effective Bid Price	Bid Price at q+
B1	$ 128.57	$ 28.30	$ 38.19
B2	$ 131.53	$ 42.72	$ 61.29
B3	$ 171.27	$ 8.19	$ 8.23
B4	$ 165.36	$ 61.66	$ 87.48
B5	$ 147.71	$ 121.34	$ 199.54
B6	$ 142.30	$ 106.69	$ 202.89
B7	na	na	na
B8	$ 146.64	$ 111.89	$ 276.58
B9	$ 150.56	$ 97.57	$ 122.91
B10	$ 114.11	$ 107.25	$ 203.70
B11	$ 134.84	$ 80.36	$ 110.82
B12	$ 146.93	$ 46.94	$ 77.81
B13	$ 124.23	$ 15.52	$ 24.19
B14	$ 131.14	$ 113.73	$ 320.59
B15	$ 114.30	$ 19.96	$ 29.49
B16	$ 98.49	$ 63.04	$ 256.96

* see notes for Figure 5.

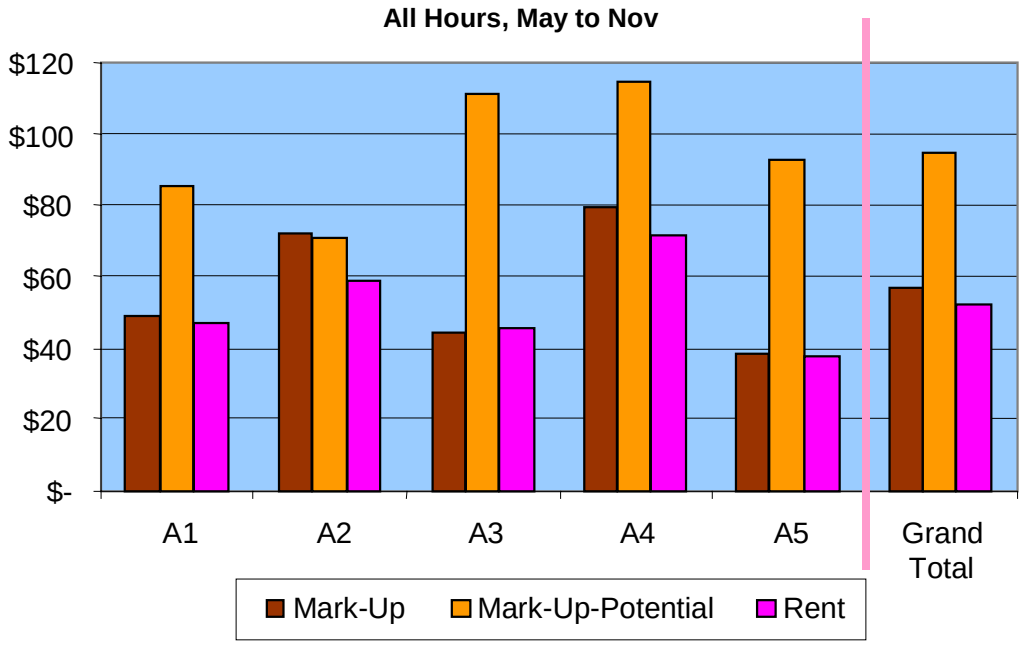
Figure 6. Strategic Bidding that Ensures High Market Prices for All Demand Conditions (Bidding at output levels below and above actual dispatch level)



Average Bid Prices for 4 (out of 5) most aggressive large in-state suppliers:

- At q, these suppliers bid MCP most of the time. On average, it is almost equal.
- If the demand were higher by 50MW for each supplier (at q+), they had much higher bid price ready to push up the price much further.
- If the demand were lower by 50MW for each supplier (at q-), they still had fairly high bids in waiting to support high prices.
- Note the increase for higher demand will be much significant than the drop when demand is lower. Another indicator of well planned strategic bidding.

Figure 7. Behind High Bid Prices are High Bid Mark-ups In-state (Top) and Importers (Bottom)



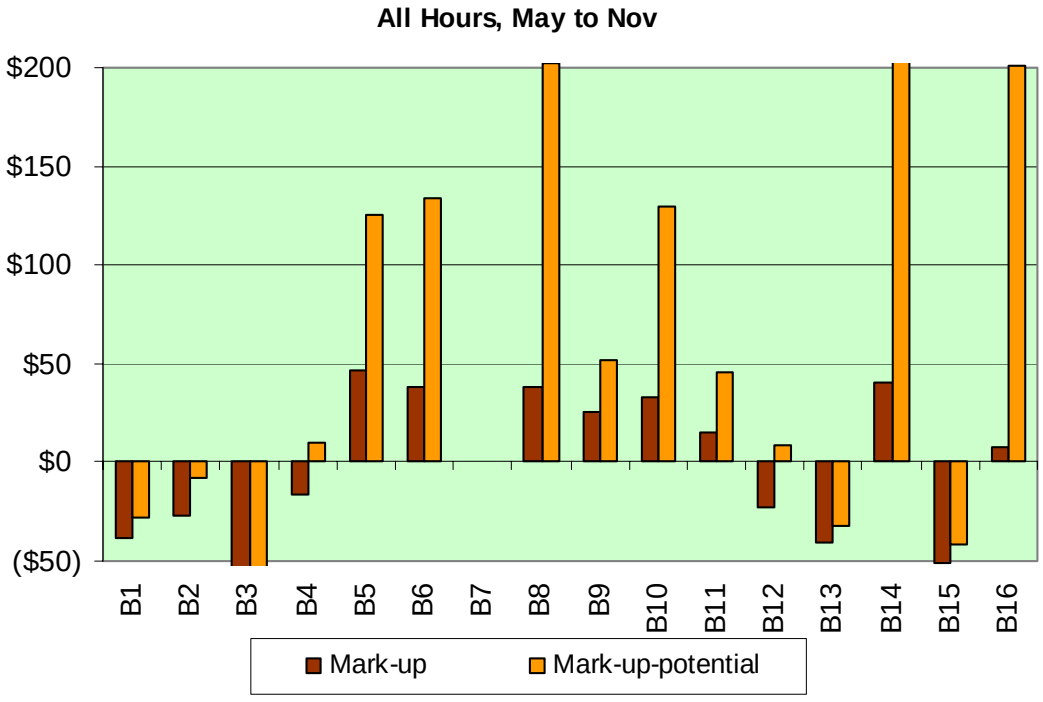


Table 4. Average Bid Mark-ups (In-state and Importers, All Hours, May to Nov. 2000)

In-state Suppliers	Mark-up	Mark-up-potential
A1	$ 48.81	$ 85.37
A2	$ 72.40	$ 70.77
A3	$ 44.19	$ 111.22
A4	$ 79.68	$ 114.99
A5	$ 38.69	$ 92.55
Grand Total	$ 56.76	$ 94.98

Importers	Mark-up	Mark-up-potential
B1	$ (37.95)	$ (28.06)
B2	$ (26.49)	$ (7.92)
B3	$ (62.36)	$ (62.32)
B4	$ (16.03)	$ 9.79
B5	$ 47.01	$ 125.21
B6	$ 38.14	$ 134.34
B7	na	na
B8	$ 37.89	$ 202.58
B9	$ 26.06	$ 51.40
B10	$ 33.38	$ 129.83
B11	$ 15.00	$ 45.46
B12	$ (22.26)	$ 8.61
B13	$ (40.43)	$ (31.76)
B14	$ 40.52	$ 247.39
B15	$ (50.84)	$ (41.31)
B16	$ 7.32	$ 201.25

Table 5. Average Bid Mark-ups (MU) by Month (5 In-state Suppliers, Peak Hours)

	A1	A2	A3	A4	A5
May	$ 43.63	$ 50.14	$ 44.99	$ 28.93	$ 45.94
June	$ 107.38	$ 38.56	$ 103.98	$ 112.46	$ 94.87
July	$ 84.79	$ 144.06	$ 72.17	$ 90.03	$ 68.23
August	$ 88.13	$ 78.09	$ 67.89	$ 158.71	$ 73.36
September	$ 55.00	$ 60.58	$ 39.14	$ 111.13	$ 36.96
October	$ 32.86	$ 92.53	$ 38.44	$ 83.89	$ 12.37
November	$ 36.18	$ 91.22	$ 35.72	$ 71.64	$ 19.80

Figure 8. Excessive Rents Earned in Real-time Market for the Top Ten Suppliers (Cumulative Rent for May to November 2000

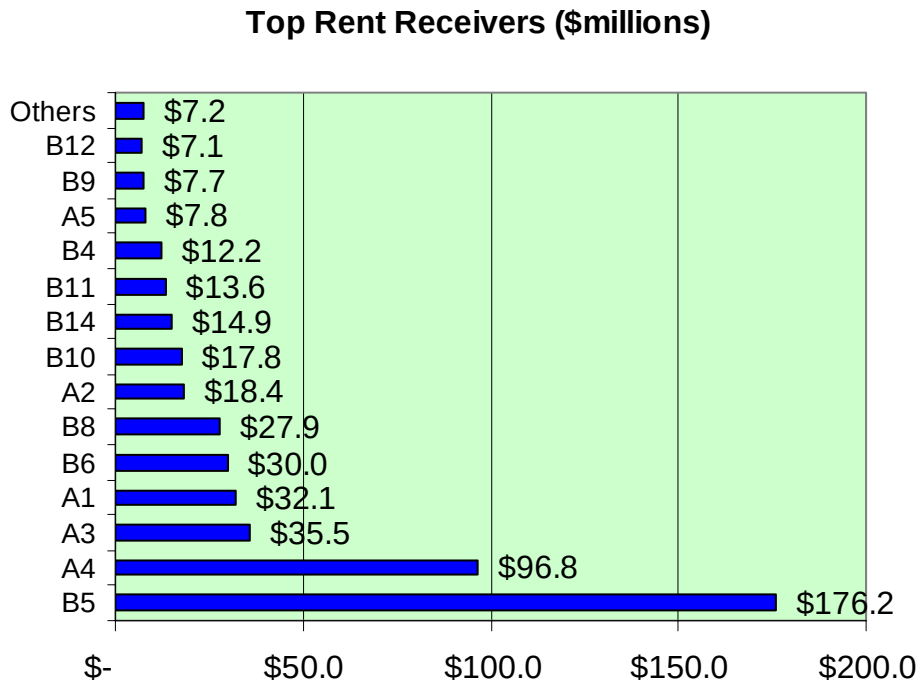


Figure 9. Monthly Trend of Monopoly Rents Earned by Large In-state and Import Suppliers

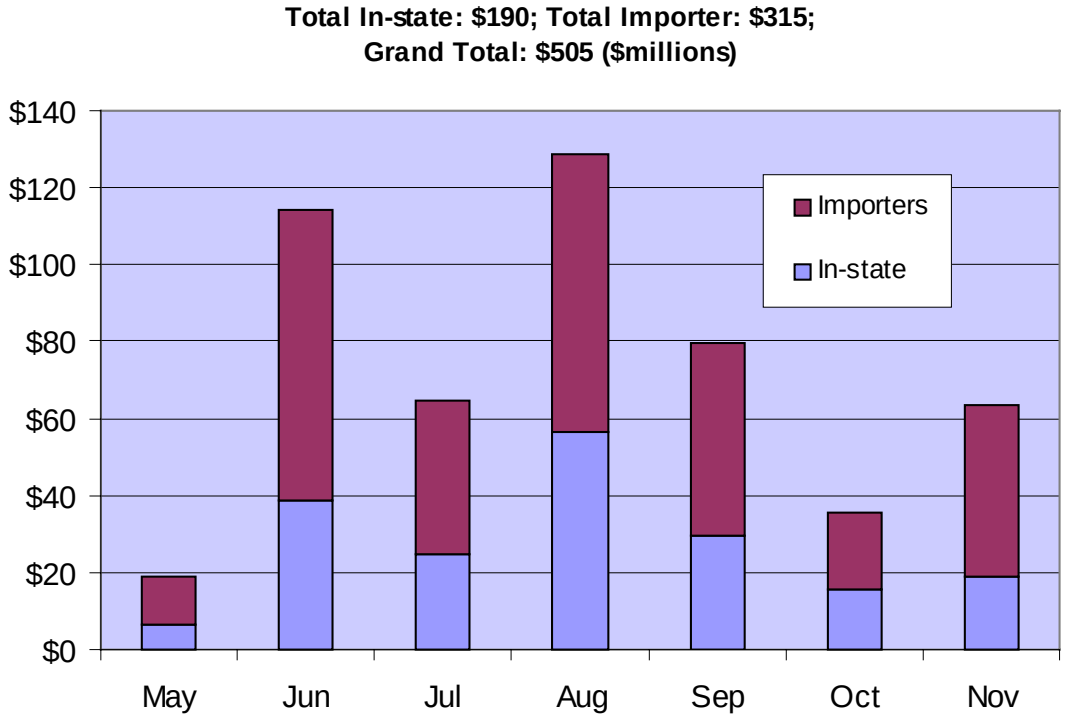


Table 6. Monopoly Rent by Months (in $ millions, In-state and Importers)

	May	Jun	Jul	Aug	Sept	Oct	Nov	TOTAL
In-State Suppliers								
A1	$ 2.863	$ 7.990	$ 5.710	$ 8.708	$ 3.567	$ 1.598	$ 1.638	$ 32.074
A2	$ 0.456	$ 1.151	$ 0.939	$ 2.428	$ 3.183	$ 3.750	$ 6.476	$ 18.383
A3	$ 1.865	$ 10.629	$ 3.317	$ 10.198	$ 4.753	$ 1.227	$ 3.501	$ 35.490
A4	$ 0.898	$ 15.742	$ 14.042	$ 34.466	$ 17.049	$ 8.509	$ 6.050	$ 96.756
A5	$ 0.336	$ 3.507	$ 0.920	$ 0.469	$ 1.308	$ 0.360	$ 0.946	$ 7.844
Importers								
B5	$ 7.521	$ 43.443	$ 24.592	$ 28.293	$ 24.741	$ 12.561	$ 35.077	$ 176.229
B6	$ 0.866	$ 5.764	$ 3.207	$ 11.393	$ 8.704	$ 0.004	$ 0.051	$ 29.989
B8	$ 1.020	$ 6.098	$ 1.882	$ 9.676	$ 5.207	$ 1.976	$ 1.993	$ 27.852
B10	$ 1.170	$ 5.110	$ 4.266	$ 5.291	$ 1.064	$ 0.287	$ 0.590	$ 17.778
B14	$ 0.501	$ 2.802	$ 0.359	$ 2.168	$ 6.867	$ 1.242	$ 0.922	$ 14.860
B11	$ 0.540	$ 0.696	$ 2.347	$ 6.698	$ 1.031	$ 1.089	$ 1.192	$ 13.593
B4	$ 0.000	$ 1.146	$ 0.649	$ 3.453	$ 1.184	$ 2.451	$ 3.278	$ 12.162
B9	$ 0.117	$ 2.419	$ 0.738	$ 2.807	$ 0.624	$ 0.567	$ 0.411	$ 7.684
B12	$ 0.161	$ 4.153	$ 0.048	$ 0.980	$ 0.273	$ 0.085	$ 1.441	$ 7.140
Others Importers	$ 0.274	$ 3.249	$ 1.591	$ 1.831	$ 0.227	$ 0.035	$ 0.022	$ 7.229
						Grand Total		**$ 505.064**